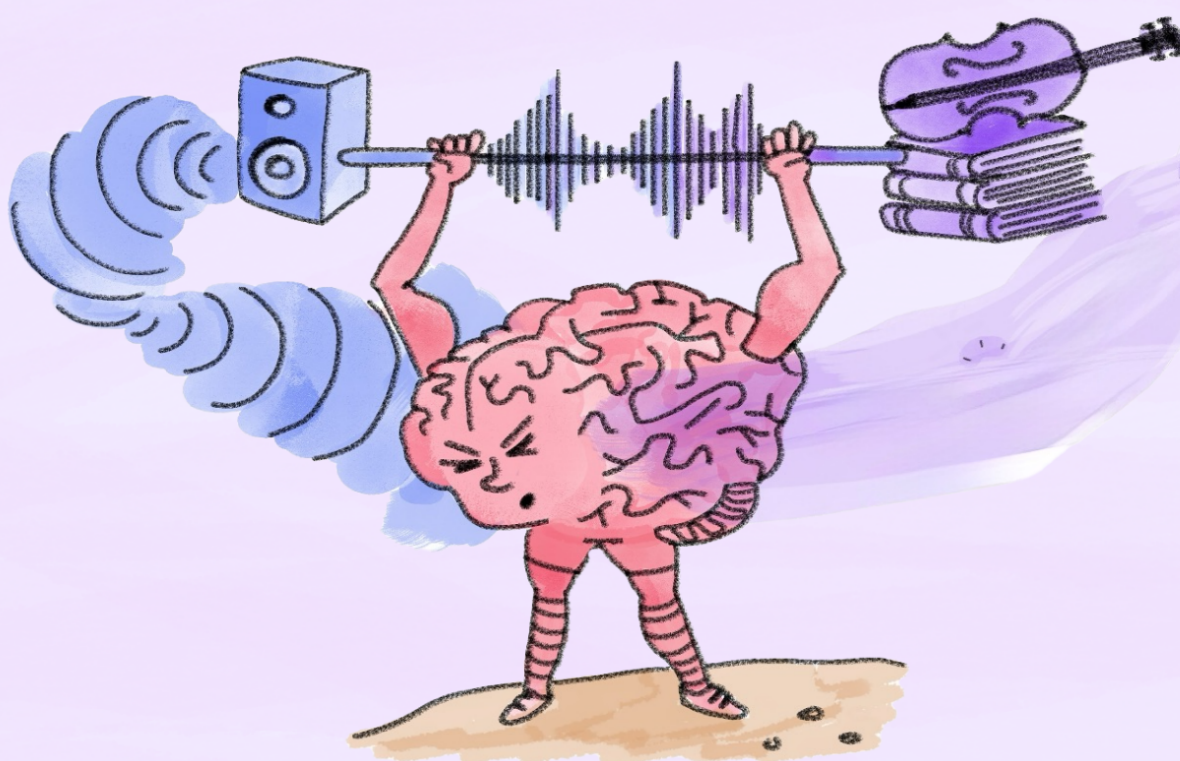




Auditory Neuroscience Laboratory

2024 Holiday Newsletter

brainvolts.northwestern.edu



Dear Friends of Brainvolts,

“And the lonely voice of youth cries, ‘What is truth?’” —Johnny Cash, *What is Truth*

Students often ask me for answers. They hope for AN answer. But usually the best I can offer, especially if the question has heft, is “it depends.”

In 1906, the Nobel Prize in Physiology and Medicine was jointly awarded to Italian Camillo Golgi and Spaniard Santiago Ramón y Cajal. Yet the two scientists refused to speak to one another. They each had strongly held theories about the structure of neurons: Golgi believed cells connected to one another forming a giant interconnecting net. By contrast, Ramón y Cajal believed cells were single, differentiated entities.

As we know now, they are both right. Neurons are connected biochemically via synapses. Thus, they are both connected *and* separate.

Opposing views are often true. Science reveals truths but at the same time, has enormous limitations.* The more we are called upon to give unambiguous answers in our machine-driven society, the more we become like machines ourselves.

At Brainvolts, we pledge to keep searching past easy answers to find out what rings true.

* See McGilchrist, *The Matter with Things*, chapters 20 and 21 for a deep discussion of truth and science.



Nina

Trent (rock-of-the-lab) Nicol, Jennifer Krizman, Silvia Bonacina, Joseph Luetkehans, Blaise Malisch, Jenna Cunningham, Charlie Culbert, Yuhan Zhang, Judy Chen, Olivia Black, Josh Sevier, Anoop Basavanahalli Jagadeesh, Chaitra Nayak

Students: Courtney Baker, Kaitlyn Burkamper, Anika Kaushikkar, Maggie Powers, Lane Herbert, Johanna Endres, Joy Chiang, Jubilee Chen, Anusha Saraf, Sinziana Lazar

Artist collaborator: Katie Shelly



Golgi's cell stain, showing connected cells



Ramón y Cajal's drawing of cells as single entities

Publications

- Kraus N (2024) [Sound Connects Us](#). in *Music and Mind: harnessing the arts for health and wellness* (Renee Fleming, Ed). Viking: New York
- Krizman J, Colegrove D, Cunningham J, Bonacina S, Nicol T, Nerrie M, Kraus N (2024) [Concussion Acutely Disrupts Auditory Processing in Division I Football Student-athletes](#). *Brain Injury*. 1-9.
- Skoe, E & Kraus, N (2024) [Neural Delays in Processing Speech in Background Noise Minimized After Short-Term Auditory Training](#). *Biology*. 13(7):509.
- Bonacina S, Krizman J, Farley J, Nicol T, LaBella CR, Kraus N (2024) [Persistent Post-Concussion Symptoms Include Neural Auditory Processing in Young Children](#). *Concussion*. 28;9(1):CNC114.
- Bonacina S, Lichtenstein JD, Niemczak C, Magohe A, Fellows A, Nicol T, Massawe E, Kraus N, Buckey JC (2024) The Relationship Between HIV and Reading Performance for Children in Tanzania. *AIDS*. in press.
- Ealer C, Niemczak CE, Nicol T, Magohe A, Bonacina S, Ziyin Z, Rieke C, Leigh S, Kobrina A, Lichtenstein J, Massawe ER, Kraus N, Buckey JC (2024) [Auditory Neural Processing in Children Living with HIV Uncovers Underlying Central Nervous System Dysfunction: a Tanzanian Cohort Study](#). *AIDS*. 38(3): 289-298

Brainvolts 2024 by the numbers

- 22 talks
- 11 keynotes
- 14 podcasts & interviews
- 6 publications
- 8 poster presentations

2024 Highlights

Nina Kraus wins a Guggenheim

Nina has won a Guggenheim Fellowship. This award goes “to exceptional individuals in pursuit of scholarship in any field of knowledge and creation in any art form, under the freest possible conditions.” Nina’s award will support the writing of her still-unnamed follow up to *Of Sound Mind* that will address the question “what can music can teach us about our biology?”

Follow the link for more information.

<https://www.gf.org/fellows/nina-kraus/>



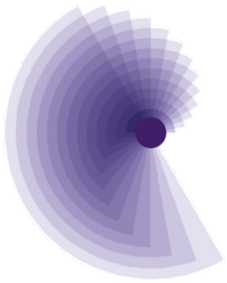
Nina Kraus is named the winner of the Guyot Prize 2024

Nina won the 2024 Guyot Prize. Established in 1914, the Guyot Prize is awarded every five years by the University Medical Center of Groningen, Netherlands. The prize celebrates exceptional contributions to auditory science. This award puts Nina in very good company. Among the 21 previous winners are Georg Von Békésy, who discovered the foundational biophysics of the cochlea, and Peter Dallos, who demystified of the role of the outer hair cell of the cochlea.



Nina & Jen take leadership of the Knowles Hearing Center

Northwestern | Knowles Hearing Center



Nina and Jen have assumed leadership of the Knowles Hearing Center, which has been a force in advancing hearing health and science since 1988. With strong backing from new departmental Chair Bharath Chandrasekaran and Dean E. Patrick Johnson, they are bringing fresh energy to the Center's mission. Their vision is deeply personal: to create a vibrant community of experts from neuroscience, audiology, engineering, medicine, and the arts, all working together to improve hearing health for everyone.

This year, they're thrilled to celebrate Dame Renée Fleming as the Knowles Prize recipient. Her *Sound Health Initiative* beautifully reflects the Center's commitment to blending art and science, a goal inspired by founder Hugh Knowles' belief in the power of sound to touch all aspects of life. Under their leadership, the Center is expanding its efforts to foster groundbreaking research, promote interdisciplinary collaboration, and elevate clinical care.

From hosting engaging seminars and community outreach to launching a [revamped website](#), the Center is buzzing with activity. Recent highlights include a symposium on hypersensitivity to sound and a talk by Matt Hay, author of "Soundtrack of Silence." As a recipient of an auditory brainstem implant, Matt exemplifies the principle that making sense of sound is more than meets the ear. Through these efforts, Nina and Jen aim to make the Center a beacon for hearing health and ensure that Northwestern becomes the premier destination for hearing care.



The speakers of the Hypersensitivity to Sound Symposium

Renée Fleming to be awarded the Knowles Prize



The Knowles Hearing Center has stepped outside the halls of academia for the first time in awarding its eleventh Hugh Knowles Prize to soprano Dame Renée Fleming. The hearing sciences owe a great deal to music; early discoveries about the physics and physiology of sound were in the service of understanding music. Fleming is most known as a Kennedy Center honored soprano who has worked with the Metropolitan Opera, Houston Grand Opera, the San Francisco Opera, and closer to Brainvolts, the Lyric in Chicago. She has recorded many critically acclaimed albums and claimed five Grammy Awards. But she is also a leading advocate for studying the connections between the arts and health. She spearheaded the Sound Health Initiative, a collaboration with the NIH and the NEA to bring attention to research and clinical practice at the intersection of sound, health, and neuroscience. Fleming regularly delivers lectures to diverse audiences on the topic of “Music and the Mind,” covering the therapeutic potential of sound across a number of medical applications, including recovery from brain trauma, fighting depression, offering relief to people with dementia and strokes, and its role in the cancer recovery process. Moreover, she regularly performs her science advocacy from the stage. As she travels worldwide for her musical performances, she seeks out auditory-themed scientists from whatever city she finds herself in. Then, along with the local scientist, she informs the audience about what science has to say about sound and health. We are proud that the Knowles Prize board made a leap in choosing to honor Ms. Fleming with this important award.

More information about Dame Renée Fleming and the prize here...

<https://knowleshearingcenter.northwestern.edu/knowles-prize/#RenéeFleming>

Frequency-Following Response (FFR) Workshop

FREQUENCY
FOLLOWING
RESPONSE
WORKSHOP

2024

CHICAGO

In June, Jen helmed the organization of the immensely successful 2024 FFR Workshop. The frequency following response is a measure of brain health that Brainvolts

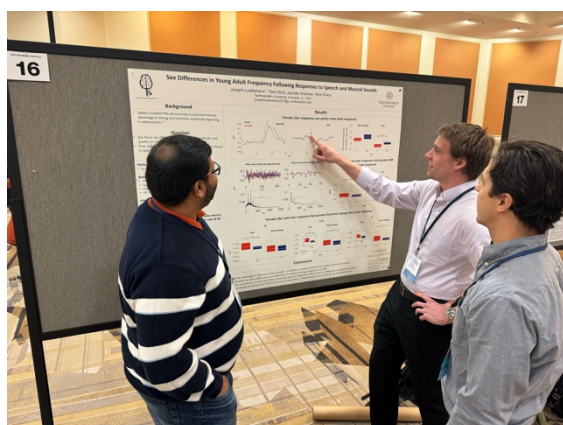
pioneered and is now used worldwide. This year's edition of the Workshop, which was the first to be hosted in the United States since 2016, brought together neuroscientists, audiologists, behavioral scientists, doctors, and musicians from around the world to share and discuss the cutting edge of research using the frequency following response. The theme of this year's workshop was unity: bridging the gap between scientific and clinical applications of the FFR to support our shared pursuit of a healthier hearing brain. We thank all our attendees, sponsors, staff, and organizers for their invaluable contributions to this year's workshop!



2024 FFR Attendees and organizers gathered for the famous Chicago Architecture Boat tour

Sex Differences According to Joe

Newly-minted PhD Candidate Joe successfully defended his Qualifying Research Project, Sex differences in the auditory processing of musical sounds as revealed with the frequency



Joe presenting the sex differences study at the ARO conference in Anaheim

following response, to his committee in July. This project, building on Brainvolts' previous research on sex differences in sound processing, showed that sex differences in the timing of brain responses to sound present on multiple levels. Not only do female brains respond to sound faster than male brains, but they do so with more consistency in the timing of individual response components. Joe's project is among the first to make use of our Brain Keyboard testing paradigm

and has laid some groundwork for future investigations of how our brains respond to music, and the biological factors that underlie individual differences in this function of the brain.

Athletes and Music

Support from the National Endowment for the Arts allows us to continue our collaboration with Lurie Children's Hospital - Institute for Sports Medicine physician, Cynthia LaBella, M.D. With this small grant, we will perform exploratory research on the use of rhythm as a treatment for concussion. We hope this will lay the foundation to secure funding for a comprehensive, well-powered research program in this sphere.

Dartmouth update

Our collaboration with the Space Medicine Innovations Lab at Dartmouth, headed by astronaut Jay Buckey is continuing strong. In spring 2024, NIH renewed the funds for the ongoing study on



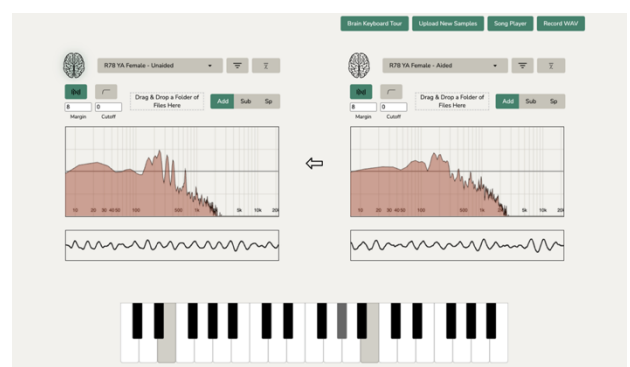
Dartmouth
GEISEL SCHOOL OF
MEDICINE

young children in Dar Es Salaam Tanzania. Within this project, Silvia Bonacina led the analysis exploring the relationship between HIV and literacy using an internationally validated measure (Early Grade Reading

Assessment - EGRA) to assess progress toward learning to read. Despite the biological and environmental confounds, children with HIV performed significantly worse than children without HIV on the EGRA's subtests, indicating literacy skill development in HIV positive children needs early intervention. This finding was recently finalized in a manuscript in press at AIDS. Longitudinal analyses, including electrophysiological and behavioral data, are in their initial stage to explore the factors associated with poor reading and literacy performance in children with HIV.

The Brain Keyboard continues

The Brain Keyboard, our program that transforms neural responses to music into playable sounds, has come a long way since we first demoed it at a 2018 NIH event at the Kennedy Center. 2024 brought the



implementation of new denoising methods, additional ways to average and make comparisons across subjects, and an overhauled web app interface, making it an even more powerful tool for understanding how our brains process musical information. The Brain Keyboard proved instrumental in several key studies this year, including our investigations of sex differences in auditory processing and our research on middle-aged hearing. As a demonstration tool, it allows us to share our understanding of how the brain processes music and continues to inspire audiences to think about their own brain in sound.

The Scientific Argument for Music Education – in Paris!



In May 2024, Nina took part in the Music, Brain, and Education Conference in Paris, hosted by the Vareille Foundation and College de France. Nina's talk titled *The Scientific Argument for Music Education* highlighted that we have actual proof of the benefits of music education on the brain.

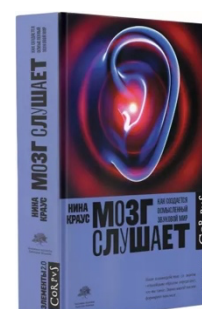
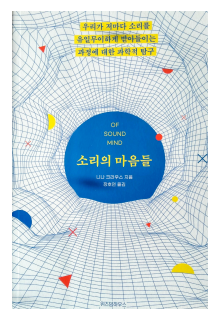
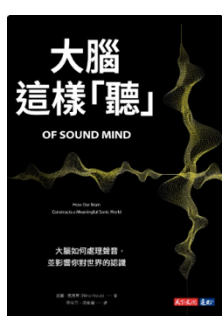
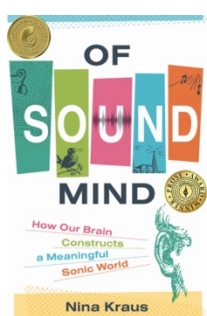
La mente sonora

Nina's *Of Sound Mind* has been translated into Italian and is available now via Italian publisher Hogrefe Editore. With Italian as her mother tongue, Nina is thrilled to present her 'love letter to sound' to an Italian audience.

Of Sound Mind is also available in English, Chinese, Japanese, Russian, and Korean, with a Turkish translation in progress.

Find more information here...

<https://www.hogrefe.it/catalogo/volumi/saggi/la-mente-sonora-come-il-nostro-cervello-elabora-i-suoni-intorno-noi/>



2024 BrainMind + Your Brain on Art Summit



Susan, Nina, and Ivy at the Your Brain on Art Summit

On Saturday June 1st in New York City, Nina joined fellow scientists and artists at this summit inspired by Susan Magsamen and Ivy Ross's book "Your Brain on Art," which explores how the arts measurably transform our brains. Nina presented on Auditory Learning Power and Neurobiological Basis of Sound. BrainMind is an organization dedicated to supporting and cultivating the most important discoveries in brain science.

Panel in Italian about the Italian translation of *Of Sound Mind*



con i bambini per la neurologia infantile

In late November, Nina and Silvia participated to a virtual panel session in Italian organized by SONG onlus / Sistema in Lombardia (Italy) in collaboration with the Mariani Foundation. The discussion was led by Maria Majno and centered on *La Mente Sonora*, the Italian translation of Nina's book. An overview of the book with its main features and the power of music as a resource to foster development were tackled in the lively conversation. Luisa Lopez and Tomaso Vecchi also took part in the discussion.

Italian friends may be interested to listen to it at the following link:

<https://fb.watch/wiSspxfjdz/>



Welcomes

This past June Silvia Bonacina welcomed baby **Giulia** to her family. So far, big brothers Filippo and Pietro enjoy entertaining and cuddling their baby sister.



Silvia's children Giulia, Filippo, and Pietro.

This past year, Jen traded in her running shoes for a new kind of race, welcoming baby **Matthew** into the world. The journey to this moment has been a long one, but the real adventure of parenthood is just beginning!



Jen's son Matthew Richard Zic

Music Making!



Otto, Nina's grandson, is an enthusiastic drummer.



Julian, also Nina's grandson, jamming in his pajamas with his mom.

Northwestern University provides Brainvolts with its lab space and Nina's salary as a tenured professor. Absolutely everything else - our equipment, computers, supplies, and most importantly, our people - must be funded by grants and philanthropic gifts. Please consider [helping Brainvolts](https://giving.nu/Brainvolts)* this year.

<https://giving.nu/Brainvolts>

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