

# Karl D. Lerud

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## Education

- 2013 – 2019 + **Ph.D., University of Connecticut** in Psychological Sciences; Adviser: Edward W. Large  
Thesis title: *Electrophysiological, neural, and perceptual aspects of pitch.*
- 2011 – 2013 + **Florida Atlantic University** in Complex Systems and Brain Sciences.
- 2009 – 2011 + **M.A., University of Wisconsin–Milwaukee** in Liberal Studies.  
Thesis title: *An approach to systems-theoretic music cognition.*
- 2002 – 2006 + **B.F.A., University of Wisconsin–Milwaukee** in Music Composition and Technology.

## Employment History

- 2022 – present + **Postdoctoral Associate.** *Institute for Systems Research*, University of Maryland, College Park; Adviser: Jonathan Z. Simon
- 2019 – 2022 + **Postdoctoral Fellow.** *Neurology*, Baystate Health and University of Massachusetts Medical School; Adviser: Gottfried Schlaug
- 2013 – 2019 + **Research Assistant.** *Music Dynamics Laboratory*, University of Connecticut.  
+ **Teaching Assistant.** *Department of Psychological Sciences*, University of Connecticut.
- 2015 – 2018 + **Scientific Programmer.** Oscilloscope, LLC.
- 2011 – 2013 + **Teaching Assistant.** *Center for Complex Systems and Brain Sciences*, Florida Atlantic University.

## Research Publications

### Journal Articles

- 1 **Lerud, K. D.**, Hancock, R., & Skoe, E. (2023). A high-density EEG and structural MRI source analysis of the frequency following response to missing fundamental stimuli reveals subcortical and cortical activation to low and high frequency stimuli. *NeuroImage*, 279, 120330.  
<https://doi.org/10.1016/j.neuroimage.2023.120330>
- 2 Ross, D. A., Shinde, A. B., **Lerud, K. D.**, & Schlaug, G. (2023). Multielectrode network stimulation (ME-NETS) demonstrated by concurrent tDCS and fMRI. *bioRxiv : the preprint server for biology*. <https://doi.org/10.1101/2023.06.13.544867>
- 3 **Lerud, K. D.**, Vines, B. W., Shinde, A. B., & Schlaug, G. (2021). Modulating short-term auditory memory with focal transcranial direct current stimulation applied to the supramarginal gyrus. *NeuroReport*, 32(8), 702–710. <https://doi.org/10.1097/wnr.0000000000001647>
- 4 Shinde, A. B., **Lerud, K. D.**, Munsch, F., Alsop, D. C., & Schlaug, G. (2021). Effects of tDCS dose and electrode montage on regional cerebral blood flow and motor behavior. *NeuroImage*, 237(April). <https://doi.org/10.1016/j.neuroimage.2021.118144>
- 5 **Lerud, K. D.** (2019b). Residue pitch perception of shifted frequency complexes. *submitted*.

- 6 **Lerud, K. D.**, Kim, J. C., Almonte, F. V., Carney, L. H., & Large, E. W. (2019). A canonical oscillator model of cochlear dynamics. *Hearing Research*, 380, 100–107.  
<https://doi.org/10.1016/j.heares.2019.06.001>
- 7 **Lerud, K. D.**, & Large, E. W. (2019a). Nonlinear frequency components in auditory responses to complex sounds: Physiology, measurement, and generation. *in prep.*
- 8 **Lerud, K. D.**, Almonte, F. V., Kim, J. C., & Large, E. W. (2014). Mode-locking neurodynamics predict human auditory brainstem responses to musical intervals. *Hearing Research*, 308, 41–9.  
<https://doi.org/10.1016/j.heares.2013.09.010>

## Conference Proceedings

- 1 Tonelli, L., **Lerud, K. D.**, Mechtenburg, H., Myers, E., & Skoe, E. (2023). Automated Segmentation of Brainstem, Midbrain, Thalamus, and Auditory Cortex: Test-Retest Reliability and Comparison to Manual Segmentation. In C. Cedderoth (Ed.), *Proceedings of the Association for Research in Otolaryngology*. Association for Research in Otolaryngology.
- 2 **Lerud, K. D.** (2019a). A high-density EEG and structural MRI source analysis of the frequency following response to pitch shifted stimuli. In A. Calcus & T. Schoof (Eds.), *Frequency Following Response Workshop* (p. 15).
- 3 **Lerud, K. D.**, & Large, E. W. (2019b). Source analysis of the frequency following response to pitch-shifted stimuli with high-density EEG. In P. Martens & F. Upham (Eds.), *Proceedings of the Society for Music Perception and Cognition* (p. 57).
- 4 Hoglund, E. M., Klyn, N. A., **Lerud, K. D.**, Oh, Y., Large, E. W., & Feth, L. L. (2016). Testing a computational model for detection of “real-world” sounds. In *Proceedings of the Acoustical Society of America* (pp. 3273–3273). Acoustical Society of America.  
<https://doi.org/10.1121/1.4970391>
- 5 **Lerud, K. D.**, Kim, J. C., Almonte, F. V., Carney, L. H., & Large, E. W. (2015). A canonical nonlinear cochlear model. In L. J. Hood (Ed.), *Proceedings of the Association for Research in Otolaryngology* (PS–368).
- 6 **Lerud, K. D.**, Kim, J. C., & Large, E. W. (2014a). A neurodynamic account of residue pitch. In M. K. Song (Ed.), *Proceedings of the International Conference on Music Perception and Cognition* (p. 185).
- 7 **Lerud, K. D.**, Kim, J. C., & Large, E. W. (2014b). Pitch shift of the residue and its brainstem electrophysiological correlates are explained by nonlinear oscillation. In *Proceedings of the Acoustical Society of America* (p. 2166). Acoustical Society of America.  
<https://doi.org/10.1121/1.4877038>
- 8 **Lerud, K. D.**, Kim, J. C., & Large, E. W. (2013a). Auditory brainstem EEG, residue pitch, and nonlinear dynamical systems. In M. Schutz & F. A. Russo (Eds.), *Proceedings of the Society for Music Perception and Cognition* (2B–3.3).
- 9 **Lerud, K. D.**, Kim, J. C., & Large, E. W. (2013b). Nonlinear oscillation accounts for the perception of residue pitch and its brainstem EEG correlate. In *2013 Neuroscience Meeting Planner* (356.06/UU7). Society for Neuroscience.
- 10 **Lerud, K. D.**, Kim, J. C., & Large, E. W. (2012). A nonlinear dynamical systems approach to pitch perception. In *2012 Neuroscience Meeting Planner* (462.12/W15). Society for Neuroscience.

## Teaching and training

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General Psychology I Lab	+ Scientific literacy, research methods, statistics, neuroscience
Principles of Research Lab	+ Experimental design, research methods, IRB submission, data collection, regression and advanced statistical analyses, research presentation
Sensory Neuroscience Lab	+ Intro to programming in MATLAB, auditory neuroscience, fundamental signal processing
EEG execution and data analysis	+ Electrode, EEG net, and amplifier preparation and usage, EEG data storage and manipulation, EEG data processing and analysis
MRI image and data analysis	+ Complete pipeline from raw MRI image volumes to analyzed data: DICOM to NIfTI conversion, preprocessing, standard space transformation, and segmentation, manual ROI creation and application, and subsequent statistical evaluations

## Skills and activities

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Academic	+ Research methods, teaching, consultation, MATLAB training and analysis, L <sup>A</sup> T <sub>E</sub> X typesetting and publishing, Git version control
Programming Languages	+ MATLAB, Python, R, L <sup>A</sup> T <sub>E</sub> X, LilyPond, Git, Bash
Software	+ SPM, FSL, FreeSurfer, MRICro/n/GL, MNE, SimNIBS, EEGLAB, FieldTrip, Brainstorm
Coding Projects	+ <b>GrFNN Toolbox for numerical integration of networks of non-linear oscillators</b> , <a href="https://github.com/MusicDynamicsLab/GrFNNToolbox">🔗 https://github.com/MusicDynamicsLab/GrFNNToolbox</a>
	+ <b>GrFNN Cochlea Toolbox for simulation of a canonical nonlinear cochlear model</b> , <a href="https://github.com/MusicDynamicsLab/GrFNNCochLea">🔗 https://github.com/MusicDynamicsLab/GrFNNCochLea</a>
Academic journal reviewer	+ <i>Neuropsychologia</i> , <i>Brain Research</i> , <i>AIMS Neuroscience</i>

## Awards

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2016	+ <b>Connecticut Institute for the Brain and Cognitive Sciences (IBaCS) Seed Grant</b> , \$ 22,000 for dissertation research.
2014	+ <b>SEMPRE Travel Award for International Conference on Music Perception and Cognition</b> , \$ 662 for travel to ICMPC in Seoul, South Korea.