HARVARD
Otolaryngology

News from the Department of Otolaryngology at Harvard Medical School

243 Charles Street, Boston, MA 02114

HARVARD MEDICAL SCHOOL | DEPARTMENT OF Otolaryngology

Massachusetts Eye and Ear
Beth Israel Deaconess Medical Center
Boston Children's Hospital
Brigham and Women's Hospital
Massachusetts General Hospital

FALL 2017 ■ VOL. 14, NO. 2

NEWS FROM THE DEPARTMENT OF OTOLARYNGOLOGY AT **HARVARD MEDICAL SCHOOL**

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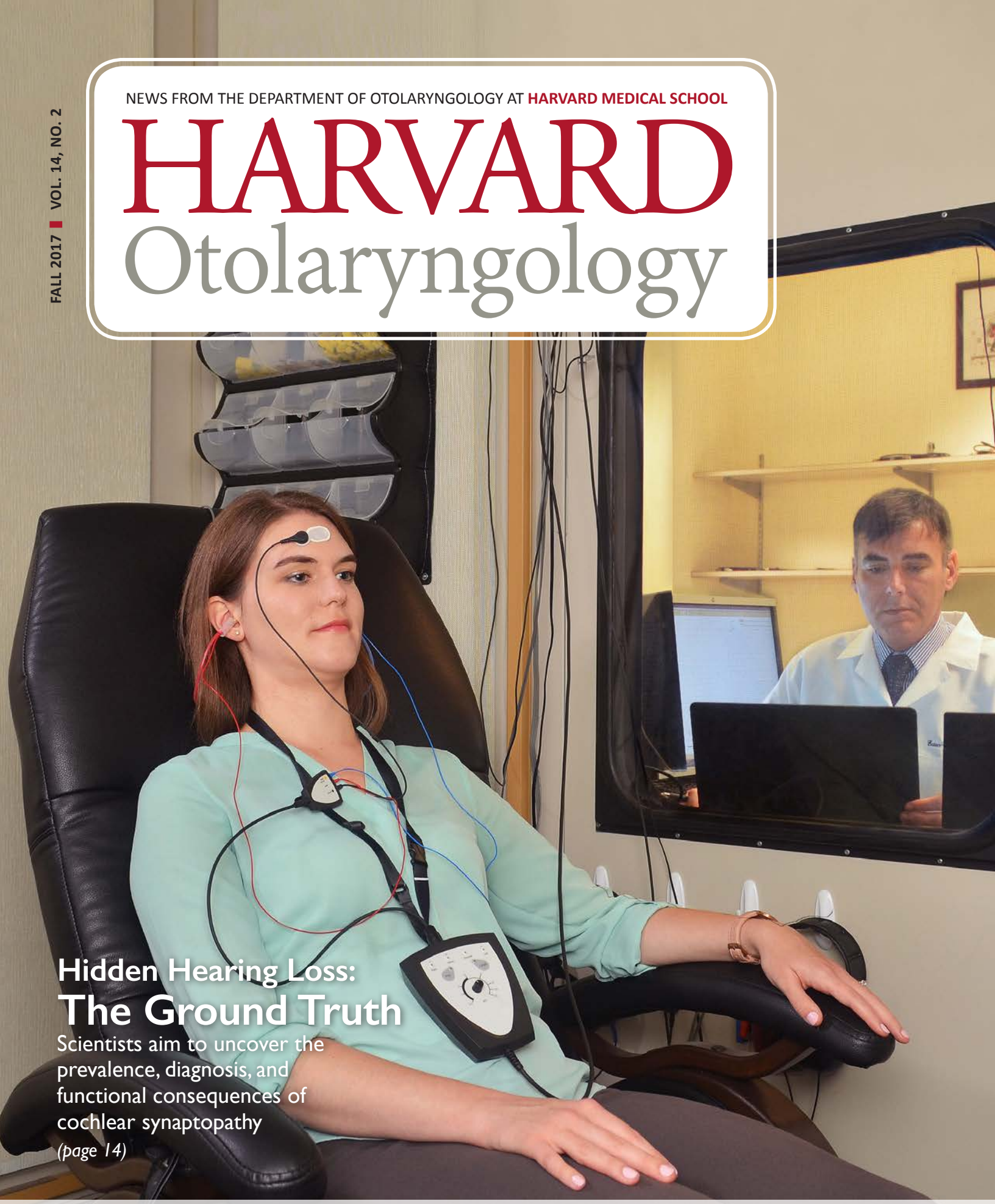

Hidden Hearing Loss: The Ground Truth

Scientists aim to uncover the prevalence, diagnosis, and functional consequences of cochlear synaptopathy

(page 14)

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On the cover: Dr. Stéphane Maison with a study participant. Cover photo by Garyfallia Pagonis.

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Dear colleagues and friends,

In 2009, researchers from the Eaton-Peabody Laboratories (EPL) at Massachusetts Eye and Ear/ Harvard Medical School uncovered a new type of inner ear damage known as cochlear synaptopathy, or hidden hearing loss. Previously, hearing loss, which is often caused by excessive exposure to noise or aging, was thought to primarily arise from damage to the sensory cells of the cochlea. However, these investigators showed that damage to the connections between the auditory nerve fibers and the sensory cells of the cochlea actually happens first and leads to complaints such as difficulty understanding speech in noisy environments.

Since this synaptic loss cannot be detected by a standard audiogram, patients who appear to have 'normal hearing' (as determined by an audiogram), but still have auditory complaints, have long eluded physicians and audiologists. Now, it is thought that this condition is affecting a large percentage of these patients.

With funding from a National Institutes of Health P50 grant, EPL investigators have set out to develop sensitive measures that can clinically test for cochlear synaptopathy. In our cover story starting on page 14, we discuss how the investigators plan to assess this condition to determine its prevalence and functional consequences. Our hope is that this work will soon help us see the full extent of age- and noise-induced damage to the inner ear.

Also in this issue, we highlight our recent work using nanoparticles to deliver small interfering RNA (siRNA) therapeutics to potentially treat hearing loss associated with vestibular schwannomas. We also discuss the importance of patient-centered care as we delve into how our faculty at Brigham and Women's Hospital are using patient-reported outcome measures to improve their practice.

We're excited to share with you more about our research advances and current progress across the field. Thank you for your interest in and support of the Department's activities.

Sincerely,

D. Bradley Welling, MD, PhD, FACS

Walter Augustus LeCompte Professor and Chair
Department of Otolaryngology
Harvard Medical School

Chief of Otolaryngology
Massachusetts Eye and Ear
Massachusetts General Hospital

Drs. Neil Bhattacharyya, Gregory Randolph, and Brad Welling.

Gregory W. Randolph, MD, FACS, FACE, Promoted to Professor of Otolaryngology at Harvard Medical School

The Department recently celebrated the promotion of Gregory W. Randolph, MD, FACS, FACE, Chief of the General Otolaryngology and Thyroid and Parathyroid Endocrine Surgery Divisions at Massachusetts Eye and Ear, to Professor of Otolaryngology at Harvard Medical School.

Dr. Randolph, who is also the Claire and John Bertucci Endowed Chair in Thyroid Surgical Oncology at Harvard Medical School, trained at both Cornell University and Harvard Medical School before formally joining the Mass. Eye and Ear faculty in 1993.

Prior to his arrival, the hospital did not have an established thyroid program. It was Dr. Randolph's interests in this area that led to the formation of the Thyroid and Parathyroid Endocrine Surgery Division in 2004. In the same year, he also recruited the first clinical fellow in thyroid and parathyroid surgery to Mass. Eye and Ear.

Since then, he has led and grown the Division to become one of the top thyroid cancer surgical care centers in the country.

For more than two decades, Dr. Randolph has dedicated much of his career to clinical research in laryngeal nerve monitoring and the development of preoperative laryngeal exam guidelines in thyroid and parathyroid surgery. He launched the thyroid intraoperative nerve monitoring program at Mass. Eye and Ear and co-founded the International Neural Monitoring Study Group, which has generated multiple publications and standards guidelines for neural monitoring during thyroid surgery. He has also published two acclaimed textbooks, *Surgery of the Thyroid and Parathyroid Glands* and *The Recurrent and Superior Laryngeal Nerves.*

As a long-standing advocate of global health, Dr. Randolph has led thyroid surgical missions to Russia, China, Kenya, rural India, and the Ukraine. He has directed surgical courses in Italy, Germany, Switzerland, and Russia and directs the Harvard Thyroid and Parathyroid Surgery Course at Mass. Eye and Ear. Recently, he co-directed the 2017 World Congress on Thyroid Cancer, which is the largest thyroid meeting in the world and brought more than 1,400 surgeons from 74 countries to Boston this past summer.

Among his many accomplishments, Dr. Randolph was the first otolaryngologist member of the American Association of Endocrine Surgeons and of the International Association of Endocrine Surgeons, as well as the first US surgeon to be board-certified in endocrine surgery in the European Union. Currently, he serves as a Past-President of the American Academy of Otolaryngology—Head and Neck Surgery and its Foundation.

"Dr. Randolph has not only led Mass. Eye and Ear to become a leader in thyroid surgical oncology, but his contributions to the worldwide community have permanently enhanced the way many patients with endocrine cancers are treated," said D. Bradley Welling, MD, PhD, FACS, the Walter Augustus LeCompte Professor and Chair of Otolaryngology at Harvard Medical School. "It is because of the dedication of physicians like Dr. Randolph that we are able to make significant advancements. We are proud to have him as part of our team." ●

Top: Mass. Eye and Ear President and CEO John Fernandez with Dr. Gregory Randolph.

Middle: Dr. Gregory Randolph with his Research Fellow, Selen Soylu (left), and Research Director, Dipti Kamani (right).

Bottom: Dr. Gregory Randolph, surrounded by family.

Massachusetts Eye and Ear

Receives Largest Philanthropic Gift in Its History

An anonymous gift exceeding $20 million will advance efforts to find cures for hearing loss and balance disorders

Massachusetts Eye and Ear recently received an anonymous gift totaling more than $20 million, which is the largest in the hospital's nearly 200-year history. With the goal of advancing discoveries in the areas of hearing and balance, this gift will provide long-term sustained research support, seed new Chairs for faculty, and enable the recruitment of additional top researchers to Mass. Eye and Ear.

"Hearing loss robs millions of people of the ability to easily communicate with loved ones, colleagues, and friends, and often results in devastating social isolation," said D. Bradley Welling, MD, PhD, FACS, the Walter Augustus LeCompte Professor and Chair of Otolaryngology at Harvard Medical School. "This historic donation to our research program comes at an exciting time, when advances are happening every day and we are closer than ever before to developing new treatments to restore hearing."

Affecting more than one-third of the world's population over the age of 65, hearing loss is a serious public health problem. While currently available therapies for hearing loss, such as hearing aids and cochlear implants, do offer relief to patients, they fall short of achieving the ultimate goal of restoring the body's natural ability to hear. As a leading hearing research and patient care enterprise, Mass. Eye and Ear is uniquely positioned to deliver on this goal.

Since 1958, Mass. Eye and Ear's Eaton-Peabody Laboratories (EPL), a multidisciplinary group of more than 25 investigators dedicated to the study of hearing and deafness, has led the field in basic and translational research aimed at uncovering the mechanisms underlying hearing and hearing loss. Now, fueled by more resources for research and training, enhanced facilities, and better equipment, EPL investigators will be primed to strengthen their many contributions to hearing science and move even closer to developing new clinical therapies for hearing loss.

"This generous gift is a transformational event for us and for the future of our research," said M. Charles Liberman, PhD, Director of the Eaton-Peabody Laboratories at Mass. Eye and

Name a $2M Chair in Otolaryngology with a gift of $1M

Mass. Eye and Ear has two opportunities to name a Chair in Otolaryngology for just $1M. Your gift or pledge will be immediately matched by a second $1M to complete and establish the Chair. The named Chair will live on in perpetuity as a legacy for you or a loved one, forever advancing the academic mission of Mass. Eye and Ear.

If you are interested, please contact **Melissa Paul**, Chief Development Officer, at 617-573-4168 or *melissa_paul@meei.harvard.edu.*

Ear and the Harold F. Schuknecht Professor of Otolaryngology at Harvard Medical School. "The creation of this sizable endowment is critical to maintaining our shared research infrastructure that supports collaborative work throughout our department."

Funds from the gift have already enabled the recruitment of two hearing researchers who specialize in auditory neuroscience. Artur A. Indzhykulian, MD, PhD, and Anne E. Takesian, PhD, who both recently finished postdoctoral fellowships, will join the EPL to investigate the hearing process. More specifically, Dr. Indzhykulian will study the molecular mechanisms by which the hair cells of the inner ear convert sound-evoked vibrations into electrical signals, while Dr. Takesian will study how the auditory brain processes sound, particularly in patients suffering from tinnitus. The EPL also plans to recruit a third scientist.

This gift also enabled Mass. Eye and Ear to seed five faculty Chairs. Three have already been committed, including the Joseph B. Nadol, Jr., MD, Chair in Otolaryngology, whose first incumbent is Michael J. McKenna, MD; the Sheldon and Dorothea Buckler Chair in Otolaryngology, whose first incumbent is Konstantina M. Stankovic, MD, PhD, FACS; and the Amelia Peabody Chair in Otolaryngology, whose first incumbent is Daniel B. Polley, PhD. The ongoing stream of funding provided by these Chairs will allow these investigators to advance their research and teaching missions in finding new treatments and cures for hearing and balance disorders.

> *"This generous gift is a transformational event for us and for the future of our research."*
>
> *— Dr. Liberman*

Given this gift's unprecedented nature, the full extent of its significance has yet to be realized. But one thing is for sure—a gift of this size has the potential to transform lives in a way that's never before been possible. ●

Tumor-Targeting Nanotechnology

Scientists establish a platform for the development and pre-clinical screening of molecular therapeutics against vestibular schwannomas

As one of the most common intracranial tumors, vestibular schwannomas (VSs) are known to arise from the balance nerves. For reasons that are not yet completely understood, these non-malignant tumors cause hearing loss and/or tinnitus in a majority of its patients.

While the mainstays of treatment, which include surgery and radiation, can be quite successful at removing these tumors or preventing them from growing, they have significant potential side effects, including worsening hearing loss. With no FDA-approved systemic medical therapy currently available, there is a need for treatments that address both the tumor and the presenting symptoms.

In order to develop treatments, the mechanisms behind VS-induced hearing loss and tinnitus must first be identified. Previously, tumor size was regarded as one of the most likely causes of auditory complaints, but this assumption failed to explain why some patients with large tumors have normal hearing and some patients with small tumors have profound hearing loss.

Recent work in the Molecular Neuro-Otology and Biotechnology Laboratory at Massachusetts Eye and Ear/Harvard Medical School suggests there might be other underlying mechanisms affecting the inner ear—ones that could be potentially targeted in a clinical setting.

"The mechanisms of hearing loss in patients with vestibular schwannomas are not totally clear," said Konstantina M. Stankovic, MD, PhD, FACS, an otologic surgeon at Mass. Eye and Ear and Associate Professor of Otolaryngology at Harvard Medical School who directs the Molecular Neuro-Otology and Biotechnology Laboratory. "It's been thought that vestibular schwannomas cause hearing loss by growing large enough to compress the auditory nerve. What we've found is that tumor secretion of molecules toxic to the inner ear can also contribute to hearing loss."

"Understanding more about these secretions and if they can be targeted could inform the development of future therapies that prevent or treat hearing loss associated with vestibular schwannomas," she continued.

Since this discovery, Dr. Stankovic and her team have been studying resected tumors from patients with good hearing and patients with poor hearing to identify and compare differences in secreted molecules. They discovered that tumors associated with poor hearing secrete higher levels of tumor necrosis factor alpha (TNFα) than tumors associated with good hearing. TNFα is a cell signaling protein involved in many cellular processes, including orchestrating the inflammatory response. When applying VS secretions high in TNFα directly to cochlear explants from mice, the investigators found substantial damage to hair cells and the organization of neurons in the cochlea. When they neutralized TNFα in tumor secretions, they detected much less damage to cochlear explants—meaning the abnormal TNFα signaling may represent a novel mechanism in VS-induced hearing loss.

"As molecular pathways, such as TNFα signaling, are discovered, methodologies to deliver interventions may also be identified," said Yin Ren, MD, PhD, a resident in otolaryngology at Mass. Eye and Ear/Harvard Medical School. "With clinical therapeutics already developed to address TNFα in other diseases, such as rheumatoid arthritis, there might be therapies available that can downregulate the ototoxic effects of this protein and help rescue hearing in patients with vestibular schwannomas."

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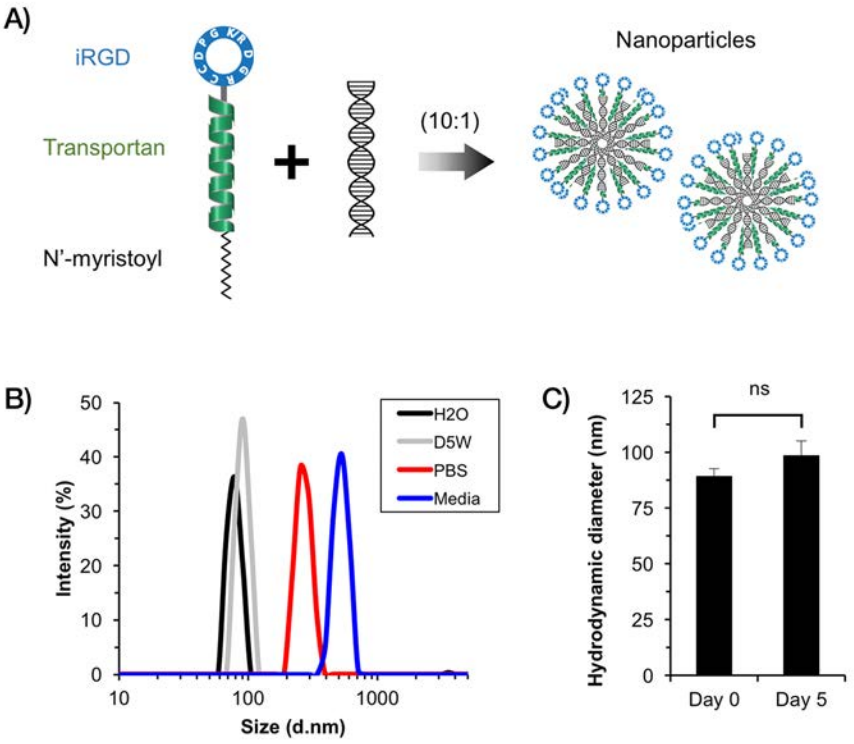
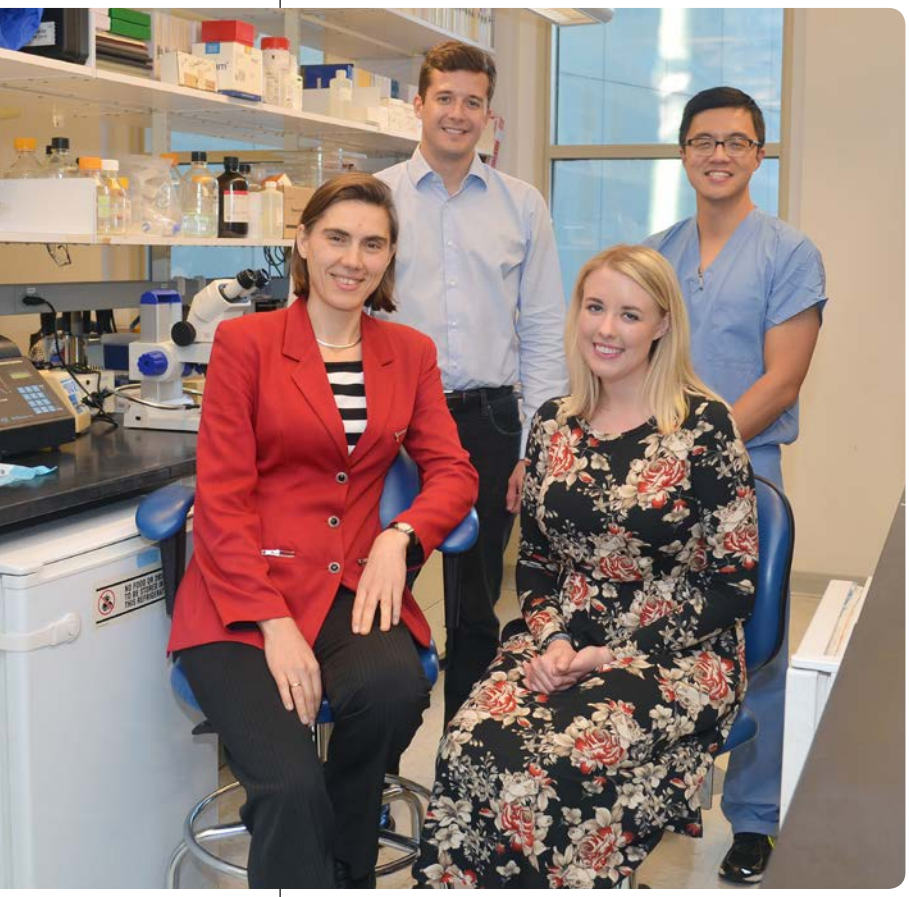
"It's been thought that vestibular schwannomas cause hearing loss by growing large enough to compress the auditory nerve. What we've found is that tumor secretion of molecules toxic to the inner ear can also contribute to hearing loss."

— Dr. Stankovic



Characterization of iRGD-targeted nanoparticles. ***A.*** *Schematic of iRGD nanoparticle formation.* ***B.*** *Dynamic light scattering (DLS) measurements of hydrodynamic diameter of nanoparticles in pure water (H2O, black), five percent dextrose in water (D5W, gray), phosphate buffered saline (PBS, red), or DMEM cell culture media (Media, blue). Representative histograms from five independent preparations are shown.* ***C.*** *The hydrodynamic diameter of nanoparticles does not change significantly after incubating for five days at room temperature.*

Ren Y, Sagers JE, Landegger LD, Bhatia SN, Stankovic KM. Tumor-penetrating delivery of siRNA against TNFα to human vestibular schwannomas. Sci Rep. 2017 Oct 10; 7(1):12922.



Researchers from the Molecular Neuro-Otology and Biotechnology Laboratory: (left to right) Dr. Konstantina Stankovic, Dr. Lukas Landegger, Jessica Sagers, and Dr. Yin Ren.

Delivering therapeutics with tumor-targeting nanoparticles

For diseases such as rheumatoid arthritis and for many cancers, short interfering RNA (siRNA) therapeutics, a class of therapeutics that can silence gene expression with high potency, specificity, and minimal side effects, are often used against TNFα. Nanoparticles, which serve as targeted delivery agents, are commonly used to deliver the siRNA molecules. Dr. Ren, who has previously worked with cancer nanotechnologies, suggested using this system to deliver therapeutics to VSs.

In a recent study, using the tissue cultures of fresh tumor cells derived from patients with sporadic VSs, Dr. Ren, alongside Dr. Stankovic and her team, demonstrated, for the first time, that RNA interference and tumor-targeting nanotechnology can be used in a synergistic fashion to potently silence gene expression and protein secretion of TNFα in VS cells.

They began with testing the tumor cells to identify what receptors were overexpressed on the surface and which could be amendable for targeting. They then developed and optimized a new formulation of siRNA-carrying nanoparticles to silence TNFα. Once the receptors were verified, they used the newly formulated nanotechnology to deliver siRNA to the VS cells and studied the downstream effects.

Finding TNFα secretion to be suppressed as a result of this drug delivery is promising for ultimate advancements in treating VS patients with sensorineural hearing loss. It is thought that this delivery system could eventually be used to mitigate hair cell and neuronal loss and/or damage locally (at the time of surgery) or systemically (through injections or with other treatments such as chemotherapy).

"The genomic landscape of vestibular schwannomas is complex and many of the molecules implicated represent targets not amenable to antibody-based or small molecule therapeutics," said Dr. Ren. "Tumor-targeted delivery of siRNA therapeutics, however, provides a direct and effective means to interrogate targets, including secreted molecules in vestibular schwannomas."

Potential for new research opportunities

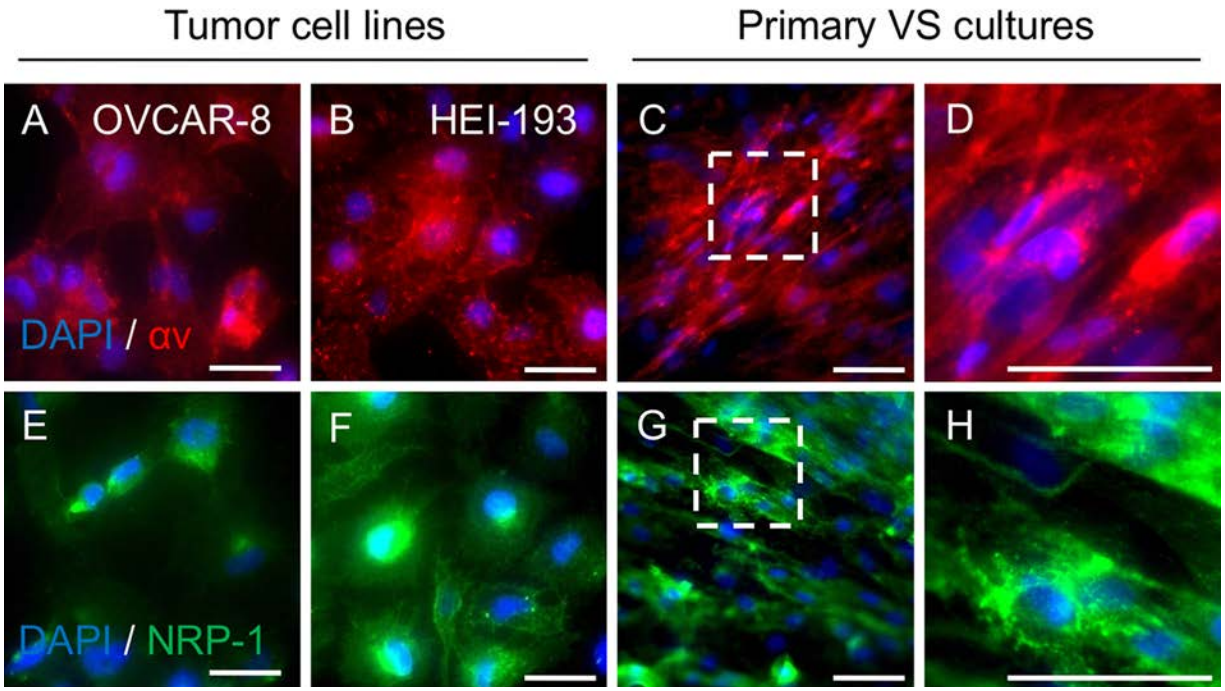
By showing that TNFα secretion can be reduced in primary, cultured VS cells, the researchers not only introduced a new approach that leverages tumor-targeting nanoparticles to deliver siRNA to VSs, but they also opened up new opportunities for research.

Through this work, the investigators have established a suitable vehicle for testing other genes and/or targets causing hearing loss in VSs. This platform can be easily adapted to validate those genes and provide a paradigm for pre-clinical screening of new therapies for VS. It might also have the potential to help with investigations of genes implicated in other forms of hearing loss.

"There are a lot of things that can be gained from applying something new to different diseases," said Dr. Ren. "If we can find out a way to address TNFα in patients with hearing loss associated with vestibular schwannomas, we might find the same techniques to be useful for uncovering molecules in other types of inner ear disease."

Looking ahead, future studies testing the efficacy and toxicity of this delivery system in animal models will be needed. Eventually, the investigators hope to establish a pipeline to bring this system from the laboratory into a clinical setting.

"Our hope is that this work will eventually provide an adjuvant therapy for vestibular schwannomas and a new tool to help us identify and validate other molecular targets to treat this tumor and the associated symptoms," said Dr. Stankovic.



Expression of surface receptors in tumor cell lines and primary human vestibular schwannoma cultures for iRGD nanoparticle targeting. Six independent experiments were performed for established cell lines, whereas three different tumors were analyzed.

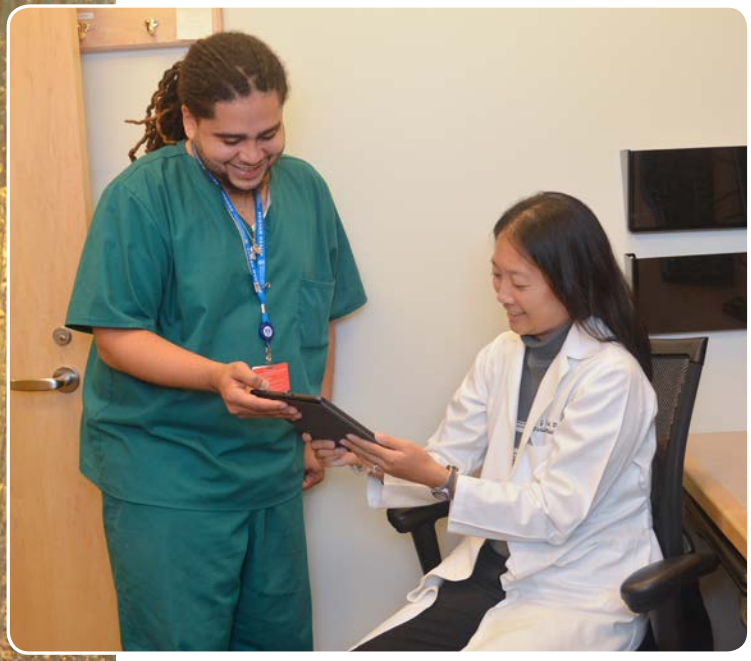
Ren Y, Sagers JE, Landegger LD, Bhatia SN, Stankovic KM. Tumor-penetrating delivery of siRNA against TNFα to human vestibular schwannomas. Sci Rep. 2017 Oct 10;7(1):12922.

A woman completing the tablet questionnaire at check-in.

The Significance of

Patient-Reported Outcome Measures

Otolaryngologists use patient-centered measurement tools to enhance the healthcare experience



Dr. Jennifer Shin and her Medical Assistant, Herberto Eric Soto, reviewing patient questionnaire scores.

Traditionally, physicians have used subjective outcome measures to determine the efficacy of a treatment. In most cases, these measures reflect the impact of an intervention on patient health; however, they don't always consider aspects of health status that are relevant to quality of life, such as symptoms and functionality.

With patient-centered care becoming a prominent topic in healthcare, many physicians are seeking ways to enhance the patient experience by considering more than they have in the past. As a result, these physicians are beginning to use tools such as patient-reported outcome measures (PROMs) to evaluate treatment efficacy directly from the patient's perspective.

PROMs are measurement instruments that document and quantify a patient's experience related to their disease-specific and/or general health. Through the use of validated questionnaires, patient perceptions of symptoms and functionality are recorded, providing a firsthand account of the patient's experience. This level of insight helps physicians to provide a more individualized experience based on how patients answer the questions.

Jennifer J. Shin, MD, SM, Associate Professor of Otolaryngology and Vice Chair of Academic Affairs (Longwood) at Harvard Medical School, and surgeon at Brigham and Women's Hospital, has been using PROMs to enhance patient interactions, which has enabled her to more completely and accurately understand how her patients feel and function.

"Using patient-reported outcome measures has been transformational for my practice," said Dr. Shin. "It not only helps provide rapid insight into how disease impacts a patient, it helps us make more informed decisions about their care. It's very helpful to have a common basis for discussion with the patients and their families, too, so it's a win-win for both physicians and patients."

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Saving time, improving the overall experience

Dr. Shin, who has always had an interest in evidence-based practice, became the first otolaryngologist in Partners HealthCare to develop a system to integrate these instruments into her routine practice, which spans the full spectrum of ear, nose, and throat care. These questionnaires measure patient quality of life, health status, functional impact, and symptom burden.

Initial questionnaires are completed on an electronic tablet before the patient sees Dr. Shin. This gives her more time to focus on understanding the patient's goals and discussing how she can help them during their visit. Since PROMs collect key information directly from the patient, the electronic platform is also used to gather intake and screening information, which saves time and reduces administrative and documentation burden on the office.

Additional questionnaires are later administered depending on treatment to measure effectiveness, patient experience, and satisfaction scores.

"Patients and families often want to be involved in decisions about their care. Using this tool is an easy and effective way to get your patients involved in a format that they can understand."

—Dr. Shin

"We see an impressive range of patients completing the tablet questionnaires," said Dr. Shin. "Patients of all ages do well with it. I even had one patient who had never used a tablet before go buy one after his appointment. What we've also noticed is that it's not just nice for our patients, but for us as well. This program is a team effort and really allows everyone to contribute in important ways."

Once a questionnaire is completed, each symptom noted produces a numerical score to assess items such as severity of disease. This information can then be used to help assess the need for surgery and probability of improving with surgery, among other things. For physicians, this can act as a decision-making point for surgery and deciding who the best surgical candidates are. After treatment, this data is also used to describe how well a procedure or therapy has worked.

"Patients and families often want to be involved in decisions about their care," said Dr. Shin. "Using this tool is an easy and effective way to get your patients involved in a format that they can understand. It also provides a platform for shared decision-making. With my patients, I see them responding favorably to our efforts to include them in decisions about their treatment."

Expanding the use of PROMs

One of the benefits of PROMs is its versatility—it can have relevance in nearly every disease. In addition, it can be used in most medical settings. Still, routine use of PROMs has traditionally been slow and difficult to implement. Dr. Shin has been working to change that.

Earlier this year, Dr. Shin was the recipient of the 2017 Maureen Hannley Research CORE Grant from the American Academy of Otolaryngology—Head and Neck Surgery Foundation. This grant historically supports patient-oriented inquiries and is now supporting Dr. Shin as she operationalizes and assesses the impact of collecting patient-reported outcomes at institutions across the country. In addition to Brigham and Women's Hospital, the University of Washington, University of Michigan, and University of Texas-Southwest are all participating sites.

"We have great colleagues at other institutions who share similar interests working with us on this project," said Dr. Shin. "We are really looking forward to what we

can discover together about the feasibility and practice impact of patient-reported outcome measures."

Impacting future practices

After five years, Dr. Shin has seen the promise these tools have for improving the patient experience. In fact, two of the physicians in Dr. Shin's department who have used the system the longest have the highest capture rates and have two of the department's highest patient satisfaction scores.

Dr. Shin is hoping to make the use of PROMs more streamlined so that it could be part of routine practice for all physicians. With the ability to better define outcomes and prove the value of an intervention, PROMs could be the answer to employing a valuable patient-centered approach that improves the patient experience and outcomes.

"With patient-reported outcome measures, we are able to carefully track exactly what patients think and how they feel, which is something we really haven't done before," said Dr. Shin. "This level of information has the potential to not only improve individual care, but it might also improve care for populations of patients, which we are hopefully on our way to seeing."

Dr. Jennifer Shin's team at Brigham and Women's Hospital. From left to right: Chanelle White, Maxine Van Doren, Dr. Anthony Prince, Katrina Meadows, Dr. Thomas Carroll, Dr. Jennifer Shin, Tanisha Turner, Michele Hart-Alford, Odlet Louis, Lindsey Gordon, Amanda Headley, Jeanny Gomez, Andrea Fetrow, Chelsea Scheeler, and Shanna Pires.

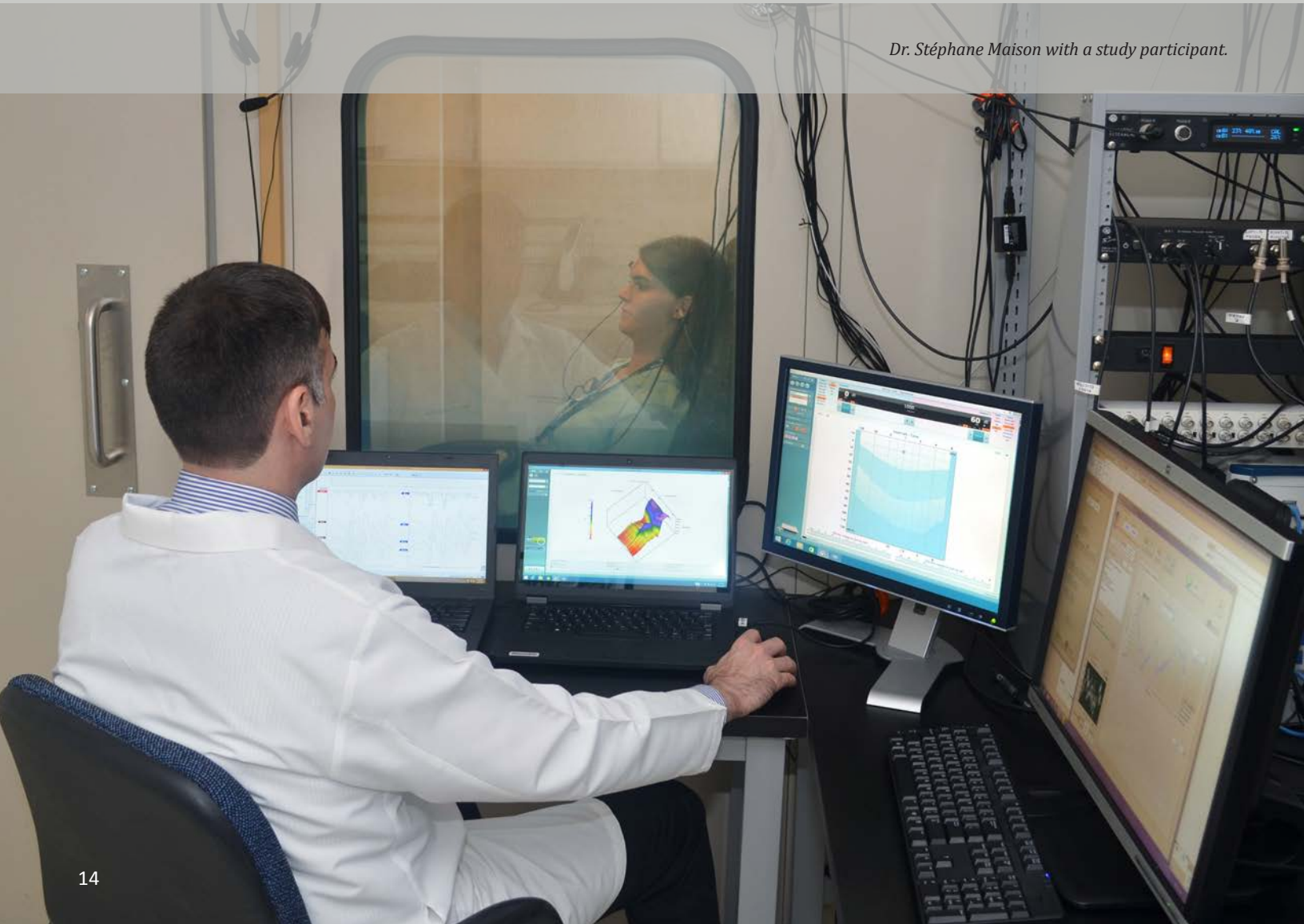
Hidden Hearing Loss: **The Ground Truth**

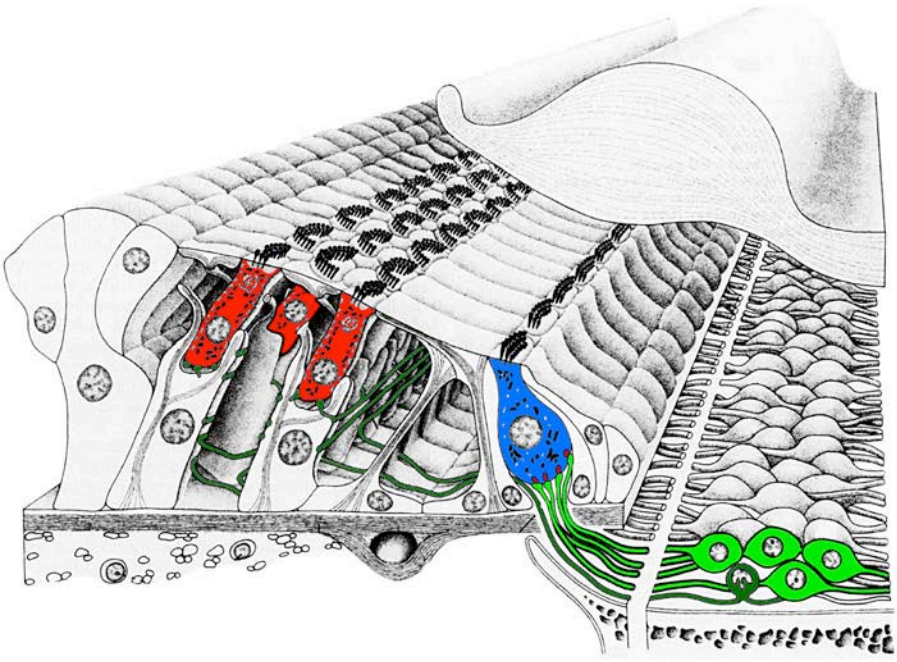
Scientists aim to uncover the prevalence, diagnosis, and functional consequences of cochlear synaptopathy

For years, clinicians and auditory neuroscientists have assumed that hair cells are the most vulnerable elements in the inner ear. Hair cell damage is typically the cause of hearing loss, as detected by the threshold audiogram (the gold standard test of hearing sensitivity); however, it's been noted that two individuals with the same audiogram results can have very different hearing handicaps—notably, the ability to understand words in a noisy environment.

It wasn't until a research team led by Sharon G. Kujawa, PhD, and M. Charles Liberman, PhD, of Massachusetts Eye and Ear/Harvard Medical School, uncovered a new type of inner ear damage that this phenomenon could be easily explained. In 2009, they found that the neural synapses responsible for communication from the ear to the brain are actually the most vulnerable structures in the inner ear. With age or noise exposure, many of these synaptic connections can disappear and decrease the fidelity of the auditory information sent to the brain.

Dr. Stéphane Maison with a study participant.





Outer hair cells: Cellular motors that amplify motions

Inner hair cells: Transduce information into electrochemical signals

Cochlear nerve fibers: Carry the signals from the IHCs to the brain

IHC synapses: Communication conduits between IHCs and ANFs

Artist's rendition of the normal structure of the inner (blue) and outer (red) hair cells in the inner ear that turn sound vibrations into electric signals in the fibers of the cochlear nerve (green).

Kiang NYS. Peripheral neural processing of auditory information. Compr Physiol 2011, Supplement 3: Handbook of Physiology, The Nervous System, Sensory Processes: 639–674. First published in print 1984. doi: 10.1002/cphy.cp010315.

"Previously, we thought that neural loss happened only after hair cell loss," said Dr. Kujawa. "What we learned, however, is that damage to neural synapses can occur without permanently affecting hair cells or audiometric thresholds. This makes it undetectable by a standard audiogram, which is one reason it was undiscovered for so long."

Known as cochlear synaptopathy, or hidden hearing loss, the degree and extent of this nerve damage in human populations has yet to be determined. It's been linked to difficulties understanding speech in noise and is thought to instigate tinnitus and hyperacusis. But in order to properly treat it, clinicians must also understand its prevalence and functional consequences.

With support from a National Institutes of Health (NIH) P50 grant, Dr. Kujawa and Dr. Liberman, along with Stéphane F. Maison, PhD, AuD, CCC-A, and Daniel B. Polley, PhD, also of Mass. Eye and Ear/Harvard Medical School, are combining their efforts to explore these mechanisms. Through four projects, the investigators will work toward the refinement of diagnostic measures in human populations, which will be essential in assessing future therapies to repair the nerve damage.

"With the help from this grant, we are aiming to uncover the full extent of this disorder," said Dr. Maison. "There's evidence supporting the idea that cochlear synaptopathy may have major implications in understanding many inner ear diseases, so it's possible that our work will influence the way many patients are treated in clinic."

Translating insights from animals to humans

Since this nerve damage cannot be directly assessed in living humans, the first two projects will measure the degree of cochlear nerve damage in animal models and human ears obtained at autopsy. Both projects will study cases of the most common causes of acquired sensorineural hearing loss (SNHL) in humans, which include 'normal' aging, noise exposure, and ototoxic drugs.

"Previously, we thought that neural loss happened only after hair cell loss. What we learned, however, is that damage to neural synapses can occur without permanently affecting hair cells or audiometric thresholds. This makes it undetectable by a standard audiogram, which is one reason it was undiscovered for so long."

—Dr. Kujawa

In previous work, the investigators have provided clear evidence of early and progressive synaptic and neural loss with age and after noise exposures that only temporarily changed hearing thresholds and had no hair cell loss. With project one, Dr. Kujawa will examine consequences of noise and ototoxic drug exposures in animal models over varying degrees of damage—from temporary to permanent, and with and without hair cell loss and threshold sensitivity loss.

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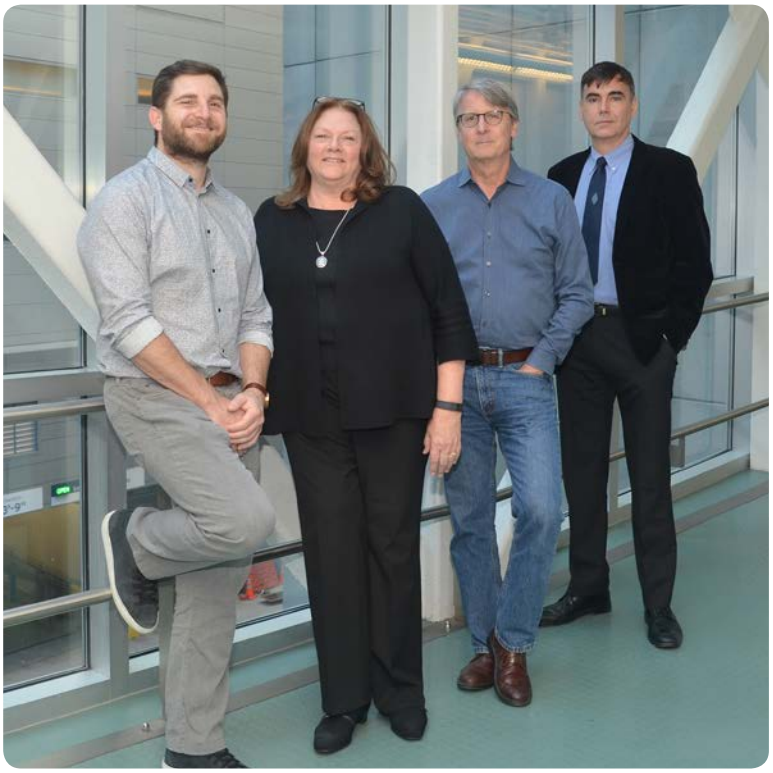
A key feature of these studies is that they will closely mirror the techniques that will be applied in the human studies to assess exposure-related changes in function and characterizing the underlying injury. In doing so, the diagnostic power of the tests can be determined directly by comparison with the histopathology. The researchers expect that the injury from these exposures will be widespread and that it will be reflected as abnormal function, particularly for responses acquired in background noise.

The second project, led by Dr. Liberman, will focus on quantifying the loss of neurons and hair cells in human subjects. With the use of modern immunostaining approaches, the hair cells and neural synapses will be counted in archival autopsy material that is available through the Temporal Bone Bank at Mass. Eye and Ear, which is the largest collection of human inner ear specimens in the world. The degeneration patterns will be compared to audiograms and speech-in-noise scores obtained in the same subjects prior to death.

"Our working hypothesis is that, in 'normal' ears, we will see dramatic degeneration of the neural elements with increasing age before the loss of hair cells. In cases with a history of acoustic overexposure or exposure to ototoxic drugs, we expect to see the neural degeneration to be even greater," said Dr. Liberman. "By comparing these results with the audiometric tests, we can directly test the idea that differences in neural loss are major contributors to the performance decrements on speech recognition tests."

Drs. Daniel Polley, Sharon Kujawa, Charles Liberman, and Stéphane Maison.



Understanding cochlear synaptopathy in humans

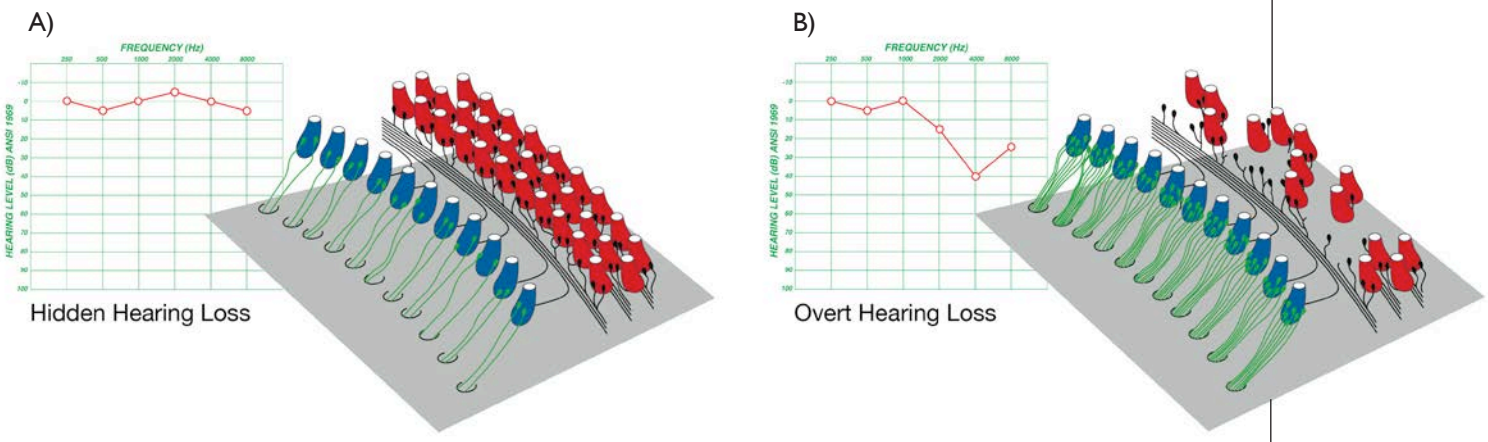
The final two projects will involve looking for evidence of cochlear synaptopathy in living humans, specifically college students with normal hearing thresholds and older adults with high-frequency hearing loss.

In a pilot study, Dr. Maison found signs of neural damage in young adults with repeated exposure to loud music that were correlated with increased difficulties understanding speech in noisy environments. Dr. Maison is extending this study in project three to administer, in a large cohort of adults with normal audiograms, a test battery aimed at finding the best test combination that can predict signs of cochlear synaptopathy in a clinical setting.

The same test battery will be repeated over a five-year period in a cohort of young musicians with regular and continued acoustic overexposure to track how signs of cochlear synaptopathy and difficulties understanding speech in challenging environments progress over time.

"Our previous work suggested that young people with a normal audiogram and continued ear abuse already experience signs of neural damage and increased difficulties hearing in noisy environments," said Dr. Maison. "We are now offered the opportunity to implement, in a large-scale population, a series of tests that will help define diagnostic criteria to identify candidates for neuroregenerative therapies that may be on the horizon."

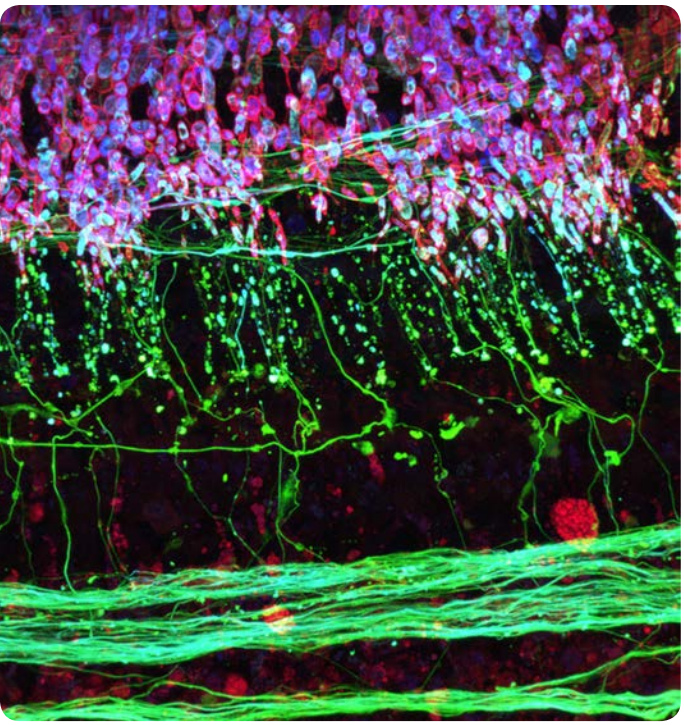
The final project, led by Dr. Polley, will aim to explain the longstanding conundrum that two people with identical down-sloping audiograms can have different hearing abilities, as seen with responses to word recognition



Schematic drawings of inner hair cells (blue), outer hair cells (red), and cochlear nerve fibers (green) showing that in Hidden Hearing Loss (left), the hair cells are intact but a fraction of the nerve fibers have disappeared. This causes no change in the threshold audiogram but causes difficulties hearing in noise. In cases of Overt Hearing Loss (right), the audiogram shows that tones must be presented at a higher sound level to be heard and there is often a loss of hair cells.

tasks. It is thought that this variance might be caused by hidden differences in the neural processing of low-frequency signals that convey speech information.

"We want to identify the neural signatures of tinnitus and impaired speech recognition in noise," said Dr. Polley. "This could help us detect the underlying pathology in patients with explicit hearing loss and better understand the brain's response to a loss of input from the ear."



Cochlear nerve fibers can be seen in the inner ear of a normal-hearing human, removed at autopsy. This image was obtained using a confocal microscope after treating the tissue with antibodies to a type of protein present in all nerve fibers (green) and with a dye that marks the myelin sheaths surrounding them (red).

Since the most common complaints from patients suspected to have cochlear synaptopathy involves speech and noise, both projects three and four will measure how individual subjects understand speech by tracking speech outcomes and neural predictors over time. Whereas project three will track the decline of neural processing and speech recognition in individuals exposed to high levels of noise, project four will track improvement through the use of an interactive audiomotor training interface that was programmed by Dr. Polley.

Moving toward a diagnosis and treatment

In addition to uncovering more about cochlear synaptopathy, preliminary work has also suggested there may be an opportunity to rescue the lost connections and reconnect nerves and sensory cells. Therefore, the investigators are also thinking about treatment strategies.

In order to start treating patients, proper diagnostics will be needed first. Only with a reliable diagnosis will clinicians be able to choose the right candidates for clinical trials and determine the efficacy of a treatment. The researchers are optimistic that their work will bring us closer to both goals.

"We believe that cochlear synaptopathy is present—and a problem—in many individuals," said Dr. Kujawa. "We're hopeful that our work will provide important insights that will lead to better diagnostics and treatments for our patients." ●

Harvard Medical School Department of Otolaryngology Celebrates 2017 Graduation and Fifth Annual Meeting

Faculty and staff from the Department of Otolaryngology at Harvard Medical School gathered in the Meltzer Auditorium at Massachusetts Eye and Ear on Friday, June 23, to celebrate the 2017 graduating class of residents and fellows.

Five chief residents and nine clinical fellows graduated from the program, which was led by Harvard Medical School Otolaryngology Residency Director Stacey T. Gray, MD, Associate Residency Director Kevin S. Emerick, MD, and Walter Augustus LeCompte Professor and Chair of Otolaryngology at Harvard Medical School, D. Bradley Welling, MD, PhD, FACS, among others.

"Graduation is not only a time to celebrate the accomplishments of our residents and fellows, but it's also a time to cherish the relationships that have been built throughout their time with us," said Dr. Gray. "We are proud to have this group represent our program throughout their careers, and even more proud to have them now a part of our otolaryngology family."

Keynote speaker Clayton M. Christensen, DBA, Kim B. Clark Professor of Business Administration at Harvard Business School, delivered this year's graduation address. In his speech, Dr. Christensen spoke about how life does not need to be measured by numbers or dollars. He stressed the importance of finding a metric by which you want your life to be judged, such as how you've helped others become better people, and make a resolution to live every day trying to fulfill that metric.

Prior to the graduation ceremony, the day began with the Department's fifth annual meeting, an event that brings together our faculty, residents, and fellows. The meeting featured chief resident research talks on topics from implantable otologic microphones to valuing patient preferences, followed by scientific presentations given by Sharon G. Kujawa, PhD, and Ahmad R. Sedaghat, MD, PhD.

Each year, this meeting provides a special opportunity for thoughtful discussion among faculty and staff across the different subspecialties and clinical venues that make up the Harvard Medical School Department of Otolaryngology.

Congratulations to all of our graduates, whom we are confident will make us proud in their successes for years to come.

Awards

Annual Poster Session

Anuraag Parikh, MD, and
Sid Puram, MD, PhD
1st Place Poster Award
"Single cell RNA-seq reveals programs of intertumoral and intratumoral heterogeneity in head and neck cancer"
Mentors: Derrick T. Lin, MD, FACS, and Bradley E. Bernstein, MD, PhD

Yin Ren, MD, PhD
2nd Place Poster Award
"Tumor-penetrating delivery of nanoparticles to human vestibular schwannomas"
Mentor: Konstantina M. Stankovic, MD, PhD, FACS
(See page 6 for more on this work.)

Trevor McGill Excellence in Teaching Award

Greg R. Licameli, MD

Jeffrey P. Harris, MD, PhD, Research Prize

Presented to one of the graduating chiefs for his or her FOCUS research project.

Matthew R. Naunheim, MD, MBA
"Valuing Patient Preferences"
Mentor: Mark G. Shrime, MD, MPH, PhD, FACS

Fellow Teaching Award

Callum Faris, MD

Chief Resident Teaching Award

Taha A. Jan, MD

William W. Montgomery, MD, Faculty Teaching Award

Kevin S. Emerick, MD

Harvard Otolaryngology Resident Well-Being Award

Michael B. Rho, MD, FACS

Dr. Matthew Naunheim (middle) receives the Jeffrey P. Harris, MD, PhD, Research Prize, presented by Drs. Brad Welling (left) and Stacey Gray (right).

Graduating Class of 2017

Residents

Throughout residency, **Francis "Pete" X. Creighton, Jr., MD**, always showed a genuine level of interest in and concern for his patients. When it came to his research, he extended this same level of interest as he used his biomedical engineering background to develop piezoelectric sensors for implantable otological microphones under the guidance of Heidi Nakajima, MD, PhD, Associate Professor of Otolaryngology at Harvard Medical School. This work was presented at several meetings, won an American Neurotology Society poster award, and was published in *Otology and Neurotology*. His experience also included additional presentations and papers, one of which received the William W. Montgomery, MD, Resident Research Award at the Triological Society meeting. Dr. Creighton is currently pursuing fellowship training in neurotology and lateral skull base surgery at the Johns Hopkins University School of Medicine.

The 2017 graduating class of Harvard Otolaryngology residents. From left to right: Drs. Matthew Naunheim, George Scangas, Rebecca Hammon, Taha Jan, and Pete Creighton, Jr.

Rebecca J. Hammon, MD, joined Mass. Eye and Ear/Harvard Medical School as a seven-year research track resident and spent her two research years working with James W. Rocco, MD, who is now a Professor of Otolaryngology at The Ohio State University, investigating the role of apoptosis in the response of head and neck squamous cell carcinoma to Cisplatin treatment. She was awarded an Academy CORE grant for this work and was also involved in a multitude of publications throughout her residency. By aligning her research with her interests in head and neck oncology, she was able to approach clinical care with a scientific mind, really thinking about each case from different perspectives. She is continuing to pursue these interests at the Johns Hopkins University School of Medicine as their head and neck surgery/microvascular reconstruction fellow.

The 2017 graduating class of Mass. Eye and Ear clinical fellows. From left to right: Drs. Callum Faris, Adam Campbell, Heather Osborn, and Ruwan Kiringoda. Not pictured: Dr. Regan Bergmark.

Known for his unwavering work ethic and devotion, **Taha A. Jan, MD**, was recognized by his fellow residents at graduation as the recipient of the Chief Resident Teaching Award. During residency, Dr. Jan worked with

continued on page 20

Konstantina M. Stankovic, MD, PhD, FACS, Associate Professor of Otolaryngology at Harvard Medical School, on investigating the effects of secreted factors from human vestibular schwannomas on murine cochlear cells. He received an Academy CORE grant for this work. He also gave multiple oral and poster presentations, including being an invited speaker by the National Institute on Deafness and Other Communication Disorders. He is now at Stanford University in their T32 Clinician-Scientist Training Program in otolaryngology and will complete a neurotology fellowship there subsequently.

During residency, **Matthew R. Naunheim, MD, MBA**, was known for his inclusiveness and attention to detail. Working with Mark G. Shrime, MD, MPH, PhD, FACS, Assistant Professor of Otolaryngology and of Global Surgery at Harvard Medical School, he explored the importance of patient preference in medical care, looking to find a new perspective on how medical care can be delivered in a more patient-centric way. This work resulted in multiple publications, poster and oral presentations, and many awards, including the Jeffrey P. Harris, MD, PhD, Research Prize at graduation. Dr. Naunheim is currently pursuing fellowship training in laryngology at the Icahn School of Medicine at Mount Sinai and will join the Mass. Eye and Ear/Harvard Medical School faculty upon completion.

Known for his calm and caring nature, **George A. Scangas, MD**, was a kind, thorough, and thoughtful clinician during his residency. For his research FOCUS project, he worked with Ralph B. Metson, MD, Professor of Otolaryngology at Harvard Medical School, on clinical outcomes research and cost-utility analysis in patients with chronic rhinosinusitis (CRS). This work led to multiple first author presentations and publications and an American Rhinologic Society clinical research award. Dr. Scangas is currently pursuing his fellowship training in rhinology and anterior skull base surgery at Mass. Eye and Ear/Harvard Medical School.

Clinical Fellows, Mass. Eye and Ear

Regan W. Bergmark, MD
Rhinology
Fellowship Directors: Ralph B. Metson, MD, Stacey T. Gray, MD, Eric H. Holbrook, MD
Future Plans: Gliklich Healthcare Innovation Scholar, Massachusetts Eye and Ear/Harvard Medical School

Adam P. Campbell, MD
Rhinology
Fellowship Directors: Ralph B. Metson, MD, Stacey T. Gray, MD, Eric H. Holbrook, MD
Future Plans: Faculty, Georgia Nasal and Sinus Institute

Callum Faris, MD
Facial Plastic and Reconstructive Surgery
Fellowship Director: Tessa A. Hadlock, MD
Future Plans: Faculty, Academic Facial Nerve Centre, University of Nijmegen, Netherlands

Ruwan Kiringoda, MD
Neurotology
Fellowship Director: Daniel J. Lee, MD, FACS
Future Plans: Otologist/Neurotologist, Palo Alto Medical Foundation

From left to right: Drs. Kevin Emerick, Michael McKenna, Jennifer Shin, Steven Rauch, Brad Welling, Stacey Gray, Jo Shapiro, David Caradonna, and Mark Varvares.

Dr. Brad Welling (left) with Keynote Speaker Dr. Clayton Christensen (right).

The 2017 graduating class of Boston Children's Hospital pediatric otolaryngology fellows with Dr. Trevor McGill (far left) and Dr. Margaret Kenna (far right). The fellows include (from left to right) Drs. Jeffrey Yeung, Colleen Heffernan, and Nikolaus Wolter. Not pictured: Dr. Steven Rosenblatt.

Heather A. Osborn, MD, FRCSC
Head and Neck Surgical Oncology/ Microvascular Surgery
Fellowship Directors: Daniel G. Deschler, MD, FACS, Derrick T. Lin, MD, FACS
Future Plans: Head and Neck Oncology Faculty, Yale University

Pediatric Otolaryngology Fellows, Boston Children's Hospital

Fellowship Director:
Reza Rahbar, DMD, MD, FACS

Colleen Heffernan, MD
Future Plans: Pediatric Otolaryngologist, Royal Hospital for Children, Glasgow, Scotland

Steven D. Rosenblatt, MD
Future Plans: Pediatric Otolaryngologist, Weill Cornell Medical College

Nikolaus E. Wolter, MD
Future Plans: Pediatric Otolaryngologist, The Hospital for Sick Children, Toronto, Canada

Jeffrey C. Yeung, MD
Future Plans: Otolaryngology Faculty, McGill University

The Otolaryngology Residency Program at Harvard Medical School

The Department welcomes five new otolaryngology interns, **Eric R. Barbarite, MD**, **Adeeb Derakhshan, MD**, **Krupa R. Patel, MD**, **Tiffany V. Wang, MD**, and **Phoebe Kuo Yu, MD**.

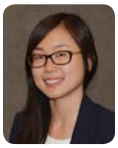
We would like to recognize our five new PGY-2 residents, **Nicholas B. Abt, MD**, **Jenny X. Chen, MD**, **Shekhar K. Gadkaree, MD**, **Ashley L. Miller, MD**, and **Vinay K. Rathi, MD**.

Meet the PGY-2 Residents

Nicholas B. Abt, MD, grew up in South Florida and attended the University of Florida, where

he graduated *summa cum laude* with a degree in microbiology and cell science. Valedictorian and commencement speaker of his graduating class, Dr. Abt's thesis focused on how to identify glioblastoma multiforme circulating tumor cells. Subsequently, he attended medical school at the Johns Hopkins University School of Medicine, graduating Alpha Omega Alpha. Dr. Abt has research interests in head and neck cancer epidemiology, surgical oncology outcomes, surgical quality improvement, and tissue bioengineering.

Originally from Toronto, Canada, **Jenny X. Chen, MD**, completed her undergraduate



education at Harvard College, where she graduated *summa cum laude* with degrees in human developmental and regenerative biology and global health and health policy. She then attended Harvard Medical School, where she worked with Daniel J. Lee, MD, FACS, Associate Professor of Otolaryngology at Harvard Medical School, to complete her thesis on the application of optogenetics in auditory implants. Dr. Chen has a broad background in quantitative research methods in both basic science and clinical research disciplines, including stem cell research, auditory neuroprosthetics, evidence-based medicine, and medical education. She is interested in tissue engineering, clinical outcomes, and innovations in medical education.

Shekhar K. Gadkaree, MD, grew up in Big Flats, New York, and graduated *summa cum laude* from the University of Rochester with a major in biomedical engineering. Here, he was awarded the Robert L. Wells Award for outstanding competency in engineering and

the humanities. Following his undergraduate work, he spent a year at the National Institutes of Health in the Intramural Research Training Award program. He then matriculated at the Johns Hopkins University School of Medicine, where he graduated Alpha Omega Alpha. During medical school, he developed interests in refugee health care, tumor immunology, aging and epidemiology, and global health innovation. His research interests include biomedical device design, applied engineering, immunology, and epidemiology.

Hailing from Cincinnati, Ohio, **Ashley L. Miller, MD**, attended the University of North

Carolina (UNC) at Chapel Hill, where she graduated with a degree in biology. She spent time in the laboratory of Victoria L. Bautch, PhD, Professor and Chair of Biology at UNC, studying blood vessel development in mice and was mentored by Kathryn A. Wikenheiser-Brokamp, MD, PhD, of Cincinnati Children's Hospital/University of Cincinnati Research Foundation, as she investigated molecular mechanisms of chemoresistance in small cell lung cancer. During medical school at the University of Michigan, she participated in clinical outcomes research and investigated the relationship between preoperative functional status and postoperative outcomes in older surgical patients. She remains interested in risk assessment and preoperative optimization as it relates to otolaryngology patients.

Originally from Reston, Virginia, **Vinay K. Rathi, MD**, studied anthropology at Washington

University in St. Louis, where he served as a class marshal at graduation. He then attended the Yale School of Medicine, where he was awarded the Samuel Jordan Graham Scholarship in Academic Surgery and the William U. Gardner Prize for the most outstanding thesis in his graduating class. During medical school, he worked at McKinsey & Company and the Center for Outcomes Research and Evaluation. His research interests include medical device regulation, physician-industry relationships, and alternative payment models. With support from a National Institutes of Health T32 Training Grant, he will study the newly implemented Medicare Merit-based Incentive Payment System. He is an MBA candidate at Harvard Business School and his work has been published in *JAMA* and the *BMJ*.

New Clinical Fellows

Mass. Eye and Ear

Facial Plastic and Reconstructive Surgery
Joseph R. Dusseldorp, MD

Facial Plastic and Reconstructive Surgery
Jacqueline J. Greene, MD

Head and Neck Oncology/ Microvascular Surgery
Joseph Zenga, MD

Neurotology
Nicholas A. Dewyer, MD

Pediatric Otolaryngology
Sarah Bouhabel, MD

Rhinology
Edward T. El Rassi, MD

Rhinology
George A. Scangas, MD

Thyroid and Parathyroid Surgery
Mohamed Shama, MD

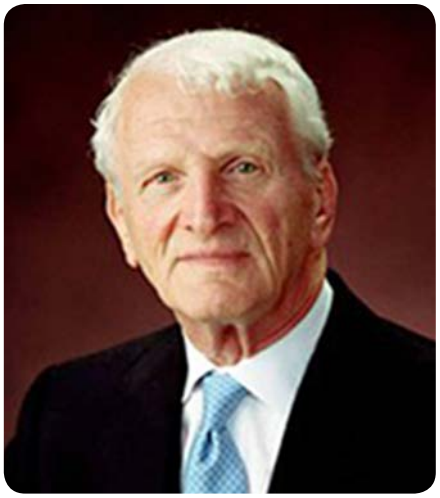
Boston Children's Hospital

Pediatric Otolaryngology
Jennifer A. Brooks, MD, **Jad R. Jabbour, MD**, **Claire M. Lawlor, MD**, and **Graham M. Strub, MD, PhD**.

Alumni Profile

Eugene N. Myers, MD, FACS, FRCS Edin (Hon), Otolaryngology Resident, Class of 1965

A legacy in head and neck surgery



Before becoming a doctor, Eugene Myers, MD, FACS, FRCS Edin (Hon), watched his father, a well-known middle ear surgeon, perform a stapes mobilization. Watching this procedure, an earlier treatment for otosclerosis, inspired Dr. Myers to consider a career in medicine.

"I was fascinated by the fact that, with a 20-minute operation under local anesthesia, my father could make someone hear again for the first time in decades. It was like watching a miracle happen, and from that moment, I wanted to get into the 'miracle business,'" said Dr. Myers, who is the Distinguished Professor and Emeritus Chair of the Department of Otolaryngology at the University of Pittsburgh School of Medicine.

Following in his father's footsteps, Dr. Myers became the third generation of physicians in his family, and grew to be an internationally known leader in head and neck surgery. His father, David Myers, MD, was Chairman of the Department of Otolaryngology at Temple University School of Medicine, and now, his son, Jeffrey N. Myers, MD, PhD, FACS, is the Alando J. Ballantyne Distinguished Professor and Chair of the Department of Head and Neck Surgery at the MD Anderson Cancer Center.

A graduate of the Wharton School of the University of Pennsylvania, Dr. Eugene Myers received his medical degree from Temple University. After completing an internship at Mount Sinai Hospital in New York City, he did his residency training in otolaryngology at Massachusetts Eye and Ear/Harvard Medical School under the leadership of Harold F. Schuknecht, MD, the Harvard Medical School Chair of Otolaryngology.

"When I was a medical student, my father encouraged me to be open minded and explore each specialty rotation, but nothing was as attractive to me as otolaryngology," said Dr. Myers. "Once I began training with Dr. Schuknecht and others, I found myself completely absorbed by this field."

Following two years as an otolaryngologist with the US Army Medical Corp in Frankfurt, Germany, Dr. Myers completed a fellowship in head and neck surgery with John J. Conley, MD, at Saint Vincent's Hospital in New York. During this year, Dr. Conley introduced the use of regional pedicle flaps for immediate reconstruction of defects in the head and neck, which led to a renewed interest in head and neck surgery within otolaryngology.

In 1972, Dr. Myers became Chairman and the first academic faculty member of the Department of Otolaryngology at the University of Pittsburgh School of Medicine. During his 33-year tenure as Chair, he introduced the department to modern head and neck surgery and cultivated a leading academic department. He estimates that he has performed more than 9,000 operations and mentored more than 150 residents and fellows. In fact, 25 of his former trainees are now Chairs at academic institutions.

Throughout his career, Dr. Myers has published more than 300 papers and many books, including *Cancer of the Head and Neck,* which is now in its 5th edition and considered the standard text on this topic, and *Operative Otolaryngology: Head and Neck Surgery,* now in its 3rd edition. He has served on many editorial boards and as president of many organizations, including the American Board of Otolaryngology, American Academy of Otolaryngology—Head and Neck Surgery, American Laryngological Association, and American Head and Neck Society.

He was also President of the Pan-American Association of Otolaryngology—Head and Neck Surgery and is an honorary member of more than 20 overseas national societies of otolaryngology. At the 2009 IFOS World Congress, he was awarded a Gold Medal for his international activities. He currently serves as Honorary President of the Balkan Society of Otolaryngology and is the Regional Advisor to the Balkans for the American Academy of Otolaryngology—Head and Neck Surgery.

In addition to the thousands of patients he has helped, Dr. Myers says his greatest joy results from the successes and achievements of his family and those who he has taught. He credits his wife Barbara, who he married just before starting medical school, with his successes.

"During your career you come across people from all over the world and when you're training them, you want to do what you can to help them succeed," said Dr. Myers. "One of the most rewarding aspects of my career has been watching my former trainees lead the field from academic institutions around the world."

Susan E. Voss, PhD, Eaton-Peabody Laboratories at Massachusetts Eye and Ear/Harvard Medical School, 1992–1998

Inspiring the pursuit of engineering

Susan Voss, PhD, first took a dive into electrical engineering at Brown University.

"I arrived at Brown passionate about biomedical engineering and biology, and the one kind of engineering I was sure I would not pursue was electrical engineering," said Dr. Voss, currently the Achilles Professor of Engineering at Smith College in Northampton, Massachusetts. "But as I took courses, I realized electrical engineering is the field I am most passionate about."

Now an accomplished electrical engineer focused on speech and hearing, much of the work Dr. Voss does uses mathematics developed by electrical engineers to describe how auditory information is stored, processed, and transmitted.

A native of New Jersey, Dr. Voss received her bachelor of science in engineering from Brown University, where she worked on computer speech recognition and developed an interest in the auditory system. After a summer of researching the middle ear at Bell Laboratories in Murray Hill, New Jersey, she began her graduate studies in both the Electrical Engineering and Computer Science Department at the Massachusetts Institute of Technology (MIT) and the Harvard Medical School-MIT Speech and Hearing Bioscience and Technology (SHBT) program.

During this time, Dr. Voss worked in the Eaton-Peabody Laboratories at Massachusetts Eye and Ear/Harvard Medical School examining the auditory effects of eardrum perforations. Under the guidance of William T. Peake, ScD, former Professor of Electrical and Bioengineering at MIT, and John J. Rosowski, PhD, Professor of Otolaryngology and of Health Sciences and Technology at Harvard Medical School, she developed an acoustically-based mathematical model that predicts hearing loss given the size of a perforation.

"For me, the Speech and Hearing Bioscience and Technology program was amazing. It offered different learning opportunities that complemented my interests in both electrical engineering and speech and hearing," said Dr. Voss.

"One opportunity that really inspired me during this time was the semester we spent in the clinics at Mass. Eye and Ear. Seeing the physicians with patients taught me what kinds of problems are important to solve. In fact, my interest in how a perforation affects middle-ear sound transmission grew directly out of that clinical course," she continued.

Dr. Voss continued at MIT as a postdoctoral associate within the Research Laboratory of Electronics. During this time, she identified inaccuracies within widely used audiometric testing procedures and taught electrical engineering courses.

In 2001, Dr. Voss joined the Picker Engineering Program faculty at Smith College, just as the program was being established. As the first ABET accredited engineering program at an all-women's college, Dr. Voss was able to help design a program that combines a liberal arts education with a technically rigorous engineering curriculum, while also offering a positive learning environment for women studying engineering.

"I'd always wanted to teach engineering but teaching at an all women's liberal arts college is something I never knew could be an opportunity," Dr. Voss noted.

In addition to teaching, Dr. Voss manages a National Institutes of Health-funded research laboratory at Smith College studying the acoustics of the auditory system. Her main projects include measuring and modeling ear canal reflectance to develop a noninvasive diagnostic tool for middle ear problems and developing noninvasive tools to monitor changes in intracranial pressure using the auditory response of otoacoustic emissions.

"I think I've made some significant contributions to the auditory mechanics field through my research, but what I'm most proud of is the engineering program I've helped establish," said Dr. Voss. "Most of our 350 graduates are pursuing satisfying careers in engineering and showing the world that this is a field in which women can excel. I continue to be impressed with what our graduates accomplish and truly enjoy being part of their journeys." ●

HARVARD MEDICAL SCHOOL | DEPARTMENT OF Otolaryngology

The Alumni Giving Society of the Department of Otolaryngology at Harvard Medical School

The Department of Otolaryngology at Massachusetts Eye and Ear/Harvard Medical School established the Alumni Giving Society in 2015 to recognize faculty and alumni who make gifts of $1,000 or more during the fiscal year (October 1–September 30). Participation is a way to stay connected and to help deliver the finest teaching experience for today's otolaryngology trainees.

Our alumni know from firsthand experience that support of the vital work of our students and faculty in the Department of Otolaryngology helps drive continued achievement across all areas of education, research, and patient care. To date, we have 49 members whom we thank for their generosity and for partnering with us to achieve our department goals and institutional mission.

If you are not a member, please consider joining your colleagues today by making a gift with the enclosed envelope. As a member, you may designate your gift in the way that is most meaningful to you.

To learn more, please contact Julie Dutcher in the Development Office at 617-573-3350.

Alumni Giving Society Leadership

D. Bradley Welling, MD, PhD, FACS
Walter Augustus LeCompte Professor and Chair of Otolaryngology, Harvard Medical School
Chief of Otolaryngology, Massachusetts Eye and Ear/ Massachusetts General Hospital

Michael B. Rho, MD, FACS, '05
President, Harvard Otolaryngology Alumni Society
Medical Director, Otolaryngology, Mass. Eye and Ear, Stoneham

Alumni Leaders

Daniel G. Deschler, MD, FACS
Richard E. Gliklich, MD, '93, '94
Donald G. Keamy, Jr., MD, MPH
Paul M. Konowitz, MD, FACS
John B. Lazor, MD, MBA, FACS, '95, '96
Jon B. Liland, MD, '72
Derrick T. Lin, MD, FACS, '98, '02
Leila A. Mankarious, MD
William W. McClerkin, MD, '73
Ralph B. Metson, MD, '87
Michael M. Paparella, MD
Herbert Silverstein, MD, FACS, '66

Drs. Sarah Bowe, Matthew Brigger, Ralph Metson, David Jung, Josh Meier, Michael Rho, and Lindsay Reder at the 2017 Academy meeting in Chicago, Illinois.

Alumni Giving Society

Current Alumni Giving Society members for fiscal year 2017 from October 1, 2016, to September 30, 2017, are listed below. With your gift of $1,000 or more, you will be included in the 2018 Alumni Giving Society.

CHAMPION: Gifts of $25,000 or more
Michael S. Cohen, MD

VISIONARY: Gifts of $10,000 to $24,999
Eric H. Holbrook, MD
Daniel J. Lee, MD, FACS
Michael B. Rho, MD, FACS
D. Bradley Welling, MD, PhD, FACS

INNOVATOR: Gifts of $5,000 to $9,999
Fred G. Arrigg, Jr., MD
Nicolas Y. BuSaba, MD
Stacey T. Gray, MD
Paul M. Konowitz, MD, FACS
Jon B. Liland, MD
Joseph B. Nadol, Jr., MD
Steven D. Rauch, MD

PIONEER: Gifts of $2,500 to $4,999
Carlos Ayala, MD, FACS
Barry J. Benjamin, MD
Daniel G. Deschler, MD, FACS
Frank P. Fechner, MD
Richard E. Gliklich, MD
Leila A. Mankarious, MD
Cliff A. Megerian, MD
Ralph B. Metson, MD
Michael G. Moore, MD
David E. Nash, MD
H. Gregory Ota, MD
Sunil Puria, PhD
Jeremy D. Richmon, MD
Noah S. Siegel, MD

FRIEND: Gifts of $1,000 to $2,499
Samir M. Bhatt, MD
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Kevin S. Emerick, MD
Paul E. Hammerschlag, MD, FACS
Kenneth E. Hancock, PhD
Christopher J. Hartnick, MD, MS
Ralph A. Iannuzzi, MD
Nate Jowett, MD, FRCSC
Jennifer C. Kim, MD
John B. Lazor, MD, MBA, FACS
Derrick T. Lin, MD, FACS
William W. McClerkin, MD
Michael J. McKenna, MD
Adrian James Priesol, MD
Mark F. Rounds, MD
Herbert Silverstein, MD, FACS
Earl F. Singleton, MD
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Eric H. Stein, MD
Theodoros N. Teknos, MD
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News from every corner of the Department of Otolaryngology at Harvard Medical School.

New Faculty

Kevin H. Franck, PhD, MBA, CCC-A, has joined Mass. Eye and Ear/Harvard Medical School as the new Director of Audiology. A graduate of Dartmouth College, he has his master's in biomedical engineering (Johns Hopkins University), PhD in hearing science (University of Washington), and MBA (Wharton School of Business). He is one of three founding members of Ear Machine LLC, a National Institutes of Health-funded start-up focused on developing hearing tools that was acquired by Bose Corporation. Throughout his career, he has directed clinical programs and provided care in the hospital environment, led independent grant-funded research and educational programs, developed products and strategies for hearing product companies, and volunteered on the boards of national non-profit hearing loss-related organizations.

Kenneth M. Grundfast, MD, FACS, has joined Mass. Eye and Ear's main campus and Longwood locations to focus on patients with tinnitus and dizziness. He received his medical degree from SUNY Upstate Medical Center before completing his surgical internship and a one-year fellowship in community health and social medicine at Tufts Medical Center. He completed his residency in otolaryngology at Boston University (BU) and fellowship in pediatric otolaryngology at the Children's Hospital of Pittsburgh. He has led several departments throughout his career, including the Department of Otolaryngology at the BU School of Medicine/Boston Medical Center as Chair for the past 18 years.

Artur A. Indzhykulian, MD, PhD, has joined the Eaton-Peabody Laboratories at Mass. Eye and Ear/Harvard Medical School. He received his medical degree and PhD in human anatomy from Dnipropetrovsk State Medical Academy in Ukraine before completing postdoctoral training at the University of Kentucky and Harvard Medical School. His research focuses on hair cells, specifically the proteins that form the mechano-transduction complex, which converts sound to an electrical signal our brain can understand. Since malfunctions of these proteins cause Usher syndrome, a condition known for causing blindness and deafness, his work also aims to better understand protein function and develop new gene therapy methods to treat this debilitating disorder.

Yuna C. Larrabee, MD, has joined Mass. Eye and Ear's Quincy and East Bridgewater locations. Specializing in facial plastic and reconstructive surgery, she earned her medical degree from Columbia University prior to completing her otolaryngology residency at New York Presbyterian-University Hospital of Columbia and Cornell and fellowship training in facial plastic and reconstructive surgery at the University of Michigan. In Quincy and East Bridgewater, she practices general otolaryngology while focusing on patients with cosmetic and/or reconstructive needs of the head and neck.

Kristina Simonyan, MD, PhD, Dr. med., is the new Director of Laryngology Research at Mass. Eye and Ear/Harvard Medical School. A neuroscientist with clinical training in laryngology, she will lead a research program focused on neurological disorders affecting voice, speech, and other related motor behaviors. She received her medical degree from Yerevan State Medical University in Armenia, PhD in neurobiology from TiHo University of Hannover, and Dr. med. from Georg-August University, both in Germany. She completed her residency in otolaryngology in Armenia and Germany, and a clinical research fellowship with the National Institutes of Health. Dr. Simonyan uses brain imaging to identify the causative pathophysiology of spasmodic dysphonia and other focal dystonias and to develop new diagnostic and treatment options for these disorders.

Anne E. Takesian, PhD, has joined the Eaton-Peabody Laboratories at Mass. Eye and Ear/Harvard Medical School. She obtained her PhD from the Center for Neural Science at New York University before completing postdoctoral training at Boston Children's Hospital/Harvard University under the guidance of Takao K. Hensch, PhD. Her research is focused on understanding how sound experience shapes and perturbs auditory cortical circuits. She hopes to develop new treatments to promote cortical plasticity to reverse pathological processes and recover auditory function following hearing loss.

HMS Promotions

Nate Jowett, MD, FRCSC, Assistant Professor of Otolaryngology

David H. Jung, MD, PhD, Assistant Professor of Otolaryngology

Hideko Heidi Nakajima, MD, PhD, Associate Professor of Otolaryngology

Jeremy D. Richmon, MD, Associate Professor of Otolaryngology

Gregory W. Randolph, MD, FACS, FACE, Professor of Otolaryngology

(See page 2 for more on Dr. Randolph's promotion.)

Dr. Tessa Hadlock with ten of her current and former facial plastic and reconstructive surgery fellows at the International Facial Nerve Symposium held in Los Angeles this past summer. From left to right: Drs. Joseph Dusseldorp, Callum Faris, Jacqueline Greene, Marc Hohman, Doug Henstrom, Babak Azizzadeh, Tessa Hadlock, Jennifer Kim, Prabhat Bhama, Nate Jowett, and Caroline Banks.

Awards, Grants, and Honors

Regan W. Bergmark, MD, the Gliklich Healthcare Innovation Scholar at Mass. Eye and Ear, was awarded a grant from the American Board of Medical Specialties.

Benjamin S. Bleier, MD, received the Top Science Abstract Cohort from the American Rhinologic Society for his study, "Development of non-invasive liquid biopsy of chronic rhinosinusitis with nasal polyps using mucus derived exosomal proteomics."

Thomas L. Carroll, MD, was the Chair of the Laryngology-Bronchoesophagology Education Committee for the American Academy of Otolaryngology—Head and Neck Surgery annual meeting and was the Co-Program Chair for The Fall Voice Conference.

Yoojin Chung, PhD, gave an invited talk at the 2017 Conference on Implantable Auditory Prostheses in California.

Michael S. Cohen, MD, has received a grant from the Deborah Munroe Noonan Memorial Research Fund in the amount of $80,000 for his project, "Use of amplification in children with unilateral hearing loss."

Michael J. Cunningham, MD, FACS, was invited to write an editorial for *JAMA Otolaryngology—Head and Neck Surgery* on post-tonsillectomy hemorrhage.

Stacey T. Gray, MD, is the Chair of the Otolaryngology Program Directors Organization and the Chair of the Rhinology and Allergy Education Committee for the American Academy of Otolaryngology—Head and Neck Surgery.

John J. Guinan, Jr., PhD, was honored at the 2017 Mechanics of Hearing International Meeting, which was held at Brock University in Canada and co-chaired by **Sunil Puria, PhD**. He was recognized for his scientific contributions to auditory mechanics.

Elliott D. Kozin, MD, Mass. Eye and Ear/Harvard Medical School resident, was elected to the National Resident Matching Program Board of Directors for a two-year term and is a 2017 Star Reviewer for *Otolaryngology—Head and Neck Surgery.*

Daniel J. Lee, MD, FACS, **Sunil Puria, PhD**, **Hideko Heidi Nakajima, MD, PhD**, and **John J. Rosowski, PhD**, were invited speakers and guests at a symposium celebrating the 100th anniversary of the University Hospital Zurich Department of Otorhinolaryngology, Head and Neck Surgery.

M. Charles Liberman, PhD, received a five-year, $3.8 million grant from the NIDCD to study noise-related neural degeneration in the inner ear and to continue developing therapeutic approaches to re-establish these missing connections.

Robin W. Lindsay, MD, served as the 2016–2017 Chair of the Plastic and Reconstructive Surgery Committee for the American Academy of Otolaryngology—Head and Neck Surgery.

Brian J. Park, MD, MPH, FACS, has been accepted as a fellow of the American College of Surgeons.

Gregory W. Randolph, MD, FACS, FACE, co-directed the 2017 World Congress on Thyroid Cancer, which is the largest thyroid meeting in the world.

Steven D. Rauch, MD, and research fellows **Ngoc-Nhi C. Luu, MD**, and **Judith S. Kempfle, MD**, received the Hearing Health Foundation emerging research grant for a clinical study investigating radiographic differences in the vestibular aqueduct in early and late onset Ménière's disease.

Aaron K. Remenschneider, MD, MPH, **Alicia M. Quesnel, MD**, and research fellow **Iman A. Ghanad** are working with the Massachusetts Commission for the Deaf and Hard of Hearing on continued support for the Boston Marathon bombing victims. The researchers have established a formal collaboration with the Commission to serve and support survivors, and collect clinical outcomes data on patients who are local.

David W. Roberson, MD, and **Gerald B. Healy, MD, FACS**, published a commentary in the September bulletin of the American College of Surgeons, "The Global Tracheostomy Collaborative: Multidisciplinary Quality Improvement in Tracheostomy Care."

Rosh Sethi, MD, MPH, Mass. Eye and Ear/Harvard Medical School resident, gave a talk at the second World Congress on Endoscopic Ear Surgery in Bologna, Italy.

Howard C. Shane, PhD, received the University of Massachusetts School of Public Health and Health Sciences 2017 Alumni Award for Significant Contributions.

Jennifer A. Shin, MD, SM, gave the Cotton-Fitton Endowed Lecture in Pediatric Otolaryngology at the American Academy of Otolaryngology—Head and Neck Surgery annual meeting.

The Mark A. Varvares, MD, Endowed Lectureship in Otolaryngology has been established at Saint Louis University (SLU) to honor and pay tribute to **Mark A. Varvares, MD, FACS**, SLU's former Chair of Otolaryngology. For the first annual lectureship, Mark L. Urken, MD, a world leader in head and neck reconstructive microsurgery and head and neck cancer management from Mount Sinai, was the invited speaker.

The following are select research advances from the Department of Otolaryngology at Harvard Medical School.

Basic Science

Connectome-wide phenotypical and genotypical associations in focal dystonia

Laryngeal dystonia (LD), or spasmodic dysphonia, is a movement disorder that selectively affects the production of speech due to impaired voluntary control of vocal fold movements. Early studies have pointed to segregated changes in brain activity and connectivity. Only recently, the notion that dystonia pathophysiology may lie in abnormalities of large-scale brain networks has appeared. In support of this emerging view, a team of researchers led by **Kristina Simonyan, MD, PhD, Dr. med.**, of Mass. Eye and Ear/Harvard Medical School, conducted detailed investigation of the architecture of large-scale functional brain networks in a uniquely large population of 90 LD patients and 32 healthy subjects.

Taking into account the potential for distinct pathophysiological mechanisms underlying different phenotypes and genotypes of LD, the researchers examined the network architecture across the different genotypes (sporadic and familial) and clinical phenotypes (adductor and abductor) of the disorder. Using a novel neural community detection strategy and graph theoretical analysis of functional MRI data during symptomatic speech production, they showed that LD was characterized by abnormal global functional coupling of sensorimotor cortical areas, particularly primary sensorimotor and parietal cortices, as well as cerebellum, basal ganglia, and thalamus.

These findings provide the first comprehensive atlas of functional topology across different phenotypes and genotypes of focal dystonia. It constitutes an important paradigm-shifting step towards defining dystonia as a large-scale network disorder.

Fuertinger S, Simonyan K. Connectome-wide phenotypical and genotypical associations in focal dystonia. J Neurosci. 2017 Aug 2;37(31):7438–7449.

A corticothalamic circuit for dynamic switching between feature detection and discrimination

One of the largest components of the auditory pathway is also one of the most mysterious. In the central auditory pathway, descending centrifugal projections (from cerebrum towards brainstem) outnumber centripetal projections (from brainstem towards cerebrum). In a *Neuron* paper, **Daniel B. Polley, PhD**, of the Eaton-Peabody Laboratories at Mass. Eye and Ear/Harvard Medical School, and colleagues used a combination of cortical anatomy, auditory psychophysics, optogenetics, and targeted neurophysiological recordings in awake mice to describe a new role for corticothalamic neurons, the largest component of the auditory centrifugal pathway.

Their study reported that corticothalamic neurons can enhance or suppress auditory responsiveness in the cortex and thalamus, depending on the precise time interval separating corticothalamic activity and the arrival of sound. They observed that the strongest modulation of neural activity and sound perception occurred just after corticothalamic neurons stopped spiking, not while they were active. When corticothalamic spiking ended at a longer interval before sound onset, sensory gain in the auditory cortex was increased and mice could more easily detect—but not discriminate—target sound features. Conversely, suppressed auditory cortex responses and sharper frequency tuning observed at a shorter delay between corticothalamic spiking and sound onset were associated with improved behavioral sound discrimination, but elevated detection thresholds.

The authors report that corticothalamic neurons activate a local circuit in the cerebral cortex that controls the amplitude and phase of low-frequency electrical oscillations in the brain. As this circuit activates, the auditory cortex oscillates between phases of dampened and enhanced excitability. These findings identify a mechanism that might be used during "active listening" for enhanced processing of anticipated sounds.

Guo W, Clause AR, Barth-Maron A, Polley DB. A corticothalamic circuit for dynamic switching between feature detection and discrimination. Neuron. 2017 Jul 5;95(1):180–194.e5.

Histopathology

Histopathology of the human ear in Cogan's syndrome with cochlear implantation

Cogan's syndrome is a rare disorder characterized by non-syphilitic interstitial keratitis and audiovestibular symptoms with profound sensorineural hearing loss reported in approximately 50 percent of patients with this disorder, often resulting in candidacy for cochlear implantation. A team of researchers including **Joseph B. Nadol, Jr., MD**, of Mass. Eye and Ear/Harvard Medical School, recently completed a study that became the first histopathologic report of a patient with Cogan's syndrome who, during life, had undergone bilateral cochlear implantation. Preoperative MRI scan revealed tissue with high density in the basal turn of both cochleae and both vestibular systems consistent with fibrous tissue due to labyrinthitis. Histopathologic study demonstrated fibrous tissue and new bone formation within the cochlea and vestibular apparatus, somewhat worse in the right ear. Degeneration of the vestibular end organs and new bone formation in the labyrinth was seen more often on the right.

Although severe bilateral degeneration of the spiral ganglion neurons was seen, the postoperative word discrimination score was between 50 and 60 percent bilaterally. The histopathology seen within the inner ear was the result of labyrinthitis secondary to Cogan's syndrome in addition to the immune-mediated response to the implantation process.

Kamakura T, Lee DJ, Herrmann BS, Nadol JB Jr. Histopathology of the human inner ear in the Cogan syndrome with cochlear implantation. Audiol Neurootol. 2017;22(2):116–123.

Clinical Practice

Treatment disparities in the management of epistaxis in US emergency departments

With limited data on epistaxis presentation and management patterns in US emergency departments (EDs), a team of researchers from Mass. Eye and Ear/Harvard Medical School, including **Stacey T. Gray, MD**, and otolaryngology resident **Rosh Sethi, MD, MPH**, aimed to characterize patients who present to the ED with epistaxis and identify factors associated with nasal-packing use. They studied US ED epistaxis presentation and management patterns using a national database. In their analysis of more than one million ED visits for epistaxis, they found that 19.7 percent of patients receive nasal packing. They also identified several factors associated with packing utilization, including lower socio-economic status, geographic location, hospital trauma designation, seasonality, and medical co-morbidities. Their results revealed potential disparities in packing utilization that may impact patient morbidity and increase healthcare costs.

Sethi RKV, Kozin ED, Abt NB, Bergmark R, Gray ST. Treatment disparities in the management of epistaxis in United States emergency departments. Laryngoscope. 2017 Jul 8.

Epidemiology of firearm and other noise exposures in the US

Senior Author **Neil Bhattacharyya, MD, FACS**, from Brigham and Women's Hospital/Harvard Medical School, and colleagues from the University of California, Irvine recently quantified epidemiology of firearms noise exposure and other noise exposures in the US. They found that approximately 5.3 percent and 21.7 percent of American adults were exposed to "loud" or "very loud" sounds at work regularly. Unfortunately, they also found that only 18.7 percent and 43.6 percent, respectively, were consistently using hearing protection. In fact, 38.2 percent (1.9 million Americans) with "very loud" occupation noise exposures never used hearing protection. Also concerning was the finding that, 62.3 percent (6.3 million Americans) never used any hearing protection when exposed to "loud/very loud" recreational noise such as lawnmowers.

For the first time, this research also quantified firearm use and firearm noise exposure, finding that 36.6 percent of adults had firearm noise exposure over their lifetime and 11.5 percent used firearms in the past 12 months. Notably, 21.7 percent (7.6 million Americans) who used firearms consistently, sometimes firing as much as 10,000 rounds of ammunition per year, never used hearing protection. These findings will likely become more important at an occupational level and recreational level, especially as hearing loss and preventable hearing loss become important healthcare goals in the setting of an aging US population.

Bhatt JM, Lin HW, Bhattacharyya N. Epidemiology of firearm and other noise exposures in the United States. Laryngoscope. 2017 Oct;127(10):E340–E346.

Rethinking the laryngopharyngeal reflux treatment algorithm

Otolaryngologists routinely offer empiric proton pump inhibitor (PPI) trials for suspect laryngopharyngeal reflux (LPR), and a majority of the patients respond to acid suppression therapy. However, twice daily (BID) PPIs are falling out of favor as scientific and public awareness of potential serious side effects emerge. A team of researchers, including **Thomas L. Carroll, MD**, from Brigham and Women's Hospital/Harvard Medical School, evaluated the efficacy of once-daily 40 mg omeprazole and once nightly 300 mg ranitidine (QD/QHS) dosing as an alternative first step in the treatment of clinically suspected LPR before any objective testing.

The researchers found that a QD/QHS regimen improved the majority (67 percent) of patients who presented with signs and symptoms of LPR and 74 percent demonstrated an ultimate response to empiric acid suppression. This suggests that the QD/QHS dosing scheme can be considered as a reasonable alternative empiric treatment option in cases where multichannel intraluminal impedance (MII) and high-resolution manometry (HRM) may not yet be available or in patients who refuse testing up front. Conservative cost estimates also showed that the QD/QHS regimen was more expensive than placing patients immediately on BID high dose PPIs for six months, but arguments can be made surrounding compliance, risk, and patient satisfaction to offset these costs. This study also suggests that up front MII and HRM testing may offer an approximately 40 percent cost minimization in the treatment of LPR in the US as compared to empiric acid suppression trials.

Carroll TL, Werner A, Nahikian K, Dezube A, Roth DF. Rethinking the laryngopharyngeal reflux treatment algorithm: Evaluating an alternate empiric dosing regimen and considering up-front, pH-impedance, and manometry testing to minimize cost in treating suspect laryngopharyngeal reflux disease. Laryngoscope. 2017 Oct;127 Suppl 6:S1–S13.

Global Surgery

Effect of removing the barrier of transportation costs on surgical utilization

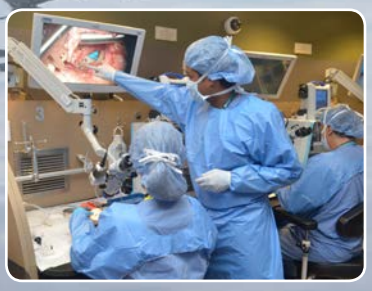
Eighty-one million people face impoverishment from surgical costs every year. The majority of this impoverishment is attributable to the non-medical costs of care—transportation, food, and lodging. Of these, transportation is the largest, but because it is not viewed as an actual medical cost, it is frequently unaddressed. In a study led by **Mark G. Shrime, MD, MPH, PhD, FACS**, of Mass. Eye and Ear/Harvard Medical School, researchers examined the barrier that transportation costs raise to accessing surgery in low-income countries.

To study this, the researchers used data over four years from Mercy Ships, an organization that delivers free specialized surgical care in Sub-Saharan Africa. Over these four years, the ship was docked in three countries (Guinea, Republic of the Congo, and Madagascar) and saw 4,340 surgical patients, 2,629 of whom lived further than five hours away. For various reasons, some patients had their transportation paid for while others did not. They found that when controlling for all possible confounders, the no-show rate dropped by nearly half when transportation was paid for. This highlights that decreasing demand-side barriers to surgical care cannot be limited only to the removal of user fees.

Shrime MG, Hamer M, Mukhopadhyay S, Kunz LM, Claus NH, Randall K, Jean-Baptiste JH, Maevatombo PH, Toh MPS, Biddell JR, Bos R, White M. Effect of removing the barrier of transportation costs on surgical utilisation in Guinea, Madagascar, and the Republic of Congo. BMJ Glob Health 2017;2:e000434.

Massachusetts Eye and Ear is top-ranked in the nation for otolaryngology care by *U.S. News & World Report.*

In a report released by *U.S. News & World Report* and the physician network Doximity, the Department of Otolaryngology at Mass. Eye and Ear/Massachusetts General Hospital was ranked #2 in the nation for otolaryngology care.



Upcoming Events

MassEyeAndEar.org/ENTCalendar

Please visit the online calendar for updated information about upcoming events in the Harvard Medical School Department of Otolaryngology.