

Auditory Neuroscience Laboratory

2021 Holiday Newsletter



Sound fills the space surrounding you and me, and connects us when we speak. Sound is alive. We have no script when we talk; we are everyday improvisors. When we're having a conversation there is reciprocity, reverberation and tunedness, psychiatrist and scholar lain McGilchrist calls it "betweenness". It is probably the most precious communication there is.

Sound helped us communicate for hundreds of thousands of years before there was print. Hearing evolved to keep us fed, to keep us safe from predators, to warn us of danger, and to connect us with mates. Sound has deep biologic roots. As our society becomes increasingly alienated, isolated, depressed, anxious, and divisive, sound can heal if we relearn to value it. We can make more music with our friends and families. We can talk to our children instead of to our phones. I believe sound holds a key for fostering a new sense of engagement and meaning in the twenty-first century.

rand

Nina

Trent Nicol, Jennifer Krizman, Silvia Bonacina, Rembrandt Otto-Meyer, Anoop Basavanahalli Jagadeesh, Chaitra Nayak, Jenna Cunningham, Cindy King, Jacob Farley

Kayla Byrne, Yohan Eskrick-Parkinson, Omkar Prabhavalkar, Braeden Heald, Courtney Baker, Anika Kaushikkar, Hallie Garfield, Aaron Robinson

Brainvolts 2021 by the numbers

2 op-eds

WSJ & LA Times

20 publications
24 science talks
25 podcasts
4 new lab members
4 new lab members
1 new post-doc fellow
8 students
51 news features
1 book published OF SOUND MIND

2021 Highlights

OF SOUND MIND



Nina's first book <u>OF SOUND MIND: How Our Brain Constructs a Meaningful</u> <u>Sonic World</u> is written for her favorite audience - the intellectually and spiritually curious person looking to better understand the powerful forces in our lives - like sound. It is a love letter to sound, how sound connects us, its biological impact on making us us, and how it affects the society we live in.

The book begins with 'How Sound Works' - a story Nina can hear and tell again and again, like a child asking for the same book to be read yet once more.

Most of the book is 'Our Sonic Selves' and covers a range of themes from language to birdsong. The book



Katie Shelly

is full of personal stories and the contributions of lab members, past and present. Science is a deeply human endeavor.



Signing OF SOUND MIND at local bookstore: Bookends & Beginnings

Katie Shelly is responsible for 40 of the 80 illustrations in OF SOUND MIND. She helps us celebrate the art in science and creates an integral part of Brainvolts' décor.

Vive la différence!

In collaboration with Kasia Bieszczad and Elena Rotondo at Rutgers University, we explored whether sex hormones, specifically estrogen, can influence the neural encoding of sound. Consistent with findings in humans, the strength of harmonic encoding was modulated by estrogen in female rats. The greater the estrogen, the stronger the harmonic representation. After all, if he says, 'I love you', she needs to know whether he means it!

Krizman, Rotondo et al. 2021, Scientific Reports.



Rhythm: A case for digital music medicine

In music, the time signature indicates the beat or pulse - what we tap our foot to. Note values and rests create the rhythmic pattern. These rhythm activities track with brain rhythms ranging from microsecond-to-second time scales, and with language and memory skills. Nothing is better than



actually making music, but digital music medicine may offer therapeutic benefits. In a series of studies using Interactive Metronome (IM) led by Silvia Bonacina, we have learned that IM tracks with foundational rhythmic skills (beat and pattern), their corresponding brain rhythms and cognitive skills. The BEET/PLUM framework encapsulates these ideas: Beat Engages Exquisite Timing (BEET) and Pattern Learning Unlocks Memory (PLUM).

With the evidence we have for music as a potent way to change the brain for the better, that rhythm is an integral part of music, and the flexibility this sort of program offers

in the classroom and the clinic, digital rhythmic medicine has earned a place at the table when therapeutic and educational decisions are made. <u>Kraus, 2021, Hearing Journal</u>.

Accented Speech

Understanding non-native accents and communicating in a nonnative language, especially in noisy settings, can be a listening challenge. Through her recently awarded 'NIH R-21' grant, Professor Jen Krizman is exploring how auditory, cognitive, and linguistic processing is used differently by native and non-native listeners to enable successful communication.



Athlete Update



Our Big Ten athletes were grateful to keep competing throughout the year, and Brainvolts gratefully assessed them. We are taking strides towards understanding sound processing and the brain in student athletes with more than 3000 testing sessions to date. In line with our continued findings that concussion can disrupt the hearing brain, we often hear about difficulty hearing in noise and hypersensitivity to sound following head injury. The athletes know.

Dartmouth Update

Our collaboration with the Space Medicine Innovations Lab at Dartmouth, headed by astronaut Jay Buckey and Abigail Fellows is going strong. In Dar Es Salaam Tanzania and Beijing China, we are researching the central-nervous system effects of HIV infection and of anti-retroviral therapies. In 2021, The Tanzania



project was especially fruitful, producing three joint Dartmouth-Brainvolts publications examining auditory function in HIV-positive individuals.

Learning about Concussion using Rhythm

Collaboration with Lurie Children's Hospital is back on track after the pandemic curtailed things for a bit. This project, using the frequency following response and Interactive Metronome to look at how concussions in children impact auditory processing and rhythmic abilities, is going strong. Recently one Jacob (Wild) was replaced by another (Farley). New Jacob has picked up the torch, working closely with Dr Cynthia LaBella, head of the Lurie's Institute for Sports Medicine, recruiting and testing young participants. Welcome Jacob!

The BEAMS Hypothesis

Our memory for sound is grounded in the BEAMS hypothesis, focusing on the intricate balance between stability and flexibility that exists in the hearing **B**rain. The brain-to-ear (**E**fferent) pathways provide ongoing flexible contributions while the ear-to-brain (**A**fferent) pathways imparts stability (after sustained experience). This delicate balance creates our **M**emory for **S**ound which contributes to making us us. <u>Kraus, 2021, Hearing Research.</u>





Welcomes and Welcome backs

We are thrilled to welcome Dr. Anoop Basavanahalli Jagadeesh, and Mrs. Chaitra Venkataramana Nayak who have crossed the ocean and oceans of Covid-themed bureaucratic challenges to join us. Anoop earned his doctorate in Audiology from India and Chaitra brings her expertise as an audiologist.



Anoop Basavanahalli Jagadeesh (left) Chaitra Venkataraman Nayak (right)



Jenna Cunningham (left) Cindy King (right)

We welcomed Courtney Baker, Hallie Garfield (Au.D program), Anika Kaushikkar (undergraduate), and Aaron Robinson (Sound Arts and Industries program). With enormous joy, we welcome home our alumni –Jenna Cunningham and Cindy King, Founding Mothers of Brainvolts' biological approach.

Send offs

On a bitter-sweet note, the lab bids adieu to long-term lab member Travis White-Schwoch who has taken up a new role in advertising. We are grateful for Travis's immense contribution to the lab over the past decade, and wish him a successful career in business.



On a different note



Jennifer Krizman is now a Marathoner. After completing the 43rd edition of the Annual Chicago marathon, Jen becomes the first and only lab member to complete the 26-mile marathon. Congratulations Jen! We are over-the-moon proud of you.

In another marathon, Silvia Bonacina completed 9-month training and won herself, and the rest of us, Filippo's little brother – Pietro!



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