

Summary

Biomedical engineering Ph.D., experienced neuroscientist and neuroengineer with 10+ years of research in developing and utilizing innovative techniques to decipher brain circuits underlying sensory and emotions, generating 8 publications in top journals with more than 160 citations; proficient in programming and data analysis.

Education

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

Skills

- Proficient with MATLAB, Python, and neurological data analysis, including acoustic signals, video-based behavior data, EEG, and high bandwidth in vivo recording data.
- A strong experience with building and programming experimental instrumentations.
- Proficient in animal surgery, and in vivo electrophysiological recording experiments.
- Proficient with neurological experimental skills, including optogenetics, pharmacogenetics manipulation and behavioral test, in vivo fiber photometry calcium imaging, histology, and anatomical tracing technique.
- Experience with C/C++, Java, R, SQL, and LabVIEW.
- Experience with microscopy and optics.
- Experience with computational neuroscience and machine learning algorithms.

Experience

- Postdoctoral Scholar & Research Associate (2017-, University of Southern California, Mentor: Prof. Li I. Zhang and Prof. Huizhong W. Tao)
 - Built up **awake multi-channel electrophysiology recording system** for mice, including **data acquisition** with Optrode, NI card, or *Open Ephys*, **hardware programming** with *LabVIEW*, **spike sorting** and **data analysis** using *MATLAB* and Python.
 - Developed multiple **automatic behavioral assay apparatus**, including self-stimulation behavior setup, real-time closed-loop behavior control toolbox with video-based animal tracking, licking detection using Python and C++/*Arduino*.
 - Implemented a sleep cycle auto-scoring algorithm and GUI, based on **EEG** and **EMG** signals using *MATLAB*.
 - Utilizing the recording platform, automatic behavior setup and optogenetics, pharmacogenetics manipulation to study sensory and emotion related neural circuits, generated 5 publications in top journals, including *Nature Neuroscience* and *Neuron*.
- Graduate Research Assistant (2010-2017, Lab of Neural Engineering, Tsinghua University, Mentor: Prof. Bo Hong)
 - Applying **in vivo single cell extracellular recording in rat**, revealed the neural mechanism underlying novel sound processing; Built up a **two-layer feedforward neural network** to simulate the neuronal architecture for novel sound processing. Work resulted in 2 publications and were highlighted in *The Oxford Handbook of the Auditory Brainstem*.
 - Built a **neural-based mechanistic model** for novel sound processing (Cooperated with Dr. John Rinzel, New York University). Results were presented at 2014 *Meeting of the Association for Research in Otolaryngology*

in San Diego.

- Applying *in vivo* recording and **system identification** methods, characterized the functional connectivity of neighboring neurons for sound spectro-temporal processing in rat auditory midbrain, and revealed the hierarchical representation for the natural sound statistics. Results were orally presented in 2015 *Advances and Perspectives in Auditory Neurophysiology in Chicago*.
 - Designed and implemented home appliances wireless controller based on Zigbee protocol for **EEG-based Brain-Computer Interface (BCI) system**, including electronic circuit design, micro-controller programming with C, GUI design with MATLAB.
- Visiting scholar, CINACS International Graduate Research Group, University Medical Center Hamburg-Eppendorf, Germany. (2010, 2012, Mentor: Prof. Andreas K. Engel)
- **Multi-sites *in vivo* simultaneously recording** in ferret inferior colliculus and superior colliculus to study auditory and visual cross-modal processing.
- 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.

Publications

- Zhang G, **Shen L**, Tao C, Peng B, Jung A, Li Z, Tao HW, Zhang LI (2021). Medial Preoptic Area Antagonistically Mediates Stress-induced Anxiety and Parental Behavior. *Nature Neuroscience*. <https://doi.org/10.1038/s41593-020-00784-3>.
- Zhang G, **Shen L**, Li Z, Tao HW, Zhang LI. Track-Control (2019). An automatic video-based real-time closed-loop behavioral control toolbox. Preprint at *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.

Selected conference presentations

- **Li Shen**, Yili Yan, Ning Guo, Bo Hong. Functional connectivity for spectrotemporal processing of neighboring neurons in inferior colliculus. Oral talk at 2015 *Advances and Perspectives in Auditory Neurophysiology (APAN)*, Chicago, USA.
- **Li Shen**, Zitian Yu, Bo Hong, John Rinzel. A minimal neuromechanistic model for stimulus specific adaptation (SSA). Poster presentation at 2014 *MidWinter Meeting of the Association for Research in Otolaryngology (ARO)*, San Diego, USA.