

# Mark Saddler

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Ph.D. candidate in MIT's Laboratory for Computational Audition developing machine learning models of human hearing. I am interested in how our ears and environment shape auditory perception and my research focuses on pitch perception, hearing loss, and audio enhancement via deep learning.

## EDUCATION

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**Massachusetts Institute of Technology**  
Ph.D. Candidate in Brain and Cognitive Sciences

**Cambridge, MA**  
Expected 08/2023

**The University of Chicago**  
B.A. in Biological Sciences (specialization in neuroscience)  
B.S. in Biological Chemistry  
B.A. in Chemistry

**Chicago, IL**  
06/2017

## EXPERIENCE

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**MIT Laboratory for Computational Audition**  
*Ph.D. Student Researcher*

**Cambridge, MA**  
10/2017 - present

- Developing artificial neural network models of human hearing to investigate underpinnings of normal and impaired auditory behavior and to build more perceptually-aligned audio enhancement systems. Currently examining the role of peripheral auditory representations in everyday speech / voice recognition and sound localization. Advised by Dr. Josh McDermott.

**Meta Reality Labs**  
*Research Scientist Intern*

**Redmond, WA**  
05/2022 - 09/2022

- Designed experiments and objective metrics to quantify perceived realism of virtual spatial audio.

**Woods Hole Oceanographic Institution**  
*Summer Student Fellow*

**Woods Hole, MA**  
06/2016 - 08/2016

- Developed MATLAB signal processing software for analyzing audio and accelerometer data from sensor-tagged marine mammals to study the acoustic behavior of Chilean blue whales. Participated in a humpback whale tagging cruise and assisted with a grey seal necropsy. Advised by Dr. Laela Sayigh.

**The University of Chicago Epilepsy Lab**  
*Undergraduate Research Assistant*

**Chicago, IL**  
10/2015 - 06/2017

- Developed computational models of spontaneous network activity in neuron cultures to investigate mechanisms of epileptic seizure onset. Advised by Dr. Wim van Drongelen.

**UCSD Scripps Institution of Oceanography**  
*Marine Physical Laboratory Intern*

**San Diego, CA**  
06/2015 - 09/2015

- Wrote MATLAB programs to detect marine mammal echolocation clicks and measure temporal changes in ocean ambient noise in long-term underwater passive acoustic monitoring datasets. Advised by Dr. Simone Baumann-Pickering.

**Salk Institute for Biological Studies**  
*Molecular Neurobiology Lab Intern*

**San Diego, CA**  
06/2014 - 09/2014

- Studied olfactory behavior of *C. elegans*. Advised by Dr. Laura Hale and Dr. Shrek Chalasani.

## PUBLICATIONS

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4. **Saddler M\***, Gonzalez R\*, McDermott JH (2021). Deep neural network models reveal interplay of peripheral coding and stimulus statistics in pitch perception. *Nature Communications* 12, 7278.
3. **Saddler M\***, Francl A\*, Feather J, Qian K, Zhang Y, McDermott JH (2021). Speech denoising with auditory models. *Proc. Interspeech* 2021, 2681-2685.
2. **Saddler M**, Bocconcelli A, Hickmott L, Chiang G, Landea-Briones R, Bahamonde P, Howes G, Segre P, Sayigh L (2017). Characterizing Chilean blue whale vocalizations with DTAGs: a test of using tag accelerometers for caller identification. *Journal of Experimental Biology* 220, 4119-4129.
1. Bocconcelli A, Hickmott L, Chiang G, Bahamonde P, Howes G, Landea-Briones R, Caruso F, **Saddler M**, Sayigh L (2016). DTAG studies of blue whales (*Balaenoptera musculus*) in the Gulf of Corcovado, Chile. *Proceedings of Meetings on Acoustics* 27, 040002.

## PRESENTATIONS

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33. **Saddler M**, McDermott JH (February, 2023). The role of temporal coding in real-world hearing: evidence from machine learning. *Association for Research in Otolaryngology*. Orlando, FL. **(Poster)**.
32. Banerjee A, **Saddler M**, McDermott JH (February, 2023). Neural Network Models of Hearing Through a Cochlear Implant. *Association for Research in Otolaryngology*. Orlando, FL. **(Poster)**.
31. Griffith IM\*, McPherson MJ\*, **Saddler M\***, McDermott JH (February, 2023). Task-optimized models of relative pitch. *Association for Research in Otolaryngology*. Orlando, FL. **(Poster)**.
30. **Saddler M**, McDermott JH (November, 2022). The role of temporal coding in real-world hearing: evidence from machine learning. *Advances and Perspectives in Auditory Neuroscience*. San Diego, CA. **(Poster)**.
29. **Saddler M**, McDermott JH (July, 2022). The role of temporal coding in everyday hearing: evidence from machine learning. *Virtual Conference on Computational Audiology*. Virtual conference. **(Talk)**.
28. **Saddler M** (April, 2022). The role of temporal coding in everyday hearing: evidence from deep neural networks. *Laboratoire des systèmes perceptifs, Ecole normale supérieure*. Paris, France. **(Invited Talk)**.
27. **Saddler M** (April, 2022). The role of temporal coding in everyday hearing: evidence from deep neural networks. *MIT Department of Brain and Cognitive Sciences Cog Lunch*. Cambridge, MA. **(Talk)**.
26. **Saddler M**, McDermott JH (April, 2022). The role of temporal coding in everyday hearing: evidence from deep neural networks. *K. Lisa Yang Integrative Computational Neuroscience (ICoN) Center Symposium*. Cambridge, MA. **(Poster)**.
25. **Saddler M**, McDermott JH (March, 2022). The role of temporal coding in everyday hearing: evidence from deep neural networks. *Computational and Systems Neuroscience (COSYNE)*. Lisbon, Portugal. **(Poster)**.
24. **Saddler M**, McDermott JH (February, 2022). The role of auditory nerve phase locking in audition: evidence from deep neural networks. *Association for Research in Otolaryngology*. Virtual conference. **(Poster)**.
23. **Saddler M**, McDermott JH (November, 2021). The role of auditory nerve phase-locking in human hearing: evidence from deep neural networks. *Advances and Perspectives in Auditory Neuroscience*. Virtual conference. **(Invited Talk)**.
22. **Saddler M\***, Francl A\*, Feather J, Qian K, Zhang Y, McDermott JH (August, 2021). Speech denoising with auditory models. *Interspeech*. Brno, Czechia. **(Poster)**.
21. **Saddler M**, Feather J, Francl A, McDermott JH (June, 2021). Hearing-impaired artificial neural networks replicate speech recognition deficits of hearing-impaired humans. *Virtual Conference on Computational Audiology*. Virtual conference. **(Talk)**.

20. **Saddler M**, Gonzalez R, McDermott JH (February, 2021). Deep neural networks reveal interplay of peripheral coding and stimulus statistics in human pitch perception. *Association for Research in Otolaryngology*. Virtual conference. **(Poster)**.
19. **Saddler M**, McDermott JH (February, 2021). The role of auditory nerve phase-locking in human hearing: evidence from deep neural networks. *Association for Research in Otolaryngology*. Virtual conference. **(Poster)**.
18. **Saddler M**, Gonzalez R, McDermott JH (October, 2020). Deep neural networks reveal interplay of peripheral coding and stimulus statistics in human pitch perception. *Advances and Perspectives in Auditory Neuroscience*. Virtual conference. **(Poster)**.
17. Medina B, **Saddler M**, McDermott JH (October, 2020). Investigating deep artificial neural networks trained to do ecological tasks as a normative model for pitch perception. *Society for Advancement of Chicanos/Hispanics and Native Americans in Science*. Virtual conference.
16. Medina B, **Saddler M**, McDermott JH (October, 2020). Investigating deep artificial neural networks trained to do ecological tasks as a normative model for pitch perception. *Central European Conference on Information and Intelligent Systems*. Virtual conference.
15. **Saddler M**, Feather J, Francl A, McDermott JH (March, 2020). Hearing-impaired deep neural networks replicate behavioral deficits of hearing-impaired humans. *Computational and Systems Neuroscience (COSYNE)*. Denver, CO. **(Poster)**.
14. **Saddler M**, Feather J, Francl A, Gonzalez R, McDermott JH (January, 2020). Deep neural networks with simulated hearing impairment replicate behavioral deficits of hearing-impaired listeners. *Association for Research in Otolaryngology*. San Jose, CA. **(Talk)**.
13. **Saddler M**, Gonzalez R, McDermott JH (October, 2019). Characteristics of human pitch perception emerge in neural networks optimized to estimate F0 from natural sounds. *Advances and Perspectives in Auditory Neuroscience*. Chicago, IL. **(Poster)**.
12. **Saddler M** (October, 2019). Artificial Neural Network Models of Normal and Impaired Hearing. *MIT Department of Brain and Cognitive Sciences Cog Lunch*. Cambridge, MA. **(Talk)**.
11. McDermott JH, Feather J, Francl A, **Saddler M**, Zhang Y, Sarker H (September, 2019). Next-generation hearing aids via neural network models of the auditory system. *MIT-IBM AI Horizons Colloquium*. Cambridge, MA. **(Poster)**.
10. **Saddler M**, Gonzalez R, McDermott JH (June, 2019). Neural networks trained to estimate F0 from natural sounds replicate properties of human pitch perception. *McGovern Institute Retreat*. Falmouth, MA **(Poster)**.
9. **Saddler M**, Gonzalez R, McDermott JH (February, 2019). Neural networks trained to estimate F0 from natural sounds replicate properties of human pitch perception. *Association for Research in Otolaryngology*. Baltimore, MD. **(Poster)**.
8. **Saddler M**, Gonzalez R, McDermott JH (November, 2018). neural networks trained to estimate F0 from natural sounds replicate properties of human pitch perception. *MIT Quest Symposium on Robust, Interpretable Deep Learning Systems*. Cambridge, MA. **(Poster)**.
7. **Saddler M** (November, 2018). Neural network models of pitch perception. *MIT Department of Brain and Cognitive Sciences Cog Lunch*. Cambridge, MA. **(Talk)**.
6. **Saddler M**, Gonzalez R, McDermott JH (October, 2018). Neural networks trained to estimate f0 from natural sounds replicate properties of human pitch perception. *Speech and Audio in the Northeast*. Cambridge, MA. **(Poster)**.

5. McDermott JH, Gonzalez R, Feather J, Francl A, **Saddler M**, Sarker H, Zhang Y (October, 2018). Next-generation hearing aids via neural network models of the auditory system. *MIT-IBM AI Horizons Colloquium*. Cambridge, MA. **(Poster)**.
4. **Saddler M**, Bocconcelli A, Hickmott LS, Chiang G, Landea-Briones R, Bahamonde PA, Howes G, Sayigh L (June, 2017). Characterizing Chilean blue whale vocalizations with digital acoustic recording tags: a test of using tag accelerometers for caller identification. *Acoustical Society of America and European Acoustics Association*. Boston, MA. **(Poster)**.
3. **Saddler M**, Sayigh L (October, 2016). Characterizing the acoustic behavior of Chilean blue whales using DTAG accelerometers. *UChicago Undergraduate Research Symposium*. Chicago, IL. **(Poster)**.
2. **Saddler M**, Sayigh L (August, 2016). Characterizing the acoustic behavior of Chilean blue whales using DTAG accelerometers. *WHOI Summer Student Research Forum*. Woods Hole, MA. **(Poster)**.
1. Bocconcelli A, **Saddler M**, Hickmott L, Chiang G, Bahamonde P, Caruso F, Sayigh L (July, 2016). Acoustic behavior of blue whales (*Balaenoptera musculus*) in the Gulf of Corcovado, Chile, recorded on DTAGs. *4th International Conference on The Effects of Noise on Aquatic Life*. Dublin, Ireland. **(Poster)**.

## TEACHING

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### MIT Department of Brain and Cognitive Sciences

- TA: Machine-Motivated Human Vision (9.60) Spring 2023
- TA: Machine-Motivated Human Vision (9.60) Spring 2022
- TA: Introduction to Neural Computation (9.40) Spring 2020
- TA: Perception (9.35) Spring 2019

### MIT Educational Studies Program

- *HSSP Teacher*: Sensational Neuroscience 06/2019 - 08/2019
- *Splash! Instructor*: Braaaaaains! The Neuroscience of Zombies 11/2018
- *HSSP Teacher*: The Foundations of Intelligence: An Intro to Neuroscience 06/2018 - 08/2018
- *HSSP Teacher*: Memory and Mind Control: An Intro to Neuroscience 02/2018 - 04/2018
- *Splash! Instructor*: Introduction to Neuroscience 11/2017

### UChicago Biological Sciences Collegiate Division

- *Lab TA*: Biological Dynamics (BIOS 20236) Spring 2017
- *Lab TA*: Principles of Physiology (BIOS 20242) Fall 2016
- *Lecture TA*: Principles of Physiology (BIOS 20242) Fall 2015

## LEADERSHIP AND SERVICE

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### MIT Division of Student Life

Cambridge, MA

*Graduate Resident Advisor in Baker House*

08/2018 - present

- Mentoring 37 undergraduates, supervising student leaders, responding to physical and mental health crises, planning events, upholding institute policies, and promoting a safe and inclusive community for ~300 people.

### MIT OpenMind High-Performance Computing Cluster

Cambridge, MA

*Group Representative*

06/2019 - present

- Helping manage computing resources and new member onboarding for the lab and department.

### Journal Reviewer (Ad Hoc)

Cambridge, MA

*JASA, Nature Machine Intelligence, Nature Communications, eLife*

06/2019 - present

### MIT Center for Brains Minds + Machines

Cambridge, MA

Summer Research Program Mentor

04/2020 - 09/2021

- Supervised two undergraduate research projects using deep learning to investigate the impaired hearing of cochlear implant users and the role of pitch in everyday auditory tasks.

### **UChicago College Housing**

**Chicago, IL**

*Assistant Resident Head (RA) of Thangaraj / Tufts House*

04/2015 - 06/2017

### **UChicago Emergency Medical Service**

**Chicago, IL**

*Emergency Medical Responder (EMR)*

03/2014 - 01/2017

## **AWARDS**

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- 2023 Travel Award (Association for Research in Otolaryngology, Orlando)
- 2022 Best Video Pitch Award (Virtual Conference on Computational Audiology)
- 2022 Travel Award (Association for Research in Otolaryngology)
- 2021 K. Lisa Yang Integrative Computational Neuroscience (ICoN) Center Graduate Student Fellowship
- 2021 Travel Grant (Interspeech 2021, Brno, Czechia)
- 2020 Best Poster Award (Advances and Perspectives in Auditory Neuroscience)
- 2020 Angus MacDonald Award for Excellence in Undergraduate Teaching (MIT)
- 2019 Best Poster Award (IBM AI Week, Cambridge)
- 2019 Travel Award (Association for Research in Otolaryngology, Baltimore)
- 2017 Best Student Paper Award (Acoustical Society of America, Boston)
- 2017 Phi Beta Kappa (The University of Chicago)
- 2017 Francis E. Knock Prize in Biological Chemistry for highest GPA in major (The University of Chicago)
- 2016 Woods Hole Oceanographic Institution Academic Programs Office Conference Travel Grant
- 2016 Woods Hole Oceanographic Institution Summer Student Fellowship
- 2013 University Scholar Award (The University of Chicago)
- 2013 National Merit Scholarship

## **GRADUATE COURSEWORK**

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*Cumulative GPA: 5.0 / 5.0*

- Systems Neuroscience (9.011)
- Quantitative Methods and Computational Models in Neurosciences (9.014)
- Computational Cognitive Science (9.660)
- Applied Machine Learning (6.862)
- Audition: Neural Mechanisms, Perception and Cognition (9.285)
- Matrix Methods in Data Analysis, Signal Processing, and Machine Learning (18.0651)
- Automatic Speech Recognition (6.345)

## **SKILLS AND INTERESTS**

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**Software:** Python, MATLAB, Tensorflow, Keras, SLURM, online psychophysics (MTurk/Prolific), LaTeX

**Interests:** hiking, running, soccer, skiing, teaching, marine mammals