

## C. Daniel Meliza, Ph.D.

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### RESEARCH INTERESTS

Neural circuit mechanisms of pattern learning and recognition in the auditory system, with special emphasis on songbirds. My lab uses behavioral, electrophysiological, and computational methods to understand how complex acoustic signals are learned and processed in social animals.

### CURRENT & PREVIOUS POSITIONS

- 2014- Assistant Professor, Department of Psychology, University of Virginia  
Affiliate Faculty, Neuroscience Graduate Program  
Affiliate Faculty, Linguistics Graduate Program
- 2011-2013 Research Associate, University of Chicago
- 2006-2011 Postdoctoral Scholar, University of Chicago
- 2000-2006 Graduate Student, University of California at Berkeley
- 1999-2000 Software Engineer, Pinpoint Corporation, Billerica MA

### EDUCATION

- 2005 PhD in Molecular and Cell Biology, University of California, Berkeley
- 1999 BA in Biochemistry, Lewis & Clark College, *summa cum laude*

### TEACHING

#### **Courses Taught**

##### UNIVERSITY OF VIRGINIA

- 2014- Animal Minds (lecture)
- 2014- Neurobiology of Speech & Language (seminar)
- 2015- Topics in Evolutionary Neurobiology (seminar)
- 2015- Computational Neuroscience (graduate seminar)
- 2016- Psychobiology Lab (team taught)

See <http://faculty.virginia.edu/dmeliza> for course websites.

##### UNIVERSITY OF CHICAGO

- 2012 Guest lecturer, Neuroethology

##### RUSH UNIVERSITY

- 2009-2010 Co-instructor, Anatomy and physiology of the hearing and speech systems

## UC BERKELEY

- 2002 Graduate student instructor, Introduction to Neurobiology  
 2003 Graduate student instructor, Mammalian Neuroanatomy

**Supervised Trainees**

## PHD GRADUATE STUDENTS (THESIS SUPERVISOR)

- 2013–2018 Andrew Chen, Neuroscience Graduate Program  
 — Awarded UVA Presidential Fellowship for Collaborative Neuroscience (2018), \$21,900  
 2015– Margot Bjoring, Psychology  
 — Awarded Jefferson Scholars Foundation Fellowship (2019–2021)  
 2019– Christof Ferhman, Psychology  
 Yao Lu, Psychology  
 Samantha Moseley, Psychology

## OTHER TRAINEES

- 2014–2017 Tyler Robbins, Cognitive Science, honors undergraduate thesis research  
 — Awarded a Harrison Undergraduate Research Award (2015), \$3000  
 — JD student, Stanford Law School  
 2014–2016 Chelsea Haakenson, research technician  
 — PhD student, University of Maryland  
 2014–2016 Margaret O’Toole, Computer Science, undergraduate research  
 2015–2016 Jonathan Riggle, Neuroscience, undergraduate thesis research  
 — PhD student, University of Chicago  
 2015–2016 Adrienne Doebrich, Cognitive Science, honors undergraduate thesis research  
 — MD student, University of Virginia  
 2015–2018 Crystal Gong, Cognitive Science, honors undergraduate thesis research  
 — Awarded a Harrison Undergraduate Research Award (2016), \$3000  
 2015–2016 Ayush Sagar, Computer Engineering (M.E.), independent research  
 2016–2017 Zheng Wang, Computer Engineering (M.E.), independent research  
 2016–2018 Hasan Khan, Cognitive Science and Computer Science, undergraduate research  
 2017 Dove-Anna Johnson, Virginia-North Carolina Alliance summer research scholar  
 — Received a FASEB Diversity Resources for Enrichment, Access and Mentoring award  
 — Awarded a Harrison Undergraduate Research Award (2018), \$3000  
 2017– Fatima Ahsan, Neuroscience, undergraduate research assistant  
 — Awarded a Harrison Undergraduate Research Award (2020), \$3100  
 2017–2019 Neal Chen, undergraduate research assistant  
 2018 Carson Lambert, undergraduate research assistant  
 2018– Kayla Hess, Biology, undergraduate research assistant  
 2018 Alexis Jones, Virginia-North Carolina Alliance summer research scholar  
 2019 Michael Hall, Virginia-North Carolina Alliance summer research scholar  
 2019– Leah Kiely, undergraduate research assistant

## QUALIFYING &amp; DISSERTATION COMMITTEES

- 2014–2017 Lindsay Collins, Psychology

- 2015–2019 Kelly Wroblewski, Psychology
- 2015–2016 Laura Getz, Psychology
- 2016–2018 Rolf Skyberg, Psychology
- 2016–2019 Mark Dombrowski, Biology
- 2016– John Leonard, Biology
- 2017– Adam Lu, Pharmacology
- 2018– Amalia McDonald, Psychology
- 2019– Robert Moulder, Psychology
- 2019– Brandon Jacques, Psychology
- 2019– Emily Weichart, Psychology

#### UNDERGRADUATE ADVISEES

Faculty advisor to about 30 College of Arts & Sciences students majoring in Psychology

#### FELLOWSHIPS & AWARDS

- 2012 Gordon Research Conference (Auditory System) Travel Award
- 2007–2010 NIH-NIDCD National Research Service Award F32DC008752  
Receptive field correlates of starling song recognition behavior
- 2000–2003 NSF Graduate Research Fellow
- 1997–1999 Barry M. Goldwater Scholarship and Excellence in Education Scholar

#### RESEARCH SUPPORT

##### **Ongoing**

- 2019–2022 Hartwell Foundation, Individual Biomedical Research Award  
Early Detection of Auditory Learning Deficits in a Novel Model of Dyslexia and Other  
Developmental Language Disorders  
PI: Meliza  
Direct Costs: \$300,000
- 2020–2025 NSF, IOS-1942480  
CAREER: Neural mechanisms of auditory object recognition  
PI: Meliza  
Direct Costs: \$934,942

##### **Pending**

- 2020–2025 NIH, Ro1DC018621-01  
Experience-dependent plasticity of auditory processing for vocal communication  
PI: Meliza  
Direct Costs: \$1,423,581  
*Pending council review; impact score in 11th percentile*
- 2020–2024 NIH, Ro1LM013433-01  
Container technology for improved reproducibility in biomedical data analysis

Role: Co-I, 5% effort  
 PI: Nathan Sheffield

### Completed

- 2015–2016 Jeffress Trust Award in Interdisciplinary Research.  
 Biophysical, Dynamical-Systems Models of Neurons that Recognize Complex Acoustic Patterns  
 PI: Meliza  
 Direct Costs: \$100,000
- 2018–2019 Transformative Neuroscience Pilot Grant, University of Virginia Brain Institute  
 A novel model for dyslexia and other language-processing disorders  
 PI: Meliza  
 Direct Costs: \$100,000
- 2018–2019 Three Cavaliers Seed Grant, University of Virginia  
 A systems approach to understanding a neuronal circuit for detecting motion  
 PIs: Barry Condran, Meliza, Scott Acton  
 Direct Costs: \$60,000

### Mentor for Fellows with Extramural Support

- 2016–2019 NSF Graduate Research Fellowship  
 Emergent Object Recognition in the Avian Auditory Forebrain  
 Fellow: Margot Bjoring

### PUBLICATIONS & TALKS

#### Journal Articles

- 2020 A. N. Chen<sup>†</sup>, **C. D. Meliza**. Experience- and age-dependent intrinsic plasticity in the zebra finch auditory cortex during song memorization. *Journal of Neuroscience*, doi:10.1523/JNEUROSCI.2137-19.2019.
- 2019 M. C. Bjoring<sup>†</sup>, **C. D. Meliza**. A low-threshold potassium current enhances sparseness and reliability in a model of avian auditory cortex. *PLoS Computational Biology*, doi:10.1371/journal.pcbi.1006723.
- 2017 A. N. Chen<sup>†</sup>, **C. D. Meliza**. Phasic and tonic cell types in the zebra finch auditory caudal mesopallium. *Journal of Neurophysiology*, doi:10.1152/jn.00694.2017.
- 2016 S. Keen, **C. D. Meliza**, J. Pilowsky, D. R. Rubenstein. Song in a social and sexual context: vocalizations signal identity and rank in both sexes of a cooperative breeder. *Frontiers in Ecology and Evolution*, doi:10.3389/fevo.2016.00046.
- A. Nogaret, **C. D. Meliza**, D. Margoliash, H. D. I. Abarbanel. Automatic construction of predictive neuron models through large scale assimilation of electrophysiological data. *Scientific Reports*, doi:10.1038/srep32749.

<sup>†</sup> PhD student

- 2014 **C. D. Meliza**, M. Kostuk, H. Huang, A. Nogaret, D. Margoliash, H. D. I. Abarbanel. Estimating parameters and predicting membrane voltages with conductance-based neuron models. *Biological Cybernetics*, doi:10.1007/s00422-014-0615-5.
- C. Knowlton, **C. D. Meliza**, D. Margoliash, H. D. I. Abarbanel. Dynamical estimation of neuron and network properties III: Network Analysis. *Biological Cybernetics*, doi:10.1007/s00422-014-0601-y.
- 2013 **C. D. Meliza**, S. C. Keen, D. R. Rubenstein. Pitch- and spectral-based dynamic time warping methods for comparing field recordings of harmonic avian vocalizations. *Journal of the Acoustical Society of America*, doi:10.1121/1.4812269.
- S. C. Keen, **C. D. Meliza**, D. R. Rubenstein. Flight calls signal group membership and individual identity but not kinship in a cooperatively breeding bird. *Behavioral Ecology*, doi:10.1093/beheco/art062.
- 2012 **C. D. Meliza** and D. Margoliash. Emergence of selectivity and tolerance in the avian auditory cortex. *Journal of Neuroscience*, doi:10.1523/JNEUROSCI.0845-12.2012.
- M. Kostuk, B. A. Toth, **C. D. Meliza**, D. Margoliash, H. D. I. Abarbanel. Dynamical estimation of neuron and network properties II: Path integral Monte Carlo methods. *Biological Cybernetics*, doi:10.1007/s00422-012-0487-5.
- P. Adret, **C. D. Meliza**, D. Margoliash. Song tutoring in pre-singing zebra finch juveniles biases a small population of higher-order song selective neurons towards the tutor song *Journal of Neurophysiology*, doi:10.1152/jn.00905.2011.
- 2011 **C. D. Meliza**. Effects of auditory recognition learning on the perception of vocal features in European starlings (*Sturnus vulgaris*). *Journal of the Acoustical Society of America* 130(5):3115–24.
- B. A. Toth, M. Kostuk, **C. D. Meliza**, D. Margoliash, H. D. I. Abarbanel. Dynamical estimation of neuron and network properties I: Variational methods. *Biological Cybernetics*, doi:10.1007/s00422-011-0459-1.
- 2010 **C. D. Meliza**, Z. Chi, D. Margoliash. Representations of conspecific song by starling secondary forebrain auditory neurons: towards a hierarchical framework. *Journal of Neurophysiology* 103(3):1195–208.
- 2006 **C. D. Meliza** and Y. Dan. Receptive-field modification in rat visual cortex induced by paired visual stimulation and single cell spiking. *Neuron* 49(2):183–9.
- 1999 J. R. Abney, **C. D. Meliza**, B. Cutler, M. Kingma, J. E. Lochner, B. A. Scalettar. Real-time imaging of the dynamics of secretory granules in growth cones. *Biophysical Journal* 77(5):2887–95.
- 1998 J. E. Lochner, M. Kingma, S. Kuhn, **C. D. Meliza**, B. Cutler, B. A. Scalettar. Real-time imaging of the axonal transport of granules containing a tissue plasminogen activator/green fluorescent protein hybrid. *Molecular Biology of the Cell* 9(9):2463–76.

### Unpublished Manuscripts

C. Fehrman<sup>†</sup>, T. D. Robbins<sup>‡</sup>, **C. D. Meliza**. Inferring intrinsic neuronal dynamics from extracellular auditory responses. *In preparation*.

<sup>†</sup> undergraduate student

C. M. Haakenson, F. A. Ahsan<sup>†</sup>, J. P. Riggle<sup>†</sup>, **C. D. Meliza**. Morphological cell types of the caudal mesopallium of the zebra finch (*Taeniopygia guttata*). *In preparation*.

### Scientific Presentations

- 2012 C. D. Meliza, D. Margoliash. Hierarchical emergence of selectivity and tolerance in the auditory cortex of European starlings. Gordon Research Conference (Auditory System).  
C. D. Meliza, D. Margoliash. Redefining the avian auditory functional hierarchy: selectivity and tolerance in the auditory cortex of European starlings. *Soc Neurosci Abstr* **38**:225.01
- 2008 C. D. Meliza, Z. Chi, D. Margoliash. Mechanisms of complex feature selectivity in the auditory forebrain. Computational and Systems Neuroscience annual meeting.

### Posters

- 2019 M. Bjoring<sup>†</sup>, C. D. Meliza. The neural basis of auditory restoration for familiar zebra finch song. *Soc Neurosci Abstr* **43**:233.07
- 2017 D-A. Johnson<sup>†</sup>, C. D. Meliza. Cell types of the zebra finch caudal mesopallium. 2017 Annual Biomedical Research Conference for Minority Students.  
M. Bjoring<sup>†</sup>, C. D. Meliza. The effects of phasic excitability on neural selectivity and tolerance for zebra finch song. *Soc Neurosci Abstr* **41**:66.1
- 2016 A. N. Chen<sup>†</sup>, C. D. Meliza. Mechanism and function of physiologically heterogeneous cell types in caudolateral mesopallium. *Soc Neurosci Abstr* **40**:251.08  
T. D. Robbins<sup>†</sup>, C. D. Meliza. Simultaneous estimation of receptive fields and intrinsic dynamics of auditory neurons using affine-invariant MCMC. *Soc Neurosci Abstr* **40**:327.14
- 2015 A. N. Chen<sup>†</sup>, C. D. Meliza. Intrinsically phasic and tonic excitatory neurons in the avian auditory mesopallium. *Soc Neurosci Abstr* **39**:596.02
- 2014 A. N. Chen<sup>†</sup>, C. M. Haakenson, C. D. Meliza. Physiological and Anatomical Cell Types of the Caudal Mesopallium. *Soc Neurosci Birdsong Satellite*.
- 2012 H. D. I. Abarbanel, C. D. Meliza, M. Kostuk, H. Huang, D. Margoliash. Dynamic parameter estimation for biophysical models of HVC neurons. *Soc Neurosci Abstr* **38**:712.24.
- 2011 S. C. Keen, D. R. Rubenstein, C. D. Meliza. Identifying pathways to cooperation: flight calls and kin selection in superb starlings. American Ornithologists' Union.
- 2010 C. D. Meliza, D. Margoliash. The emergence of selectivity for elements of conspecific song in the starling auditory pathway. *Soc Neurosci Abstr* **36**:207.12.  
H. D. Abarbanel, M. Kostuk, R. Farsian, D. Margoliash, C. D. Meliza. The use of dynamical electrophysiology to probe nucleus HVC. *Soc Neurosci Abstr* **36**:108.4.
- 2009 C. D. Meliza, D. Margoliash. Receptive fields for elements of conspecific song in the starling auditory forebrain. *Advances and Perspectives in Auditory Neurophysiology VII*.
- 2007 C. D. Meliza, Z. Chi, D. Margoliash. Auditory features of song motifs learned during a perceptual learning task are sparsely coded. *Soc Neurosci Abstr* **33**:505.12

C. D. Meliza, Z. Chi, D. Margoliash. Avian forebrain neurons code for disjoint auditory features of learned songs. International Congress of Neuroethology.

C. D. Meliza, Z. Chi, D. Margoliash. Auditory features of song motifs learned during a perceptual discrimination task are sparsely coded. GRC Neural Circuits and Plasticity.

2004 C. D. Meliza, N. Caporale, Y. Dan. Spike timing-dependent plasticity of visually evoked synaptic responses. Society for Neuroscience annual meeting.

2002 C. D. Meliza, R. C. Froemke, Y. Dan. The role of actin dynamics in spike timing dependent plasticity in the visual cortex. Society for Neuroscience annual meeting.

1999 C. D. Meliza, B. A. Scalettar, J. E. Lochner. Analysis of the sorting signals required for regulated secretory trafficking of tissue plasminogen activator using green fluorescent protein hybrids. American Society of Biochemistry and Molecular Biology annual meeting.

### **Invited Seminars**

8/2020 “What can single neurons do and how can we know about it?” Annual Computational Neuroscience Meeting, Melbourne, Australia. (declined)

2/2017 “Characterizing diverse neuronal dynamics in sensory circuits” RIKEN International Symposium on Data Assimilation, Japan.

1/2017 “Diverse neuronal dynamics and their role in auditory learning” MURI Winter School, UCSD.

12/2011 “Learning to hear differences: how experience influences neural discrimination in the auditory cortex of starlings” RIKEN Brain Science Institute, Japan.

3/2010 “Perceptual Learning and Individual Recognition in European Starlings.” Columbia University, Neurolunch Seminar Series.

1/2010 “Neuronal Representations and Perceptual Learning of Conspecific Songs by European Starlings.” University of Wyoming, Neuroscience and Physiology Seminar Series.

2/2007 “How Songbirds Tell Themselves Apart: Pattern Recognition and Perceptual Learning.” Lewis & Clark College, Departments of Biochemistry and Molecular Biology.

### SERVICE

#### **Professional**

##### MEMBERSHIP

2000– Society for Neuroscience

2011– International Society for Neuroethology

2015– International Max Planck Research School on the Life Course

2017– American Physiological Society

##### REVIEW

Review Editor, *Frontiers in Neural Circuits*

Provided ad hoc reviews of manuscripts for the following journals:

*Animal Cognition*  
*European Journal of Neuroscience*  
*Journal of Neuroscience*  
*Nature Neuroscience*

*Journal of Neurophysiology*  
*PLoS Computational Biology*  
*PLoS ONE*  
*Scientific Reports*  
*JARO*

Early career reviewer for National Institutes of Health AUD Study Section (2018)

Served as member of National Science Foundation grant review panel (2015)

Served as external merit reviewer for National Science Foundation (2011)

## University of Virginia

### DEPARTMENT

- 2020 Area coordinator for graduate student recruitment
- 2019–2020 Evaluation of Teaching and Learning Committee
- 2018–2019 Faculty Search Committee for Neuroscience area
- 2018–2019 Graduate Curriculum Subcommittee
- 2016 Faculty Search Committee for Quantitative area
- 2015 Bicentennial Campaign Committee
- 2014–2017 Computer Committee

### COLLEGE OF ARTS & SCIENCES

- 2020– Chair, Interdisciplinary Fellowship in the Quantitative Biology of Behavior
- 2017 Faculty Search Committee (outside member) for Biology Department
- 2015 Faculty Search Committee for Jefferson Scholars endowed professorship

### UNIVERSITY

- 2020– Senior Advisory Council, Neuroscience Graduate Program
- 2019 Poster Judge, Neuroscience Undergraduate Program
- 2018–2020 Seminar Committee (Chair), Neuroscience Graduate Program
- 2018 Internal reviewer, Brain Institute Presidential Fellowship for Collaborative Neuroscience
- 2017 Curriculum Committee, Neuroscience Graduate Program
- 2016–2017 Seminar Committee, Neuroscience Graduate Program
- 2015–2019 Internal reviewer, Jeffress Trust limited submission
- 2015–2016 Admissions Committee, Neuroscience Graduate Program
- 2015 Poster Judge, Huskey Research Exhibition
- 2015 Graduate Student Mentor, Mentoring Institute, Diversity Programs in the Office of Graduate and Postdoctoral Affairs
- 2014–2019 Reviewer, Harrison Undergraduate Research Award

## Outreach

- 2017 Hosted Peabody Middle School science students for lab tour
- 2011 Workshop leader, “Learning and the Brain”, University of Chicago Laboratory Schools.

## Open-source Software

See <https://github.com/melizalab> for a complete list.



- 2017 **spyks**: automated generation of simple dynamical neuron models. [doi:10.5281/zenodo.1100986](https://doi.org/10.5281/zenodo.1100986)
- 2011 **chirp**: pitch detection in bioacoustic signals. [doi:10.5281/zenodo.1101007](https://doi.org/10.5281/zenodo.1101007)
- 2010 **znote**: extracting vocal components of bioacoustic signals (with Zhiyi Chi). [doi:10.5281/zenodo.1101031](https://doi.org/10.5281/zenodo.1101031)
- 2009 **libtfr**: time-frequency reassignment spectrogram library. [doi:10.5281/zenodo.1101017](https://doi.org/10.5281/zenodo.1101017)
- 2007 **decide**: operant apparatus control and auditory stimulus presentation
- 2005 **metaphys**: data acquisition and visual stimulus presentation system for intracellular physiology