

Yarden Cohen - Curriculum Vitae

CONTACT INFORMATION	12 Ha'Rav Yaakov Berman. Rehovot, 7621318 Israel	+972 505-109-870 yardencsmail@gmail.com https://yardencsgithub.github.io/
RESEARCH INTERESTS	Systems Neuroscience, Neuroethology, Complex Systems, Reinforcement Learning, Tool Development, Motor Sequencing & Learning, Dynamical Systems, Electrophysiology, Neuropotonics.	
EDUCATION	Weizmann Institute of Science, Feinberg Graduate School , Rehovot, Israel Ph.D., Neurobiology, <i>January 2016</i> <ul style="list-style-type: none">• Advisors : Rony Paz, Ph.D and Elad Schneidman, Ph.D Weizmann Institute of Science, Feinberg Graduate School , Rehovot, Israel M.Sc., Physics, <i>February 2010</i> <ul style="list-style-type: none">• Advisor : Elad Schneidman, Ph.D The Hebrew University , Jerusalem, Israel B.Sc., Physics and Mathematics as part of the "Talpiot" excellence program of the Israeli Ministry of Defense and the Hebrew University, <i>June 2000</i>	
RESEARCH EXPERIENCE	Assistant Professor Weizmann Institute of Science, Department of Brain Sciences <i>Research Summary</i> : My lab studies how the brain learns, controls, and perceives the syntax of flexible behavior. We combine behavior studies, electrophysiology and calcium imaging in freely singing canaries, and neural networks theory – working at the intersection of physics, engineering, and biology at the realm of systems physiology, machine learning, and computational cognitive neuroscience.	August 2021 to Present
	Research Fellow Williams Lab, Massachusetts General Hospital Department of Neurosurgery and Harvard Medical School <i>Research Summary</i> : Use novel ultrahigh resolution microelectrode arrays to study the processes by which humans produce and comprehend language : project design, neuronal analysis and modeling, and manuscript writing.	May 2020 to June 2021
	Postdoctoral Associate Gardner Lab, Boston University Department of Biology <i>Research Summary</i> : (1) Adapted calcium imaging techniques to awake behaving canaries and studied neural coding of correlated song sequences. The key finding was that hidden network states support behavior transition syntax rules with long-range history dependence. (2) Deep neural network algorithms development - outperforming the state-of-the-art method for birdsong annotation. (3) Collaborated with the Cogan lab from UT Dallas to develop scalable ultramicroelectrode arrays for neural stimulation and recording.	January 2016 to April 2020
	Graduate Student Paz and Schneidman labs, Weizmann Institute of Science Department of Neurobiology <i>Research Summary</i> : Modeled human classification learning. Found that visual feature-based reinforcement learning models can capture, predict and be used to influence behavior - and boost learning. Trained monkeys on classification tasks and recorded single neurons while the animals learned new rules. Developed a novel projection of neural activity on visual features to discover different learning dynamics in cortex and striatum.	October 2007 to January 2016
WORK EXPERIENCE	Project Manager Israeli Ministry of Defense (M.O.D) <i>Work Summary</i> : Electronics, communication, management.	October 2005 to December 2006
	Electronics Engineer Israeli Ministry of Defense (M.O.D) <i>Work Summary</i> : Electronic circuit development.	February 2005 to October 2005

Israeli Ministry of Defense (M.O.D)

Work Summary : Measurements and simulation of wave propagation, psychoacoustics, electro-acoustics, research and development.

JOURNAL
PUBLICATIONS

1. **Cohen Y**, Engel TA, Langdon C, Lindsay GW, Ott T, Peters MAK, Shine JM, Breton-Provencher, V, & Ramaswamy S (2022) "Recent Advances at the Interface of Neuroscience and Artificial Neural Network". *J. Neurosci.* . 42, 8514–8523.
2. **Cohen Y**, Nicholson DA, Sanchioni A, Mallaber EK, Skidanova V, & Gardner TJ (2022) "Automated annotation of birdsong with a neural network that segments spectrograms". *eLife*. 11, e63853
3. **Cohen Y**, Schneidman E, Paz R (2021) "The geometry of neuronal representations during rule learning reveals complementary roles of cingulate cortex and putamen". *Neuron*, 109, 839-851.e9.
4. **Cohen Y**, Shen J, Semu D, Leman DP, Liberti WA III, Perkins N, & Gardner TJ (2020) "Hidden neural states underlie canary song syntax". *Nature* 582, 539-544.
5. Deku F, Frewin C, Stiller A, **Cohen Y**, Aqeel S, Joshi-Imre A, Black B, Gardner TJ, Pancrazio JJ, & Cogan SF (2018) "Amorphous Silicon Carbide Platform for Next Generation Penetrating Neural Interface Designs". *Micromachines*, 9(10), 480.
6. Deku F, **Cohen Y**, Joshi-Imre A, Kanneganti A, Gardner TJ, & Cogan SF (2018) "Amorphous Silicon Carbide Ultramicroelectrode Arrays for Neural Stimulation and Recording". *J. Neural Eng.* 15, 016007.
7. **Cohen Y**, Paz R (2015) "It All Depends on the Context, but Also on the Amygdala". *Neuron* 87 : 4 : 678–80. ([Preview](#))
8. **Cohen Y**, Schneidman E (2013) "High-order feature-based mixture models of classification learning predict individual learning curves and enable personalized teaching". *Proc Natl Acad Sci USA* 110 :684–689.

PEER-REVIEWED
CONFERENCE
PUBLICATIONS

1. Nicholson DA and **Cohen Y** (2023) "vak : a neural network framework for researchers studying animal acoustic communication". *Accepted, SciPy 2023*.
2. **Cohen Y**, Shen J, Semu D, Otchy TM & Gardner TJ (2018) "Calcium imaging in canary (serinus canaria) HVC reveals latent states supporting behavioral sequencing with long range history dependence". *2018 Conference on Cognitive Computational Neuroscience* doi :10.32470/CCN.2018.1133-0.

UNDER REVIEW /
IN BIORXIV

1. **Cohen Y**, Nicholson DA, & Gardner TJ (2020) "TweetyNet : A neural network that enables high-throughput, automated annotation of birdsong".
(<https://www.biorxiv.org/content/10.1101/2020.08.28.272088v2.full.pdf>)
2. **Cohen Y**, Cvitanovic P, & Solla SA (2021) "A novel approach to the empirical characterization of learning in biological systems".
(<https://www.biorxiv.org/content/10.1101/2021.01.10.426118v1>)
3. Leman DP, Chen IA, Yen, WW, **Cohen Y**, Perkins, LN, Liberti III WA, Kilic K, Cruz-Martin A, Gardner TJ, Otchy TM, & Davison IG (2021) "Large-scale cellular-resolution imaging of neural activity in freely behaving mice". *Submitted*
(<https://www.biorxiv.org/content/10.1101/2021.01.15.426462v1>)

HONORS AND
AWARDS

- Alon Fellowship (Personal starting grant for young outstanding Israeli PIs) 2022
- Israeli Science Foundations (ISF). Personal Research Grant 2022
- Dr. Oboh-Weilke Postdoctoral Travel Award 2019
- Nvidia GPU Grant 2017
- Neurizons2013 2nd place poster prize 2013
- Member of the honors program of the faculty of science, *The Hebrew University* 1997-2000

PRESENTATIONS Conference Abstracts

- “Towards a software community for researchers studying acoustic communication”,(*Talk*) *CCBS, Sardinia* ,2023
- “Advances and opportunities in collaborative development of deep learning algorithms for high throughput processing of complex vocal communication”,(*Talk*) *ISFN, Eilat* ,2022
- “Advances and opportunities in collaborative development of deep learning algorithms for high throughput processing of complex vocal communication”,(*Talk*) *SFN, San Diego* ,2022
- “Dynamics of canary syntax across days and weeks”,(*Talk*) *CCBS, Sardinia* ,2022
- “A new tool for automated annotation of complex birdsong reveals dynamics of canary syntax rules”,(*Talk*) *COSYNE, Lisbon* ,2022
- “Calcium imaging and machine learning tools for birdsong annotation reveal stability and neural correlates of canary song syntax” *SFN, Chicago* ,2019
- “Hidden neural states underlie history-dependent canary song sequences”, *COSYNE, Lisbon* ,2019
- “A novel approach to the empirical characterization of learning in biological systems” *COSYNE, Lisbon* ,2019
- “Hidden neural states underlie history-dependent canary song sequences” *SFN, San Diego* ,2018
- “A combined convolutional-recurrent deep neural network for accurate annotation of large birdsong datasets” *SFN, San Diego* ,2018
- “Calcium imaging in canary (*serinus canaria*) HVC reveals latent states supporting behavioral sequencing with long range history dependence”, *CCNeuro, Philadelphia* ,2018
- “Neural Networks for Segmentation of Vocalizations”(*Talk*) *PyData, NYC* ,2017
- “Calcium signals of order, syntax, and action in canary (*serinus canaria*) HVC” *SFN, Washington DC* ,2017
- “Self-splaying silicon carbide electrode assemblies for stable recording and stimulation” *SFN, San Diego* ,2016
- “Learning in a noisy environment : a Lyapunov equation approach” *APS, Baltimore* ,2016
- “Single neuron dynamics in primate striatum and prefrontal cortex during classification learning” *COSYNE, Salt Lake City* ,2016
- “Learning to classify : from behavior to neural dynamics”(*Talk*) *Weizmann Institute of Science* ,2015
- “Learning to classify with high-order features : from behavior to neural correlates” *Neurizons, Göttingen* ,2013
- “Improving individual classification learning using a predictive maximum entropy model” *COSYNE, Salt Lake City* ,2012

Invited Talks

- Tel-Aviv University, Sackler medical school December 2022
- Tubingen University, Institute of Neurobiology June 2022
- Max Planck Institute of Ornithology June 2022
- NeuroPSI, Université Paris-Saclay March 2022
- Laboratoire Ethologie Cognition Développement, Université Paris Nanterre March 2022
- Max Planck Institute of Human Development, Berlin June 2021
- York College, City University of New York, Dept. of Biology May 2021
- Weizmann Institute of Science, Dept. of Neurobiology November 2020
- Hebrew University, Edmond & Lily Safra Center for Brain Sciences November 2020
- Birdsong, SFN satellite meeting October 2020
- Weizmann Institute of Science, Dept. of Complex Systems October 2020
- Technion, Rappaport medical school, Dept. of Neuroscience December 2019
- Hebrew University, Haddassah medical school December 2019
- Weizmann Institute, Dept. of Neurobiology December 2019
- Janelia HHMI, Junior Scientist Workshop on Mechanistic Cognitive Neuroscience October 2019
- BU, Neurophotonics Symposium January 2019
- BU, Junior Faculty Meeting December 2018
- UC Berkeley, invited seminar December 2018

	<ul style="list-style-type: none"> • Birdsong, SFN satellite meeting • NYU, Center for Neural Science • Columbia University, Dept. of Biological Sciences • Harvard University, Dept. of Physics • Boston University, Dept. of Biology • UC Berkeley , Dept. of Molecular and Cell Biology • UCSD, Dept. of Physics • Weizmann Institute of Science, Minna James Heinemann workshop 	November 2018 April 2015 April 2015 April 2015 April 2015 April 2015 April 2015 January 2015
TEACHING AND MENTORSHIP	<p>CAS NE520 Invited lecturer ; <i>Developed and presented a graduate level presentation of research in canaries.</i></p> <p>Neurophotonics bootcamp Lecturer ; <i>Taught basic concepts in photonics to graduate trainees in a lecture and a hands-on lab.</i></p> <p>Daniel Leman Research Technician ; <i>Developed surgical/optical methods to longitudinally record cells in HVC. Co-author on a manuscript.</i></p> <p>Alexa Sanchioni Undergraduate Researcher ; <i>Worked on audio annotation and, with a UROP award, pioneered analyses of neuronal ensemble activity in stereotyped birdsong.</i></p> <p>Emily Mallaber Undergraduate Researcher ; <i>Piloted data analysis of behavioral perturbation in canary song sequences.</i></p> <p>Vika Skidanova Undergraduate Researcher ; <i>Initiated behavior analyses of pharmacological perineural net. digestion in premotor song nuclei.</i></p> <p>Haley Cerratani Undergraduate Researcher ; <i>Initiated behavior analyses of pharmacological lesions in striatal song nuclei.</i></p> <p>Carlos Gomez Research Technician ; <i>Developed measurement setups and techniques for SiC electrode QA tests. Contributed to results in 2 publications.</i></p>	spring 2019 summer 2019 2017–2019 2017–present 2018 2018 2019 2016–2017
COMMUNITY OUTREACH AND SERVICES	<p>Popular lectures for school children</p> <p><i>Overview</i> : My presentations in a local elementary school, “What can we learn from songbirds?” aim to communicate the passion for science and describe some of the questions we have and how songbirds can help us answer them in the lab.</p> <p>Ad Hoc Referee : <i>Journal of Behavioral Processes</i></p> <p>Ad Hoc Referee : <i>PLoS Computational Biology</i></p> <p>Ad Hoc Referee : <i>Journal of Physiology</i></p>	2018 2017–present 2020–present 2021–present
PUBLICLY AVAILABLE SOFTWARE TOOLS	<ul style="list-style-type: none"> • Deep neural net. for birdsong segmentation and annotation (python) (https://github.com/yardencsGitHub/tweetynet) • Automated annotation of animal vocalizations (python) (https://github.com/vocalpy/vak) • GUI for manual sound annotation (Matlab) (https://github.com/yardencsGitHub/BirdSongBout/tree/master/helpers/GUI) 	