Li Shen, PhD.

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Summary

Biomedical Engineering Ph.D., Experienced Neuroscientist and Neuroengineer with 10 years of research in developing and utilizing innovative techniques to deciper brain circuits underlying sensory and emotions. 8 publications yield more than 158 citations. Skilled in neuronal data analysis and programming.

Education

- Ph.D. of Biomedical Engineering (2010-2017)
  Department of Biomedical Engineering, School of Medicine, Tsinghua University, China
- Bachelor of Biomedical Engineering (2006-2010)
  Department of Biomedical Engineering, School of Medicine, Tsinghua University, China

Research fields

- Auditory neuroscience
- Fear and reward learning related neural circuit
- Network and neural-based computational modeling

Technical skills

- Multi-channel in vivo electrophysiology and optrode recording in rodents/ Tetrode making
- Optogenetic/ pharmacogenetic manipulation and behavioral test
- Photometry in vivo calcium imaging and brain slice imaging
- Histology and anatomical tracing
- Programming and data analysis: C/C++, Java, Matlab, Python, Labview, SQL
- Signal processing and machine learning: time-frequency analysis, acoustic and neural signal

Publications

- Zhang G, **Shen L**, Tao C, Peng B, Jung A, Li Z, Tao HW, Zhang LI (2020). Medial Preoptic Area Antagonistically Mediates Stress-induced Anxiety and Parental Behavior. *Nature Neuroscience*. In press.
- Zhang G, **Shen L**, Li Z, Tao HW, Zhang LI. Track-Control (2019). An automatic video-based real-time closed-loop behavioral control toolbox. *bioRxiv* doi: 10.1101/2019.12.11.873372.
- Wang X, Chou X, Peng B, **Shen L**, 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, **Shen L**, 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, **Shen L**, 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, **Shen L**, 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.

- **Shen L**, 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, **Shen L**, Feng L, Hong B (2011). Stimulus-specific adaptation and its dynamics in the inferior colliculus of rat. *Neuroscience*. 181(5):163-174.

Research Experience

- Postdoctoral Scholar Research Associate (2017-now, University of Southern California, Mentor: Prof. Li I. Zhang and Prof. Huizhong W. Tao)
  - Built up **awake *in vivo* single cell electrophysiology recording system** from mice, including **Data Acquisition** with Optrode, *NI* card, or *Open Ephys*, **Hardware Programming** with *Labview*, **Spike Sorting** and **Data Analysis in *Matlab* and Python**.
  - Utilizing this platform, optogenetic/pharmogenetic manipulation and behavioral assays, we discovered a novel auditory pathway to **transform auditory cues into aversive emotion**, revealed **anxiety, fear learning, defense and parental behavior** related neural circuits, resulting in 5 publications in top journals, including *Nature Neuroscience* and *Neuron*.
  - Developed **automatic real-time closed-loop behavior control toolbox with video-based animal tracking in Python and *Arduino*,** published in *BioArxiv*.
  - Developed **automatic animal lick detection from video in Python and *Matlab***, utilizing this method and other novel approaches to study **reward learning** related neural circuits. The manuscript is in revision.
- Graduate Student (2010-2017, Lab of Neural Engineering, Tsinghua University, Mentor: Bo Hong)
  - With ***in vivo* single cell extracellular recording in rat**, revealed the temporal dynamic and frequency properties of **Stimulus-Specific Adaptation in the auditory midbrain** neurons which show stronger response to rare sound than common sounds; Built up a **two-layer tonotopically-organized feedforward neural network** to simulate the neuronal architecture for novel sound processing. 2 publications in *Neuroscience* and *Frontiers in neural circuits*. Work were cited in *The Oxford Handbook of the Auditory Brainstem* in large paragraph.
  - Proposed a **neural-based mechanistic model** for stimulus specific adaptation **(**Cooperated with Dr. John Rinzel, New York University). Results were presenting in 2014 *Meeting of the Association for Research in Otolaryngology in San Diego.*
  - Recording combined with **system identification** methods to depict **spectro-temporal receptive field** of rat auditory midbrain and reveal the **hierarchical representation for the natural sound statistics.** Using **local neuronal correlation** to study the **functional connectivity of neighboring neurons in rodent auditory midbrain**. Results were orally presented in 2015 *Advances and Perspectives in Auditory Neurophysiology in Chicago.*
- Visiting scholar, CINACS International Graduate Research Group, University Medical Center Hamburg-Eppendorf, Germany. (2010, 2012, Mentor: Prof. Andreas K. Engel)
  - **Multiple sites *in vivo* simultaneously recording** to study auditory and visual **cross-modal** processing in ferret inferior colliculus and superior colliculus
- Exchange student, Johns Hopkins University, USA. (2009, Mentor: Prof. Xiaoqin Wang)
  - Designed and performed **psychophysical** experiments on human subjects and **mathematical modeling** of self-generated sound perception

Selected Meeting presentations

- **Li Shen**, Yili Yan, Ning Guo, Bo Hong. Functional connectivity for spectrotemporal processing of neighboring neurons in inferior colliculus. 2015 *Advances and Perspectives in Auditory Neurophysiology (APAN)*, Chicago, USA, Oral presentation

- **Li Shen**, Zitian Yu, Bo Hong, John Rinzel. A minimal neuromechanistic model for stimulus specific adaptation (SSA). Abstract of 2014 *MidWinter Meeting of the Association for Research in Otolaryngology (ARO)*, San Diego, USA, Poster session

Awards

2015. Comprehensive Excellent Scholarship of Tsinghua University

2014. Third Prize in Biomedical Engineering Academic Speech Contest for Ph.D. students in Beijing

2011. Academic Excellent Scholarship of Tsinghua University

2010. Excellent Undergraduate Award of Tsinghua University