Sounds Like Research: More Graduate Student Stories

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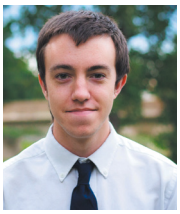
The Acoustical Society of America (ASA) is fortunate to have many talented student members from diverse academic backgrounds who are actively contributing to fields ranging from human health to animal ecology. The purpose of this essay is for the ASA Student Council to highlight some of these outstanding student members, with a particular focus on those who have recently completed their graduate studies or are nearing graduation. This is the second installment in our "Sounds Like Research" series (see bit.ly/3m6gdY0). The Student Council hopes that these articles will serve not only to showcase the innovative research being conducted by young ASA members but also to provide an opportunity for readers to "meet" members of the next generation of leaders in acoustics.

Victoria V. Doheny

(vdoheny@bu.edu; see bit.ly/VictoriaDoheny) graduated in May 2023 with a PhD in mechanical engineering from Boston University, Boston, Massachusetts. She has always been fascinated by how complicated medical problems can be solved using sound, and she gained early exposure to research in this area during an undergraduate Oak Ridge Institute for Science and Education (ORISE) research fellowship at the Food and Drug Administration (FDA). During this internship, Victoria studied the heating of bone and surrounding tissue due to ultrasound. This work inspired Victoria to apply to graduate school and pursue a PhD in biomedical acoustics. Her graduate advisor, R. Glynn Holt, introduced her to the added therapeutic effects that can be obtained using microbubbles in the presence of ultrasound.

> "Peritoneal adhesions develop from almost all deep abdominal surgeries. They can bind adjacent organs together, constrict or obstruct intestines, and cause chronic pain. Currently, there is no way of either diagnosing or treating adhesions without the patient undergoing a second surgery. This is counterproductive because a second surgery can cause more adhesions to form. Therefore, there is a critical need for imaging and removing adhesions noninvasively without causing additional adhesion formation. My research is on the detection and treatment of adhesions using targeted microbubbles. When exposed to ultrasound, these microbubbles oscillate and have the potential to break up soft, early-stage peritoneal adhesion tissue formed in the first 48 hours postsurgery. My dissertation focuses on characterizing the dynamics of these microbubbles under ultrasound exposure and determining the mechanism of nascent adhesion break up" (Victoria V. Doheny).

After graduation, Victoria hopes to continue in the field of therapeutic ultrasound as a postdoctoral researcher, deepening her knowledge of the applications for microbubbles under ultrasound exposure.



Daniel Guest

(daniel_guest@urmc.rochester.edu; see guestdaniel.github.io) graduated in May 2022 with a PhD in psychology from the University of Minnesota, Minneapolis. He summarizes his path into acoustics as a kind of domino effect in which "each research interest I've had has naturally led me in new directions, always orbiting around the broad themes of language, communication, information, and acoustics." His undergraduate studies in speech, language, and psychology led to a research opportunity studying the ways that voice pitch impacts our perception of speech. This research opportunity led to his interest in the fundamentals of how pitch is perceived by the human auditory system, which then led him to do graduate work in Andrew Oxenham's Auditory Perception and Cognition Laboratory (see apc.psych.umn.edu).

> "Pitch, which is the attribute of sound that maps onto the concept of 'low' and 'high' in speech and music, is

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important to how we experience the auditory world. Pitch perception is generally less accurate at high frequencies (above 4-8 kHz) than at low frequencies. My PhD sought to investigate the origin of this difference by combining behavioral techniques (measuring the sensitivity of human listeners to small changes in pitch, amplitude, and other features of sound at high frequencies) and computational techniques (building and analyzing computer models of how the auditory system responds to high-frequency sounds). My work suggested that differences in pitch perception at high frequencies likely do not originate in the early auditory system (e.g., cochlea, auditory nerve) but may originate instead in later stages (e.g., auditory subcortex)" (Daniel Guest).

This finding increased Daniel's interest in the auditory subcortex, leading him to his current position as a postdoc at the University of Rochester, Rochester, New York. As he dives deeper into speech communication research, Daniel hopes to continue cultivating cross-disciplinary relationships and finding new perspectives on classic problems in the study of the human auditory system.

Colin Malloy

(malloyc@uvic.ca; see bit.ly/ColinMalloy) will graduate in late 2023 with a PhD in interdisciplinary studies (music/computer science) from the University of Victoria, Victoria, British Columbia, Canada. As a musician, his entrance into programming was motivated by the desire to create custom audio effects. He soon realized that many of the existing audio effects did not work well for one of his favorite instruments, a type of drum known as the steelpan that originated in Trinidad and Tobago. In an effort to improve these audio effects, Colin began the acoustics studies that led to his PhD research with George Tzanetakis (see webhome.csc.uvic.ca/~gtzan).

"My thesis covers many topics surrounding the steelpan and music technology. The core of the work is the acoustical analysis of the steelpan, with studies ranging from the timbres produced using different types of mallets to the effectiveness of different pitch detection methods. More recently, I developed an AI-based steelpan pitch detection system that outperforms the available state-of-the-art methods. I view what I do as a holistic approach to analysis, processing, and application in musical performance. Acoustics starts the process and informs everything downstream while the issues I encounter in sound design and performance determine what aspect of the acoustics I will study" (Colin Malloy).

Colin's accomplishments include original steelpan compositions (see colinmalloy.com/crushed-atmos) as part of his PhD work as well as a 2022 Artist-in-Residence position at Ocean Networks Canada. Additionally, thanks to the skills he gained as a graduate student, Colin works as a contract digital signal-processing engineer. He plans to continue in the music technology industry after graduation, applying his acoustics knowledge to the design of new instruments and audio effects.

Christopher Pacia

(pacia.christopher@gmail.com; see bit.ly/ChristopherPacia) graduated in April 2022 with a PhD in biomedical engineering from Washington University in St. Louis, St. Louis, Missouri. He entered graduate school with a passion for acoustics as "the next frontier of innovative biomedical technology." His experience in Hong Chen's laboratory (see chenultrasoundlab.wustl.edu) affirmed this time and time again as he worked with others who were also dedicated to understanding disease diagnosis and treatments. Inspired by the new devices and the ways of thinking he witnessed, he pushed the boundaries of ultrasound techniques in the application of brain disease diagnosis.

"Brain cancer severely threatens human health due to its disruption of neurological function, poor prognosis, and substantial reduction in quality of life. Advances in patient care have suggested that the accurate diagnosis of molecular subtypes is critical for individualized targeted treatment and improving survival outcomes for brain cancer patients. This work provided evidence that combining focused ultrasound and microbubbles can release brain tumor-derived biomarkers into the blood circulation to improve the sensitivity for noninvasive molecular characterization of brain cancers (i.e., sonobiopsy). This enhanced capability could have an important impact throughout the continuum of patient care from brain disease diagnosis and treatment monitoring to recurrence detection. In addition, sonobiopsy could also support the investigation of disease-specific molecular

mechanisms and accelerate the development of targeted therapy" (Christopher Pacia).

As his research and understanding of patient care progressed, Christopher's career goal became clear: *drive innovation and deliver solutions to patients in need*. He now uses his technical expertise as a life sciences consultant with the Triangle Insights Group, providing biotech and pharmaceutical companies with data-driven, patient-focused recommendations and helping deliver novel technologies that can transform patient's lives.

Morgan Ziegenhorn

(maziegenhorn36@gmail.com; see bit.ly/MorganZiegenhorn) graduated in August 2022 with a PhD in oceanography from the Scripps Institution of Oceanography, University of California (UC) San Diego, La Jolla. She first learned about acoustics as a method for studying animal behavior during her undergraduate studies at UC Berkeley, Berkeley. Morgan appreciated the large amount of information that could be obtained without disturbing the species of interest. She pursued graduate school with the goal of using acoustics to inform the conservation efforts surrounding marine mammals.

"My PhD research focused on using an existing passive acoustic monitoring (PAM) dataset to study toothed whales at several sites in the Hawaiian Islands region. PAM is an incredibly useful tool for studying these species because it provides us with cost-effective, continuous monitoring that's relatively noninvasive. However, this can result in a *lot* of unlabeled data. In my work, I leveraged machine learning tools to label over 10 years of near-continuous acoustic recordings for toothed whale species. This allowed for spatiotemporal analyses and habitat modeling that led to valuable ecological insights. I found that species' temporal behavior differed between sites even within the relatively small region of the Hawaiian Islands. I also linked longer term patterns in marine mammal presence to variations in climate indices. These insights expanded our current knowledge of toothed whale behavior in Hawai'i and beyond" (Morgan Ziegenhorn).

Morgan completed her PhD work under the supervision of Simone Baumann-Pickering (see sbaumann.scrippsprofiles.ucsd.edu) and John A. Hildebrand (see jahildebrand.scrippsprofiles.ucsd.edu) and then worked as a postdoctoral researcher at the Scripps Institution of Oceanography. She hopes that the research she has done on marine mammals will be useful to future researchers and species' managers, and she looks forward to contributing more to ecologically focused acoustic research in the future.

Conclusion

Through the introduction of these young researchers and their work, the ASA Student Council offers a glimpse into the future of acoustics research and the impact that these emerging leaders may have. We hope that this essay will inspire readers to learn more about both the exciting developments in acoustics research and the people behind those developments, perhaps even leading to future collaborations or job offers. We also invite you to say hello to these individuals if you see them at future ASA meetings! Connections between members of the ASA at all career stages enriches the acoustics community of today and prepares it for the innovations of tomorrow.

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