Li Shen, PhD.

Zilkha Neurogenetic Institute, University of Southern California, Los Angeles, 90033, USA

EDUCATION

Ph.D. in Biomedical Engineering, Tsinghua University, Beijing, CHINA2017Thesis: Neural Circuits and Networks for Spectrotemporal Processing of Sounds in the Auditory MidbrainBachelor's in Biomedical Engineering, Tsinghua University, Beijing, CHINA2010

PUBLICATIONS

- Zhang G, <u>Shen L</u>, Tao C, Jung A, Peng B, Li Z, Zhang LI, Tao HW (2021). Medial preoptic area antagonistically mediates stress-induced anxiety and parental behavior. *Nature Neuroscience*. 24: 516–528.
- Wang X, Chou X, Peng B, <u>Shen L</u>, Huang JJ, Zhang LI, Tao HW (2019). A cross-modality enhancement of defensive flight via parvalbumin neurons in zonal incerta. *eLife*. 8: e42728.
- Zhang G, <u>Shen L</u>, Zhong W, Xiong Y, Zhang LI, Tao HW (2018). Transforming Sensory Cues into Aversive Emotion via Septal-Habenular Pathway. *Neuron*. 99: 1016-1028.
- Chou X, Wang X, Zhang Z, <u>Shen L</u>, Zingg B, Huang J, Zhong W, Mesik L, Zhang LI, Tao HW (2018). Inhibitory gain modulation of defense behaviors by zona incerta. *Nature Communications*. 9:1151.
- Zhang G, Sun W, Zingg B, <u>Shen L</u>, He J, Xiong Y, Tao HW, Zhang LI (2018). A Non-canonical Reticular-Limbic Central Auditory Pathway via Medial Septum Contributes to Fear Conditioning. *Neuron*.97:406-417.
- <u>Shen L</u>, Zhao L, Hong B (2015). Frequency-specific adaptation and its underlying circuit model in the auditory midbrain. *Frontiers in Neural Circuits*. 9:55.
- Zhao L, Liu Y, <u>Shen L</u>, Feng L, Hong B (2011). Stimulus-specific adaptation and its dynamics in the inferior colliculus of rat. *Neuroscience*. 181(5):163-174.
- Zhang G, <u>Shen L</u>, Li Z, Tao HW, Zhang LI. Track-Control (2019). An automatic video-based realtime closed-loop behavioral control toolbox. *bioRxiv* doi: 10.1101/2019.12.11.873372.

SKILLS

- Computational neuroscience and neuron-inspired modeling
- Signal processing & data analysis: time-series analysis, time-frequency analysis, filtering, denoising, dimensional reduction, clustering; audio signals, image/video processing, electroencephalogram (EEG), electromyography (EMG), high bandwidth *in vivo* neurological data
- Statistical inference and machine learning algorithms: GLM, SVM, PCA, K-means, k-NN, decision-tree, deep learning (CNN, YOLO, SSD, Faster R-CNN, FPN, LSTM, HMM).
- **Biomedical experiment skills:** awake electrophysiological recording, behavioral test, optogenetics, pharmacogenetics, *in vivo* fiber photometry calcium imaging, histology, anatomical tracing, microscopy, and optics
- Programming skills: Python, MATLAB, C, C++, R, SQL, Java
- **Building instrumentations and devices:** FPGA, DSP, MCU, Arduino, Zigbee, LabVIEW, 3D modeling (Maya), virtual reality (Unity)

Li Shen

RESEARCH EXPERIENCE

Postdoctoral Scholar & Research Associate (University of Southern California, USA) 2017-

Advisors: Dr. LI Zhang, Dr. Huizhong Tao

Neural Circuits underlying sensory and emotion:

- Built an awake multi-channel electrophysiology signal recording and processing pipeline for rodent neuroscience experiment.
- Developed multiple experimental instruments or toolboxes for research purposes (e.g., selfstimulation box for addiction assessment, sleep-cycle auto-scoring toolbox, automatic behavior control toolbox with video-based animal tracking, licking detection in Python, *MATLAB*, and C++/*Arduino*).
- Discovered neural pathways for sensory and emotion processing with this recording platform, behavior setups, and other cutting-edge techniques.

Graduate Research (Tsinghua University, China)

2010-2017

Advisor: Dr. Bo Hong

Neural circuits and networks for sound processing in auditory midbrain:

- Implemented audio signal recording, processing, manipulation, calibration, and generation for auditory neuroscience study.
- Revealed frequency-specific adaptation and its underlying circuit model in the auditory midbrain using *in vivo* multi-channel electrophysiology recording and neuro-inspired network modeling.
- Characterized hierarchical and functional connectivity for spectrotemporal representation for natural sound statistics in auditory midbrain using *in vivo* recording and kernel methods.

Visiting student (CINACS International Graduate Research Group, University Medical Center Hamburg-Eppendorf, Germany) 2010, 2012

Advisor: Dr. Andreas K. Engel

Visual and auditory cross-modal processing:

Performed *in vivo* multi-sites simultaneous recording in ferret inferior colliculus and superior colliculus

Visiting student (Johns Hopkins University, USA)

Advisor: Dr. Xiaoqin Wang

Modeling for self-generated sound perception:

 Designed and performed psychophysical experiments on human subjects and mathematical modeling of self-generated sound perception.

TEACHING EXPERIENCE

Teaching Assistant, Bio-Medical Measurement, Tsinghua University, China 2011-2012

CONFERENCE PRESENTATIONS

- Zhang G, <u>Shen L</u>, Zhong W, Xiong Y, Zhang LI, Tao HW. Transforming sensory cues into aversive emotion by septal-habenular pathway. *SfN Annual Meeting* 2018, San Diego, USA, Poster Session
- Functional connectivity for spectrotemporal processing of neighboring neurons in inferior colliculus. 2015 Advances and Perspectives in Auditory Neurophysiology (APAN), Chicago, USA.

2019

*Selected as oral presentations

- <u>Shen L</u>, Yan Y, Guo N, Hong B. Functional connectivity for spectrotemporal processing of neighboring neurons in inferior colliculus. *SfN Annual Meeting* 2015, Chicago, USA, Poster Session
- <u>Shen L</u>, Yu Z, Hong B, Rinzel J. A minimal neuromechanistic model for stimulus specific adaptation (SSA). 2014 *MidWinter Meeting of the Association for Research in Otolaryngology (ARO)*, San Diego, USA, Poster session
- <u>Shen L</u>, Zhao L, Hong B. Spectral receptive field plasticity may underlie stimulus-specific adaptation in rat inferior colliculus. 2013 *MidWinter Meeting of the Association for Research in Otolaryngology (ARO)*, Baltimore, USA, Poster session
- Yu Z, <u>Shen L</u>, Hong B, Rinzel J. A recurrent network model for stimulus specific adaptation dynamics. 2012 *MidWinter Meeting of the Association for Research in Otolaryngology (ARO)*, San Diego, USA, Poster session
- <u>Shen L</u>, Zhao L, Hong B. Change of frequency tuning underlies stimulus-specific adaptation in rat inferior colliculus. *SfN Annual Meeting 2011*, Washington DC, USA, Poster Session
- Yu Z, <u>Shen L</u>, Hong B, Rinzel J. An adaptive network for tone frequency change detection. 2nd Beijing International Symposium on Computational Neuroscience, 2011, Beijing, China, Poster session

Awards

- 2015. Comprehensive Excellent Scholarship of Tsinghua University
- 2014. Awards for Excellent Undergraduate Counsellor of Tsinghua University
- 2014. Third Prize in Biomedical Engineering Academic Speech Contest for Ph.D. students in Beijing
- 2011. Excellent Student Cadre of Tsinghua University
- 2011. Academic Excellent Scholarship of Tsinghua University
- 2010. Self-Star Award of Tsinghua University (one of ten)
- 2010. Excellent Undergraduate Award of Tsinghua University

Journal Reviewer

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Associations

Society of Neuroscience