SOUND MINDS

A Newsletter by UC Irvine Center for Hearing Research, January 2020

Director's Messages:

Fan-Gang Zeng

In 2019, I was an advisor to help launch two international hearing centers: Institut de l'Audition in Paris and National Otolaryngology Center in Beijing. Both centers have great leadership, bold vision and strong financial support that would allow them to build state-of-the-art infrastructure, attract global talents and likely produce high-impact research for years to come.

Back at home, I have been reflecting on the role for the Center for Hearing Research (CHR), which is one of 12 Campus Centers at the University of California Irvine (UCI). Different from the two international centers, the CHR is unlikely to get tens of millions dollars to construct a building that will house the faculty under the same roof, nor do we need one. What we need is to connect faculty and students from different departments and fields, with minimal administrative and overhead burden, so that we can exchange ideas freely and ultimately create new ones.

Here I highlight two translational projects to illustrate the importance of this connectivity.

The first project is the development of an Intraneural Auditory Prosthesis. While at the University of Michigan, John Middlebrooks did animal research to demonstrate that placing penetrating electrodes in the auditory nerve bundle produced superior pitch performance compared to a conventional cochlear implant. Since joining UCI in 2008, John has been trying to translate this basic research result into human clinical application without much success until he exchanged his idea with CHR member Harrison Lin. Harrison is a neurotologist who appreciates the potential of intraneural stimulation for improving the performance of cochlear implants. With cooperation from cochlear-implant manufacturer Advanced Bionics, John and Harrison developed a plan to combine an intraneural electrode with a conventional cochlear implant. The cochlear implant would deliver the high-frequency envelope information that is important for speech recognition, and the intraneural electrode could add the pitch perception

that is missing from present-day cochlear implants. Exploiting their complementary basic and clinical skills, John and Harrison were successful in obtaining a “translational grant” to test their revolutionary idea in humans (see Grants section).

The second project is the use of nicotine to enhance human auditory and cognitive performance. Raju Metherate has shown a strong and positive nicotinic effect on auditory neural responses in rats and wanted to see if nicotine can enhance human auditory performance or even potentially reverse age-related hearing loss. He and Fan-Gang had been talking about testing this translational idea for several years until a doctoral student, Carol Pham, joined the CHR as a trainee. Co-advised by both Fan-Gang and Raju, Carol converted the animal protocol into an IRB-approved human protocol and found that nicotine can indeed enhance human performance under difficult listening conditions (see Publications section).

In the last several years, the CHR has added significant faculty strength in artificial intelligence and language processing. I fully expect that the CHR’s connectivity will promote and enhance collaboration between traditional hearing researchers and members in these two new areas of research.

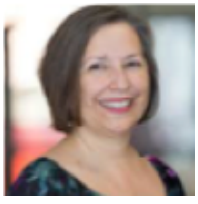
The CHR’s role is to ensure that the whole is greater than the sum of its parts.

From myself and all of us at the UCI Center for Hearing Research, best wishes for a happy and healthy 2020!

CHR NEWS

Faculty appointed to leadership roles

Karina Cramer, Associate Dean for Academic Personnel, School of Biological Sciences.



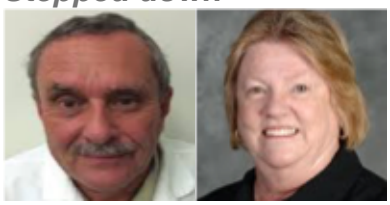
Elizabeth Peña, Associate Dean of Faculty Development and Diversity, School of Education.

Advisors honored

Richard Miyamoto, CHR Advisory Board Member was recognized at the "Academic Excellence at Indiana University" for his memberships in the National Academy of Medicine, the Royal Society of Medicine, and for receiving an Honorary Doctor of Engineering from the Rose-Hulman Institute of Technology.

Peter Narins, CHR Advisory Board Member and UCLA Distinguished Professor won the Award of Merit, the highest honor bestowed by the Association for Research in Otolaryngology in February, 2019.

Stepped down



Glen and Brenda Longsbury-Martin stepped down this past year as Senior Research Scientists at the VA Loma Linda, and are now Senior Faculty Mentors to junior faculty, assisting them in writing grant applications and submitting research manuscripts to peer-reviewed journals.

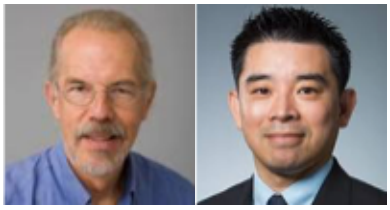
New Member

Judith Kroll is Distinguished Professor of Language Science at the University of California Irvine and the former director of the Center for Language Science at Pennsylvania State

University. Her research uses the tools of cognitive neuroscience to examine the way that bilinguals juggle the presence of two languages in one mind and brain. She is excited to be able to contribute to the cross-disciplinary effort at UCI to build the language sciences. An exciting feature of her move to California has been access to a diverse group of speakers whose bilingualism provides a basis for new research on how the variation of language experience changes not only language use but also new language learning. With Penn State colleagues, she was the PI on an NSF PIRE (Partnerships for International Research and Education) grant to develop an international research network and program of training to enable language scientists at all levels to pursue research abroad on the science of language learning and bilingualism. She has brought a portion of *the PIRE grant to UCI* where she hopes to interest undergraduates and graduate students in conducting research that will benefit from comparative studies of language learning here and with colleagues in Latin America, Europe, and Asia. She is one of the founding organizers of *Women in Cognitive Science*, a group supported by NSF to promote the advancement of women in the cognitive sciences. When she is not in Irvine, she lives in LA with her husband, David Rosenbaum, a distinguished professor of psychology at UC Riverside, and close to her daughters and their spouses and three adorable grandchildren who keep her busy!

RESEARCH HIGHLIGHTS

Grants



John Middlebrooks, PhD, and **Harrison Lin**, MD, received a five-year research grant from the NIH to develop an intraneural auditory prosthesis. This award is specifically intended to translate a basic-science result to clinical application. In this case, the result was that stimulation of low-frequency fibers in the auditory nerve with a penetrating electrode activates a brainstem pathway that is specialized for transmission of fine timing information. The clinical application will be to test whether the addition of such an electrode to a conventional cochlear implant can enhance deaf people's perception of the pitches of sounds, which is important for recognition of voices, appreciation of music, and understanding of tonal languages.

Elizabeth Peña received a $3.2 million RO1 grant on Test of English Language Learning. She will develop a test of morphosyntax for identifying developmental language disorder (DLD) in bilingual children based on their English language performance. She will translate information about DLD in Spanish-English bilinguals and extend this to Vietnamese-English bilinguals. The outcome will be a test, given in English, that will help the 94% of speech language pathologists who speak only English identify DLD in bilingual children.

Xiangmin Xu received a three-year, $4.3 million Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative grant. His team will lead the development of a new brain mapping tool for neuroscience research. The mapping tool is based on genetically engineered herpes viruses. Herpes simplex virus (HSV) type 1, strain 129 (H129) will be harnessed as an anterograde, monosynaptic viral tracer with high labeling efficacy and low toxicity for neural circuit analysis. This tool development will benefit anatomical and physiological mapping of auditory pathways and systems.

Publications

Carol Pham, M Kapolowicz, R Metherate, FG Zeng. Nicotine enhances auditory processing in healthy and normal-hearing young adult nonsmokers. *Psychopharmacology* (2019).

Jonathon Venezia, AG Martin, G Hickok, VM Richards. Identification of the spectrotemporal modulations that support speech intelligibility in hearing-impaired and normal-hearing listeners. *Journal of Speech, Language & Hearing Research*(2019).

E Larrea-Mancera, T Stavropoulos, E Hoover, D Eddins, F Gallun, and **Aaron Seitz**. Portable Automated Rapid Testing (PART) for auditory research: Validation in a normal hearing population. *bioRxiv* (2020).

TEACHING AND TRAINING

Undergraduate Minor in Hearing and Speech Sciences

Virginia Richards led the effort to establish a *Minor in Hearing and Speech Sciences* at UCI five years ago. So far 10 students have completed the minor, and potentially another 10 students will complete this year and the following year. These students are from four different schools and are interested in either continuing their education as PhD students or in the allied heath fields such as Speech-Language Pathology, Audiology and Occupational Therapy. To help these students gain experience in clinical environments, Virginia plans to not only introduce an internship course but also arrange a “meet and greet” event for students, academic counselors and faculty in the coming academic year.

Pre- and Post-Doctoral Training

Elizabeth Peña received a $1.25 million, five-year training grant from the US Department of Education to prepare doctoral graduates for leadership positions in language and reading disabilities. Liz also taught a new course in *Language development and disorders*.

Raju Metherate has continued to run a productive Interdisciplinary Training Program in Hearing Research sponsored by the National Institutes of Health (T32). Over the last four years, the program has supported 16 trainees including 11 predoctoral students and five postdoctoral scholars. Raju submitted an excellent renewal application for the training grant last year and is waiting for a funding decision from the NIDCD Council.

Nine Presented Seminars in 2019

- **Adrián Rodríguez-Contreras**, The City College of New York (1/15). "Coordinated development of vascular and perivascular cells during a critical period of synaptic refinement in the auditory system".
- **Li Zhang**, University of Southern California (2/26). "Neural Circuits for Auditory Behaviors and Emotions".
- **Nace Golding**, University of Texas Austin (3/5). "Developmental regulation of temporal precision in the mammalian sound localization circuitry".
- **Assal Habibi**, University of Southern California (4/2). "The Brain's Crescendo: How Music Training Impacts Child Development".
- **Sven Vanneste**, Trinity College Dublin (5/7). "Towards and Understanding of Tinnitus Heterogeneity".
- **Antje Ihlefeld**, New Jersey Institute of Technology (6/4). "Leveraging an animal model to study hearing in noisy situations".
- **Karolina Charaziak**, University of Southern California (10/1). "A Fresh Look at the Generation of Cochlear Microphonics".
- **Peter Narins**, University of California Los Angeles (11/5). "High-end Audio: Neuroethology of Ultrasonic Communications in Amphibians".
- **Maoli Duan**, Karolinska Institute Stockholm (11/20). "Prevention and Treatment of Inner Ear Diseases".

Annual CHR Symposium on VARIATION FROM HEARING TO LANGUAGE

On June 1, 2019, eighty researchers and clinicians attended the 14th Annual CHR symposium organized by Liz Peña. Eight speakers presented 40-min talks:

- **Laurie Eisenberg**, University of Southern California - "Spoken language development after cochlear implantation: Results from the National CDaCI Study".
- **Mary Fagan**, Chapman University - "Infant Agency in Creating Variability in the Input".
- **Lisa Bedore**, Temple University - "An Ear for Grammar: How bilingual children's knowledge of grammar is influenced by input".
- **Stephanie de Anda**, University of Oregon - "Language input to young children: Measuring and manipulating variation".
- **Antje Ihlefeld**, New Jersey Institute of Technology - "Leveraging an animal model to study hearing in noisy situations".
- **John Middlebrooks**, UCI - "The Cochlear Implant Plus One".
- **Elizabeth Peña**, UCI - "Rethinking the Bilingual Delay".
- **Judith Kroll**, UCR - "Variation matters: Some consequences of linguistic diversity for language processing and learning".

Save-the-Dates

Tuesday, February 2, 2020 @ 4 pm, John Oghalai, Professor and Chair of the Department of Otolaryngology-Head and Neck Surgery at USC will present: “Optical Imaging of Cochlear Function and Dysfunction”, CNLM Herklotz Center.

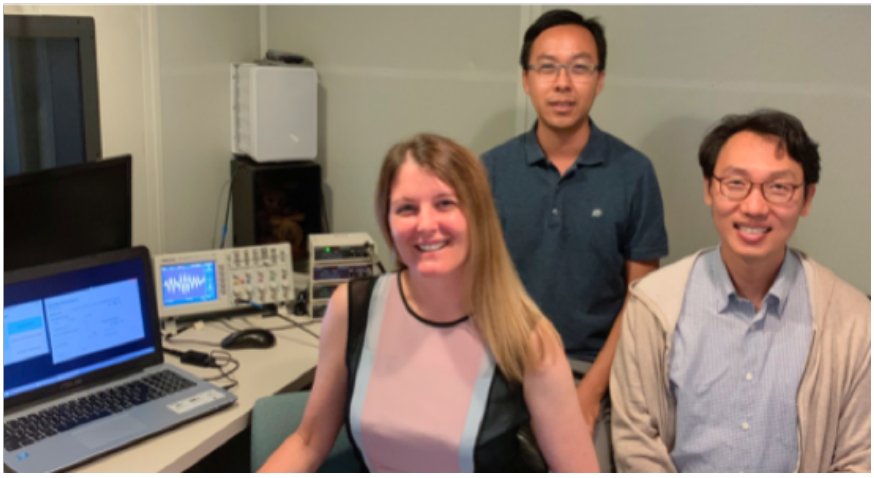
Tuesday, March 3, 2020 @ 4 pm, Laura Dilley, Associate Professor of the Department of Communicative Sciences & Disorders at Michigan State University will present: “Acquisition of temporal patterns in child speech and language production”, CNLM Herklotz Center.

PUBLIC SERVICE

American Tinnitus Association Board Visit

On April 12, 2019, American Tinnitus Association’s Board of Directors, led by CEO Torryn Brazell (front row, second from right), visited UCI to not only learn the latest research but also enjoyed participating in tinnitus matching and masking tests and interacting with students and young researchers.

The 2019 winter issue of ***Tinnitus Today*** featured three CHR young researchers, Michelle Kapolowicz, PhD, Phillip Tran, PhD, and Myung-Whan Suh, MD/PhD (L-R).



Why were you drawn to tinnitus research?

"The prevalence of tinnitus is very high. In both the clinic and the lab, it is one of the most common complaints from patients. Unfortunately, we do not have a solution. Currently, all that we can do is to counsel patients to find a way to make living with this devastating disorder more manageable. It makes us feel helpless and incompetent, yet extremely motivated to find a way to help these desperate patients. Another issue that piques our interest stems from the social cost of unproven treatments. Because there is no standard treatment, it seems that some people want to make money by deceiving others bothered by tinnitus. Some patients pay unbelievable costs for faulty remedies. We hope our research can contribute to stopping such problems. Additionally, tinnitus seems to share similarities with other disorders that remain difficult to treat, such as phantom limb pain, chronic pain, or even post-traumatic stress disorder. By better understanding the mechanisms involved with tinnitus, our research may serve to inform research and treatment for these other disorders as well."

Donate to CHR

CHR is committed to providing an intellectually stimulating and interactive home to advance collaborative and multidisciplinary research, training, and service in hearing loss and other communication disorders. Your support will help us achieve this vision.

University of California Irvine Center for Hearing Research

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