Auditory Neuroscience Laboratory

2019 Holiday Letter

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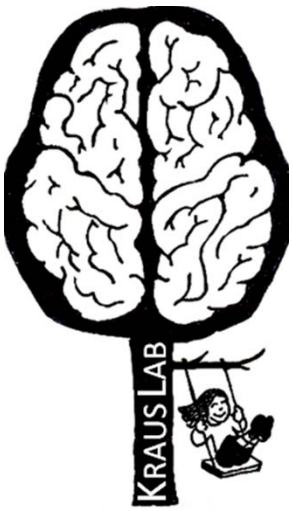


A monumental year in the lab

Dear Friends,

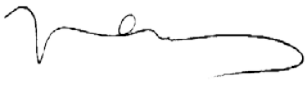
It has been a terrific year at Brainvolts. At this time of reflection, we're grateful for the ongoing support of colleagues, collaborators, and advocates as we continue our work to understand the biological basis of sound processing in the brain and how it affects our lives. Thank you.

We are excited to continue our research on concussions, sound processing, and the brain. Our NIH-funded partnership with Northwestern Athletics continues to thrive. We've now tested hundreds of Division I student-athletes. In parallel, our partnership with the Institute for Sports Medicine at Lurie Children's Hospital and North Side Community Football has grown. Our productivity was possible from the generous support from NAMM and NOCSAE.

The past year saw the publication of several landmark publications (see feature on next page). We've continued our emphasis on connecting with diverse community audiences beyond science's conventional providence, including educators, policymakers, and healthcare providers.

A personal highlight was to appear in conversation with opera legend Renée Fleming at the Harold Washington Library Center in Chicago. I was also deeply honored to receive the Music has Power® Award from the Institute for Music and Neurologic Function.

With deep gratitude for your ongoing engagement with our work,



Nina,
Trent Nicol, Jennifer Krizman, Travis White-Schwoch, Silvia Bonacina, Rembrandt Otto-Meyer

Jillian Escobar, Caroline Tilley, Stephanie Huang, Ross Heilberg, Caleb Eckstein, Austin Webster, Lucas Zecker, Nathan Salon

2019 by the numbers

- **17** publications
- **31** talks and posters to diverse groups of scholars, clinicians, educators, and policymakers
- **11** community outreach events around the country
- **$12,000** in competitive grants won by students to support their independent research projects
- **16** students pursuing original research
- **20** news features
- **1** visit from Grateful Dead percussionist Mickey Hart

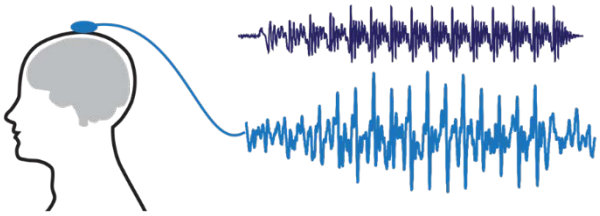
Research Highlights

Healthy athletes, healthy brains

Everybody knows that physical activity is good for the body, and some researchers have suggested it benefits brain health as well. Such studies to date have been in relatively small cohorts and have not considered auditory processing, a key aspect of brain health. As part of our NIH-funded collaboration with Northwestern Athletics, we measured biological responses to speech in nearly 1,000 young adults, evenly divided into matched groups of elite collegiate student-athletes and controls. Student-athletes had augmented brain responses to speech, made possible by lower levels of background noise. This suggests that physical activity can drive "cleaner" sound processing in the brain, potentially strengthening communication skills. As our country engages in an important conversation about sports and safely, we hope these new insights add a valuable perspective. **Krizman, Lindley, Bonacina, Colegrove, White-Schwoch & Kraus (2019) Sports Health.**

Analyzing the FFR: A tutorial

Our lab continues to innovate and refine the frequency-following response (FFR), a measure of the integrity of sound processing in the brain. In a seminal 2010 paper, we provided detailed guidance on how to measure FFRs. Here, in a much-needed follow-up, we provide a complementary tutorial on how to analyze an FFR. After briefly reviewing FFR theory and fundamentals, we dig into the methods to extract data from an individual's FFR. This will serve as a valuable resource for scientists and clinicians seeking to incorporate the FFR into their work. **Krizman & Kraus (2019) Hearing Research.**



Sex differences in sound processing

Men and women hear the world differently. We've known for decades that there are sex differences in biological responses to sound onsets as early as birth. Now we can paint a more nuanced picture. We measured biological responses to speech in 500 males and females between the ages of 3 and 26. Aspects of sound processing were different from the earliest ages, and stayed different through life. Others were equivalent in males and females. Intriguingly, still other aspects of sound processing were similar in preschoolers but different in adulthood. This developmental pattern may help explain why males

seem more vulnerable to language disorders than females, and provides a firm set of normative data on biological responses to speech. **KRIZMAN, BONACINA, KRAUS (2019) HEARING RESEARCH.**

Neurosensory Functions in Youth Tackle Football

Measures of neurosensory functions—including hearing, balance, and vision—are gaining popularity as important components of concussion assessments. Relatively little data are available regarding healthy young athletes' performance on these tests, however. In collaboration with Lurie Children's Hospital's Institute for Sports Medicine and the North Side Youth Football League, we tracked neurosensory performance in young tackle football players across two consecutive seasons. We found that, absent a concussion, performance on these tests is normal and reliable in healthy young athletes, supporting their use in clinical contexts. We also found that performance in hearing, balance, and vision each contribute a distinct insight into brain health. **WHITE-SCHWOCH, KRIZMAN, MCCRACKEN, BURGESS, THOMPSON, NICOL, LABELLA & KRAUS (2019) BRAIN INJURY; IBID. (2019) CONCUSSION.**

Spotlight on Rhythm

Rhythm is in the spotlight in our ongoing research on the effects of music on the nervous system. Rhythm is not a monolithic ability; rather, it is a cluster of skills that combine to support musical performance. We tested a large group of children ages 5-8 years on their abilities to drum along to a steady beat (think time signature), recall rhythmic patterns (think note values), and clap in time with visual feedback (Interactive Metronome). There was no relationship between children's abilities to drum along to a beat and to perform rhythmic patterns, and these rhythm abilities aligned with distinct responses from the auditory brain. Interestingly, their ability to perform the Interactive Metronome task corresponded to their performance on all of the other, distinct rhythmic skills. This work shows that the complex taxonomy of rhythmic skills is already present in very young children, and provides a framework to explore early rhythmic interventions that might augment language and cognitive skills. **BONACINA, KRIZMAN, WHITE-SCHWOCH, NICOL & KRAUS (2019) GLOB PEDIATRIC HEALTH**

Visit us online!

Our website, www.brainvolts.northwestern.edu, remains a point of pride. Please visit us to learn more about our ongoing research projects, download publications, and find out about our next talk. This year we unveiled a new *video tour* you can take to learn all about the website and its resources.

… and be sure to find us on social media!