2017-2018

InsideSARGENT

Boston University College of Health & Rehabilitation Sciences: Sargent College

THE HARDWIRING THAT MAKES US HUMAN

HOW THINKING AND FEELING CONNECT IN THE BRAIN'S MOST COMPLEX REGION

BOSTON UNIVERSITY

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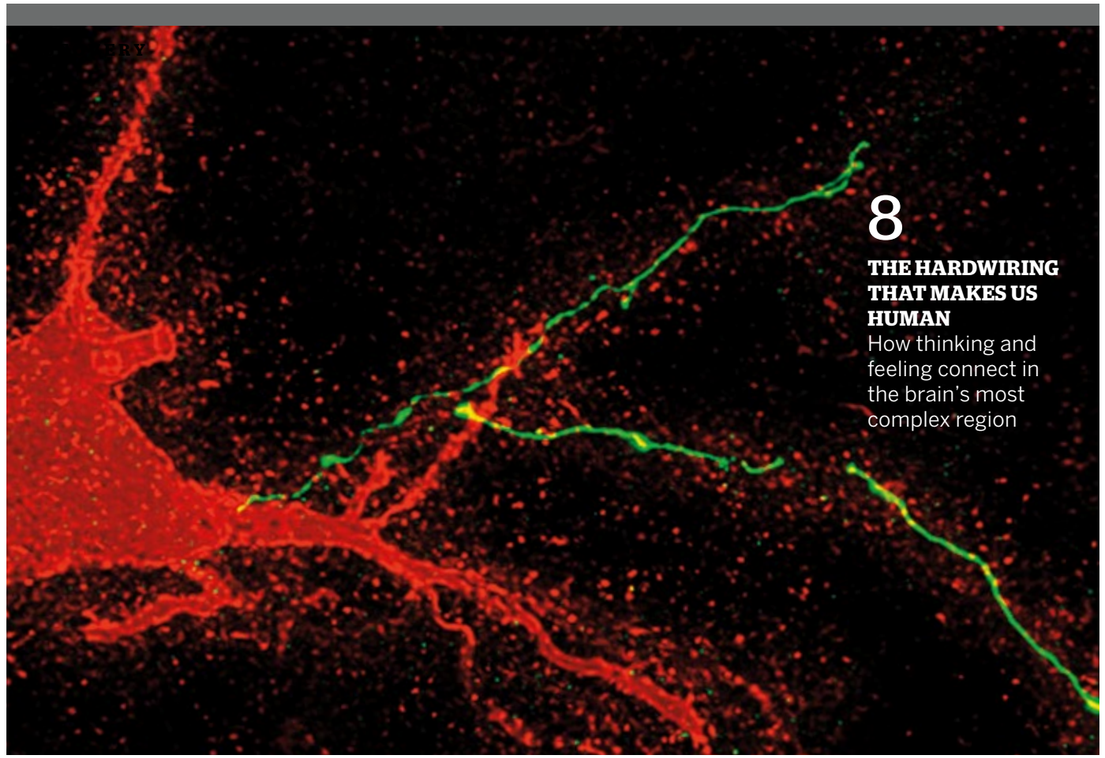

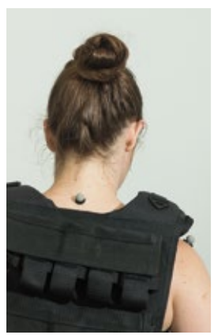

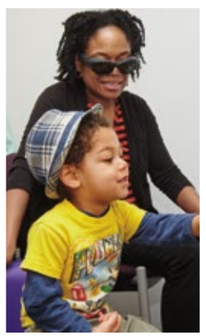

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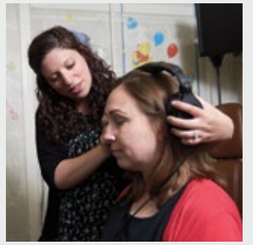

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ONLINE EXTRAS

Move Over, Iron Man
Watch how a soft exosuit can help people re-train their gait after a stroke at **go.bu.edu/sargent/inside-sargent**.

From Classroom to Community
See a slideshow of Sargent students in the global health study abroad program in Ghana at **go.bu.edu/sargent/inside-sargent**.

A Source for Research News
Bookmark **bu.edu/sargent** for regular research updates.

2017 Meredith E. Drench Lecture
Watch Alyson McGregor (MED'98,'03) explain why pharmaceutical testing should be broadened to include women, as well as transgender men and women, in a video at **go.bu.edu/sargent/inside-sargent**.

InsideSARGENT
2017–2018

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Dean
Christopher A. Moore, PhD

Communications Manager
Stephanie Rotondo

Editor
Lara Ehrlich (UNI'03)

Contributors
Kate Becker, Julie Butters, Amy Laskowski, Sara Rimer, and Andrew Thurston

Designer
Hy Zhitnik

Cover image
Courtesy of Helen Barbas

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About
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Dean's Message

"The threads weaving together the stories in this issue are our studies of the human brain....Sargent researchers yield exciting new discoveries by constantly challenging our assumptions about how the brain works and analyzing its previously neglected regions."

Dear Friends,

It's my pleasure to introduce another issue of *Inside Sargent* magazine. The threads weaving together the stories in this issue are our studies of the human brain. The cover story features the research of renowned neuroscientist Professor Helen Barbas, who examines emotion and cognition, two processes that have previously been viewed as independent, but are actually connected in surprising ways. By mapping the pathways that transmit information throughout the brain, Barbas and her team discovered that the regions for processing emotions and thoughts are inextricably linked. Their work mapping these connections will help researchers and doctors understand the brain's circuits to determine where to intervene in combatting neurodegenerative disorders like PTSD, depression, and schizophrenia.

Assistant Professor of Speech, Language & Hearing Sciences (SLHS) Tyler Perrachione is also studying surprising connections within the brain, investigating the link between its adaptation to sights and sounds and reading disorders like dyslexia. And our SLHS doctoral students are exploring how the brain may hold the key to one of the most common childhood voice disorders: vocal nodules that can make speaking difficult and exhausting, undermining kids' confidence during crucial language development. Sargent researchers yield exciting new discoveries by constantly challenging our assumptions about how the brain works and analyzing its previously neglected regions.

Some of the advances we make here are early-stage breakthroughs, the foundation for future studies and therapies; others have the potential to make an impact much sooner. Assistant Professors Lou Awad and Terry Ellis have made headlines for their strides in advancing the rehabilitation of movement following stroke with an innovative exosuit (a Sargent collaboration with the Wyss Institute at Harvard University) that could be available in clinics as soon as 2018. Making this technology a part of standard care could improve recovery for the more than 15 million people worldwide who experience a stroke each year. We also feature occupational therapy graduate student Clare Brabson ('18), who used her Schweitzer Fellowship to develop sensory activities that may help slow the loss of cognitive function in older adults who have dementia.

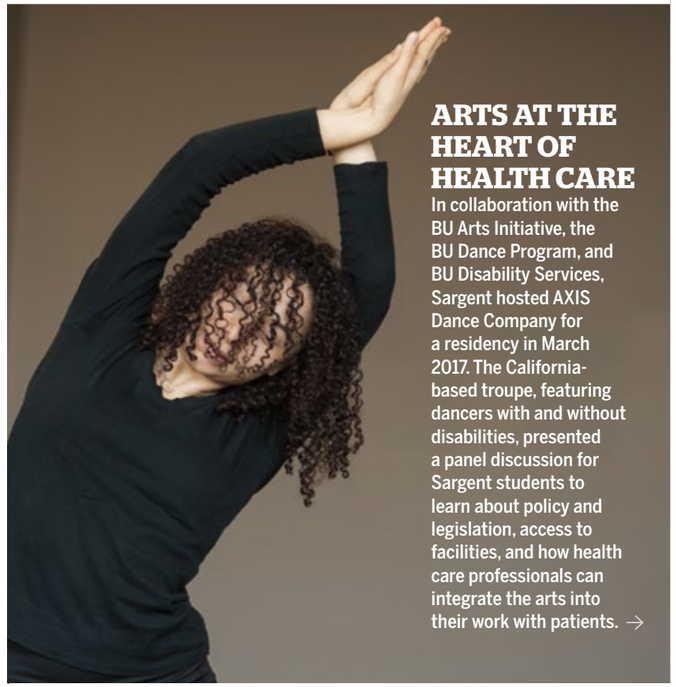
Sargent continually seeks out new connections at BU and beyond to broaden the influence of our research, enhance students' academic experiences, and ensure innovative clinical opportunities for our students. Our Interprofessional Education Program encourages students across departments to further their understanding of various healthcare professions and excel in teams, and Perrachione will be working in BU's new Rajen Kilachand Center for Integrated Life Sciences & Engineering, which will allow him to explore more connections beyond his own field of expertise. In their collaboration with the Wyss Institute, Awad and Ellis work with engineers, computer scientists, and business developers to make sure the exosuit's pioneering technology serves its medical function. And international partnerships, like the Accra Global Health Program we developed with England's Lancaster University, afford our faculty and students the opportunity to exchange knowledge, culture, and ideas in a variety of health settings.

I'm excited about all that's planned for this year, including new research efforts and curricula, and enhanced clinical service. I encourage you to share with me your questions and comments about *Inside Sargent* and any of our endeavors.

Best wishes,

Christopher A. Moore
Dean and Professor, @SARDeanBU

DAN AGUIRRE



CYDNEY SCOTT

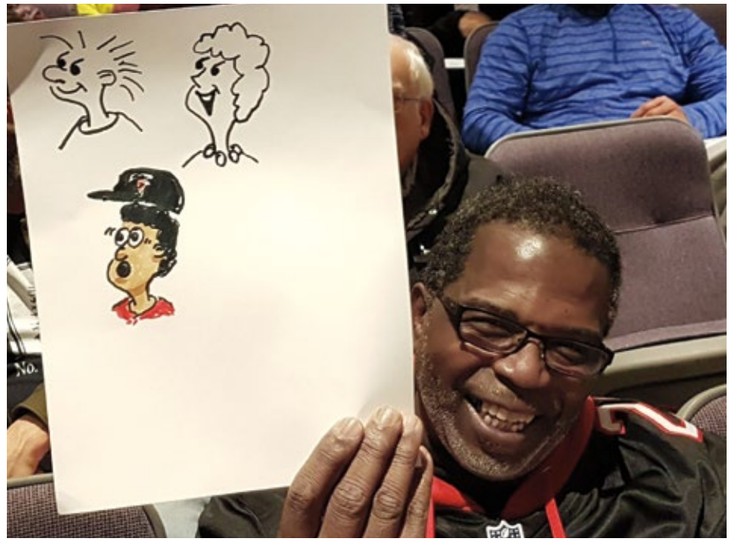
ARTS AT THE HEART OF HEALTH CARE

In collaboration with the BU Arts Initiative, the BU Dance Program, and BU Disability Services, Sargent hosted AXIS Dance Company for a residency in March 2017. The California-based troupe, featuring dancers with and without disabilities, presented a panel discussion for Sargent students to learn about policy and legislation, access to facilities, and how health care professionals can integrate the arts into their work with patients. →

continued from previous page

Sargent hosts a variety of arts initiatives throughout the year, including a screening of the film *Becoming Bulletproof* (featuring actors with and without disabilities) and an inclusive dance program that OT and PT students ran at the Boys & Girls Club in Dorchester, Mass. And in February 2017, Sargent's Aphasia Community Group hosted cartoonist Graham Shaw, who took the participants through the process of drawing cartoon faces that convey emotions they may not be able to express in words.

"Incorporating art into the curriculum encourages students to develop critical thinking, communication, and observational skills," says Karen Jacobs, clinical professor of occupational therapy.



THE APHASIA COMMUNITY GROUP

SARGENT HOSTS 2017 OCCUPATIONAL THERAPY SUMMIT OF SCHOLARS

In June 2017, Sargent hosted the annual Occupational Therapy Summit of Scholars, where OT researchers shared their work and networked. One major topic of discussion was how interdisciplinary collaborations can lead to the discovery of innovative solutions to research questions on health and disability. The summit also provided PhD students, post-docs, and junior faculty with professional development opportunities. In addition to the summit's 170 attendees, 30 entry-level graduate OT students from throughout the US and Puerto Rico attended a one-day Future Scientists Institute, which provided them with an overview of OT research careers.

INTERPROFESSIONAL EDUCATION PROGRAM ADVANCES COLLABORATIVE PRACTICE

Sargent's Interprofessional Education (IPE) Program encourages students across departments to further their understanding of various healthcare professions and develop the skills they need to excel working in teams. Craig Slater, director of interprofessional education and practice, is working with faculty to implement the curriculum.

Beginning in fall 2017, students in the graduate programs of athletic training, nutrition, occupational therapy, physical therapy, and speech-language pathology are participating in interactive online modules that address the core competencies for interprofessional collaborative practice. They will also work in groups to develop teamwork skills, understand various professions, and devise collaborative plans for practice.

NEW FACULTY AND PROMOTIONS

NEW FACULTY

Maggie Balz Breazeale, lecturer, speech, language & hearing sciences

Miguel Garcia-Cabezas, research assistant professor, health sciences

Elin Roverud, research assistant professor, speech, language & hearing sciences

Marijane Staniec, lecturer, health sciences, programs in nutrition

LaDora Thompson, professor and department chair, physical therapy & athletic training

Adrian Wright-Fitzgerald, lecturer, physical therapy & athletic training

PROMOTIONS

Simone Gill, associate professor, occupational therapy

Susan McGurk, professor, occupational therapy

EMERITI

Elizabeth Gavett, clinical associate professor emerita, speech, language & hearing sciences

Kenneth Holt, associate professor emeritus, physical therapy & athletic training

Jean Peteet, clinical assistant professor emerita, physical therapy & athletic training

WHY PHARMACEUTICAL TESTING SHOULD INCLUDE MORE WOMEN

Ambien may give you a good night's sleep—but for some women, it was fatal. The insomnia drug, which used to be exclusively tested on men, remains in a woman's bloodstream longer than in a man's. As a result, many women experienced drowsiness the morning after taking Ambien, which led to several car accidents. Other drugs, too, put women at a higher risk than men, but pharmaceutical testing is still primarily geared toward men. Alyson McGregor (MED'98,'03) is trying to change that.

In Sargent's 2017 Meredith E. Drench Lecture, "How the Evolution of Sex and Gender-based Research Impacts the Practice of Medicine," McGregor explained why pharmaceutical testing should be broadened to include women, as well as transgender men and women. It would be "a cognitive transformation," McGregor said in her lecture. "Having to change the way that you design and analyze your research, and practice medicine, is challenging."

As a first step in that direction, "consider research, clinical care, and education," McGregor said. "All of these things have to happen simultaneously."

McGregor is an associate professor of emergency medicine at the Warren Alpert Medical School of Brown University and the cofounder and director for the Division of Sex and Gender in Emergency Medicine at Brown University's Department of Emergency Medicine. She is also a cofounder and vice chair for the national organization Sex and Gender Women's Health Collaborative.

WebExtra

Watch the lecture at **go.bu.edu/sargent/inside-sargent.**

Alyson McGregor (MED'98,'03) explains why pharmaceutical testing should include women and people who are transgender.

CAT LAINE

TOP AWARDS

FACULTY

Terry Ellis, an assistant professor of physical therapy & athletic training (PTAT), received the Chattanooga Research Award from the American Physical Therapy Association (APTA). **Karen Jacobs**, a clinical professor of occupational therapy (OT), was named a fellow of the Human Factors & Ergonomics Society. The American Occupational Therapy Association (AOTA) named Jacobs and **Wendy Coster**, an OT professor, among the 100 most influential people in OT. **Julie Keysor**, an associate professor of PTAT, was selected to the *Arthritis Today* medical advisory panel. **Gerald Kidd**, a professor of speech, language & hearing sciences (SLHS), was named to the National Institute of Health Auditory System Study Section. **Mark Laursen**, a clinical associate professor and director of athletic training services, received the Tim Kerin Award from the National Athletic Trainers' Association. **Cara Lewis**, an associate professor of PTAT, was honored with the Biomechanics Early Career Investigator Award from the APTA Biomechanics Special Interest Group. **LaDora V. Thompson**, chair of PTAT, was named the inaugural Travis Roy Endowed Professor, a unique opportunity to translate basic research to clinical application, and to collaborate with other scientists, students, and patients to improve the lives of people with spinal cord injuries and other disabilities.

STUDENTS

Jordan Badger ('18) was named outstanding dietetics student of the year by the Massachusetts Academy of Nutrition and Dietetics. The following doctor of OT students were selected for American Occupational Therapy Association internships: **Maddy Emerson ('19)**, **Natalie Petrone ('19)**, and **Casey Primeau ('19)**. The following SLHS students and alumni received American Speech-Language-Hearing Foundation Awards: **Rachael Campbell ('18)**, **Karen Chenausky ('15)**, **Teresa Gray ('15)**, **Sabrina Horvath ('19)**, and **Erin Meier ('18)**. SLHS PhD students **Natalie Gilmore ('19)** and **Jeff Johnson ('18)** will deliver an American Congress of Rehabilitation Medicine platform talk.

A LOADED RESEARCH QUESTION

DO MALE AND FEMALE SOLDIERS CARRY THEIR EQUIPMENT DIFFERENTLY?

BY SARA RIMER

CHRIS MCINTOSH

Helmet, uniform, boots, armor, weapon, ammo, food, canteens, compass, first aid kit—everything a soldier wears and carries (their "load") can add up to more than 68 pounds. In a combat mission, that weight can skyrocket to as much as 120 pounds. Carrying a heavy load while walking, marching, running, or even fighting is essential for every soldier, regardless of gender.

"A soldier can't say, 'I can't carry this much water because it weighs too much,'" says Kari Loverro ('19), a doctoral candidate who is studying the biomechanics of how soldiers carry heavy loads. "You have to carry what you need for the mission." All that weight is associated with high rates of stress fractures and other musculoskeletal injuries to soldiers' hips, legs, feet, and ankles. For female soldiers, the risk of stress fractures to their lower extremities is 2 to 10 times greater than for their male counterparts. Loverro wants to know why.

Her study comes at an important time for the military. While increasing numbers of women are serving in combat roles—the Department of Defense (DOD) lifted its ban on women in combat in 2013—there has been relatively little research on how female soldiers carry heavy loads. In general, women are shorter, and weigh less, than men. So while they are required to carry the same load as men, their relative load is greater.

To figure out if men and women carry their load differently, Loverro is modeling pressure between the bones of the hip during walking. In Sargent's Human Adaptation Lab, she outfits a group of volunteers with weighted vests that represent the loads of up to 60 pounds that soldiers may have to carry on their torsos during foot marches and combat missions. Those volunteers march on a treadmill at varying rates of speed while Loverro uses high-tech sensors, reflective markers, motion cameras, and computers to track their every movement.

In her ongoing study, Loverro is investigating whether soldiers adapt to a heavier load on their torsos by leaning forward, or slowing down, or taking shorter steps, and whether the load makes them more likely to fall. She hopes to learn how men and women change the way they walk when carrying heavy loads at different speeds, and how these adaptations may cause stress and even harm to their bones. Loverro, who is pursuing a doctorate in rehabilitation sciences, hopes her study will lead to interventions that can prevent injuries to soldiers, men as well as women.

"Our soldiers put themselves at risk in ways we cannot control," says Loverro's mentor Cara Lewis, an associate professor of physical therapy who directs the Human Adaptation Laboratory and teaches in the PhD program in Rehabilitation Sciences. "We should at least control the ways we can reduce the risk of musculoskeletal injury in training and when carrying a load."

Loverro has a personal investment in her research. Her father is a retired Air Force colonel and was deputy assistant secretary of space policy under President Barack Obama. Her mother, a retired Air Force lieutenant colonel, was a professor of aerospace studies in BU's Reserve Officer Training Corps program in the 1980s.

A SOLDIER'S RECOMMENDED LOAD

68.9 lbs.

INCLUDES:

7.8 lbs. uniform	**16 lbs.** armor plates
4.2 lbs. combat helmet	**0.5 lbs.** compass
6.4 lbs. M4 assault rifle	**1 lb.** first aid kit
4.6 lbs. 1-qt canteens of water (2 per soldier)	**2 lbs.** M67 fragmentary grenades (2 per soldier)

From the US Army Field Manual, *1990*

> "OUR SOLDIERS PUT THEMSELVES AT RISK IN WAYS WE CANNOT CONTROL. WE SHOULD AT LEAST CONTROL THE WAYS WE CAN REDUCE THE RISK OF MUSCULOSKELETAL INJURY."
> —CARA LEWIS

"I am honored to come from a military family," says Loverro, who spent four years as a postgraduate research fellow on the biomechanics team at the US Army Natick Soldier Research, Development and Engineering Center (NSRDEC) in Natick, Mass. "Even though I do not wear the uniform, I feel that this is my way of giving back to the men and women who put their lives on the line to protect us. I want to make sure that every soldier has the best possible chance of staying safe in the field while performing their mission." IS

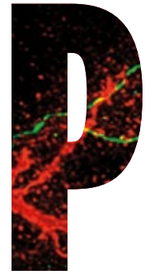
Kari Loverro was awarded a DOD Science, Mathematics and Research for Transformation (SMART) Scholarship for Service, which pays for her final two years at Sargent and ensures her return as a civilian researcher to NSRDEC. Her dissertation research is funded by a $5,000 grant from the Dudley Allen Sargent Research Fund.

Neuroscientist Helen Barbas maps the pathways neurons use to communicate, in paper-thin slices of brain tissue.

THE HARDWIRING THAT MAKES US HUMAN

HOW THINKING AND FEELING CONNECT IN THE BRAIN'S MOST COMPLEX REGION

BY LARA EHRLICH
PHOTOS BY CHRIS MCINTOSH



Plato described reason and emotion as two horses pulling the charioteer of the human soul in opposite directions. The divide between these basic human functions persisted throughout philosophy and into psychology and neuroscience, where researchers study the brain's cognitive and emotive areas independently of one another.

Our cognition, or "what makes us human," is centered in the prefrontal cortex, the most evolved part of the brain, located just behind our foreheads, says Helen Barbas, a Sargent professor of health sciences. The drives that keep us alive, like hunger and fear, are activated in the hypothalamus and the amygdala, two clusters of neurons deep inside each of the brain's hemispheres. The amygdala also interprets sensory information; for example, identifying the scent of food or the sound of a predator's growl.

Researchers tend to consider these areas separately, and "the idea that emotions are not irrational, that they make up a very important part of decision-making, is relatively new" for neuroscience, Barbas says. By mapping the pathways that transmit information throughout the brain, she reveals that the regions for processing emotions and thoughts are inextricably linked—and sundering them "is detrimental to our well-being."

Until the early 1970s, researchers considered the prefrontal cortex too functionally complex to understand through experimentation. They had found that in a subject under anesthesia, less functionally intricate areas of the brain responded to stimuli; for example, the neurons in the visual area of the brain fired in response to a light shined into the eye. But when the researchers tried to engage the prefrontal cortex, they found it unresponsive and dubbed it the "silent cortex."

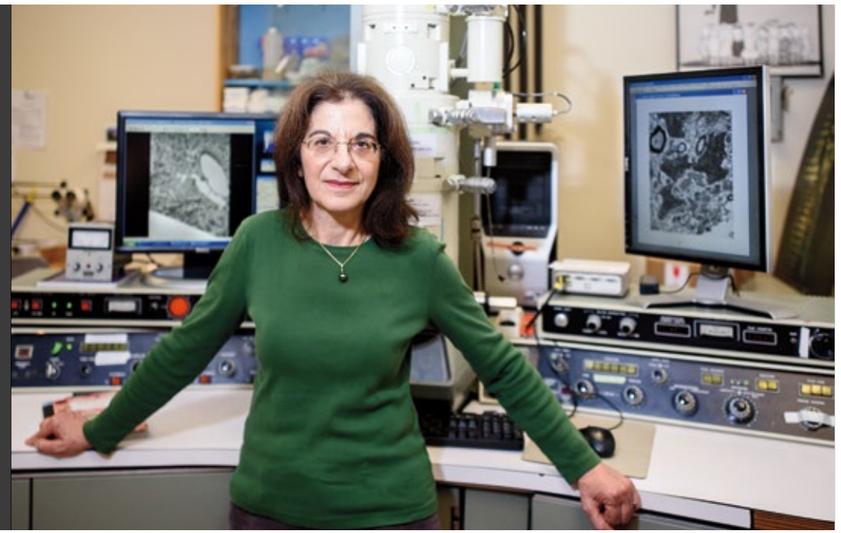
Today, neuroscientists like Barbas know this area is anything but silent. "The prefrontal cortex gets information and does something with it; it's not just a receiver of information like the sensory areas," she says. The meaning of the information is important to the prefrontal cortex, and processing it requires consciousness.

Barbas is one of the first neuroscientists to systematically and quantitatively chart the communication of neurons. She inserts dye into living brain tissue that traces the neurons as they transmit signals throughout the prefrontal cortex and into other areas. By then studying paper-thin slices of the tissue under a microscope, Barbas maps the brain's communication pathways. Her maps have provided neuroscience with what she calls a bird's-eye view of this elusive part of the brain.

Let's say you're walking along a familiar route when two cars get in a fender bender nearby. You're likely to jump, then move on. Your response to the accident is determined by the way neurons channel the information about the experience through the brain. That path, Barbas has found, takes an unexpected route.

In a study published in the book *The Prefrontal Cortex as an Executive, Emotional, and Social Brain* (Springer Japan, 2017), she and co-researcher

"THE PATTERN OF CONNECTIONS (BETWEEN EMOTION AND COGNITION) CAN TELL US WHICH NEURONS ARE MORE LIKELY TO BE AFFECTED IN SPECIFIC DISEASES."
—Helen Barbas



Miguel Ángel García-Cabezas, a research assistant professor at Sargent, describe how sensory information, like a loud bang, travels deep into the brain to the amygdala, where it is tagged with emotion. Then it heads back out to the prefrontal cortex. "The roundabout way through the amygdala is important to convey information about the significance of an event or a signal," Barbas says.

When you witness that accident, the amygdala tells your brain that it's worth noticing, and determines how you'll react. A person with a typically functioning brain will process the accident as an event of interest, and will go on with their day.

When the pathway between the amygdala and prefrontal cortex is disrupted, however, the brain will likely have a different response to the accident. People with autism, who tend to focus on specific aspects of their environment and are unable to shift their attention to an unexpected event, may not notice the accident. A person with post-traumatic stress disorder (PTSD) may have a panicked response triggered by past trauma.

The ability to shift between emotional states—from startled, back to calm, for example—is dependent on the way neurons transmit information through the amygdala. In a study published in *PLOS Computational Biology* (2016), Barbas and her colleagues—Assistant Professor Basilis Zikopoulos and Postdoctoral Research Associate Yohan John at Sargent, and Daniel Bullock, a professor of cognitive & neural systems and psychology at BU—modeled pathways between the amygdala, the thalamus, and the prefrontal cortex. These pathways facilitate flexible decision-making, the ability to make quick decisions and change our course of action. If that fender bender blocks your usual way home, you'll simply find an alternate route.

In another recent article, published in the *Journal of Neuroscience* (2017) Barbas and her colleagues studied how the pathway from the orbital prefrontal cortex, the part of the prefrontal cortex just behind the eyes, targets different types of inhibitory neurons in the amygdala, specifically those influenced by the regulating molecule dopamine. In a brain with a normal level of dopamine, these inhibitory neurons silence other neurons in the amygdala that are responsible for emotional arousal, keeping us calm. Too much dopamine, and "the system takes over," Barbas says. That's why a person with a typically functioning brain who witnesses an accident can return to a state of calm, but a person with PTSD may remain in a state of panic.

The U-turn the sensory information takes after that fender bender, and the other pathways neurons use to communicate throughout the brain, is determined in part by the brain's structure, which forms in fetal development, when the areas deep in the brain associated with emotions and cognition "hook up" with the cortex.

Understanding these connections will help researchers and doctors "look at the system in a more mechanistic way and come up with ideas for how to combat neurodegenerative disorders" like PTSD, depression, and schizophrenia, Barbas says. "A disease does not affect all neurons equally. The pattern of connections can tell us which neurons are more likely to be affected in specific diseases." The next step for Barbas and her colleagues is to study how the brain's pathways reveal the areas most vulnerable to neurodegenerative diseases, and to determine whether the pathways are responsible for their progression.

Anyone who studies neurological diseases must understand the brain's circuits to determine where to intervene. For example, many people who have epilepsy are not responsive to drugs and require surgery to remove the affected part of the brain. The surgeon must understand the pathways that will be altered by the procedure so as not to inadvertently disrupt another pathway, impairing speech or causing memory loss, for instance.

That's why it's so important for the next generation of researchers to "appreciate how the nervous system is put together and how it may fall apart," Barbas says. Many undergraduate and graduate students have never seen a brain before they arrive in her lab. "They have seen pictures, but it's not like the real thing," she says. "When they work with the brain, they come to appreciate its complexity and how much needs to be done." IS

Memory Games

How balloon volleyball can benefit older adults with dementia

BY ANDREW THURSTON

It's just about the most serene version of volleyball ever. There's no diving to the floor, no aggressive spiking or jump serving. Balloon volleyball won't become an Olympic sport anytime soon, but a group of older adults amiably batting balloons back and forth at a Boston care center might be the most heartwarming sporting matchup of the year.

Balloon volleyball is more than a fun diversion. Many of the players have dementia, and engaging in a sport—even a sedate one—could help slow their mental decline. According to the Alzheimer's Society, physical activity could benefit people at all stages of the condition, from helping to stall loss of cognitive function to boosting social interaction.

The volleyball game was organized by occupational therapy graduate student Clare M. Brabson ('16,'18), who spent a year working with Upham's Elder Service Plan, a Boston-based care program for older adults. Brabson provided a regular series of physical, cognitive, and sensory activities for people with dementia. Three days a week, she'd visit Upham's Dudley Square health center to get a group of about six participants moving their bodies, exercising their brains, and testing their sensory skills.

"I was very excited when I started; I had planned all these groups and thought, everyone's going to love it," says Brabson. "They're not used to many activities—beyond crafts—being offered, so coming in as this young student saying 'Let's go play some balloon volleyball' made them a bit hesitant at first."

As Brabson built a rapport with the participants, more began to show up to her sessions, gamely trying beach ball tennis or musical instrument bingo. Now, even when Brabson swings by to check in, she says, someone will ask, "Oh, are you doing a group today?" Whether she'd planned to or not, she'll run an informal activity.

Brabson scoured research papers and occupational therapy blogs for inspiration, studying the common challenges faced by people with dementia and developing activities to address them. One favorite was a tactile matching game, for which she glued lace, felt, cotton, and other textured items to ordinary drink coasters. Players flipped them over one by one in a quest to hunt down matching textures. "Sensory activities are very important for people with dementia, and can be good for their memory, overall stimulation, and interaction with an environment," she says.

Brabson also turned to her academic mentor, Sue Berger, a clinical associate professor of occupational therapy, for guidance. "Sue's background and many years of clinical experience working with older adults have been a great resource," says Brabson. Berger also provided tips from her own 35 years in practice.

"Although Clare had excellent on-site mentoring and I provided support, as needed, she really took the initiative to develop some activities specific to the needs of the individuals at this site," says Berger. She adds that Brabson also brought occupational therapists from Upham's Programs of All-Inclusive Care for the Elderly (PACE) to Sargent to talk with students about their complete care approach, where doctors, social workers, nutritionists, and therapists all work alongside each other.

"Sensory activities are very important for people with dementia, and can be good for their memory, overall stimulation, and interaction with an environment."
—Clare Brabson ('16,'18)

The work at Upham's was supported by an Albert Schweitzer Fellowship, a program for graduate students carrying out community service projects that target health disparities. The neighborhoods around Dudley Square, where Brabson worked, have some of the highest rates of premature deaths, low birth weights, diabetes, and poverty in Boston. Schweitzer fellows—there are just 15 annually in the organization's Boston chapter—are given a $2,000 stipend to help fund 200 hours of service work; they also submit monthly reports, attend regular meetings with other fellows, and participate in community service outings.

Brabson will complete her degree with two internships—at Torit Montessori School and then Spaulding Rehabilitation Hospital, both in Boston—but she's leaving the center with detailed guides to running her activities.

"My takeaway is that while I can't change the whole world right now," says Brabson, "I do have the power to change the world of some individuals; I did have a positive impact on the seniors at Upham's." IS

Mentored by Clinical Associate Professor Sue Berger (left), Clare Brabson ('16,'18) organized balloon volleyball and other activities to help people with dementia slow their mental decline.

MICHAEL D. SPENCER

THE DYSLEXIA PARADOX

DIFFERENCES IN HOW THE BRAIN ADAPTS TO SIGHTS AND SOUNDS COULD BE AT THE ROOT OF READING DISORDERS

BY KATE BECKER

It's there, at the start of every conversation: the moment it takes your brain to adjust to an unfamiliar voice. The hesitation only lasts for a second or two, but in that brief time, your brain is thumbing its radio dial, tuning in to the unique pitch, rhythm, accent, and vowel sounds of a new voice. Once it is dialed in, the conversation can take off.

This process is called rapid neural adaptation, and it happens constantly. New voices, sounds, sights, feelings, tastes, and smells trigger this brain response. It is so effortless that we are rarely even aware it's happening. But, according to recent work from Tyler Perrachione, an assistant professor at Sargent, and colleagues at the Massachusetts Institute of Technology and Massachusetts General Hospital, problems with neural adaptation may be at the root of dyslexia, a reading impairment that affects millions of Americans, including an estimated one-in-five to one-in-twenty schoolchildren. Their experiments, published in 2016 in the journal *Neuron*, are the first to use brain imaging to compare neural adaptation in the brains of people with dyslexia and those who read normally.

In the team's first experiment, volunteers without dyslexia were asked to pair spoken words with images on a screen while the researchers used functional magnetic resonance imaging (fMRI) to track their brain activity. The subjects tried the test two ways. In one version, they listened to words spoken by a variety of different voices. In the second version, they heard the words all spoken by the same voice. As the researchers expected, the fMRI revealed an initial spike of activity in the brain's language network at the start of both tests. But during the first test, the brain continued revving with each new word and voice. When the voice stayed the same in the second test, the brain did not have to work as hard. It had adapted.

But when subjects with dyslexia took the same tests, their brain activity never eased off. Like a radio that can't hold a frequency, the brain did not adapt to the consistent voice and had to process it fresh every time, as if it were new. The difference was even clearer in dyslexic children between ages six and nine, who were just learning to read; in a similar experiment, their brains didn't adapt at all to repeated words.

Perrachione and his colleagues wondered if the adaptation glitch was unique to spoken words, or if people with dyslexia would have trouble adapting to other kinds of stimuli, too. So they tried a second set of experiments, in which they showed subjects a repeating series of words, pictures, or faces, again using fMRI to look for the decline in brain activity that signals neural adaptation. Again, they found that the brains of people with dyslexia did not adapt, or did not adapt as well, as those without. "We found the signature everywhere we looked," says Perrachione.

The results suggest that dyslexic brains have to work harder than "typical" brains to process incoming sights and sounds, requiring additional mental overhead for even the simplest tasks. "What was surprising for me was the magnitude of the difference. These are not subtle differences," says Perrachione. This finding dovetails with his other work on the dyslexic brain, which has found that individuals with dyslexia also struggle with phonological working memory, the ability to hold speech sounds in mind. The extra brainwork might not be noticeable most of the time, but it seems to have a singularly prominent impact on reading. The results could solve a paradox that has stumped dyslexia researchers for decades.

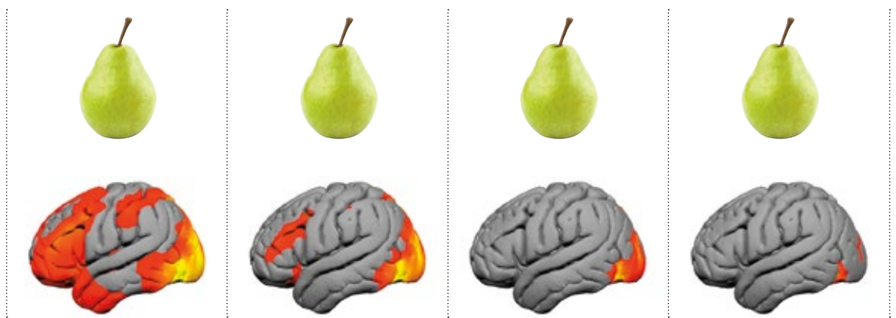
"People with dyslexia have a specific problem with reading, yet there is no 'reading part' of our brain," says MIT neuroscientist John Gabrieli, co-author on the *Neuron* article. Injuries to specific parts of the brain can cause people to lose particular skills, like the ability to speak, that sit in those brain regions. But because the brain doesn't have a discrete reading center, it's hard to understand how a disorder could handicap reading and only reading.

This new work partially solves the paradox because rapid neural adaptation is a "low-level" function of the brain, which acts as a building block for "higher-level," abstract functions. Yet that opens up another mystery, says Gabrieli. "Why are there other domains that are so well done by people with reading difficulty?"

The answer has to do with the way we learn to read, the researchers think. "There's almost nothing we learn that's as complicated as reading," says Gabrieli. That's because learning to read is mentally cumbersome. The human brain did not evolve to read—literacy has been commonplace only in the last two centuries—so the brain must repurpose regions that evolved for very different ends. And the evolutionary newness of reading may leave the brain without a backup plan. "Reading is so demanding that there's not a successful alternative pathway that works as well," says Gabrieli. It's like using a stapler to pound a nail—the stapler can get the job done, but it takes a lot of extra effort.

The fMRI results show which parts of the brain are straining but don't tell researchers exactly why people with dyslexia have a different adaptation response. Perrachione and his colleagues hope to examine how neurons and neurotransmitters change during adaptation. "Finding a basic thing that's true in the whole brain gives us a better opportunity to start looking for connections between biological models and psychological models," says Perrachione. Those connections may one day lead to better ways to identify and treat people with dyslexia. IS

Perrachione and colleagues' research was supported by the Lawrence Ellison Foundation, the National Institutes of Health, and the National Science Foundation.



Upon first hearing a voice or viewing an image—like this pear—the brain experiences a spike of activity as represented in the initial and most colorful fMRI image. Then, rapid neural adaptation helps the brain process the pear more efficiently, so it does not have to work as hard upon repeated viewings. Problems with the adaptation process may contribute to dyslexia.

TYLER PERRACHIONE

TYLER PERRACHIONE'S EXPERIMENTS ARE THE FIRST TO USE BRAIN IMAGING TO COMPARE NEURAL ADAPTATION IN THE BRAINS OF PEOPLE WITH AND WITHOUT DYSLEXIA.

CYDNEY SCOTT

MAGIC WORDS

WHEN A CHILD CAN'T TELL YOU WHAT THEY UNDERSTAND, HOW DO YOU HELP THEM LEARN?

BY JULIE BUTTERS

Sudha Arunachalam was flying to Berlin for a conference in 2014 when the woman across the aisle began entertaining her two young children. "I spy, with my little eye, something..." she'd begin. Then she'd add a clue about the object she'd picked—a color or other adjective—and the children would look around and start guessing. Arunachalam, an assistant professor of speech, language & hearing sciences, might have forgotten the scene had she not been puzzling over the best way to determine how children process what their parents say. She decided to use a game-like format for her study; the subsequent findings have big implications for speech-language clinicians.

Arunachalam discovered that parents seem to have an innate sense for constructing sentences to help their children understand and learn language. The study revealed subtle speech nuances—such as where to place an adjective in a phrase—that help children learn but hadn't been previously measured.

Arunachalam, who is also the director of BU's Child Language Lab, believes her study is the first to measure children's comprehension while their parents speak, to see what parents are doing naturally (without researchers' input) to make language easier for their children to understand.

In the study, a parent and their typically developing child, aged roughly three to five, looked at images of six objects, three per row, on a computer screen. The researcher privately communicated to the parent which object to help the child find, as quickly as possible. The parent then instructed the child however he or she chose—for example, "Find the striped umbrella" to help the child distinguish that umbrella from one with dots. Eye-tracking technology revealed how quickly the child located the object.

DAVE GREEN

"WE THINK THIS [RESEARCH] IS REALLY USEFUL, LONG-TERM, FOR SUPPORTING CHILDREN WHO ARE STRUGGLING WITH LANGUAGE, SUCH AS CHILDREN WITH AUTISM SPECTRUM DISORDER WHO DON'T NECESSARILY GIVE THEIR PARENTS GREAT FEEDBACK ABOUT WHAT THEIR LANGUAGE LEVEL IS AND HOW MUCH THEY UNDERSTAND."
—SUDHA ARUNACHALAM

CHITOSE SUZUKI

Arunachalam was surprised that parents instinctively constructed sentences to help their children understand their meaning. When helping a child locate the striped umbrella in a slide that also contained the dotted one, parents usually placed the relevant adjective after the noun ("umbrella with stripes") instead of before it ("striped umbrella"). This happened nearly 80 percent of the time, compared to about half the time when viewing a slide with just one umbrella. When children heard "umbrella with stripes," they looked at the correct umbrella significantly faster than when they heard "striped umbrella," says Arunachalam, whose findings were published in the *Journal of Memory and Language* in 2016.

This parental instinct seemed almost magical to Arunachalam. She theorizes that parents unconsciously recognize that young children will more easily understand "umbrella" than "striped," or that they will understand a noun better than an adjective, and put the simplest word first. "We think this is really useful, long-term, for supporting children who are struggling with language, such as children with autism spectrum disorder (ASD) who don't necessarily give their parents great feedback about what their language level is and how much they understand," she says.

Parents also seem to know how to adapt to their child's needs, according to a related Sargent study by postdoctoral student Angela Xiaoxue He, which is funded through Arunachalam's $150,000 Charles H. Hood Foundation Child Health Research Award. Preliminary data from this study of children ages three and a half to seven who have ASD suggest their parents "tailor their language to the child's language level rather than the child's chronological age," says Arunachalam, whose study with typically developing toddlers was also funded by a grant from the National Institutes of Health.

These studies may give parents and clinicians more detailed information about how to help children understand and learn language, says Arunachalam. This is especially important for people working with children at risk for language disorders—or who have autism spectrum disorder. Children with ASD, says He, face "a major challenge" with social-communicative behaviors like joint attention—paying attention to something at the same time as someone else—that are helpful for learning language. When the research is concluded and the findings are confirmed, clinicians may be able to give parents advice, such as "talk slower, break up complex ideas into multiple short sentences, repeat the same word," says Arunachalam.

The next stage of Arunachalam's research will focus on children who have ASD. She says she's seen parents of typically developing children and parents of children with ASD go to great lengths to describe the umbrella when their child doesn't appear to acknowledge it—yet the eye tracker shows the child is looking right at it.

Some parents find it difficult to tell if their child is having trouble learning or just being a kid. "When you say to a two-year-old, 'Go put your shoes on,' and they do nothing, is it because they don't know what shoes are, or they don't feel like it, or they're distracted by something else?" says Arunachalam. She hopes her work will reveal that all children "understand a lot more than they often show." IS

TEACHING LATE TALKERS

Understanding how children learn the meaning of words—especially verbs—is critical to helping those who struggle with language. "Verbs are particularly important for language development," says Sabrina Horvath, a speech, language & hearing sciences doctoral student, "because they bootstrap children into more advanced language." Horvath ('19) is studying late talkers, whom she describes as otherwise typically developing two-year-olds "who have small vocabularies and maybe aren't combining words" at a level appropriate for their age. She hopes her study, which uses videos of objects in motion to test late talkers' grasp of verbs, will reveal what verbal cues to use when introducing new words, and will help diagnose children with language impairments at an earlier age.

"This particular population is so important, because one-quarter of late talkers will have a formal diagnosis of a language disorder by the age of five," Horvath says. Even those who don't develop a language disorder have poorer academic outcomes than their peers or demonstrate atypical neural activation during language tasks, she says, and they're "at greater risk for socioemotional disorders in adulthood."

Horvath's research is funded by the $2,000 American Speech-Language-Hearing Foundation Student Research Grant in Early Childhood Language Development—which is supported by the Noel and Arlene Matkin Memorial Fund—and by Sudha Arunachalam's $25,000 American Speech-Language-Hearing Foundation New Century Scholars Research Grant.

BEYOND THE IVY WALLS

HELPING YOUNG ADULTS WITH NEUROLOGICAL CHALLENGES TURN LIFE GOALS INTO LIFE CHANGES

BY STEPHANIE ROTONDO

ANASTASIA ALEKSIEIEVA

By the time she graduated from Ivy Street School, Mary* had conquered social anxiety so severe she couldn't leave her house. The school, in Brookline, Mass., helps teens and young adults like Mary who have autism, brain injuries, and behavioral health issues develop the skills they need to successfully transition to adult life. But at age 22, with no concrete steps for what to do next and a well-meaning family whose concern made it hard for her to pursue independence, Mary soon became depressed and her anxiety returned.

Ivy Street occupational therapist and transition coordinator Brooke Howard ('05) had seen this happen before. As students make gains at school, many struggle with their burgeoning autonomy at home. Howard asked herself, "How can we help the whole family move forward in a way that honors the goals and dreams" of the young person? In May 2016, she launched a solution: Skills for Life, a client-centered, community-based occupational therapy intervention, helps young adults aged 16 to 26 take the skills they learned at Ivy Street to the outside world.

Family dynamics can be a significant barrier to a smooth transition. Young people like Mary are "coming into adulthood in their family home," says Howard. And because of their diagnosis, they often don't go through the typical teenage rebellion. Instead, youth and parents continue "entrenched patterns," even though change could benefit them all.

"After 20 years of making breakfast for their child, parents aren't just going to stop," says Howard, clinical director of Skills for Life. Families burn out trying to meet their children's needs, while the young adults crave more independence.

Skills for Life pairs clients with an occupational therapist for weekly two-hour sessions to help them develop functional daily living skills. The treatment is framed around a client's goals, which can range from the everyday (clean the bathroom) to less commonplace pursuits (travel to Japan), and the therapist tailors all services to the client's functional ability. Rather than simulating a client's daily experience in a clinical setting, the therapist provides treatment in the family's home or in the community, at the moment it's needed. "We don't sit and talk about your routine," says Howard. "We do it."

After graduating with a BS in neuroscience, Howard worked with kids recovering from brain injuries at the Franciscan Children's hospital. Although impressed with their progress, Howard often wondered if the young patients would get the support they needed outside the hospital.

"We talk about having a clinical itch," says Howard's mentor, Ellen Cohn, a Sargent clinical professor of occupational therapy. "If you see something in practice that's bothering you, you're challenged to ask, 'How can I provide more effective service?'"

Now at the end of its first year, Skills for Life has served 25 clients. Howard, who earned a master's in occupational therapy, has begun to expand the program outside Ivy Street School, working to bring its services to supported group living communities in the Boston area. While she initially envisioned a short-term intervention, clients can continue with the program indefinitely. Several have already achieved their initial goals and set new ones. Mary, now 26, has once again overcome her social anxiety and is working with Skills for Life on finding a job. Her ultimate goal? "Learn to live on my own." IS

**Name changed to protect client confidentiality*

BACK TO BU

Since graduating, Brooke Howard has remained connected with Sargent, serving as an adjunct lecturer and supervising OT fieldwork students at Ivy Street School. She received the 2017 Occupational Therapy Alumni Award during the BU reception at the annual American Occupational Therapy Association conference.

In her work with Ivy Street School and the Skills for Life program, Howard employs measures developed by OT Professor and Department Chair Wendy Coster who, along with Associate Professor Gael Orsmond, received a $1.5 million Institute of Education Sciences grant to study how and when students with autism learn the skills necessary for self-management of daily responsibilities. Their goal is to better understand what high schools are doing to prepare these young people for life after graduation, which will provide evidence for future programs like Skills for Life. Learn more about Coster and Orsmond's research at **sites.bu.edu/roadahead**.

Hearing Voices

Could the brain hold the key to the most common voice disorder in children?

BY KATE BECKER

If happiness had a sound, this might be it: yelling, screaming, squealing children on the playground. Kids make a racket. For many years, doctors thought all that hollering was responsible for vocal nodules, callus-like growths on the vocal folds. One of the most common voice disorders in children, vocal nodules cause persistent hoarseness that can make speaking difficult and exhausting, and undermine kids' confidence.

To prevent nodules from forming, doctors often advise their young patients to talk less—a counterproductive prescription, as children need practice when developing language and speech skills. Researchers like Liz Heller Murray ('18), a doctoral candidate studying pediatric voice disorders at Sargent, are rethinking the cause of these nodules. Heller Murray believes the problem may originate in the brain, not the voice.

The vocal folds (popularly known as vocal cords) are the soft tissue on top of the windpipe. They snap shut to keep food from traveling down the "wrong pipe," and when they vibrate, they make the sounds we use for speech. When the folds slam together too hard, too frequently, or with too much effort, hard white nodules can build up where they meet.

Researchers study vocal nodules by taking videos of them with a nasal endoscope, a narrow scope threaded through the nostril to the top of the throat. This technique can reveal abnormalities in how the vocal folds move, but it doesn't explain why vocal nodules develop in the first place. Did the unusual vocal cord movement cause the nodules, or did the nodules come first?

"We don't know why kids get in these patterns," says Heller Murray. "Even at a young age, they can realize that they're not able to do everything they want with their voice. They're not all going to be actors and singers, but you want them to be able to give a book report without getting hoarse."

In summer 2017, with support from a three-year National Institutes of Health predoctoral research grant, Heller Murray initiated a series of experiments designed to zero in on the cause of vocal nodules and ultimately help prevent them from forming. She thinks the fault might be a break or kink in the neural feedback loop that allows us to adjust the pitch and quality of our voice based on what we hear.

She is testing that idea in participants between the ages of 7 and 11, half of whom have vocal nodules and half of whom don't. While each participant says a steady "ah" and listens to the sound of his or her voice through headphones, Heller Murray secretly nudges the pitch of the playback about half a note higher or lower. If the brain's feedback system is working correctly, the participant should adjust his or her pitch to try to return to the target note. If there is a flaw in the brain's feedback system, though, the child may not adjust their pitch, or may over- or under-correct.

The experiment is the first of its kind in children. "It's very innovative. No one has looked at children with voice disorders in this way," says Heller Murray's mentor, Assistant Professor Cara Stepp, who directs the STEPP LAB for Sensorimotor Rehabilitation Engineering at Sargent and has done similar work with adults.

> "[Children are] not all going to be actors and singers, but you want them to be able to give a book report without getting hoarse."
> —Liz Heller Murray

To figure out how to adapt the experiments for kids, Heller Murray drew on years of experience working with young people, including a job as a speech-language pathologist at Boston Children's Hospital. "Clinically, it's a population that I love," says Heller Murray. "It's always different. You're always thinking and adapting your skills."

While the immediate goal is to help kids maintain healthy voices, Heller Murray also hopes her work can serve as a foundation for a new science of vocal development, analogous to the well-studied field of speech development in young children. "The interaction between development and voice is fascinating," says Heller Murray. "There's just so much to be learned about this developing vocal system." IS

KELLY DAVIDSON

With the support of her mentor Cara Stepp (seated), Liz Heller Murray is zeroing in on the cause of vocal nodules in children.

MOVE OVER, IRON MAN

A SOFT, WEARABLE ROBOT COULD HELP PEOPLE WALK FARTHER AND FASTER AFTER A STROKE

BY ANDREW THURSTON

ROLEX/FRED MERZ

WebExtra
Watch the exosuit in action at **go.bu.edu/sargent/inside-sargent**.

Powered by a chunky robotic suit, Iron Man can leap from buildings and soar into space. The superhero's gold and titanium getup might look great when taking down villains, but it'd be overkill for spending a morning with the grandkids. For people who are recovering from a stroke and want to get back to enjoying their favorite activities, there's something better: a soft, lightweight, bionic walking aid that straps to the leg and can be worn anywhere.

Sargent physical therapy professors Lou Awad and Terry Ellis are part of the team behind the medical exosuit, a wearable robot that can help people who have had a stroke walk faster, farther, and more safely. Instead of Iron Man's titanium, it has breathable wraps made from proprietary materials, thin cables, and a series of small motors that help it mimic human muscles and tendons.

The technology has already been licensed and a suit could be commercially available for use in clinics within the next few years. That would be life changing for thousands. Every year, 795,000 Americans have a stroke, which stops blood flow to parts of the brain and can leave survivors with chronic weakness or paralysis, turning walking into a frustrating—even dangerous—chore. For 15 to 35 percent of survivors, learning to walk independently can take more than six months. Many of those who do learn to walk again will not regain their former speed or stability; according to *Stroke Connection* magazine, about 40 percent of all survivors have a serious fall within a year of their stroke.

EQUALING NATURE

For a robot, the exosuit is understated, more high-tech sports brace than sci-fi cyborg; it weighs only about 10 pounds. A matchbox-sized sensor attaches to the outside collar of the shoe close to the ankle, while two black wraps cover most of the lower leg and the waist. Cables, similar to those used to control bicycle brakes, run from inside the wearer's shoe to their calf and from the shoe's tongue to their shin. Motors—worn around the waist and regulated by a computer unit loaded with algorithms—apply forces through the cables to help the wearer walk.

"People who have had a stroke have trouble with dorsiflexion, or foot clearance," says Ellis; they have a reduced ability to bend their ankle and lift their foot. When they try to plant their heel on the ground to walk, they instead "drag their toes and their foot gets caught." The exosuit counteracts that issue by retracting the cable attached to the shoe's tongue, applying a small amount of force to bring the toes up. When the wearer needs to take a step forward, the rear cable contracts to ensure their foot pushes off the ground, a movement called plantar flexion.

The exosuit traces its roots to a soft robot designed for the military by a team at the Harvard Biodesign Lab at the Wyss Institute for Biologically Inspired Engineering at Harvard University. That suit, developed in collaboration with Sargent's Kenneth Holt, an associate professor emeritus of physical therapy & athletic training, is intended to help soldiers and emergency personnel carry heavy loads with minimum effort. With a similar cable, wrap, and motor combination, it works in harmony with the body to help reduce the strain associated with lugging hefty packs. By applying assistive forces to the ankle and hip, the suit—which is still in development—

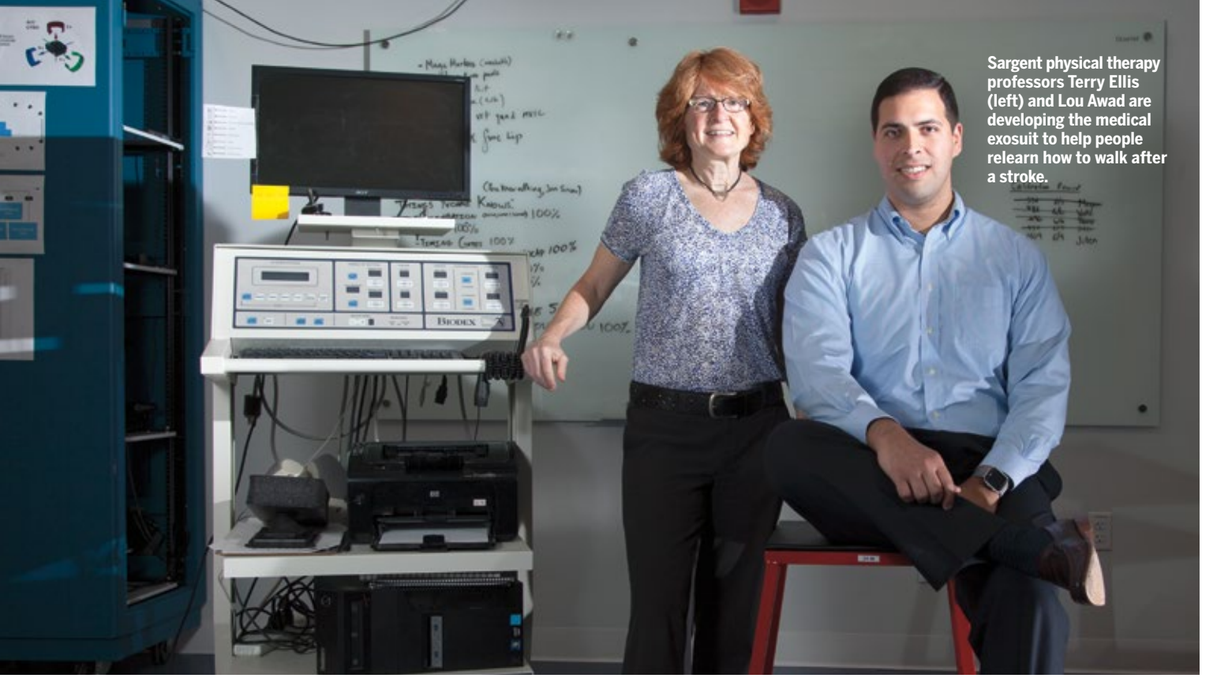
> "THE GOAL WITH THE MILITARY SUIT IS TO BEAT NATURE, BREAK THAT BARRIER THAT NATURE PROVIDED. WITH THE MEDICAL EXOSUIT, THE GOAL IS TO BRING PEOPLE BACK TO WHERE THEY WERE."—LOU AWAD

reduces the amount of energy needed to carry a load equivalent to 30 percent of a wearer's body weight by around 7 percent, according to a study published in the May 2016 *Journal of NeuroEngineering and Rehabilitation.*

To adapt the suit to a medical purpose, Wyss and Holt—a biomechanist who worked with engineers to inform the suit's therapeutic applications—invited Ellis and Awad to join their team of engineers, computer scientists, and business developers. They needed "researchers who are embedded in the clinical world and work with patients," says Ellis, director of the BU Center for Neurorehabilitation. The first major challenge was a practical one. The military suit was designed for "fit individuals who can handle the high amount of force" the exosuit applies to the body, says Awad.

For the suit to work, the wearer needs to be able to bear the typical forces our muscles, tendons, and bones absorb every day, as well as those the exosuit adds. That's less of an issue for an athletic solider than it is for a person who has suffered a stroke.

When developing the medical version, the team began by exploring less rigid textiles than those used for the military suit. "The first prototypes used seat belt webbing," says Awad, director of the BU Neuromotor Recovery Laboratory; in contrast, the



Sargent physical therapy professors Terry Ellis (left) and Lou Awad are developing the medical exosuit to help people relearn how to walk after a stroke.

DANA SMITH

medical suit is made of "composite materials that create a secure, breathable, and form-fitting interface with the wearer's leg." They made other changes, too. Although the original is worn on both legs versus the medical suit's one leg, it only assists with the pushing off—the military doesn't have to worry about soldiers dragging their toes. "The goal with the military suit is to beat nature, break that barrier that nature provided," says Awad. "With the medical exosuit, the goal is to bring people back to where they were."

Both versions of the suit have sensors that tell the computer control unit—Awad calls it the brain—where a person is in their stride, so it can deliver the right amount of force for each individual. The brain is adaptive, says Awad, "so if a person suddenly starts walking faster or changes their cadence, it recognizes that and responds accordingly." It should eventually allow wearers to navigate uneven terrain, although testing has so far been limited to the lab.

Awad says the suit's on-the-fly thinking is one of the features that sets it apart from others in development—and one of the Sargent team's major contributions. Like the less rigid fabrics, the algorithms plugged into the medical exosuit's control unit also help ensure it doesn't put too much pressure on the wearer's body.

"It's a product of a deep understanding of how people move and how movement goes awry after something like a stroke," he says. "That came from our discussions with the biomechanics team, the engineers, teaching them how people with a stroke move; they didn't have that experience."

"OMG! OMG! OMG!"

The medical exosuit is light years ahead of the current alternative for rehabilitation after a stroke: the ankle foot orthosis, an ungainly contraption of molded plastic that's been in use since the early 1980s. The stiff boot runs down the calf and under the heel, holding the leg and foot at a 90-degree angle. By keeping the ankle locked, the orthosis prevents the wearer from stubbing their toes and tripping, "but because you have a rigid 90-degree angle, you can't push off, so you sort of lift the leg and lose some of the key features of a normal gait," says Ellis. The boot allows people to gain a degree of independence, but it doesn't get them back to the activities they love. And, Awad adds, it may bring its own complications. "If you had a stroke at a young age," he says, "the muscles that may not have been directly impacted by the stroke are going to suffer."

In testing, some participants wearing the medical exosuit have been able to nearly regain their pre-stroke walking speeds. In one exosuit testing session, the user began outpacing the physical therapist monitoring his progress. In another, Awad watched as a participant began shouting, "OMG! OMG! OMG!" in happiness. "She told me, 'I was thinking about my grocery list; I'm never able to think about anything except walking, the next step in front of me, otherwise I'm going to fall.'"

In a series of presentations and journal articles, the researchers have quantified the suit's impact. They found participants pushed off from the ground more effectively and used less energy, and that they walked faster over longer distances. The research, which began with military funding through the DARPA Warrior Web Project and has also been supported by the National Science Foundation, Wyss Institute, Harvard Paulson School, and American Heart Association, was published in the July 26, 2017, issue of *Science Translational Medicine*. The principal investigator is Conor Walsh, an associate professor of engineering and applied sciences at Harvard and a core faculty member at the Wyss Institute.

Ellis notes that the suit doesn't replace physical therapists in stroke rehabilitation. Instead, it could be used to help people relearn walking in the immediate aftermath of a stroke and allow them to practice walking at home after being discharged.

ROLEX/FRED MERZ

A SENSOR TELLS THE COMPUTER CONTROL UNIT WHERE A PERSON IS IN THEIR STRIDE SO IT CAN DELIVER THE RIGHT AMOUNT OF FORCE FOR EACH INDIVIDUAL.

"In this country, once you've had a stroke, after about three months, you're done with all the rehab," she says. "It's a real drawback because there are a lot of studies that show that rehab in the chronic phases is very effective and can enhance function. A therapist could prescribe the exosuit with parameters helpful for each individual."

PERFECTING THE SCIENCE

The team is pursuing funding to investigate how best to use the exosuit beyond the lab and recently won a National Institutes of Health grant, awarded through the National Institute of Child Health and Human Development, to continue developing the technology. They plan to explore other applications, like customizing the suit to help people with Parkinson's disease, multiple sclerosis, or cerebral palsy. For now, though, the primary goal is getting the suit ready for people who have had a stroke. The medical exosuit currently only augments the ankle, but a new project with Harvard will focus on a system that integrates support for the knee and hip.

In a separate project, funded by a BU Clinical & Translational Science Institute pilot grant, Awad is studying ways to improve how wearable devices like exosuits sense and assist impaired movement. He says the current sensors are good at tracking data like joint angle and joint speed—how fast the leg is moving—but not as successful at determining the activity associated with that movement: is the user walking or marching in place, are they turning or walking in a straight line? With Roberto Tron, an assistant professor at BU College of Engineering, he's exploring systems that could compute both.

According to ReWalk Robotics, the company that has licensed the technology, the current version of the medical exosuit could—pending FDA approval—be ready to ship as soon as 2018. It won't help anyone swoop into the stratosphere like Iron Man, but it could give plenty of grandparents the chance to play superheroes again. IS

STRONGER TOGETHER

PROFESSOR SUPPORTS BREAST CANCER SURVIVORS THROUGH GROUP INTERVENTION

BY STEPHANIE ROTONDO

Desiree Jones-Eaves took the elevator to the radiation oncology department in the basement of Boston Medical Center (BMC) and changed into a hospital gown to await her chemotherapy treatment. After the session, she put on her wig, penciled in her eyebrows, and rushed back to the ninth floor to tend to her patients. "People would tell me, 'You're doing such a good job'" [balancing the demands of a challenging career with the stress of chemotherapy], says Jones-Eaves (CGS'82, SON'85), a nurse at BMC, "but they had no idea."

Throughout 6 weeks of 33 treatments, Jones-Eaves struggled with fatigue, memory loss, and the multitasking demands of her job. Those cognitive difficulties didn't go away when her treatment ended. After months of doctor's appointments, chemotherapy, and constant stress, cancer survivors like Jones-Eaves often face continuing challenges that make it hard to get back to their daily lives.

A new program to support breast cancer survivors after treatment can help. Robin Newman, a Sargent clinical assistant professor of occupational therapy, developed the six-week intervention. Hosted at BMC, the program is designed for women who have been in remission for 6 to 24 months and who are experiencing cancer-associated cognitive impairment, such as memory loss or trouble focusing.

"Breast cancer patients have needs, not just during diagnosis and treatment, but beyond," says Naomi Ko, an oncology physician at BMC and a BU School of Medicine assistant professor. Ko describes Newman's program as a "great way to take care of all aspects of the person; not just their disease, but their lives."

The first week includes a private appointment with Newman at which the women discuss challenges and goals, followed by four weeks of group sessions and a final one-on-one evaluation to review outcomes.

The weekly sessions focus on the participants' goals for self-care, work, and leisure and are moderated by Newman, who is an occupational therapist and a certified lymphedema therapist. The women help each other generate strategies to feel more in control of difficult situations. Jones-Eaves addressed her memory loss by developing a system for taking notes, for example, and centered herself by taking brief rest breaks. The group became a safe space for the women to share the difficulties they faced from week to week, from the serious (workplace meltdowns) to the mundane (piles of laundry).

The program also helped the women feel less alone as they came to understand their challenges as part of the recovery process, instead of as a personal failing. When Jones-Eaves shared her concerns about her low energy level with the other three women in her group, "I realized I wasn't just being lazy," she says.

> **"IT'S OUR RESPONSIBILITY TO LISTEN DEEPLY TO WHAT THE PATIENT'S DAILY LIFE CHALLENGES ARE AND PROVIDE TREATMENTS THAT MEET THOSE NEEDS."**
> —ROBIN NEWMAN

Susie, another group member, is a self-described morning person who used to finish her errands and housework by noon on Saturday. After her diagnosis, however, she couldn't maintain that pace, and the group has helped her learn acceptance. "Your priorities change," she says.

The women in Newman's group had not previously worked with an occupational therapist as part of their breast cancer recovery, and they considered the experience eye-opening. "I wish everyone could have a session to discuss what to expect" after treatment, Jones-Eaves says. "It gave us tools to continue to work on what we needed."

Dima Thabit ('16,'18), who lost her grandmother to breast cancer, volunteered with two cohorts of women while earning a master's in OT, observing group and private sessions. The work offered an experience "you can't learn in a classroom, where you can't see that dynamic unfold," says Thabit of the group intervention. "I learned the importance of understanding the population you're working with and their needs."

Robin Newman, an occupational therapist and a certified lymphedema therapist, moderates weekly group interventions for breast cancer survivors that focus on the participants' goals for self-care, work, and leisure.

MICHAEL D. SPENCER

The women also gave Newman insight into her practice. "I ask better, deeper questions when I work with people," she says. "If someone tells me they're fine, I probe a bit more. I try to instill in students that it's our responsibility to listen deeply to what the patient's life challenges are and provide treatments that meet those needs."

Newman believes OT intervention should be standard care for breast cancer survivors, and her initial research groups, though small, have shown positive results. Since 2016, three cohorts have completed the program, and the majority of the women have reported greater satisfaction with their ability to participate in work, self-care, leisure, and social activities, which they were also able to undertake with more ease. They reported better functional well-being and were less frustrated by the impact of their cognitive impairments on their daily lives. Their participation in familiar and new activities also increased.

"There's power in doing things that are meaningful to you," says Thabit. "There's a therapeutic aspect to it."

Jones-Eaves acknowledges her own attitude shift. "Now, instead of feeling bad and embarrassed," she says of her memory lapses, "I just let it go. The program taught me to sit still and not feel guilty." After spending her career taking care of others, she's learned the importance of looking after herself. IS

The program's pilot year was part of a feasibility study funded through a grant from the Boston University Clinical & Translational Science Institute. A Dudley Allen Sargent grant will fund Newman's 2017–2018 programs.

ON THE GROUND IN GHANA

INVESTIGATING WATER POLLUTION, TEACHING SAFE SEX, SUPPORTING CANCER PATIENTS—STUDY ABROAD GIVES STUDENTS PUBLIC HEALTH PRACTICE

BY AMY LASKOWSKI

In Accra, Ghana, an estimated 24 percent of people lack reliable access to drinking water. Some neighborhoods only receive government-rationed water at set times on certain days. The Centers for Disease Control and Prevention links cholera and other waterborne diseases to inadequate potable water supply; to avoid getting sick, most residents collect and drink the precious resource out of 500-ml "sachets," or plastic bags, that they purchase from distributors around the city. Since the sachets aren't regulated, Ghanaians take a chance every time they take a sip.

In summer 2017, BU students studying the prevention of malaria and diarrheal infections tested the water quality of seven companies' sachets. They placed droplets of water on petri dishes, which cultured for two days, then examined the results under a microscope. It turns out the sachets weren't a safe water source—six out of seven of the samples contained unacceptably high levels of fecal coliform bacteria, when measured against World Health Organization guidelines.

While the students didn't have the opportunity to act on their findings, scientists in Ghana are using these results to help develop a more detailed study on water sachet quality.

The experiment was part of the six-week Accra Global Health Program developed by Sargent College and England's Lancaster University. As part of the program, which began in 2016, eight BU students and eight Lancaster students traveled to Ghana to observe the inner workings of the country's health care system and to explore issues of public health. The undergrads took classes in microbiology and public health at the newly established Lancaster University Ghana, interned at health organizations, and made site visits to hospitals and nongovernmental organizations (NGOs). As Ghana's capital city, Accra houses the biggest hospital in West Africa and offers students the opportunity to meet health workers from other countries, like Nigeria and Sierra Leone.

"To be able to go to a global health lab, travel to another country, take courses in global health and microbiology? It's an invaluable experience," says Lawrence Were, a Sargent College lecturer in health sciences who teaches the program's public health component. "It embodies the principles of experiential learning by encouraging students to reflect on what they are doing as they learn. This teaches students skills they will need to address global challenges; allows them to self-direct their learning; and enables them to take initiative, make decisions, and be accountable for the results."

In the first half of the program, students took a month-long course divided into two sections: microbiology (where they performed the sachet testing) and social determinants of health, which the World Health Organization defines as the conditions in which people are born, grow, live, work, and age, and how these factors weigh into health inequities.

During the program's second half, students worked at practicum sites aligned with their interests. Paul Ashigbie (SPH'17), a School of Public Health research fellow who arranged the practicums, says their goal was for students to apply what they learned in the classroom to real-world situations. The sites included Cancer Connect Ghana, a nonprofit supporting people with cancer and their caregivers; Inclusion Ghana, an NGO that advocates for Ghanaians with physical or intellectual disabilities and special education needs; and Marie Stopes International-Ghana, which offers sexual and reproductive health services, including contraception and safe abortion services in all of Ghana's 10 regions.

NANA KOFI ACQUAH

THE PROGRAM "EMBODIES THE PRINCIPLES OF EXPERIENTIAL LEARNING BY ENCOURAGING STUDENTS TO REFLECT ON WHAT THEY ARE DOING AS THEY LEARN."
—LAWRENCE WERE

In her work with the Adventist Development and Relief Agency, an NGO that, among other efforts, works to prevent HIV/AIDS in female sex workers, Imme Kobayashi ('19) confirmed that the ages of sex workers had been correctly entered in the computer system. "The data didn't seem real," Kobayashi says. "There were girls who fell into the category of 10 to 19, younger than me. My heart just sank. It showed me how the unequal distribution of wealth in this country affects kids."

Clara Martin ('19) interned at the West Africa AIDS Foundation, where she educated local high school students on safe sex. While Ghana has made significant progress in the fight against HIV/AIDS, Greater Accra has one of the highest HIV prevalence rates in the country, with 2.4 percent of people infected with the disease, compared to 0.7 percent of the Northern Region's population, for example.

Martin says her internship gave her an on-the-ground understanding of the topics she had discussed in the public health class. "I saw social determinants of health coming into play when considering why people might not get tested, why they engage in risky behavior that could lead to HIV infection, why patients don't come to the clinic regularly, and why they stop taking their antiretroviral therapy drugs," she says. "All of these choices—and sometimes it's not a choice—are influenced by an individual's background."

Martin says the Accra Global Health Program has inspired her to continue working in public health after graduation. "In the US, we're lacking many of the health problems that the Ghanaians have," she says. "It's been eye-opening to learn about how public health works in such a different part of the world." IS

Grant Awards

BU SARGENT COLLEGE'S FACULTY RECEIVED **$15,942,117** IN RESEARCH FUNDING IN 2016–2017. HERE IS A LIST OF OUR PROJECTS AND THE AGENCIES AND FOUNDATIONS SUPPORTING THEM.

SARGENT INVESTIGATOR	TITLE OF PROJECT	AGENCY/FOUNDATION	FUNDS AWARDED 2016–2017*	YEAR OF AWARD	TOTAL AWARD
Sudha Arunachalam, assistant professor of speech, language & hearing sciences	Improving Child-Caregiver Interactions for Young Children with Autism	Charles H. Hood Foundation	$75,000	2 of 2	$150,000
	Mechanisms Underlying Word Learning in Children with ASD: Non-Social Learning and Memory Consolidation	NIH/NIDCD	$172,195	4 of 4	$688,018
	Verb Processing and Verb Acquisition in Late Talking Toddlers	American Speech-Language-Hearing Foundation	$25,000	2 of 2	$25,000
	Boston University Conference on Language Development	NIH/NICHHD	$6,000	1 of 5	$30,000
Louis Awad, associate professor of physical therapy & athletic training	Multi-Modal Evaluation of Walking Function after Stroke	Boston University Clinical & Translational Science Institute	$78,612	1 of 1	$78,612
Helen Barbas, professor of health sciences	Organization of Prefrontal Feedback Circuits	NIH/NIMH	$461,577	2 of 5	$2,631,120
	Prefrontal Anatomic Pathways in Executive Control	NIH/NINDS	$513,113	3 of 5	$2,436,777
	Thalamic Axonal Pathways and Extracellular Matrix Abnormalities in Schizophrenia	NIH/NIMH Subcontract via McLean Hospital	$50,028	2 of 2	$99,079
Virginia Best, research associate professor of speech, language & hearing sciences	Spatial Hearing in Speech Mixtures	NIH/NIDCD	$314,606	1 of 5	$1,576,980
Jason Bohland, assistant professor of health sciences	An Open, Online Course in Neuronal Data Analysis for the Practicing Neuroscientist	NIH/NIGMS	$171,411	2 of 3	$536,637
	The Transcriptional Landscape of Genes Implicated in Speech and Language Disorders	American Speech-Language-Hearing Foundation	$25,000	1 of 1	$25,000
	The Effects of Delayed Auditory Feedback on Speech Sequencing: Acoustics, Physiology, and Computational Model	NSF	$475,500	1 of 3	$475,500
Wendy J. Coster, professor and chair of occupational therapy, and Jessica Kramer, assistant professor of occupational therapy	The Pediatric Measure of Participation: A Staging and Replenishment Study	Shriners Hospital for Children	$20,920	1 of 2	$41,987
Terry Ellis, assistant professor of physical therapy & athletic training	Human Machine Interaction with Mobility Enhancing Soft Exosuits	NSF Subcontract via Harvard Wyss Institute for Biologically Inspired Engineering	$78,318	3 of 4	$328,803
	Maintaining Physical Independence in Older Adults	Partners Healthcare System, Inc.—RX Foundation Subcontract	$13,570	2.5 of 2.5	$165,310
	Women in Control: A Virtual Study of Diabetes Self-Management	NIH Subcontract via Boston Medical Center	$78,318	3 of 4	$328,803
Marianne Farkas, director of training & international services, BU Center for Psychiatric Rehabilitation, and E. Sally Rogers, executive director, BU Center for Psychiatric Rehabilitation	Bringing Recovery Supports to Scale Technical Assistance Center Strategy	SAMHSA	$43,899	1 of 4	$388,687
	Bringing Recovery Supports to Scale Technical Assistance Center Strategy	SAMHSA	$25,000	5 of 5	$708,521
	Integrated Scaling Approach	ACL	$499,984	1 of 5	$2,470,141
Daniel Fulford, assistant professor of occupational therapy	Enhancing Social Functioning in Schizophrenia through Scalable Mobile Technology	NIH/NIMH	$217,663	1 of 2	$458,867
Miguel Garcia-Cabezas, research assistant professor, health sciences	Circuits and Molecular Features of Anterior Cingulate Areas and Depression	Brain & Behavior Research Foundation	$30,000	2 of 2	$65,000
Simone Gill, associate professor of occupational therapy	Massive Weight Loss and its Effects on Postural Stability and Fall Risks	NIH/NIAMS	$98,191	3 of 3	$270,438
Frank Guenther, professor of speech, language & hearing sciences	Neural Modeling and Imaging of Speech	NIH/NIDCD	$349,563	1 of 5	$1,751,089
	Sequencing and Initiation in Speech Production	NIH/NIDCD	$349,559	2 of 5	$1,811,733
	Minimally Verbal ASD: From Basic Mechanisms to Innovative Interventions	NIH/NIDCD	$394,066	4 of 4	$1,982,833
Kenneth G. Holt, associate professor emeritus of physical therapy & athletic training	Biologically Inspired Soft Smart Exosuit for Injury Prevention and Performance Augmentation	NSF Subcontract via Harvard Wyss Institute for Biologically Inspired Engineering	$108,088	2 of 2	$175,888
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	$176,845	1 of 3	$498,560
Dorothy Hutchinson, director of services, BU Center for Psychiatric Rehabilitation	The Learning and Working During the Transition to Adulthood RRTC	NIH/NIDRR	$6,756	1 of 3	$201,024
	MA Youth Suicide Prevention Project	HHS/SAMHSA	$33,887	2 of 5	$156,233
Karen Jacobs, clinical professor of occupational therapy	Project Career: Development of a Multidisciplinary Demonstration to Support the Transition of Students with Traumatic Brain Injuries from Postsecondary Education to Employment	US Department of Education Subcontract via Kent State University	$89,424	4 of 5	$407,210
Susan Kandarian, professor of health sciences	The Molecular Basis of Muscle Wasting in Cancer Cachexia	NIH/NIAMS	$368,325	5 of 5	$1,815,430
Julie Keysor, associate professor of physical therapy & athletic training	ENACT	Department of Health and Human Services Administration for Community Living NIDILRR	$799,991	5 of 5	$3,999,923
	Osteoarthritis Action Alliance	Arthritis Foundation Subcontract via University of North Carolina	$43,786	2 of 2	$43,786
Gerald Kidd, professor of speech, language & hearing sciences	Spatial Hearing, Attention and Informational Masking in Speech Identification	Department of Defense—AFOSR	$190,000	1 of 4	$760,000
	Central Factors in Auditory Masking	NIH/NIDCD	$527,870	5 of 5	$2,689,489
	Top Down Control of Selective Amplification	NIH/NIDCD	$541,283	4 of 5	$2,750,773

SARGENT INVESTIGATOR	TITLE OF PROJECT	AGENCY/FOUNDATION	FUNDS AWARDED 2016–2017*	YEAR OF AWARD	TOTAL AWARD
Swathi Kiran, professor of speech, language & hearing sciences	Predicting Rehabilitation Outcomes in Bilingual Aphasia Using Computation Modeling	NIH/NIDCD	$614,920	2 of 5	$3,101,075
	The Neurobiology of Recovery in Aphasia: Natural History and Treatment-Induced Recovery	NIH/NIDCD Subcontract via Northwestern University	$300,815	5 of 5	$1,539,111
Swathi Kiran and Erin Meier, PhD student of speech, language & hearing sciences	Structural and Effective Connectivity of Re-organized Language Networks in Aphasia	NIH/NIDCD	$44,044	1 of 2	$88,088
Swathi Kiran and Caroline Niziolek, post doc of speech, language & hearing sciences	Neural Markers of Speech Error Detection and Correction Abilities in Aphasia	NIH/NIDCD	$100,038	1 of 2	$200,076
Jessica Kramer, assistant professor of occupational therapy	Evaluation of Project TEAM (Teens Making Environmental and Activity Modifications)—Effectiveness Social Validity and Feasibility	Department of Health and Human Services Administration for Community Living NIDILRR	$199,657	5 of 5	$597,509
	Multicenter Career Development Program for Physical and Occupational Therapy (CORRT)	NIH/NICHD Subcontract via Washington University	$135,000	3 of 3	$405,000
	An Environment Problem Solving Strategy for Parents of Youth with Disabilities	AOTF	$49,999	1 of 1	$49,999
	Kramer Commercialization Assistance Program (CAP) Proposal	NIH/Translation of Rehabilitation Engineering Advances and Technology (TREAT)	$16,196	1 of 1	$16,196
	Disability Mentoring Initiative	Office of Juvenile Justice & Delinquency Prevention	$8,983	1 of 3	$31,235
Deepak Kumar, assistant professor of physical therapy & athletic training	Feasibility of Mind Your Walk Intervention for Knee OA	Rheumatology Research Foundation	$27,569	1 of 1	$27,569
Susan Langmore, clinical professor of speech, language & hearing sciences	Non-Invasive Brain Stimulation for Swallowing Recovery After Dysphagic Stroke	NIH Subcontract via Beth Israel Deaconess Medical Center	$96,298	5 of 5	$476,591
Cara L. Lewis, associate professor of physical therapy & athletic training	Effect of Femoroacetabular Impingement (FAI) on Hip Motion in Young Adults	NIH/NIAMS	$130,680	4 of 5	$653,400
Megan McCrory, research associate professor of health sciences	Assessing Food Intake with the Automatic Ingestion Monitor	NIH/University of Alabama	$157,923	1 of 3	$458,640
Susan McGurk, professor of occupational therapy and senior researcher, BU Center for Psychiatric Rehabilitation	A Dismantling Study of Cognitive Remediation for Supported Employment	NIH/NIMH	$501,212	5 of 5	$2,771,031
	A Dismantling Study of Cognitive Remediation for Supported Employment	NIH/NIMH	$128,527	1 of 1	$128,527
Christopher Moore, dean and professor of speech, language & hearing sciences	Advanced Research Training in Communication Sciences Disorders	NIH/NIDCD	$434,578	2 of 5	$1,860,223
Kathleen Morgan, professor of health sciences	Actin and Focal Adhesion Remodeling as Therapeutic Targets in Cardiovascular Disease	NIH/NIA	$510,309	1 of 1	$510,309
	The Role of the Cytoskeleton in Vascular Aging	NIH/NIA	$204,625	2 of 2	$444,802
Kim Mueser, professor of occupational therapy	Treating Co-Occurring Substance Use and Mental Disorders Among Jail Inmates	NIH	$18,827	3 of 3	$56,481
Gael Orsmond, associate professor of occupational therapy	Engaging Siblings of Adults with Autism in Future Planning	NIH/NIMH	$246,750	1 of 3	$741,438
Gael Orsmond and Wendy J. Coster	Transition Outcomes of High Functioning Students with Autism: How and When Students Learn the Skills Necessary for Self-Management of Daily Responsibilities	Department of Education/ Institute of Education Sciences	$365,600	1 of 4	$1,578,509

SARGENT INVESTIGATOR	TITLE OF PROJECT	AGENCY/FOUNDATION	FUNDS AWARDED 2016–2017*	YEAR OF AWARD	TOTAL AWARD
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
	Dysfunction of Cortical Systems for Language and Working Memory in Autism Spectrum Disorder	Brain & Behavior Research Foundation	$70,000	2 of 2	$70,000
E. Sally Rogers and Marianne Farkas	Improved Employment Outcomes for Individuals with Psychiatric Disabilities	SAMHSA/ACL	$874,986	3 of 5	$4,374,848
Zlatka Russinova, research associate professor of occupational therapy and senior research specialist, BU Center for Psychiatric Rehabilitation	Testing Effectiveness of a Peer Led Intervention to Enhance Community Integration	NIMH	$528,673	2 of 4	$2,079,531
	Enhancing the Community Living and Participation of Individuals with Psychiatric Disabilities	ACL	$494,721	3 of 5	$2,499,724
	Recovery 4 Us Development of a Photovoice Based Social Media Program to Enhance the Community Participation and Recovery of Individuals with Psychiatric Disabilities	ACL	$199,966	3 of 3	$599,855
	Advanced Research Training Program in Employment and Vocational Rehab	ACL	$149,961	4 of 5	$749,806
Elliot Lee Saltzman, associate professor of physical therapy & athletic training	RI: Medium: Collaborative Research: Multilingual Gestural Models for Robust Language-Independent Speech Recognition	NSF	$52,627	4 of 4	$52,627
	Modeling the Behavioral Dynamics of Social Coordination and Joint Action	NIH/NIGMS Subcontract via University of Cincinnati	$24,900	5 of 5	$124,500
	Collaborative Research: Prosodic Structure: An Integrated Empirical and Modeling Investigation	NSF	$14,975	1 of 3	$45,994
Cara E. Stepp, assistant professor of speech, language & hearing sciences	Career: Enabling Enhanced Communication through Human-Machine-Interfaces	NSF	$103,463	3 of 5	$537,538
	Automation of Relative Fundamental Frequency Estimation	NIH/NIDCD	$163,700	3 of 3	$480,927
	Collaborative Research: Prosodic Control of Speech Synthesis for Assistive Communication in Severe Paralysis	NSF	$69,487	2 of 3	$217,670
	An Acoustic Estimate of Laryngeal Tension for Clinical Assessment of Voice Disorders	NIH/NIDCD	$426,246	1 of 5	$2,076,706
	Sensorimotor Mechanisms of Vocal Hyperfunction	NIH/NIDCD	$409,493	1 of 5	$409,493
Cara E. Stepp and Gabriel Cler, doctoral student	Optimization and Prediction for Fast and Robust AAC	NIH/NIDCD	$31,667	2 of 3	$117,204
Cara E. Stepp and Elizabeth Heller Murray, doctoral student	Vocal Motor Control in Children with Vocal Nodules	NIH/NIDCD	$39,536	1 of 3	$117,204
Stacey Zawacki, clinical assistant professor of health sciences and director of BU Sargent Choice Nutrition Center	Randomized Controlled Trial of a Learning Collaborative to Implement Health Promotion in Mental Health	NIH/NIMH Subcontract via Dartmouth College	$35,865	3 of 3	$98,921
Basilis Zikopoulos, assistant professor of health sciences	Organization of Excitatory and Inhibitory Prefrontal Circuits in Children with Autism	NIH/NIMH	$409,250	4 of 5	$2,018,222
TOTAL			**$15,942,117**		**$65,600,000**

* Includes no cost extensions.

Faculty in Print

OUR FACULTY'S RESEARCH REACHES AUDIENCES ACROSS THE GLOBE. HERE'S A SELECTION OF PUBLICATIONS AND ARTICLES WRITTEN BY BU SARGENT COLLEGE FACULTY DURING 2016-2017.

HEALTH SCIENCES

DeMarco, R. F., Brennan-Ing, M., Sprague, C., and **Brown, S. M.** (2017). Ageism, aging and HIV: community responses to prevention, treatment, care and support. *Interdisciplinary Topics in Gerontology and Geriatrics*, 42, 234–239.

DeBiasse, M. A., Bowen D. J., Pagoto, S. M., Massaro, J. M., Istfan, N., and Quintiliani, L. M. (2017). Pilot and feasibility test of an implementation intention intervention to improve fruit and vegetable intake among women with low socioeconomic status. *Journal of Health Disparities Research and Practice*, 10(2): 157–76.

Dunham, B. (2016). Homebirth midwifery in the United States: evolutionary origins and modern challenges. *Human Nature*, 27, 471–488.

García-Cabezas, M. Á., and **Barbas, H.** (2016). Anterior cingulate pathways may affect emotions through orbitofrontal cortex. *Cerebral Cortex*. [Epub ahead of print] PMID: 27655930.

Nicholson, C. J., Seta, F., Lee, S., and **Morgan, K. G. J.** (2017). MicroRNA-203 mimics age-related aortic smooth muscle dysfunction of cytoskeletal pathways. *Journal of Cellular and Molecular Medicine*, Jan; 21 (1), 81–95. doi: 10.1111/jcmm.12940. PMID: 27502584.

Soni, A., Fahey, N., Byatt, N., Prabhakaran, A., Moore Simas, T., Vankar, J., Phatak, A., **O'Keefe, E.**, Allison, J., and Nimbalkar, S. (2016). Association of common mental disorder symptoms with health and healthcare factors among women in rural Western India: results of a cross-sectional survey. *BMJ*, Open 6 (7) e010834; doi: 10.1136/bmjopen-2015-010834.

Quatromoni, P. A. (2017). A tale of two runners: athletes' experiences with eating disorders in college. *Journal of Academy of Nutrition and Dietetics*, 117, 21–31.

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Zikopoulos, B., Höistad, M., John, Y., and **Barbas, H.** (2017). Posterior orbitofrontal and anterior cingulate pathways to the amygdala target inhibitory and excitatory systems with opposite functions. *Journal of Neuroscience*, 37(20), 5051–5064. doi: 10.1523/JNEUROSCI.3940–16.2017. Epub 2017 Apr 14. PMID:28411274.

OCCUPATIONAL THERAPY

Lussenhop, A., Mesiti, L. A., **Cohn, E. S., Orsmond, G.**, Goss, J., Reich, C., Osipow, A., Pirri, K., and Lindgren-Streichen, A. (2016). Social participation of families with children with autism spectrum disorder in a science museum. *Museum and Social Issues*, 11, 122–137. http://dx.doi.org/10.1080/15596893.2016.1214806.

AlHeresh, R., Vaughan, M., La Valley, M., **Coster, W.**, and **Keysor, J.** (2016). Critical appraisal of the quality of literature evaluating psychometric properties of arthritis work outcome assessments: a systematic review. *Arthritis Care and Research* (Hoboken), 68(9), 1354–70. doi: 10.1002/acr.22814.

Chinman, M., McInnis, K., Eisen, S., Ellison, M., **Farkas, M.**, Armstrong, M., and Resnick, S. (2017). Establishing a research agenda for understanding the role and impact of mental health peer specialists. *Psychiatric Services*.

Fulford, D., Tuot, D. S., and Mangurian, C. (2016). Electronic psychiatric consultation in primary care in the safety net. *Psychiatric Services*, 67, 1160–1161.

Gill, S. V., Walsh, M. K., Pratt, J. A., Toosizadeh, N., Najafi, B., and Travison, T. G. (2016). Changes in spatio-temporal gait patterns during flat ground walking and obstacle crossing one year after bariatric surgery. *Surgery for Obesity and Other Related Diseases*, 12, 1080–5. doi: 10.1016/j.soard.2016.03.029.

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Ryan, C., **Kramer, J.**, and **Cohn, E. S.** (2016). Exploring the self-disclosure process in peer mentoring relationship for transition-aged youth with developmental disabilities. *Intellectual and Developmental Disabilities*, 54, 245–259. doi: 10.1352/1934-9556-54.4.245.

Khare, C., **Mueser, K. T.**, and **McGurk, S. R.** (2016). Vocational rehabilitation for individuals with schizophrenia. *Current Treatment Options*, 3(2), 99–110. doi: 10.1007/s40501-016-0082-9.

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PHYSICAL THERAPY & ATHLETIC TRAINING

Awad, L. N., Reisman, D. S., Pohlig, R. T., Binder-Macleod, S. A. (2016). Reducing the cost of transport and increasing walking distance after stroke: a randomized controlled trial on fast locomotor training combined with functional electrical stimulation. *Neurorehabilitation and Neural Repair*, 30(7), 661–670. PMID: 26621366. PMCID: PMC4885807.

Salazar, R., Ren, X., **Ellis, T.**, Toraif, N., Barthelemy, O., Neargarder, S., Cronin-Golomb, A. (in press). Dual tasking in Parkinson's disease: cognitive consequences while walking. *Neuropsychology*.

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Ardolino, E., **Hutchinson, K.**, Harkema, S. (in prep.). The mini-able: modified version of the activity-based balance level

evaluation (ABLE) scale for the spinal cord injury population.

Keysor, J. J., AlHeresh, R. A., Vaughan, M., LaValley, M., and Allaire, S. A. (2016). The work-it study for people with arthritis: study protocol and baseline sample characteristics. *WORK Journal*, 54(2), 473–480. doi:10.3233/WOR-162331.

Lewis, C. L., Laudicina, N. M., Khuu A., and Loverro K. L. (2016). The human pelvis: variation in structure and function during gait. *The Anatomical Record.*

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BU Sargent College

Who We Are

Students

	Undergraduate	Graduate
Number of full-time students	1,235	496
Average SAT*	92%	n/a
Average GRE*	n/a	66%

Faculty

Full-time	72
Part-time	38

Alumni

17,138 in 59 countries**

Clinical Sites

More than 1,200 in 43 states and 3 countries

Programs of Study

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

Special Programs

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

*Percentiles for incoming fall 2017
**numbers reflect alumni as of April 1, 2017

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

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

1 **Occupational Therapy Program** ranked number 1 out of 164 programs

12 **Speech-Language Pathology Program** ranked number 12 out of 249 programs

14 **Physical Therapy Program** ranked number 14 out of 217 programs

National Certification Board Exam Passing Rates

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

100% NUTRITION
96% OCCUPATIONAL THERAPY
99% PHYSICAL THERAPY
100% SPEECH-LANGUAGE PATHOLOGY

ABOUT US Boston University College of Health & Rehabilitation Sciences: Sargent College has been defining healthcare leadership for more than 130 years. Our learning environment fosters the values, effective communication, and clinical skills that distinguish outstanding health professionals, and we continuously improve our degree programs to meet their future needs. Our curricula includes fieldwork, providing students in every degree program with clinical experience, as well as internships at more than 1,200 healthcare facilities across the country. The college also operates outpatient centers that offer a wide range of services to greater Boston.

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