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# HARVARD OTOLARYNGOLOGY

News from the Harvard Medical School Department of Otolaryngology–Head and Neck Surgery

## Eaton-Peabody Laboratories: A New Era

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HARVARD MEDICAL SCHOOL | Department of Otolaryngology Head and Neck Surgery

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**News from the Harvard Medical School Department of Otolaryngology–Head and Neck Surgery**

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Mass Eye and Ear
Massachusetts General Hospital




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## FEATURES

## Dear colleagues and friends,

The Department of Otolaryngology–Head and Neck Surgery at Harvard Medical School takes pride in our collaborative efforts—from fostering meaningful trainee-mentor relationships and promoting interdepartmental discussions across affiliate hospitals to the development of joint research initiatives. We believe in inclusive conversations that encourage change, knowing that a discussion between members of our department can spark a novel discovery.

As Chair, I am inspired by the uniform commitment across all institutions to leverage collaboration and change to maximize success in improving the lives of patients with ear, nose, throat, head, and neck conditions. I am very excited for the upcoming department wide retreat, which will bring faculty together from all of our affiliate hospitals to further foster this spirit of belonging and collaboration.

In the latest edition of *Harvard Otolaryngology,* our cover story highlights a new era of the renowned Eaton-Peabody Laboratories at Mass Eye and Ear, founded in 1958 and one of the world's largest and longest-standing auditory research centers. The EPL recently completed a transformative two-year renovation to modernize and create an environment that supports future research efforts. While this was a necessary revitalization, we are reminded in this story of the seminal discoveries made within the previous labs that formed the foundation of hearing research today.

Additionally, I am pleased to report on a robust collaboration between a resident and a faculty member working to advance the future of artificial intelligence (AI) in otology. The duo focused extensively on automating otologic image interpretation using computer vision. Their first project in this field measured tympanic membrane perforations, while the second involved detecting instrument movement and anatomy during transcanal endoscopic ear surgery—both novel applications of AI. Finally, I am proud to share the exciting work ongoing at Beth Israel Deaconess Medical Center as faculty there utilize simulation to enhance education for patients, surgeons and trainees. This story discusses residents' innovating a unique application of 3D printed materials in the field, along with a plan to design a novel virtual reality simulator of Transoral Robotic Surgery (TORS).

As 2024 comes to a close, this year will remain monumental for the Department. This was Mass Eye and Ear's bicentennial year, and in honor, we had the pleasure of hosting a celebration that reunited training classes and dear colleagues who hadn't seen each other in years. I hope all those who participated can take some time to reflect on the joy that we felt reconnecting this year and carry that forward for many years to come.

As always, thank you for your interest and support of our department's research, initiatives and activities. I hope you enjoy this edition and wish you a lovely holiday season!

Sincerely,

**Mark A. Varvares, MD, FACS**
William W. Montgomery and John W. Merriam
Professor and Chair Department of Otolaryngology–
Head and Neck Surgery, Harvard Medical School

Chair, Departments of Otolaryngology–Head and Neck Surgery,
Mass Eye and Ear
Massachusetts General Hospital


# Celebrating 200 Years of Mass Eye and Ear

On Thursday, July 18, and Friday, July 19, 2024, the Department of Otolaryngology–Head and Neck Surgery (OHNS) at Mass Eye and Ear hosted a two-day celebration in honor of its bicentennial year. Over 400 current and former faculty and trainees—from all over the country—came together to commemorate two centuries of this renowned institution.

On Thursday afternoon, Michael B. Rho, MD, FACS, Instructor in OHNS at Harvard Medical School and President of the OHNS Alumni Association at Mass Eye and Ear, hosted a golf outing and reception for a group of alumni at Belmont Country Club. In the evening a Welcome Reception, hosted by Mark A. Varvares, MD, FACS, William W. Montgomery and John W. Merriam Professor and Chair of OHNS at Harvard Medical School and Chair of the Department of OHNS at Mass Eye and Ear, was held on the second floor of the Paul S. Russell Museum of Medical History and Innovation at Massachusetts General Hospital. At the event, guests had the opportunity to peruse a special exhibit space showcasing some of Mass Eye and Ear's novel innovations and initiatives over the years.

The celebration continued the morning of Friday, July 19, for a 200th Anniversary Symposium, where over a dozen Distinguished Speakers and three Honorary Chairs—Charles W. Cummings, MD; Eugene N. Myers, MD, FACS; and Herbert Silverstein, MD, FACS—presented on an extensive range of thoughtful topics. The Symposium opened with a departmental update that summarized the past, present and future of the Department of OHNS, delivered by Dr. Varvares:

"It's important for me to recognize that all our collective community, past and present, have been critical contributors for the growth and development of this department. And to our current trainees, take a good look. The luminaries you will hear from today are your lineage. Listen to their stories, as their stories will become your stories." And with that meaningful remark, the Symposium commenced.



From left to right: Charles W. Cummings, MD; Eugene N. Myers, MD, FACS; Herbert Silverstein, MD, FACS.

Throughout the day, every presentation ended with roaring applause, often accompanied by happy tears, as many speakers reminisced about the memories of their early careers and training. Speakers shared their personal experiences at Mass Eye and Ear, reflected on the "greats" they met along the way who shaped their medical careers, paid tribute to late trailblazers in the field and much more.

An "Ode to Monty" was a particularly special presentation as Drs. Cummings and Varvares, both mentees of the world-class laryngologist William W. Montgomery, MD—otherwise known as Monty—were joined by a grateful patient, Petrina Palazzo, who reminisced on the life-changing care she received. She was referred to Dr. Montgomery 50 years ago for her congenital tracheal stenosis diagnosis and was the last patient he cared for before retiring. She remembered Monty by saying, "I always say, my parents gave me life, but Monty gave me the ability to live my life."

Bicentennial Photos by Pierce Harman.

The Symposium was followed by an unforgettable 200th Anniversary Gala, held at the Four Seasons Hotel, Boston, which was attended by nearly four hundred faculty and alumni. The guests were encouraged to dress in their best, reconnect with their classmates and enjoy a once-in-a-lifetime event.

During the Gala, an additional honor, the Mass Eye and Ear Distinguished Service Award, was presented to radiology pioneer Hugh D. Curtin, MD, FACR. Following the award presentation, the evening was filled with delicious food, cocktails, endless conversations and laughter.

"Since the founding of Mass Eye and Ear in 1824, we have evolved immensely. However, what has remained unchanged since those early days is the steadfast commitment to treating patients, researching ways to cure their diseases, educating the next generation and serving our community. Here's to the next 200 years," said Dr. Varvares. ■



[1] Distinguished Award recipient Hugh D. Curtin, MD, FACR, with his wife Carole Curtin.

[2] "Ode to Monty" presenters from left to right: Charles W. Cummings, MD; Petrina Palazzo; and Mark A. Varvares, MD, FACS.

# Lifetime Achievement Award

From left to right: Mark A. Varvares, MD, FACS, with Michael J. McKenna, MD, presenting the Lifetime Achievement Award to Joseph B. Nadol, Jr., MD.

Closing the 200th Anniversary Symposium, the Mass Eye and Ear Lifetime Achievement Award was presented to **Joseph B. Nadol, Jr., MD,** a renowned trailblazer in otology and former Chief of the Department of OHNS.

As Chief, Dr. Nadol significantly expanded the Department of OHNS at Mass Eye and Ear by recruiting diverse faculty and promoting subspecialty expertise, growing from five to 49 full-time physicians during his nearly three-decade tenure. His research, notably on preserving human temporal bones for electron microscopy and studying Meniere's disease and cochlear implants, made lasting contributions to the field. Additionally, Dr. Nadol's dedication to teaching and mentoring is honored by the Joseph B. Nadol, Jr., MD, Otolaryngology Surgical Training Laboratory at Mass Eye and Ear, named in recognition of his lasting impact on future leaders in the field.

Dr. Nadol accepted this award from his two proud mentees and dear friends, Michael J. McKenna, MD, Chief Surgical Officer and Co-Founder of Akouos, and Steven D. Rauch, MD, Professor of OHNS at Harvard Medical School. Dr. Nadol expressed how deeply honored he was to receive the award and emphasized the important role his supportive family played in his career success. ■


Director of EPL, Daniel B. Polley, PhD.

# Eaton-Peabody Laboratories: A New Era

The renowned Eaton-Peabody Laboratories at Mass Eye and Ear recently underwent a transformative two-year renovation, welcoming a future filled with exciting opportunities while preserving the legacy of its innovative past.

Since 1958, the Eaton-Peabody Laboratories (EPL), one of the world's largest and longest-standing auditory research centers, has embraced its mission of "bringing basic science to the bedside." Recently, a large portion of the laboratory located on the fourth floor of Mass Eye and Ear's Boston Main Campus underwent its first renovation since the construction of the Mass Eye and Ear Tower building in 1974.

The renovation was initiated in July 2021 through a joint effort by EPL's former Director, M. Charles Liberman, PhD, the Harold F. Schuknecht Professor of Otolaryngology–Head and Neck Surgery at Harvard Medical School, Mass Eye and Ear's Vice President of Development, Melissa Paul and hospital leadership—jumpstarted by a generous gift from the Amelia Peabody Charitable Fund. Following his appointment as Director of the EPL in 2022, Daniel B. Polley, PhD, Professor of Otolaryngology–Head and Neck Surgery at Harvard Medical School, led the detailed planning and execution of this renovation. The aim was to reimagine the laboratory facilities needed for the next chapter of pathbreaking research, revitalizing the EPL as a place of inspiration to work, train and collaborate.

"Since its inception, so many fundamental insights into how hearing works and fails have come from the EPL," shared Dr. Polley. "Its remarkable infrastructure and knowledge base in auditory research are unparalleled. The original EPL layout served as the foundation, and the new renovation will shape its future."

## The early days of the EPL

The EPL's origins trace back to a collaboration between Mass Eye and Ear and Massachusetts Institute of Technology (MIT). In the 1950s, Mass Eye and Ear sought to broaden its research efforts by partnering with MIT scientists, with neurophysiologist Nelson Y.S. Kiang, PhD, at the helm. Dr. Kiang partnered with Miss Amelia Peabody, a philanthropist and former Mass Eye and Ear Board Member, to establish the laboratory, which was named in honor of Miss Peabody's stepfather, William Storer Eaton. Their goal was to promote interdisciplinary collaboration within the field of auditory physiology among scientists and clinicians at Mass Eye and Ear, MIT, Harvard Medical School and Massachusetts General Hospital.

Mass Eye and Ear faculty and staff from left to right: Melissa Paul, Vice President of Development; Heidi Nakajima, MD, PhD, Vice Chair of Diversity, Equity and Inclusion, Otolaryngology–Head and Neck Surgery; CarolAnn Williams, President; Daniel B. Polley, PhD, Director of the EPL; Catherine Clarke, Director of Research Operations; and Katherine Wislocky, Construction Project Manager.

Originally, the EPL was located in the basement of the now-demolished old building of Mass Eye and Ear, where Dr. Kiang, founding director of the EPL, published groundbreaking research in the *MIT Press* on the mammalian auditory nerve's response to sound. His 1965 study was conducted on animal models, examining the discharge patterns of single fibers in response to controlled acoustic stimuli. His findings were pivotal to understanding the basic mechanisms of hearing and set the stage for future studies of human auditory processing.

The EPL's move to the fourth floor of the new Mass Eye and Ear tower in 1974 provided additional space along with four large soundproof rooms for neurophysiological research. These spaces created ambient sound levels that were below the threshold of hearing at all frequencies—an engineering feat unmatched anywhere else in the world. These soundproof chambers and their associated control

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From left to right: Former Director of the EPL, M. Charles Liberman, PhD, and current Director of the EPL, Daniel B. Polley, PhD.

"As my tenure as Director came to an end, it became clear the legacy laboratory space on the fourth floor was outdated and inefficiently used. We desperately needed more wet lab space, as well as space for at least two additional investigators."

—M. Charles Liberman, PhD

"The original space was dark and fragmented, and some of the facilities that were considered state-of-the-art a half century ago were not well-fit to the frontier of hearing research today. But it's the trainees that are the real engines of discovery, so perhaps most importantly of all, we wanted to create a space that helped the next generation of researchers feel that the EPL is a great place to work and train."

—Daniel B. Polley, PhD

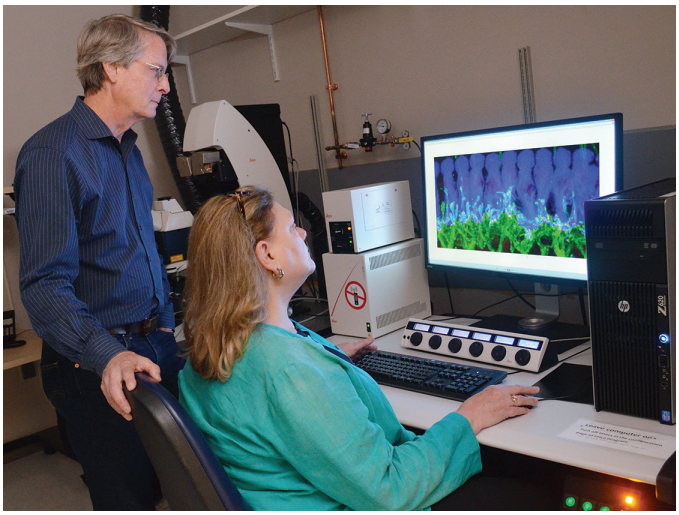
rooms were able to accommodate large-animal experiments as well as sizable computers and electronic hardware, which were being used by EPL researchers for the first time. The structure of the EPL was well-equipped for critical discoveries in auditory physiology.

## Pioneering research breakthroughs of the past

In its expanded home, the EPL remained a site for cutting-edge neurophysiological discoveries. In the 1970s and 1980s, Dr. Liberman published a series of now-classic experiments revealing how the auditory periphery can encode acoustic stimuli over a range of stimulus intensities spanning five orders of magnitude. His work revealed that the fibers of the auditory nerve comprise three distinct subpopulations that differ in sensitivity to sound and background discharge rate. He showed how the synaptic connections of these three groups differ, both in the inner ear, where they originate, and in the brain regions to which they project. The idea that low-threshold fibers are key for hearing in quiet environments and high-threshold fibers are necessary to understand speech in noisy environments remains highly influential to this day.

"In the 1970s, conducting neurophysiological experiments required 12 racks of equipment, each the size of a large refrigerator. Three of the racks housed computers and their associated disk drives. Each disk was the size of a garbage can lid," said Dr. Liberman. "Today, that same functionality is contained within a piece of hardware smaller than a toaster."

M. Charles Liberman, PhD, and Sharon G. Kujawa, PhD, study hidden hearing loss in tissue specimens from the inner ear.



Trainees and investigators utilizing the new open space to analyze data and draft publications.

In 2009, Dr. Liberman and Sharon G. Kujawa, MS, PhD, Professor of Otolaryngology–Head and Neck Surgery at Harvard Medical School and EPL investigator, published a pivotal study in the *Journal of Neuroscience* that uncovered "hidden hearing loss," a phenomenon where overexposure to loud sounds causes permanent nerve damage to the inner ear, even if hearing sensitivity recovers. This damage, undetected by standard hearing tests, may lead to difficulties hearing in noisy environments and contribute to conditions like tinnitus and hyperacusis. The findings suggested that noise-induced damage is more severe than previously understood, opening new directions for hearing research.

In 2013, Albert Edge, PhD, Professor of Otolaryngology–Head and Neck Surgery at Harvard Medical School and EPL investigator, and colleagues conducted a first-of-its-kind study, published in *Neuron,* demonstrating that new hair cells can be formed in the inner ear after they are destroyed by noise. Dr. Edge used local delivery of a small molecule selected in a drug screen of chemicals known to influence a key molecular pathway for transforming sensory progenitor cells into hair cells during embryonic development. Prior to this study, hearing loss from damage to auditory hair cells was considered permanent because mammalian hair cells don't regenerate. This new process improved hearing in the noise-damaged ears, suggesting that it could one day be a potential treatment for hearing loss in humans.

## The renovation: Shaping the future

"As my tenure as Director came to an end, it became clear the legacy laboratory space on the fourth floor was outdated and inefficiently used. We desperately needed more wet lab space, as well as space for at least two additional investigators," emphasized Dr. Liberman.

In the spring of 2022, the EPL began its exciting transformation.

This ambitious undertaking was shaped by four main principles: modernizing infrastructure, addressing future research needs, supporting early-career investigators and optimizing space for collaboration.

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"We analyzed what was working, what needed improvement, what could be condensed, and ultimately, what we wanted for our shared resources. That was the first priority," explained Dr. Polley.

Dr. Polley added, "The original space was dark and fragmented, and some of the facilities that were considered state-of-the-art a half century ago were not well-fit to the frontier of hearing research today. But it's the trainees that are the real engines of discovery, so perhaps most importantly of all, we wanted to create a space that helped the next generation of researchers feel that the EPL is a great place to work and train."

One of the major changes was the removal of two large walk-in soundproof rooms, and their expansive control rooms. This freed up space for flexible, contemporary wet lab facilities to support new research in neuroscience, human otopathology, electrical and mechanical engineering; a lab space reserved for future recruits; private offices for principal investigators; and a new microscopy area.

> "The EPL's founding Director, Nelson Kiang, PhD, believed the most fertile soil for discovery was at the intersection of disciplines that were historically separate. The EPL renovation is a testament to Dr. Kiang's idea."
>
> – Daniel B. Polley, PhD

The new layout removed several private offices and converted them to large collaborative spaces where trainees and investigators can brainstorm new ideas and share laboratory discoveries. This has facilitated intermingling of different groups within the EPL, fostering communication and collaboration among labs that were previously siloed from one another. The new space also includes a lounge with complimentary coffee, where informal conversations may lead to serendipitous discoveries, and a teaching room for group presentations.

## Looking ahead

The EPL has expanded significantly since its inception, with auditory physiology remaining a major focus, while also incorporating biomedical engineering, computational modeling, genetic medicine and neuroscience.

"The EPL is a grand experiment in hearing research," said Dr. Polley. "The experiment began in 1958 when a philanthropist, a physiologist, an otolaryngologist and a hospital president made the decision to embed a first-rate research facility in the middle of a busy specialty hospital. Now, 66 years later, we can see the wisdom of that decision. Living in close quarters with world-class physicians and patients has motivated our research, keeping us mission-focused on the societal need for better hearing health care."

The EPL is now among the largest academic hearing research facilities in the world, with 17 federally funded investigators and approximately 120 scientists studying every stage of the auditory system—from the middle ear to the auditory cortex—at levels of analysis ranging from genetics to human hearing. Translational neuroscience is an important area of active growth at the EPL, where researchers are exploring how neurons in the auditory nerve and brain sculpt conscious awareness of environmental sounds, speech and music but also cause debilitating hearing disorders. Scientists seek to develop the next generation of auditory prosthetics, to devise new physiological measurement for common hearing disorders that cannot be caught by conventional hearing tests, and to develop

neuroscience-based treatments for disorders such as difficulties hearing in noise, hyperacusis and tinnitus.

Researchers of the EPL are also delving deeper into the genetics behind hearing loss, studying which mutations cause hearing deficits and how these genes regulate the development and degeneration of the hearing organ. The development of small molecule therapeutics and genetic treatments for hearing loss is now a major area of focus at the EPL, with efforts underway to reverse heritable and acquired hearing loss via hair cell regeneration, gene therapy and genome editing technologies.

"The EPL's founding Director, Nelson Kiang, PhD, believed the most fertile soil for discovery was at the intersection of disciplines that were historically separate," said Dr. Polley. "The EPL renovation is a testament to Dr. Kiang's idea. Cross-disciplinary insights were key to the EPL's historical success, and now, the physical and intellectual blending of expertise in medicine, engineering, cell biology and neuroscience will be equally important for solving the next great mysteries of hearing, hearing loss and hearing restoration." ■

Newly renovated lab spaces.

# Exploring New Frontiers:

## AI's Emerging Role in Otology

A resident from the Harvard Combined Program in Otolaryngology–Head and Neck Surgery and a mentor from Mass Eye and Ear are collaborating to advance the future of artificial intelligence in otology.

Modern-day otolaryngologists are immersed in visual data. From reviewing audiograms to analyzing imaging to recording patient information, otolaryngologists manage a constant stream of data that demands careful interpretation, clear communication with colleagues and patients, and decision-making that can profoundly impact lives. Accurate analysis of this data is critical; however, this can often become time-consuming and highly subjective.

Artificial intelligence (AI), the field of computer science focused on developing systems that perform tasks traditionally requiring human intelligence, has been at the forefront of advancements in every industry—health care included. However, the conversation about developing and implementing AI in everyday clinical care is just beginning in otolaryngology and otology.

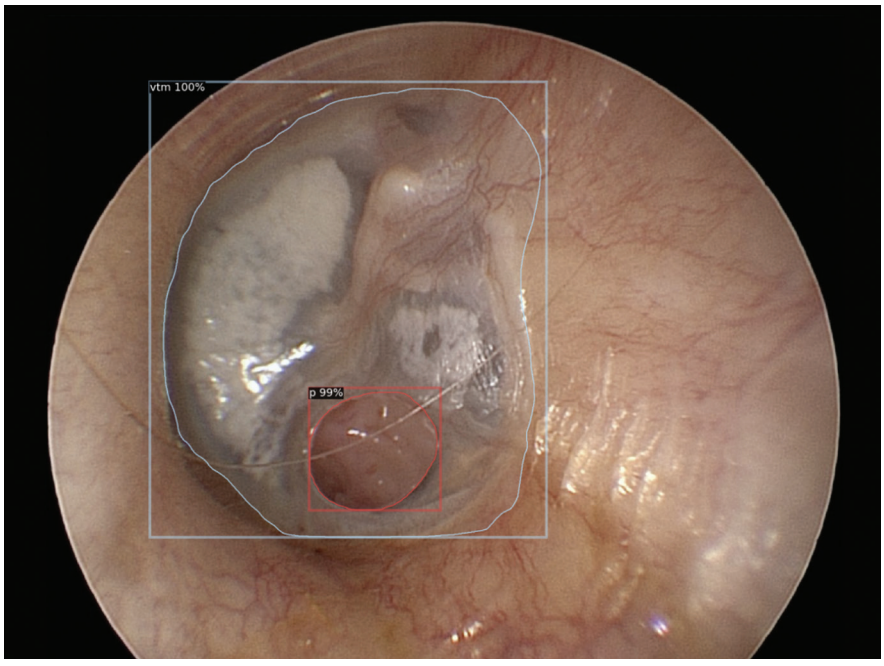
In collaboration with his mentor, Matthew G. Crowson, MD, MPA, MASc, MBI, Assistant Professor in Otolaryngology–Head and Neck Surgery at Harvard Medical School and Director of Clinical Informatics and Artificial Intelligence at Mass Eye and Ear, PGY-4 resident Obinna "Obi" Nwosu, MD, has spearheaded new approaches to incorporate AI into problems commonly encountered in otology clinics and operating rooms.

"The research being completed by Dr. Nwosu is uncommon. You can count on one hand how many people nationally are focusing their efforts on applied AI research—it's a small community," shared Dr. Crowson. "We aim to attract the brightest minds in our Harvard Combined Program in Otolaryngology–Head and Neck Surgery, and my goal in this leadership role at Mass Eye and Ear is to develop the next leaders in AI for health care delivery. And that's exactly what is happening here with trainees like Dr. Nwosu."

## Novel use cases for AI in Otology

Early on in his training, Dr. Nwosu recognized the complexity of his specialty of interest: otology. "Surgeons, particularly otologists, manage multiple streams of intricate data whether in the OR, clinic or lab, and their attention to detail greatly influences patient outcomes," said Dr. Nwosu. "This relationship, between the data we manage and our patients' outcomes, is what informs our research in AI—how can we make the creation, management and interpretation of this data more efficient and objective?"

Together, Drs. Crowson and Nwosu identified areas within otology that could benefit from AI. Their work has concentrated heavily on automating otologic image interpretation using computer vision, a subfield of AI wherein computers are trained to analyze and extract meaningful information from visual data. Their first project in this space dealt with measuring tympanic membrane perforations.




Example of an automated ear drum perforation detection.

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A tympanic membrane perforation, or a ruptured eardrum, will affect nearly six million individuals during their lifetime in the United States alone. Perforations in the tympanic membrane can negatively impact hearing and can be a predisposition to infections and the development of cholesteatoma.

The size of a perforation, or how much of the eardrum is missing, is one of many factors which inform the patient's symptoms and necessary management. Conventionally, to determine the size of the hole in the eardrum, a provider makes a gross estimation through the visual inspection with the use of an otoscope, a practice prone to inaccuracy.

From left to right: Matthew G. Crowson, MD, MPA, MASc, MBI, and Obinna Nwosu, MD.

To find a solution for more accurate measurements, Drs. Nwosu and Crowson utilized an open-source deep learning architecture to train an instance segmentation model to segment and calculate the area of perforation. "These [instance segmentation] models allow a computer to learn boundaries of an object of interest within an image," explained Dr. Nwosu. "We manually annotate the boundaries of objects of interest in high-quality images and pass these images and annotations to the model to train on. The annotated images are like a blueprint, teaching the model the key features of each object."

After training their model, the duo tested the model on a separate set of images it hadn't seen before to evaluate its ability to delineate the perforation's boundaries. The team then conducted an expert validation study comparing clinicians' ability to estimate the size of a perforation against the computer's performance. On average, clinicians overestimated perforation size by 11 percent compared to the ground truth, while the model overestimated perforation size by only 0.8 percent. These findings were published in *The Laryngoscope*.

"We were pleased with these results, as it demonstrated the feasibility of a more accurate approach to a conventional practice, that computer vision can be used to estimate tympanic membrane perforation size," said Dr. Crowson. "To our knowledge, this is the first study on this topic published in the literature, and we are especially excited and proud that the idea originated from one of our residents."

The second area in otology that could benefit from computer vision is the detection of instruments and anatomy during transcanal endoscopic ear surgery (TEES). During TEES, physicians watch live video footage captured with an endoscope, allowing them to observe anatomic structures in real-time as their surgical instruments interact with the anatomy.

The research team proposed that the high-quality video data obtained from TEES could be used to develop surgical computer vision applications. Their project applied image segmentation to analyze images of the middle ear during TEES.

To develop the computer vision model, Drs. Nwosu, Crowson and team manually annotated a large dataset of 1,145 images. These annotated images were used to train the AI model using the image segmentation framework Detectron2 (Meta Inc). Once trained, the model was tested on images and video to assess its ability to identify and outline anatomical boundaries in real time. The AI model successfully predicted and outlined the boundaries of these structures in live

video, even without having seen the exact images before. These results were published in *Otolaryngology–Head and Neck Surgery*.

The project marks foundational work in automated surgical environment understanding, central to developing systems for surgical performance assessment. The team believes there is an unmet need to develop approaches for objective and automated surgical performance assessment and computer vision models, and this work is an important step toward their development. The project is also a preliminary step toward robotic-assisted surgery. For a robot to assist or perform surgery, it must be able to "see" and understand the surgical environment, recognizing important structures to avoid. AI-driven segmentation, the duo believes, will be a key component in developing such robotic-assisted platforms.

Drs. Nwosu and Crowson's focus on automated surgical scene understanding continued in developing a novel system for real-time otologic drill motion analysis. Their work, published in *The Laryngoscope,* details a computer vision system that uses live video data to measure a variety of motion parameters of an otologic drill during mastoidectomy. This marks another step toward using AI and computer vision to maximize the data available at a surgeon's fingertips.

"I wanted to train here at Harvard in part because I wanted to innovate in the field of otolaryngology," said Dr. Nwosu. "I've always had a lot of ideas, and very early on in training, I found myself looking for someone to listen to, critique, redirect and help shape those ideas. Dr. Crowson has been consistently available and engaged in thinking through every idea I've brought to him. And now we have multiple first-of-their-kind projects, thanks to his mentorship."

## The future: Integrating AI into clinical care

Dr. Nwosu shared that identifying new routes to utilize AI in otolaryngology and proving its capability are critical steps before integrating it into clinical care and surgical practice, which is the main objective of their work.

Inevitably, there will be apprehension surrounding widely adopting AI into any health care space, which is why Drs. Crowson, Nwosu and Anaïs Rameau, MD, Assistant Professor and Director of New Technologies in the Department of Otolaryngology–Head and Neck Surgery at Weill Cornell Medical College, addressed the importance of AI governance in a commentary published in *The Laryngoscope*.

AI governance ensures that AI systems are ethical, fair and interpretable throughout their lifecycle.

Understanding AI is crucial for all involved parties, including developers, providers and patients. This involves model transparency and comprehension of how an AI model makes decisions, enabling clinicians to understand the reasoning behind the AI output. It's important for human clinicians to know the result and how and why the model arrived there.

Ensuring fairness in AI also includes mitigating bias. "For instance, while image datasets of eardrums or the middle ear anatomy may not be subject to conventional types of bias (such as ethnic or racial bias), different pathologies create drastic differences in the appearances of ear. Therefore, robust AI must be trained and validated across several diverse conditions to avoid unintended bias," explained Dr. Crowson.

> "Significant progress has been made in transitioning AI tools from development to clinical use—a process that will continue to evolve and grow. I look forward to continuing to be a part of that journey."
>
> – Obinna Nwosu, MD

To fully integrate AI into otolaryngology and health care in general, continuous oversight and monitoring are essential. This includes establishing teams to review AI tools, setting up auditing systems to detect and correct unfair models, and planning updates for AI models as needed.

"Significant progress has been made in transitioning AI tools from development to clinical use—a process that will continue to evolve and grow. I look forward to continuing to be a part of that journey," Dr. Nwosu shared. "I am elated to have the opportunity to innovate in this space and am deeply grateful to Dr. Crowson for his mentorship and support as we continue down this new and exciting research path." ■

# Simulation:
## Advancing All Facets of Education

**Beth Israel Deaconess Medical Center is leading the way in utilizing simulation to enhance education for patients, surgeons and trainees.**

Since 2006, the Shapiro Simulation and Skills Center, otherwise known as the Sim Center, at Beth Israel Deaconess Medical Center (BIDMC) has been a leader in medical and surgical simulation education. It offers training across all levels and disciplines, using innovative techniques to replicate real-life patient care scenarios, from routine procedures to acute crisis management. With its comprehensive programs and large scale, the Sim Center is one of the leading simulation training centers in the country.

In 2019, Ernest D. Gomez, MD, an Instructor in Otolaryngology–Head and Neck Surgery at Harvard Medical School, was recruited to serve as an attending physician in the Division of Otolaryngology, Head and Neck Surgery within the Department of Surgery at Beth Israel Deaconess Medical Center. Dr. Gomez's unique background in engineering, surgical robotics and design, along with his fellowship training in head and neck oncology and microvascular reconstruction, led him to dedicate a significant portion of his career to advancing simulation training and education in the field. In 2022, he was appointed the Co-director of Surgical Education Technology and External Programming at the Sim Center.


From left to right: Ernest D. Gomez, MD, and residents Lauren Schlegel, MD, and Brett Campbell, MD, holding 3D-printed components of the upper aerodigestive tract.

In 2023, he established a 3D Printing and Innovation Laboratory within the Sim Center and subsequently was named as a Multiple Principal Investigator on a National Institutes of Health (NIH) R01 grant to design a virtual reality simulator of Transoral Robotic Surgery (TORS), which currently does not exist.

"In otolaryngology–head and neck surgery, we work in extremely complex spaces, which makes it challenging to learn from flat images or even 3D models viewed on a screen," emphasized Dr. Gomez. "To assist with surgical planning, ensure patient understanding in difficult cases and maximize training efforts for residents, the use of simulation is essential."

"In otolaryngology–head and neck surgery, we work in extremely complex spaces, which makes it challenging to learn from flat images or even 3D models viewed on a screen. To assist with surgical planning, ensure patient understanding in difficult cases and maximize training efforts for residents, the use of simulation is essential."
– Ernest D. Gomez, MD

## 3D printing benefits and utilization

In the 3D Printing and Innovation Laboratory, Dr. Gomez uses various techniques to create models for different purposes. The lab includes a Polylactic Acid (PLA) printer, which quickly produces models by depositing layers of hot plastic. Depending on the size, prints can be completed in minutes or hours. Additionally, the Sim Center houses an advanced stereolithography (SLA) printer that can print both soft and hard materials in fine detail. This printer, which

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uses lasers to solidify liquid resin, prints upside down and can produce intricate models like bronchial trees, though larger prints may take days. This printer is also capable of 3D printing materials that are FDA approved for sterilization for use as surgical guides in the operating room as well as for bolsters and temporary implants.

As a head and neck oncology and microvascular surgeon, Dr. Gomez has seen the benefits of 3D printing in surgical planning. For example, in reconstructive surgery using a fibula bone to rebuild the jaw or midface, Dr. Gomez prints models to shape and bend titanium plates before surgery, saving valuable time in the operating room.

"This approach has proven effective not only in otolaryngology surgery but also in other specialties. Our lab is expanding and is being utilized throughout BIDMC," shared Dr. Gomez. "We've collaborated with interventional pulmonology to 3D print models of airway abnormalities using real patient CT scans. This allows interventional pulmonologists to practice applying stents and performing various interventions on these models before treating the actual patients."

3D models also play a key role in patient education. Dr. Gomez's team has created printed models of the larynx and temporal bone, some based on patient scans, to help explain conditions and procedures. "Many patients don't fully understand the anatomy beneath their skin," Dr. Gomez explained. He remembered working with a patient requiring jaw reconstruction, who felt reassured after seeing a 3D model of the post-surgery result. "Hearing that three-quarters of your jaw will be removed can be alarming, but the model helped build trust," Dr. Gomez added.

The final and arguably the most critical benefit of 3D printing includes trainee education. The lab produces models of organs and low-fidelity training tools, such as task trainers, for teaching basic dexterity with different instruments. More advanced projects involve 3D-printed molds to cast soft plastic materials that mimic human tissue. These materials can be sewn, cut and cauterized, making them ideal for surgical training.

"We have two residents working with Dr. Gomez to develop innovative 3D-printed simulation models for complex surgeries," said Scharukh M. Jalisi, MD, Associate Professor of Otolaryngology–Head and Neck Surgery at Harvard Medical School and Chief of Otolaryngology, Head and Neck Surgery at Beth Israel Deaconess Medical Center. "Their work is enhancing trainee education and advancing the use of this technology in our specialty."

## New approaches to trainee education

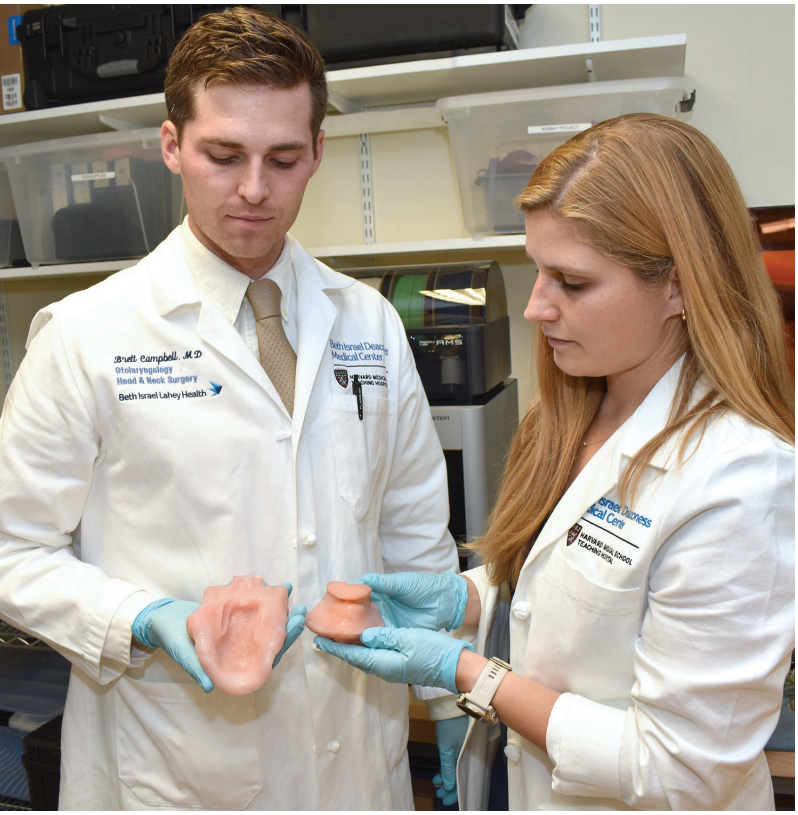
Lauren Schlegel, MD, PGY-2 resident, and Brett Campbell, MD, PGY-4 resident, both in the Otolaryngology–Head and Neck Surgery Residency Program at Beth Israel Deaconess Medical Center/ Harvard Medical School, have spearheaded groundbreaking projects in the 3D Printing and Innovation Laboratory.

Drs. Schlegel and Campbell collaborated to develop a 3D-printed model of the oral cavity and oropharynx with modular components, enabling trainees to practice challenging procedures like partial glossectomy, flap inset and TORS. "As otolaryngology residents, we understand which procedures are most difficult for trainees, helping us identify key areas that need more practice," said Dr. Schlegel.

For example, deep suturing during a partial glossectomy can be challenging, and improper technique may lead to complications such as fistulas. While Drs. Schlegel and Campbell were developing the glossectomy 3D model, Dr. Gomez suggested using polyvinyl alcohol, a material that can conduct electricity. Using this material allows trainees to practice both tumor removal and suturing, which is far more complex in the mouth's confined space.

> "Simulation in otolaryngology is rapidly advancing, and I am proud that we are training the future leaders in the field. It is a key part of our Harvard mission."
> – Scharukh M. Jalisi, MD

Dr. Schlegel emphasized, "That's what I love about simulation and 3D printing—after we've identified a weakness, we have the tools build a way to improve. With Dr. Gomez's expertise, we've built something that offers hands-on experience to refine our skills."




From left to right: Residents Brett Campbell, MD, and Lauren Schlegel, MD, holding a tongue and pharynx hydrogel created with 3D printing technology.

The model, the first of its kind to feature an electrically conductive artificial tongue for electrocautery practice, enables trainees to develop crucial psychomotor skills before entering the operating room.

Dr. Campbell shared, "At the 2024 Academy of Otolaryngology–Head and Neck Surgery Annual Meeting, we presented our model in the SIM Tank competition and won first place. Dr. Gomez's guidance has opened doors for us to present at national conferences, network and gain valuable non-clinical skills alongside our surgical training."

Looking ahead, the team plans to adapt their model for various other procedures, including tonsillectomy, TORS base of tongue resection, radical tonsillectomy, uvulopalatopharyngoplasty, tongue suspension, lingual tonsillectomy, tongue base reduction and palatoplasty.

"Simulation in otolaryngology is rapidly advancing, and I am proud that we are training the future leaders in the field. It is a key part of our Harvard mission," added Dr. Jalisi.

## The future of simulation

To advance training for complex head and neck surgeries, Dr. Gomez is collaborating with Suvranu De, PhD, Dean of the Florida State University College of Engineering, and Mouhsin Shafi, MD, PhD, a neurologist at Beth Israel Deaconess Medical Center and Associate Professor in Neurology at Harvard Medical School. Supported by a NIH R01 grant, they are developing a new method that combines brain stimulation with surgical training devices to help doctors learn TORS more quickly and efficiently.

According to Dr. Gomez, TORS is typically learned during fellowship, requiring roughly 20-35 cases for basic proficiency. "Many novice surgeons reach this benchmark while operating on live patients, which may lead to higher rates of inadequate surgical margins in some low-volume centers," he explained.

To address this, the team is creating a Virtual Transoral Robotic Surgical (VTORS) simulator integrated with transcranial direct current stimulation (tDCS) to accelerate training. The VTORS simulator will be platform-independent, cost-effective and use virtual reality technology to create a high-resolution training environment. Incorporating tDCS aims to speed up skill acquisition and improve training in complex motor skills, ultimately enhancing surgical proficiency and patient outcomes.

"This project is unique because each investigator brings different expertise," Dr. Gomez noted. Dr. Shafi will focus on brain stimulation to accelerate skill learning, Dr. Gomez will design the physical robotic tongue base surgery simulator, and Dr. De, the main principal investigator, will lead the creation of an immersive virtual reality world for the simulation.

Dr. Gomez shared that as a resident, he and a peer developed a transoral robotic surgery simulator using pig tongues, and they published their work in *The Laryngoscope*. Nearly seven years later, he is now creating a synthetic simulator, entirely lab-grown, instead of using animal tissue.

"Our work in simulation continues to evolve and build on past efforts," said Dr. Gomez. "As times change, we advance our previous work and develop new ideas, all with the goal of accelerating progress in otolaryngology–head and neck surgery. The future is bright for trainees, surgeons and patients in this vital field." ■

# FAREWELL CLASS OF 2024

## Harvard Medical School Celebrates Residents and Fellows Graduating From Combined Otolaryngology Training Program.

Faculty and staff from the Department of Otolaryngology–Head and Neck Surgery (OHNS) at Harvard Medical School (HMS) celebrated the 2024 graduating class of residents from the Harvard Combined Residency Program in OHNS and fellows on Friday, June 14. Graduating residents and fellows were honored inside the Meltzer Auditorium at Mass Eye and Ear, where they were also joined by current and former trainees and immediate family.

Five chief residents graduated from the program, which is led by HMS Otolaryngology Residency Director Stacey T. Gray, MD, Associate Residency Directors Kevin S. Emerick, MD, Alice Z. Maxfield, MD, and David H. Jung, MD, PhD, FACS, and Chair of OHNS Mark A. Varvares, MD, FACS. Seven fellows graduated from the program at Mass Eye and Ear; four clinical fellows from Boston Children's Hospital celebrated their graduation on a separate occasion.

Dr. Varvares opened the ceremony by emphasizing that "today is the best day of the year," a remark repeated throughout the graduation. He expressed his gratitude to the extraordinary mentors who have gone above and beyond to provide the highest level of training. In honor of Mass Eye and Ear's bicentennial year, he reminded the group that the organization was founded to train the future leaders of medicine and reminisced about the legacies who have trained in this program.

"To the class of 2024, we are so proud of what you have accomplished, and we celebrate with you today as you finish one chapter and prepare to start the next of what we are sure will be amazing careers," said Dr. Varvares.

Shortly after, Dr. Jung introduced Michael J. McKenna, MD, Chief Surgical Officer and Co-Founder of Akouos, as the Joseph B. Nadol, Jr., MD, Graduation Lectureship speaker. In 1988, Dr. McKenna completed his training in the Harvard Combined Residency Program in OHNS. He subsequently joined the faculty at Harvard Medical School and Mass Eye and Ear, where he developed an exceptional clinical and academic research career for the next 30 years.

In his speech, Dr. McKenna began by emphasizing that the greatest part of being an academic clinician is witnessing your trainees' careers grow and develop over time. He talked about the "greats" from Mass Eye and Ear and elsewhere who influenced his career, and highlighted the importance of mentors and robust leadership. He shared that all who have trained here are left with a desire and need to train those who follow the same path.

> "It's now your turn to look back and support those who are following in your footsteps."
>
> –Michael J. McKenna, MD

In closing, Dr. McKenna left the residents with this meaningful note: "Today is a milestone in your lives. From now on, you will be the ones making decisions that impact your patients' lives. You'll be in the operating room with no one looking over your shoulder, and it might be a little scary at first, but you will grow from that experience. Finally, it's now your turn to look back and support those who are following in your footsteps. Providing them with encouragement and guidance will be one of the most rewarding things you do in life."

Following graduation, there was an annual reception and award ceremony hosted at the Boston Museum of Science. During this year's ceremony the Chief Resident Teaching Award was presented by the PGY-4 resident class, with a surprise special announcement. After a challenging year for Dr. Varvares with personal health struggles, his colleagues have renamed and endowed in perpetuity this award to the Mark A. Varvares Chief Resident Teaching Award. The residents shared that through much adversity, he has still managed to show incredible grit, leadership and humility—this renaming was a way for the department to honor him. ■

## Awards and Honors

**Jeffrey P. Harris, MD, PhD, Research Award**
*Presented to the graduating chief resident with the most outstanding FOCUS research project.*

**Phoebe K. Yu, MD, MPH**
*Postoperative Outcomes in Sleep-Disordered Breathing*

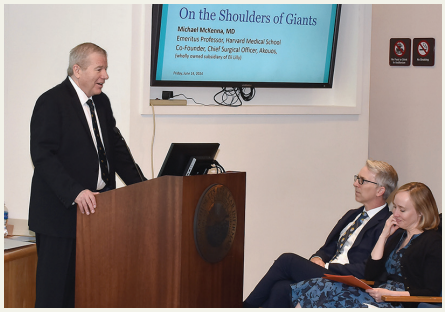
Phoebe K. Yu, MD, MPH, left, was presented the Jeffery P. Harris, MD, PhD, Research Award by David Jung, MD, PhD, FACS, right.

**Clinical Fellow Teaching Award:**
**Nicole T. Jiam, MD**

**Mark A. Varvares, MD, FACS, Chief Resident Teaching Award:**
**Michael P. Wu, MD,** and **Roy Xiao, MD**

**William W. Montgomery, MD, Faculty Teaching Award:**
**David H. Jung, MD, PhD, FACS**

**Harvard Otolaryngology Resident Life Award:**
**Julie Arria**




Guest speaker Michael J. McKenna, MD.


From left to right: Graduating Mass Eye and Ear residents Roy Xiao, MD, MS; Elliana K. DeVore, MD; Krish Suresh, MD; Phoebe K. Yu, MD, MPH; and Michael P. Wu, MD.


From left to right: Graduating Mass Eye and Ear fellows Firas Sbeih, MD; Noel Fahed Ayoub, MD, MBA; Marika D. Russell, MD, FACS; Keith D. Volner, DO; Omar A. Karadaghy, MD, MSCI; Nicole T. Jiam, MD; and Kevin J. Quinn, MD.

## Graduating Residents, Mass Eye and Ear

**Elliana K. DeVore, MD**
*Future Plans:* Laryngology Fellowship, Icahn School of Medicine at Mount Sinai

**Krish Suresh, MD**
*Future Plans:* Neurotology Fellowship, University of California San Diego

**Michael P. Wu, MD**
*Future Plans:* Head and Neck Oncologic and Reconstructive Surgery Fellowship, Washington University in St. Louis

**Roy Xiao, MD, MS**
*Future Plans:* Facial Plastic and Reconstructive Surgery Fellowship, Mass Eye and Ear/Harvard Medical School

**Phoebe K. Yu, MD, MPH**
*Future Plans:* Sleep Medicine Fellowship, University of Pennsylvania

## Graduating Fellows, Mass Eye and Ear

**Noel Fahed Ayoub, MD, MBA**
*Rhinology*
*Future Plans:* Assistant Professor, Rhinology and Skull Base Surgery, Stanford Healthcare

**Nicole T. Jiam, MD**
*Neurotology*
*Future Plans:* Assistant Professor, Division of Otology, Neurotology, and Skull Base Surgery, University of California San Francisco

**Omar A. Karadaghy, MD, MSCI**
*Head and Neck Oncology*
*Future Plans:* Assistant Professor, University of Kansas Medical Center

**Kevin J. Quinn, MD**
*Facial Plastic and Reconstructive Surgery*
*Future Plans:* Practicing Facial Plastic and Reconstructive Surgery Physician, Ohio State

**Marika D. Russell, MD, FACS**
*Thyroid and Parathyroid Surgery*
*Future Plans:* Faculty, Thyroid/Parathyroid Endocrine Surgical Division, Mass Eye and Ear, Boston and Medford

**Firas Sbeih, MD**
*Rhinology*
*Future Plans:* Assistant Professor, University of Florida, Jacksonville

**Keith D. Volner, DO**
*Pediatric Otolaryngology*
*Future Plans:* U.S. Army Pediatric Otolaryngology Head and Neck Surgery Physician, first assignment at Fort Cavazos, Texas

## Graduating Fellows, Pediatric Otolaryngology, Boston Children's Hospital

**Ghedak Ansari, MD, MPH, MSEd**
*Future Plans:* Pediatric Otolaryngologist, Children's Hospital of Richmond, Virginia Commonwealth University

**Thomas "T.C." Flowers, MD, MPH**
*Future Plans:* Pediatric Otolaryngologist, Children's Hospital of New Orleans, Louisiana State University

**Zachary Kelly, MD**
*Future Plans:* Pediatric Otolaryngologist, Medical University of South Carolina

**Sepideh Mohajeri, MD**
*Future Plans:* Pediatric Otolaryngologist, McMaster University

Graduating fellows from Boston Children's Hospital, left to right: Ghedak Ansari, MD; Sepideh Mohajeri, MD; Zachary Kelly, MD; and Thomas "T.C." Flowers, MD.

# NEW TRAINEES

## Meet our PGY-1 Residents

### Harvard Combined Residency Program in Otolaryngology–Head and Neck Surgery

**Daniel Bu, MD, MPP, MBA,** grew up in Surrey, British Columbia and graduated summa cum laude and Phi Beta Kappa from the University of Pennsylvania, earning a degree in neurobiology and French studies. He then matriculated at the Icahn School of Medicine at Mount Sinai through the Donald and Vera Blinken FlexMed Program. In medical school, he received the Oxford-Pershing Square scholarship to study at Christ Church, University of Oxford, where he completed both the Master of Public Policy (MPP) and Master of Business Administration (MBA) with distinction. Subsequently, he worked on the Impact Evaluation and New Markets teams at Zipline, a company using autonomous drones to deliver blood and medical products in Africa. Dr. Bu's interests include econometric modeling in surgery, systems science and local and international health innovation.

Originally from Seattle, Washington, **Minjee Kim, MD,** graduated summa cum laude from Amherst College with a degree in biophysics. She subsequently matriculated at Harvard Medical School, where she completed the joint Harvard-Massachusetts Institute of Technology MD program within the Division of Health Sciences and Technology. While at Harvard Medical School, Dr. Kim studied patient-reported outcome measures in hearing loss and allergic rhinitis. Her research interests include cancer genetics, patient-reported outcome measures, clinical outcomes and medical education.

**William Benjamin, MD, MPH,** of Edina, Minnesota attended the University of Michigan and received a degree in biology. He then earned a Master of Public Health in molecular epidemiology at the University of Michigan School of Public Health. He subsequently matriculated to the University of Michigan Medical School, where he graduated cum laude and with distinction in Medical Research. Throughout graduate and medical school, Dr. Benjamin conducted translational and epidemiological research on head and neck cancer. His interests include cancer biomarkers and precision oncology, cancer epidemiology, health services research and medical education.

**Calvin Kersbergen, MD, PhD,** grew up in rural central Maine on his family's organic farm. He attended Cornell University, graduating magna cum laude with a degree in biological engineering, then subsequently matriculated in the combined MD/PhD training program at The Johns Hopkins University School of Medicine. There, he obtained a PhD in neuroscience and studied how the developing inner ear and brain communicate to form and refine connections critical for detecting and processing sound, and identified how these mechanisms are altered in models of early hearing loss. As a medical student, Dr. Kersbergen also worked to identify and address persistent gender disparities in physician-scientist training. Dr. Kersbergen's interests include cochlear electrophysiology and development of novel targeted therapeutics for hearing loss.

**Sarah Nuss, MD,** of Wayland, Massachusetts, graduated magna cum laude from Duke University with degrees in Biology and Global Health. Prior to attending medical school, she conducted research at Boston Medical Center focused on improving health care accessibility and spent a year working with Partners in Health in Chiapas, Mexico. Dr. Nuss matriculated at The Warren Alpert Medical School of Brown University, where she engaged in research with the Global Otolaryngology–Head and Neck Surgery Initiative. During her medical training, she spent a year as a research collaborator with the Harvard Program in Global Surgery and Social Change and was awarded a National Institutes of Health Fogarty Global Health Training Fellowship to conduct research with Partners in Health in Rwanda aimed at improving surgical care access in district hospitals in Rwanda. Dr. Nuss' interests include global health, surgical capacity building, research equity and low-cost surgical simulation.

## New Clinical Fellows

### Mass Eye and Ear


[1] **Abel David, MD**
*Neurotology*


[2] **Katherine Larrabee, MD**
*Thyroid*


[3] **Sean McKee, MD**
*Rhinology*


[4] **Tina Munjal, MD**
*Neurotology*


[5] **Sarah Nyirjesy, MD**
*Head and Neck*

[6] **Sathish Paramasivan, MD**
*Rhinology*

[7] **E'Ching Shih, MD**
*Pediatric Otolaryngology*

[8] **Roy Xiao, MD**
*Facial Plastic*

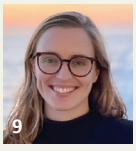



### Boston Children's Hospital

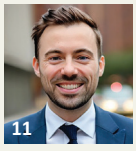
[9] **Isobel O'Riordan, MB, BCh, BAO**

[10] **Ross O'Shea, MB, BCh, BAO**

[11] **Jakob Pugi, MD**







# OHNS Residency Program at Beth Israel Deaconess Medical Center/ Harvard Medical School Hosts End-of-Year Celebration

On Friday, June 14, the Otolaryngology–Head and Neck Surgery (OHNS) Residency Program at Beth Israel Deaconess Medical Center/Harvard Medical School honored its graduating fellow and celebrated its newest class of trainees during its end-of-year celebration. The celebration was led by **Scharukh M. Jalisi, MD,** Chief of OHNS and Program Director for the Head and Neck Surgical Oncology and Skullbase Surgery Fellowship at the Beth Israel Deaconess Medical Center; **James G. Naples, MD,** OHNS Residency Director at the Beth Israel Deaconess Medical Center; and **Stephanie E. Teng, MD,** Associate OHNS Residency Director at the Beth Israel Deaconess Medical Center.

One graduating fellow was honored at the event: **Laurent Ganry, MD,** the program's Advanced Head and Neck and Microvascular Surgery Fellow. He will continue his professional journey as faculty at Long Island Jewish Hospital in Head and Neck Surgery and Oral Surgery.

From left to right: Ernest D. Gomez, MD, graduating fellow Laurent Ganry, MD, and Scharukh M. Jalisi, MD.

## Please join us in welcoming the newest class of trainees to the OHNS Residency Program at Beth Israel Deaconess Medical Center/Harvard Medical School

### Residents

Originally from India, **Nirvikalpa Natarajan, MD,** graduated magna cum laude from The University of Texas, Dallas with a degree in biology. She subsequently earned her medical degree from Stanford University, School of Medicine, with a scholarly concentration of clinical research. There, she conducted research in otology under the mentorship of Konstantina Stankovic, MD, PhD, FACS, former faculty for the Department of Otolaryngology–Head and Neck Surgery at Harvard Medical School, and Tulio Valdez, MD, MSc. Additionally, she developed elective courses and worked on research projects related to medical education under the mentorship of Lars Osterberg, MD, MPH. During her time at Stanford, she also received two Stanford Medical Scholars Research Fellowship Awards for clinical research and medical education, an Honors Certificate from the Stanford Medicine Teaching and Mentoring Academy, and the James Lyons Award for Service. Dr. Natarajan's primary interests include clinical outcomes research, mentorship and medical education.

**Kavita Prasad, MD,** of Los Altos, California, graduated from Vanderbilt University with a degree in neuroscience. There, she studied the role of the p75 neurotrophin receptor in drug-induced apoptosis of leukemia cells. After working for a year as a medical scribe at the University of California San Fransisco, she matriculated into Tufts University School of Medicine as a dual MD/MPH candidate. Between her third and fourth year of medical school, she went back to Nashville to work as a research fellow for Vanderbilt's Department of Otolaryngology. She conducted a wide range of research in head and neck oncology including studies on intraoperative augmented reality and outcomes research for patients with positive margins. She additionally participated in a surgical mission trip to Kijabe, Kenya. Dr. Prasad is interested in public and global health initiatives in otolaryngology and health tech innovations.

# Laxmeesh "Mike" Nayak, MD, '03

Since opening his private facial plastic practice more than 18 years ago, Mike Nayak, MD, has embraced the mantra "pay it forward." While he has always had a passion for teaching and helping others, Dr. Nayak can pinpoint the formative years that shaped this dedication: his residency.

During his otolaryngology residency training at Harvard Medical School/Mass Eye and Ear, Dr. Nayak was captivated by the breadth of the field and the intellect that surrounded it. As he trained across various divisions, he learned from numerous trailblazers. He studied rhinology under Salah Salman, MD, the first director of the Sinus Center at Mass Eye and Ear and one of the earliest adopters of endoscopic sinus surgery in the department; gained insight into the complexities of ear surgery under Joseph B. Nadol, Jr., MD, a pioneer in otology and the department's youngest chairman; and learned the interpersonal nuances of ambulatory patient management from Parviz Janfaza, MD, former director of the residency educational program and leader of emergency room training.

"I feel very fortunate to have trained in the era I did, influenced by larger-than-life figures in otolaryngology," shared Dr. Nayak. "I saw them in their prime, and it has shaped my career."

As his residency ended, he sharpened his focus on improving and restoring the structure and function of the head and neck, leading him to specialize in facial plastic surgery.

Dr. Nayak then completed a fellowship with the Glasgold Group in Highland Park, NJ, before returning to the St. Louis, MO area, where he grew up and attended medical school. There, he was offered two attending positions—one at Washington University, his alma mater, and another at St. Louis University.

During Dr. Nayak's residency, Mark A. Varvares, MD, FACS, now chair of the Department of Otolaryngology–Head and Neck Surgery at Harvard Medical School, Mass Eye and Ear and Massachusetts General Hospital, had been a tremendous mentor to him. Dr. Nayak referred to him as "the most prolific and gifted head and neck surgeon" he encountered in his training. By the time Dr. Nayak had completed his fellowship, Dr. Varvares had accepted the position of Chairman at St. Louis University. Dr. Nayak ultimately chose to join St. Louis University, largely due to Dr. Varvares' mentorship, sensing this was the right fit for him.

> "I feel very fortunate to have trained in the era I did, influenced by larger-than-life figures in otolaryngology. I saw them in their prime, and it has shaped my career."
> – Laxmeesh "Mike" Nayak, MD

After two years in academic medicine, Dr. Nayak realized that to truly advance his career as a facial plastic surgeon, he needed to be fully in control of his own practice.

"Dr. Varvares was incredibly understanding when I shared this news," said Dr. Nayak. "His only concern was my wellbeing, not the department's. His unconditional support is one of the many reasons his mentorship means so much to me."

When Dr. Nayak and his wife, Avani, opened Nayak Plastic Surgery, there were only three other members of the team—a nurse, office manager and esthetician. Now, 18 years later, the practice has nearly 60 staff members.

The practice comprises two main divisions: a non-surgical arm, where nurses and estheticians perform facial aesthetic procedures, and a surgical arm, led by Dr. Nayak. He is the sole otolaryngologist in the practice and has recently added a plastic surgeon associate.

Nayak Plastic Surgery has evolved significantly since its inception, and Dr. Nayak is internationally recognized for his work. "My practice now mainly consists of aging face surgery with some rhinoplasty. We have worked hard to be a leader in the country for face surgery, and as a result, 90 percent of our clients fly in for their surgery," Dr. Nayak emphasized.

In addition to seeing patients, Dr. Nayak spends approximately one-third of the year traveling for educational services. "There is an unspoken rule graduating from the Harvard Combined Program in Otolaryngology–Head and Neck Surgery that future attendings will become academicians and impact lives beyond patient care," said Dr. Nayak. "I may not be at an academic institution, but I certainly carry those values forward in my work."

Dr. Nayak also spends roughly 10 days annually on a medical mission trip to the National Otorhinolaryngology Hospital of Vietnam in Hanoi, the country's top referral center for head and neck diseases. He began participating in this yearly trip after he opened his practice as part of his ongoing humanitarian efforts. Dr. Nayak is joined by Frank Fechner, MD, a peer from his residency at Mass Eye and Ear, and typically two or three other surgeons.

The team screens several hundred patients in Vietnam to identify the most urgent and educationally valuable cases, which typically involve post-trauma or post-cancer reconstruction. When operating, Dr. Nayak and the U.S. team are accompanied by a Vietnamese attending and residents, aiming for local teams to perform more complex surgeries independently as time goes on.

Additionally, the local government brings surgeons from around the country to visit the National Otorhinolaryngology Hospital of Vietnam and observe the work of Drs. Nayak, Fechner and colleagues during their stay. Visitors gather in an auditorium to watch video feeds from the operating room and ask questions, creating a symposium-like environment to maximizes the educational impact.

"Our trip is not intended for us to complete as many cases as possible," said Dr. Nayak. "The priority is to enhance the skills of the attendings and empower them to train the next generation of head and neck surgeons in their country."

For his remaining weeks of teaching, Dr. Nayak is invited to major facial surgery conferences worldwide to give lectures, perform live surgeries or lead cadaver labs. However, his commitment to education does not end when he returns home.

At his practice in St. Louis, he hosts three surgeons per day to shadow him during surgeries. International surgeons spend a week observing, while domestic surgeons typically spend two days. Dr. Nayak wears a head-mounted camera that streams to a screen, allowing visiting surgeons to see procedures even during keyhole surgeries where only Dr. Nayak has a direct view of the surgical field.

Following these visits, Dr. Nayak noticed that many surgeons had lingering questions. "I spent nearly an hour each day answering questions, so I created a Telegram group to serve as a digital room for dialogue."

The group, called St. Louis Face, started out with Dr. Nayak's St. Louis colleagues and has now expanded to roughly 3,000 facelift surgeons worldwide. It is the largest ongoing professional community of its kind—a scientific meeting that never ends. "Every day, someone shares a question, a new insight, or a video, and ongoing discussions help the group continue learning about facial plastic and reconstructive surgery. This has become an invaluable tool for continuous education," Dr. Nayak said. "My commitment to education has only become stronger, and I am indebted to my mentors who helped me get to where I am today." ■

Visiting surgeons shadowing Mike Nayak, MD, in a cadaver lab.

## The Alumni Giving Society of the Department of Otolaryngology–Head and Neck Surgery at Harvard Medical School

The Department of Otolaryngology–Head and Neck Surgery at Mass 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 deliver critical resources, training tools and mentorship to the next generation of physicians, preparing them to become tomorrow's clinicians, researchers and leaders in otolaryngology and head and neck surgery.

Our alumni know from firsthand experience that support of the vital work of our students and faculty in the Department of Otolaryngology–Head and Neck Surgery helps drive continued excellence and innovation across education, research and patient care. In fiscal year 2024, we had 81 members who we thanked for their generosity and partnership. Their collective support helped us achieve our department goals and institutional mission.

The 200th Anniversary is a wonderful opportunity to reflect on what Mass Eye and Ear means to each of us and give back to support future generations of physicians, researchers and patients. If you are not already a member, please consider giving in honor of this historic occasion through your annual gift, named endowed gift or estate gift. 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**.

HARVARD MEDICAL SCHOOL | Department of Otolaryngology Head and Neck Surgery

**Current Alumni Giving Society members for fiscal year 2024, from October 1, 2023, to September 30, 2024, are listed below. With your gift of $1,000 or more, you will be included in the 2024 Alumni Giving Society.**

### CHAMPION

**(Gifts of $25,000 and more)**

Jeffrey P. Harris, MD, PhD
Ralph B. Metson, MD
Eugene N. Myers, MD, FACS, FRCS Edin (Hon)
Laxmeesh M. Nayak, MD
Michael M. Paparella, MD
Herbert Silverstein, MD, FACS

### VISIONARY

**(Gifts of $10,000 - $24,999)**

Michael S. Cohen, MD
Paul M. Konowitz, MD, FACS
David A. Lewis, MD
Michael J. McKenna, MD
Joseph B. Nadol, Jr., MD
Michael B. Rho, MD, FACS
Jeremy D. Richmon, MD
Josef Shargorodsky, MD
Mark A. Varvares, MD, FACS

### INNOVATOR

**(Gifts of $5,000 - $9,999)**

Fred G. Arrigg, Jr., MD
Carlos Ayala, MD
Daryl G. Colden, MD, FACS
Richard E. Gliklich, MD
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Jay T. Rubinstein, MD, PhD
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Robert L. Witt, MD
Richard J. Wong, MD
Michael Zoller, MD

*Deceased

# IN MEMORIAM: BERTRAND DELGUTTE, PhD

On August 17, 2024, a dear friend and colleague of the Department of Otolaryngology–Head and Neck Surgery at Harvard Medical School, Bertrand Delgutte, PhD, passed away.

Dr. Delgutte came to Mass Eye and Ear and the Eaton Peabody Laboratories (EPL) in 1975, when he began his doctoral research on speech coding in the auditory nerve under the co-mentorship of Kenneth Stevens, PhD, from MIT Electrical Engineering, and Nelson Y.S. Kiang, PhD, the founding Director of the EPL. After a three-year post-doctoral fellowship (1981–1984) at the Centre National d'Étude des Télécommunications in France, Dr. Delgutte returned to Mass Eye and Ear where he continued until his passing as a researcher and teacher. He was first appointed as an Assistant Professor of Otolaryngology–Head and Neck Surgery at Harvard Medical School in 1989 and promoted to Professor in 2010.

His research focused on understanding the neural basis of auditory perception with an eye toward improving the design of hearing aids and cochlear implants. He and his students published over 70 neurophysiological studies on acoustically and/or electrically evoked responses in the auditory nerve and inferior colliculus. His body of work clarifies the neural basis for the coding of pitch, the coding of binaural cues in cochlear implants, the importance of spatial hearing in challenging acoustic environments, and the neural mechanisms that allow humans to compensate for severe distortions in speech and other sounds caused by reverberation. In recognition of the importance of his research contributions, he was named a Fellow of the Acoustical Society of America in 2010. In 2023, Dr. Delgutte received the prestigious William and Christine Hartmann Prize in Auditory Neuroscience from the Acoustical Society of America, in recognition of his pioneering achievements linking auditory physiology and auditory perception.

Dr. Delgutte was a popular and effective mentor, serving as the thesis advisor for many graduate students in the Program in Speech and Hearing Bioscience and Technology (SHBT). His numerous trainees have gone on to pursue influential research careers in academia and industry, notably in key research and development (R&D) positions at leading hearing restoration companies, such as Starkey, Advanced Bionics, Regeneron Pharmaceuticals and Cochlear Corporation.

Dr. Delgutte also played a major leadership role in the SHBT program. He developed and taught a core course in the SHBT curriculum—Audition: Neural Mechanisms, Perception and Cognition. He also served as program co-director from 2003–2012 and as program director from 2012–2022, shepherding SHBT through several successful five-year renewals of the large NIH training grant that has served as its major source of financial support.

"Bertrand had a ready smile and an infectious laugh," shared M. Charles Liberman, PhD, Harold F. Schuknecht Professor of Otolaryngology–Head and Neck Surgery at Harvard Medical School and investigator in the EPL at Mass Eye and Ear. "He was a valued colleague, and he will be sorely missed." ■

# HIGHLIGHTS

News from every corner of the Department of Otolaryngology–Head and Neck Surgery at Harvard Medical School.

## New Faculty

**Introducing the newest clinicians, clinician-scientists, researchers and educators in the Department of Otolaryngology–Head and Neck Surgery.**

**Anand K. Bery, MD, FRCPC,** is a board-certified neurologist at Mass Eye and Ear. Upon earning his medical degree from the University of Toronto, Dr. Bery completed

residency training in adult neurology at the University of Ottawa, and fellowship training in ocular motor and vestibular otoneurology at The Johns Hopkins Hospital. His clinical interests include vestibular neuritis, benign paroxysmal positional vertigo, vestibular migraine and nystagmus. Dr. Bery's research focuses broadly on understanding and improving the diagnosis of vestibular disorders.

**Ciersten A. Burks, MD,** is a fellowship-trained facial plastic and reconstructive surgeon at Mass Eye and Ear. She obtained her medical degree from Indiana University School of Medicine prior to completing her residency training through the Harvard

Combined Program in Otolaryngology–Head and Neck Surgery. She then completed a fellowship at the University of Minnesota in facial plastic and reconstructive surgery. Dr. Burks specializes in the surgical and noninvasive management of facial paralysis, rhinoplasty and aesthetic facial plastic surgery. In addition, her clinical interests include total nasal reconstruction, Mohs reconstructive surgery, microvascular head and neck reconstruction and craniomaxillofacial trauma.

**Emily K. Gjini, MD,** is a board-certified general otolaryngologist who sees patients at the Mass Eye and Ear Stoneham location.

She earned her medical degree from Wake Forest School of Medicine and subsequently completed her residency training in otolaryngology–head and neck surgery at Tufts Medical Center. Dr. Gjini's clinical interests include general otolaryngology, otology and sleep surgery.

**Hiroyuki Kato, PhD,** is an investigator in the Eaton Peabody Laboratories at Mass Eye and Ear. Dr. Kato earned his PhD from the University of Tokyo and completed a

postdoctoral fellowship at the University of California, San Diego School of Medicine. Before joining Mass Eye and Ear, he started his own lab at the University of North Carolina at Chapel Hill where he served as an Associate Professor with tenure. His research investigates the neural circuit mechanisms underlying how the brain integrates auditory information in health and disease, aiming to identify potential therapeutic targets for clinical applications.

**Jennifer Kim, MD,** is the new Director of the Division of Facial Plastic and Reconstructive

Surgery at Mass Eye and Ear. Dr. Kim earned her undergraduate degree at Cornell University and medical degree from the State University of New York at Stony Brook. She completed her residency through the Harvard Combined Program in Otolaryngology–Head and Neck Surgery, and subsequently pursued a fellowship in facial plastic and reconstructive surgery at Mass Eye and Ear under the direction of William W. Montgomery, MD, Mark A. Varvares, MD, FACS, and Mack L. Cheney, MD. Dr. Kim has returned to Mass Eye and Ear after spending the last 23 years at the University of Michigan, rising to the rank of Clinical Professor and serving as Co-Director of the Facial Plastic and Reconstructive Surgery Fellowship. Dr. Kim is dual board-certified in facial plastic and reconstructive surgery as well as otolaryngology–head and neck surgery. Her clinical interests include treatment of facial paralysis, aging face surgery, cosmetic and functional rhinoplasty, skin cancer defect reconstruction and microtia reconstruction. Dr. Kim's clinical research focuses on facial reanimation and microtia reconstruction. Dr. Kim additionally serves as an oral board examiner for the American Board of Otolaryngology.

### Recent Promotions

**Benjamin S. Bleier, MD, FACS,** Professor of Otolaryngology–Head and Neck Surgery

**Jeffrey T. Cheng, PhD,** Associate Professor of Otolaryngology–Head and Neck Surgery

**Peter M. Sadow, MD, PhD,** Professor of Pathology

**Claire Lawlor, MD,** is a board-certified pediatric otolaryngologist at Boston Children's Hospital (BCH), where she serves

as the site director for rotating otolaryngology residents and is a member of the BCH education committee. She will be joining the Center for Airway Disorders, Esophageal and Airway Treatment Center, Sionasal Clinic and Sleep Center. She earned her medical degree from Tufts University School of Medicine, followed by a residency in otolaryngology–head and neck surgery at Tulane University School of Medicine. Dr. Lawlor then completed a pediatric otolaryngology fellowship at Boston Children's Hospital. Prior to returning to Boston, she served as Assistant Professor at George Washington University School of Medicine and Health Sciences and an attending physician at Children's National Medical Center in Washington, DC. Her clinical interests include airway lesions

and stenosis, swallowing and breathing difficulties, sinus disease, skull base surgery, obstructive sleep disorders and breastfeeding medicine.

**Erika Mercier, MD, MSc,** is a pediatric otolaryngologist joining the Center for Airway Disorders at Boston Children's Hospital. Dr. Mercier completed her residency at the University of Montreal and advanced fellowship training in pediatric otolaryngology at Boston Children's Hospital and Necker Enfants Malades Hospital in Paris, France. Before her return to Boston, Dr. Mercier served as an attending physician and an Associate Professor at the University of Montreal. Dr. Mercier is double board-certified in otolaryngology–head and neck surgery in both the U.S. and Canada, and holds certification in complex pediatric otolaryngology. Her clinical interests include congenital and acquired airway anomalies, pediatric sleep apnea, tracheostomy care, reconstructive airway surgery as well as pediatric head and neck masses.

**Marika D. Russell, MD, FACS,** is a fellowship-trained head and neck endocrine surgeon at Mass Eye and Ear, practicing at the Boston Main Campus and Medford locations. She earned her medical degree from Columbia University College of Physicians and Surgeons and completed her residency in otolaryngology–head and neck surgery at the University of California, San Francisco (UCSF). She then served on the faculty at UCSF for over 10 years, rising to the rank of Associate Professor. In 2022, Dr. Russell joined Mass Eye and Ear to complete both research and clinical fellowships in thyroid and parathyroid surgery. Her clinical interests include application of ultrasound to the diagnosis and management of thyroid and parathyroid conditions, radiofrequency ablation of thyroid nodules and treatment of advanced thyroid cancer. Dr. Russell is a member of the International Thyroid Oncology Group, the Vice Chair of the American Head and Neck Society – Endocrine Section, and an Associate Board Member of the World Congress on Thyroid Cancer.

**Alan D. Workman, MD, MTR,** is a fellowship-trained sinus surgeon at Mass Eye and Ear. Dr. Workman earned his medical degree from the University of Pennsylvania and subsequently completed his residency training through the Harvard Combined Program in Otolaryngology–Head and Neck Surgery. After his residency, he pursued a fellowship in rhinology at the University of Pennsylvania before returning to Mass Eye and Ear as faculty. His clinical interests include complex sinus surgery and endoscopic treatment of sinus tumors, cerebrospinal fluid leaks and skull base lesions. His research focuses on understanding the pathogenesis of inflammatory sinonasal disease and developing novel topical treatments for patients with chronic sinusitis.

## New Leadership

**Jennifer Kim, MD,** was named Director of Facial Plastic and Reconstructive Surgery at Mass Eye and Ear.

**Kevin S. Emerick, MD,** was appointed Interim Vice Chair of Faculty Development and Mentorship at Mass Eye and Ear.

## Awards, Grants and Honors

**Matthew R. Naunheim, MD, MBA,** and **Giovanni Battistella, PhD,** received the American Academy of Otolaryngology–Head and Neck Surgery Foundation Percy Memorial Research Award for their proposal titled, "Structural and functional brain networks in voice feminization therapy." This is a collaborative project between the Division of Laryngology, the Dystonia and Speech Motor Control Lab, the Voice and Speech Lab, and the Transgender Voice and Communication Modification Program, all of which are at Mass Eye and Ear. The goal is to understand how voice production changes at a neural level in transgender and nonbinary individuals by analyzing MRIs during speech tasks.

**Daniel B. Polley, PhD,** was inducted into the Collegium Oto-Rhino-Laryngologicum Amicitiae Sacrum (CORLAS) at their annual meeting held in Vienna, Austria in August 2024. CORLAS is a prestigious international otolaryngology society with members from 55 countries. New members are selected by their national delegation, although there is a quota per country. The United States is allowed a maximum of 20 clinical members and six non-clinical members.

**Daniel J. Lee, MD, PhD,** was named Multiple Principal Investigator on a new research grant from the National Science Foundation and the Swiss National Science Foundation titled, "Restoring sound perception using soft auditory brainstem implants." This is a collaborative, three-year award totaling $1.28 million to develop and test a novel conformable auditory brainstem electrode array in mouse and in primate models.

Resident **Hoang Bui-Nguyen, MD, PhD,** was awarded a Centralized Otolaryngology Research Effort grant by the American Academy of Otolaryngology–Head and Neck Surgery Foundation to study the molecular mechanisms behind resistance to immunotherapy. His research focuses on the role of dysregulated T-cell proliferation in mediating immunotherapy resistance in head and neck cancer. **Ravindra Uppaluri, MD, PhD,** will serve as his mentor.

At the 2024 Boston Investment Conference, hosted annually by Boston Children's Hospital, **Jeffrey R. Holt, PhD,** and his team were selected as the awardees for their translational research focused on the development of inner ear gene therapies.

**Judith S. Kempfle, MD,** was named Principal Investigator on a K08 Mentored Clinical Scientist Research Career Development Award from the National Institute on Deafness and Other Communication Disorders titled, "Plasticity of auditory cortex microglia and perineuronal nets after hearing loss." She will work closely with **Daniel B. Polley, PhD,**

[ continued p. 28 ]

in the Eaton-Peabody Laboratories on this five-year grant. In addition, Dr. Kempfle was awarded a Child Health award from the Charles H. Hood Foundation titled, "Characterization of sensorineural hearing loss in Neurofibromatosis Type 2," a competitive two-year grant to support scientific research of promising scientists at premier New England medical and health institutions.

**D. Bradley Welling, MD, PhD, FACS,** received the 2024 American Otological Society (AOS) Award of Merit. This is the highest and most prestigious honor awarded by the AOS. He was recognized for his outstanding contributions to otology and neurotology through exemplary leadership, impactful research and devoted mentorship of the next generation.

At the 7th Congress of European Otorhinolaryngology–Head and Neck Surgery in June 2024, **Reza Rahbar, MD, DMD,** was recognized at the meeting as a Guest of Honor for his pediatric otolaryngology accomplishments and his contributions to enhancing international pediatric otolaryngology care.

**Giovanni Battistella, PhD,** was named a recipient of the 2024 Eleanor and Miles Shore Development Award, which supports the academic success of junior faculty who are balancing early careers with significant responsibilities. Dr. Battistella was awarded the 2024 Mass Eye and Ear Fellowship Award.

In the spring of 2024, Mass Eye and Ear hosted a celebration for **Daniel J. Lee, MD, FACS,** in honor of being named the inaugural incumbent of the Ansin Foundation Chair in Otolaryngology.

Andy Ansin and Daniel J. Lee, MD, FACS.

**Faisal Karmali, PhD,** has been named Principal Investigator on a National Institute on Aging grant to study imbalance in older adults and individuals with vestibular disorders. The team aims to determine how age-related sensory dysfunction—including vestibular, somatosensory and visual impairments—contribute to imbalance. Additionally, the team will investigate deficits in central sensory integration using computational neuroscience approaches. Elucidating these mechanisms will accelerate progress toward the long-term goal of mitigating fall risk.

**Artur A. Indzhykulian, PhD,** was named Co-Principal Investigator on a Multi-PI R01 grant from the National Institutes of Health to study acquired hearing loss (AHL). In collaboration with Ruben Stepanyan, PhD, from Case Western Reserve University, he aims to investigate the role of mitochondrial calcium dysregulation in cochlear hair cells following noise-induced damage, using advanced deep learning-based microscopy techniques. This research seeks to uncover novel therapeutic targets for preventing and treating AHL.

**Gregory W. Randolph, MD, FACS, FACE, FEBS (Endocrine Surgery), MAMSE,** was inducted into the American Academy of Otolaryngology–Head and Neck Surgery Hall of Distinction at their annual meeting. In the Hall of Distinction, Dr. Randolph is recognized as a "Living Legend," a prestigious title awarded to only six otolaryngologists in the nation.

**Aaron K. Remenschneider, MD, MPH,** has been named site Principal Investigator on a Swiss National Science Foundation grant titled, "VISION-EAR: Dynamic phase-contrast microtomography of the human middle ear." In collaboration with Co-Investigator **Jeffrey Tao Cheng, PhD,** and Swiss site Principal Investigator Lukas Anschuetz, MD, the project utilizes synchrotron-based phase-contrast imaging to provide near-histologic level 3D visualization of imaged structures. The team aims to expand upon existing middle ear datasets by using this novel technique to capture 4D imaging (under sound stimulation) to refine their understanding of sound transfer mechanics at high intensity levels. This dynamic imaging method will help better quantify middle ear motion in normal, pathological and reconstructed states.

**Natalia Kyriazidis, MD,** was named the recipient of the Norman Knight Leadership Development Award at Mass Eye and Ear's Spring Meeting of the Trustees and Medical Staff. The award is endowed by the late Norman Knight, a self-made broadcast pioneer and media mogul who was a passionate champion of Mass Eye and Ear for more than 25 years.

**A. Eliot Shearer, MD, PhD,** was selected as Junior Investigator of the Translational Investigator Service (TIS) at Boston Children's Hospital. One clinician-scientist is selected per year. This five-year award provides salary support, research funding and development opportunities in translational research. TIS aims to create a multidisciplinary group of highly accomplished faculty with strong scientific, clinical and leadership skills, positioning them as future leaders in the field. The funding will support research on improving genetic testing for pediatric hearing loss, including a new method for genetic newborn hearing screening.

Two members of the Indzhykulian lab—**Frank Yeh, PhD,** a postdoctoral fellow and **Evan Hale,** a graduate student in the Harvard-MIT Program in Speech and Hearing Bioscience and Technology—received fellowship grants from the National Institute on Deafness and Other Communication Disorders. With his grant, Dr. Yeh will use adeno-associated viruses to deliver mutant and mini-PCDH15 versions to investigate the biophysical properties of tip links in hair cell mechanotransduction. Mr. Hale's grant will support his work on characterizing the TECTB-C225Y mutation, which causes progressive hearing loss in patients. His research will involve testing a cohort of TECTB-C225Y mice at various aging time points, along with additional experiments to examine the effect of noise on the hearing of the mutant mice.

**Richard F. Lewis, MD,** was named Principal Investigator of a five-year grant from the National Institute on Deafness and Other Communication Disorders. Alongside **Divya A. Chari, MD,** and **Faisal Karmali, PhD,** Dr. Lewis will study the effects of spatial orientation, navigation and neuropsychologic function for patients with peripheral vestibular damage who received vestibular implants.

**Zheng-Yi Chen, DPhil,** was named Principal Investigator on a $16 million National Institutes of Health Somatic Cell Genome Editing grant, focused on Investigational New Drug (IND)-enabling studies for platform clinical trials of genome editing in multiple diseases. This grant will be a collaborative effort across four other institutions in addition to Mass Eye and Ear.

Dr. Chen and his team will conduct an IND-enabling study focused on treating two forms of dominant genetic hearing loss: Autosomal dominant deafness-41 (DFNA41), which is caused by a mutation in the *P2RX2* gene, and autosomal dominant deafness-2A (DFNA2A), which is caused by a mutation in the *KCNQ4* gene. The study aims to streamline the regulatory path for gene-editing therapy in genetic hearing loss, with the goal of initiating two clinical trials subsequently.

Mass Eye and Ear has opened its Tinnitus Clinic under the direction of **Stéphane F. Maison, PhD, CCC-A, CH-TM.** The Tinnitus Clinic offers individualized approaches to tinnitus counseling, management and treatment. In close partnership with the Lauer Tinnitus Research Center, they also provide opportunities to participate in research studies aimed at better understanding tinnitus, with a goal to carry out clinical trials and develop life-changing cures.

## Dr. Simonyan Named Next Incumbent of Harvard Professorship

**Kristina Simonyan, MD, PhD, Dr med,** has been named the next incumbent of the John W. Merriam and William W. Montgomery Professorship of Otolaryngology–Head and Neck Surgery at Harvard Medical School.

This professorship was originally established in 1997 and named the John W. Merriam Professorship, with world-renowned laryngologist William W. Montgomery, MD, as the first incumbent. In 2016, Mark A. Varvares, MD, FACS, Chair of the Department of Otolaryngology–Head and Neck Surgery at Harvard Medical School, was bestowed the honor of this professorship, subsequently named as the John W. Merriam and William W. Montgomery Professorship, once Dr. Montgomery was no longer the incumbent. The original endowment has officially been split into two endowments allowing two separate professorships—the John W. Merriam and William W. Montgomery Professorship and the William W. Montgomery and John W. Merriam Professorship. Dr. Varvares will now hold the latter.

Dr. Simonyan's professorship includes an endowment that will support her academic research aimed at advancing dystonia care.

## Dr. Arenberg Named First Incumbent of Mass Eye and Ear Chair

**Julie G. Arenberg, PhD, CCC-A,** was named the first incumbent of the Herbert Silverstein Chair in Otology/Neurotology at Mass Eye and Ear.

Herbert Silverstein, MD, FACS, graduated from the Harvard Otolaryngology Residency Program in 1966, and since has been a pioneer in the field of otology/neurotology. He is the President and Founder of the internationally acclaimed Silverstein Institute and the Ear Research Foundation in Sarasota, FL. Throughout his career, he has authored hundreds of publications and trained more than 50 fellows in otology and neurotology.

In honor of Dr. Silverstein's trailblazing efforts in the field, it was deemed that the chairholder must echo the same level of commitment and excellence to otology/neurotology.

Dr. Arenberg's chair includes an endowment that will support her academic research on improving the quality of life for people with severe hearing loss, many of whom are treated with cochlear implants.

The following are select research advances from the Harvard Medical School Department of Otolaryngology–Head and Neck Surgery.

# Basic Research

## Genome editing restores hearing in adult mice with human microRNA mutation

More than half of all congenital sensorineural hearing loss is caused by single genetic mutations. Mutations in the *microRNA-96 (MIR96)* gene lead to autosomal dominant deafness-50 (DFNA50), a form of inherited deafness that typically manifests later in life. The discovery of microRNAs has been recognized with the 2024 Nobel Prize in Physiology or Medicine due to its significance in gene regulation and human diseases. While genome editing has improved hearing in newborn mice, its effectiveness in the inner ears of adult mice must be demonstrated before it can be applied to humans. This had not previously been accomplished, but it is necessary for potential clinical treatments.

In a study led by **Zheng-Yi Chen, DPhil,** of Mass Eye and Ear, researchers developed a mouse model carrying the *MIR96* mutation that mimics the progressive hearing loss seen in humans with DFNA50. By four weeks of age, these mice demonstrated complete hearing loss at high frequencies. The team designed a gene-editing therapy to correct a specific mutation, 14C>A, in the *MIR96* gene. Using a CRISPR/Cas9 approach, they targeted this mutation and delivered the gene-editing machinery to the mice's inner ear via an adeno-associated virus (AAV), at both young and adult stages.

The results, published in *Science Translational Medicine,* demonstrated long term hearing improvement, with efficacy increased by injection at a younger age. The study also assessed the safety of the AAV-mediated genome editing approach, finding a strong safety profile with minimal off-target effects and no detectable long-term integration of the AAV vector into the genome. The research suggests minimal risk, supporting the feasibility of future clinical applications in humans.

Zhu W, Du W, Rameshbabu AP, Armstrong AM, et al. "Targeted genome editing restores auditory function in adult mice with progressive hearing loss caused by a human microRNA mutation." *Science Translational Medicine.* 2024 Vol 16(755):eadn0689. Doi: 10.1126/scitranslmed.adn0689

## A prenatal skin atlas reveals immune regulation of human skin development

Human skin development begins after gastrulation, emerging from two primary germ layers. The epidermis, the superficial layer, along with melanocytes and neural cells, originates from the ectoderm. The dermis, located beneath the epidermis and containing endothelial and mural cells, is derived from the mesoderm. Skin appendages, such as hair follicles and sebaceous glands, form in a cephalocaudal direction. Hair follicles begin developing between 11- and 14-weeks post-conception, while sebaceous glands start forming around 16 weeks. However, much remains to be explored regarding the detailed cellular composition of prenatal skin during these stages and how cells interact within specialized niches to support skin development.

**Karl R. Koehler, PhD,** of Boston Children's Hospital, co-led a study exploring the roles

of immune cells, particularly macrophages, in developing human skin. The study found that macrophages play essential roles beyond their typical immune functions. The team assembled a comprehensive multi-omics reference atlas of prenatal human skin (7–17 post-conception weeks), combining single-cell and spatial transcriptomics data to characterize the micro-anatomical tissue niches of the skin. This atlas revealed that interactions between immune cells and other skin cells help form hair follicles, promote scarless wound healing and play a crucial role in the development of blood vessels.

Additionally, the researchers compared a lab-grown skin model made from stem cells to real prenatal and adult skin. While the model replicated most aspects of skin development, including hair follicle formation, it lacked immune cells and had fewer blood vessel-forming cells. However, when lab-grown macrophages were added to the model, blood vessel development improved. These findings, published in *Nature,* demonstrate that innate immune cells are critical for skin morphogenesis, functioning not only in immunity but also through interactions with non-immune cells to support tissue formation. This work may also offer insights for improving other organoid models currently lacking immune cells, like inner ear organoids, to enhance therapeutic applications.

Gopee NH, Winheim E, Olabi B, et al. "A prenatal skin atlas reveals immune regulation of human skin morphogenesis." *Nature.* 2024. Doi: 10.1038/s41586-024-08002-x

## Pharmacological regeneration of sensory hair cells restores vestibular function in animal models

Balance disorders affect 35 percent of adults over 40 and are the most common health complaint in individuals over 70. The human sense of balance relies on highly specialized mechanoreceptors called hair cells that live in the sensory epithelia of the inner ear. Loss of hair cells from aging or toxic exposure can lead to balance disorders, and this damage is essentially irreversible because mammalian vestibular organs cannot regenerate functional hair cells.

**Albert Edge, PhD,** of Mass Eye and Ear,

led a study using small molecules to trigger the regeneration of hair cells in a mouse model with vestibular damage, working with lab member and first author, Hanae Lahlou, PhD. This treatment was a combination of glycogen synthase kinase 3β and histone deacetylase inhibitors. The drugs stimulated supporting cell proliferation and differentiation into hair cells and the new hair cells were reinnervated by vestibular afferent neurons, rescuing otolith function by restoring head translation-evoked otolith afferent responses and vestibuloocular reflexes.

These results, published in the *Journal of Clinical Investigation,* demonstrate this combination of drugs can regenerate hair cells in mammals, representing a potential therapeutic approach to the treatment of balance disorders.

Lahlou H, Zhu H, Zhou W, Edge AS. "Pharmacological regeneration of sensory hair cells restores afferent innervation and vestibular function." The *Journal of Clinical Investigation.* 2024:e181201. Doi: 10.1172/JCI181201.

# Clinical Research

## Child mortality decreases following educational interventions in low- and middle-income countries

Pediatric intensive care units (PICUs) in low- and middle-income countries (LMICs) experience mortality rates up to 10 times higher than those in high-income countries, with intubated children being at particularly high risk. Data from a PICU in an LMIC in Latin America showed an all-cause mortality rate of 24 percent among intubated patients and an unplanned extubation rate of 31 percent, compared to approximately two percent in the United States.

To address this issue, **Christopher J. Hartnick, MD, MS,** of Mass Eye and Ear, and his team conducted a longitudinal assessment of a quality improvement (QI) program at the largest public children's hospital in El Salvador, aimed at reducing mortality in intubated pediatric patients. The researchers collected pre-intervention data over 18 months, including demographics, illness severity and mortality, before they implemented QI and educational interventions such as AI-generated Spanish-language video tutorials on intubation. Additionally, they developed data-driven Driver Map and Impact Pathway models that considered local environment and provided customized targets for interventional strategies.

147 patients were included in the sustainability cohort. When comparing the initial post-implementation group to the sustainability cohort, mortality rates in the PICU dropped from more than 22 percent to 9.5 percent in the year after the educational intervention was introduced. These findings, published in *Frontiers in Public Health,* can serve as a model for global health care to develop quality improvement programs to intervene and improve patient outcomes.

Yager PH, Callans KM, Samost-Williams A, et al. "Practical quality improvement changes for a low-resourced pediatric unit." *Frontiers in Public Health.* 2024; Vol 12 Doi: 10.3389/fpubh.2024.1411681

## The complexity of predicting word recognition performance after cochlear implantation

In patients with post-lingual hearing loss, deciding on cochlear implantation is challenging due to the lack of reliable preoperative methods for predicting postoperative outcomes. The health of spiral ganglion neurons is vital for cochlear implant effectiveness, and while some studies show a connection between neuron count and postoperative speech recognition scores, results vary. Recent findings indicate that preoperative word recognition scores with hearing aids may enhance predictions of post-implant performance.

**Stéphane F. Maison, PhD, CCC-A, CH-TM,** of Mass Eye and Ear, and PGY-4 resident **Ryan A. Bartholomew, MD,** conducted a study to determine if preoperative word recognition scores can reliably predict the outcomes of cochlear implantation, hypothesizing they cannot. The team analyzed data from 228 patients who received cochlear implants between 2002 and 2021, examining nine variables, including: age, etiology, sex, laterality of implantation, preimplantation thresholds and word scores, as well as the design, insertion approach and angular insertion depth of the electrode array. The results indicated that only age and etiology were significant predictors of post-implantation outcomes, while pre-implantation word scores did not significantly correlate with performance after surgery.

To rationalize why pre-implantation word scores fail to predict postoperative performance, the authors analyzed results from temporal bone histopathology. Word recognition scores decline only when neuronal survival drops below 40 percent, after which they drop more precipitously such that 20 percent survival supports 50 percent word recognition. Since most cochlear implant patients retain at least 20 percent of their spiral ganglion neurons, it is expected that they will improve to at least a 50 percent word recognition score post-implantation, even if their pre-implantation word scores were very low. The study, published in *Otology & Neurotology,* concluded that the lack of a reliable connection between pre-implantation scores and post-implantation performance can be attributed to the survival of sufficient spiral ganglion neurons in the majority of patients.

Bartholomew RA, Hoffman SE, Juliano AF, et al. "On the Difficulty Predicting Word Recognition Performance After Cochlear Implantation." *Otology & Neurotology.* 2024. Vol45(5):e393-e399. Doi: 10.1097/MAO.0000000000004176

## Understanding referral pathways for timely head and neck cancer care

Without a timely diagnosis and treatment for head and neck cancer patients, survival rates reduce and recurrence risk increases. Prompt referral to a head and neck cancer specialist is critical for the timeliness of care, yet the factors that affect this remain relatively unexplored. To identify the barriers and facilitators of timely care, it is important to understand the complex journey of head and neck cancer patients—from symptom onset to referral for diagnosis to treatment.

**Regan W. Bergmark, MD, MPH,** of Brigham and Women's Hospital, led a qualitative study using semi-structured interviews of patients with head and neck cancer and health care workers who care for them. Participants were recruited from head and neck cancer clinics at two tertiary care academic medical centers in Boston, MA. In total, 72 participants were interviewed, including 42 patients and 30 health care workers.

The team conducted a thematic analysis, identifying four key themes: the fragmentation of the head and neck referral and triage pathway, the critical role of primary and dental care in timely referrals, the importance of efficient inter-clinician coordination in expediting care and the value of consistent patient-practitioner engagement in alleviating patient fear. These findings, published in *JAMA Otolaryngology–Head & Neck Surgery,* highlight the complexity of the head and neck cancer referral process. Addressing barriers and enhancing facilitators can improve the timeliness of referrals, leading to better patient outcomes.

Batool S, Hansen EE, Sethi RKV, Rettig EM, et al. "Perspectives on Referral Pathways for Timely Head and Neck Cancer Care." *JAMA Otolaryngology–Head & Neck Surgery.* 2024 Jul 1;150(7):545-554. Doi: 10.1001/jamaoto.2024.0917.

[ continued p. 32 ]

## Radiologic access in Rwanda

Radiologic facilities play a significant role in the diagnosis and treatment of conditions of the head and neck. The scarcity of radiologic facilities in low- and middle-income countries severely hampers surgical care, such as the treatment of head and neck cancer, infections and trauma.

**David A. Shaye, MD, MPH, FACS,** of Mass Eye and Ear, and PGY-5 resident **Rui Han Lui, MD,** along with several Rwandan co-authors mapped the geospatial distribution of computed tomography (CT),


magnetic resonance imaging (MRI), positron emission tomography (PET), X-ray and radiation facilities in Rwanda. Accessibility to patients was assessed by overlaying population density data to maps of the radiology facilities.

Results, published in *Insights into Imaging,* revealed that Rwanda has 0.5 CT, 0.4 MRI, 0 PET, 0.1 radiotherapy, 3.7 X-ray, 0.4 mammography, and 0.4 fluoroscopy units per one million people—figures significantly below World Health Organization recommendations. Additionally, 88 percent of radiology facilities are publicly funded. Expanding radiology infrastructure remains a key component in the development of national surgical strategies for Rwanda and other countries.

Liu RH, Lindeborg M, Ncogoza I, et al. "Geospatial evaluation of radiologic access in Rwanda." *Insights into Imaging.* 2024; Vol 15(1):105. Doi: 10.1186/s13244-024-01624-9.

## Combined tonsillectomy and hypoglossal nerve stimulation to treat sleep apnea patients with oropharyngeal lateral wall collapse

Obstructive sleep apnea (OSA) is a common chronic condition with high rates of nonacceptance or nonadherence to positive airway pressure therapy (PAP). Hypoglossal nerve stimulation (HGNS) has emerged as a popular alternative to PAP, with higher adherence rates. However, the effectiveness of HGNS is highly dependent on various anatomical and non-anatomical factors, including the pattern of oropharyngeal lateral wall (OLW) collapse. Patients with OLW may still qualify for HGNS implantation but generally experience reduced success with this therapy.

**Phillip A. Huyett, MD,** of Mass Eye and Ear, and team investigated the effect of palatine

tonsillectomy on HGNS efficacy in OSA patients with OLW collapse. This case-controlled study compared two groups of patients with moderate-to-severe OSA. All of the patients in the study have complete or partial OLW collapse and small tonsils. One group underwent HGNS combined with tonsillectomy (HGNS+T), while the control group received HGNS alone.

Adding tonsillectomy to HGNS resulted in an additional 22.9 percent reduction in apnea-hypopnea index compared to HGNS alone. There were also 8.6 times greater odds of achieving successful treatment in the HGNS+T group compared to the HGNS alone group. These findings, published in *Otolaryngology–Head and Neck Surgery,* conclude that patients with OLW collapse generally have poorer outcomes with HGNS alone. However, early results suggest that combining tonsillectomy with HGNS may significantly improve success rates in these patients, making it a potentially promising treatment strategy.

Huyett P, Wellman A, Caruso V, et al. "Combination Tonsillectomy and Hypoglossal Nerve Stimulation for Sleep Apnea Patients With Oropharyngeal Lateral Wall Collapse." *Otolaryngology–Head and Neck Surgery.* 2024. Doi: 10.1002/ohn.950.

## Identifying bias in vocal fold paralysis detection models through explainable machine learning and clinician ratings

Voice recordings contain valuable information about the way individual's vocal tract works and can give insights into various health conditions. For example, certain voice characteristics have been found to help detect diseases like Parkinson's, as well as mental health disorders such as depression, schizophrenia and bipolar disorder. The ability to detect voice disorders through voice recordings reduces the need for costly clinical visits and invasive laryngoscopy exams. With the scientific understanding of the complexity of speech production, numerous acoustic features have been developed for use in machine learning models

In a study led by **Phillip C. Song, MD,** of Mass Eye and Ear, and **Satrajit S. Ghosh, PhD,** of MIT, the team examined clinical bias in acoustic samples and how machine


learning models can help identify these issues. Daniel Low, PhD, lead author of the study and recent graduate from the SHBT program, and team aimed to detect unilateral vocal fold paralysis (UVFP) from voice recordings using machine learning. Their goal was to identify which acoustic variables were important for prediction to increase trust in the model and to compare the model's performance with that of clinicians.

The study included patients with confirmed UVFP and patients with normal voices, matched by age and sex. Participants read a passage and sustained the phonation of the vowel "a." Four machine learning models of varying complexity were used, and SHapley Additive exPlanations (SHAP) identified important features for prediction. The results, published in *PLOS Digital Health,* outperformed clinicians in detecting UVFP from listening to the voice samples. The team identified biases in the data and adjusted, discovering that the models still achieved similarly high performance. The authors offer a set of recommendations to avoid bias both while collecting data and when building and evaluating machine learning models for laryngology screening.

Low DM, Rao V, Randolph G, Song PC, Ghosh SS. "Identifying bias in models that detect vocal fold paralysis from audio recordings using explainable machine learning and clinician ratings." *PLOS Digital Health.* 2024 Vol3(5) Doi: 10.1371/journal.pdig.000051

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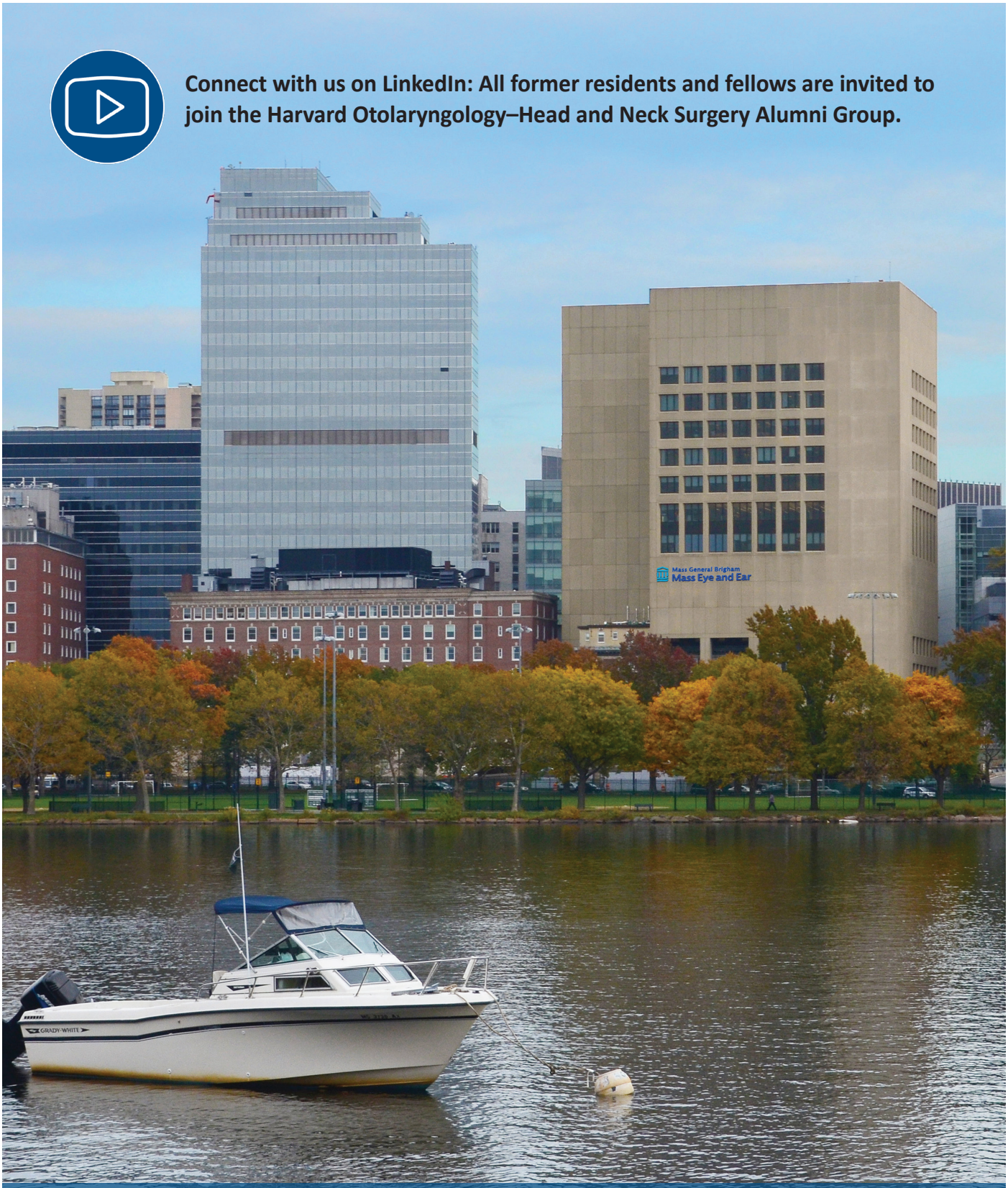


## *U.S. News & World Report* "Best Hospitals"

In its 2024-2025 "Best Hospitals" issue, *U.S. News & World Report* named **Mass Eye and Ear** and **Brigham and Women's Hospital** top hospitals for ear, nose and throat care. Mass Eye and Ear was ranked #6 in the nation for ear, nose and throat care, Brigham and Women's Hospital was ranked in the Top 30. Mass Eye and Ear remained #1 in New England, a distinction the hospital has held since the inception of the rankings in 1990.

Photo by Garyfallia Pagonis

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