

CHAOYI ZHANG

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EDUCATION

Ph.D. Zhejiang University **2022**

School of Brain Science and Brain Medicine

Neurobiology; Mentor: Hailan Hu

B.S. Wenzhou Medical University **2016**

School of Pharmacy

Biopharmaceutics

RESEARCH EXPERIENCE

Post Doc **2023-Current**

PI: Guoping Feng

Massachusetts Institute of Technology, Cambridge, U.S.

- Investigating the biological mechanism of psychiatric diseases

Post Doc **2022-2023**

PI: Gordon Fishell

Harvard Medical School, Boston, U.S.

- Investigating how the wS1 circuits assembled to control whisking behavior during the development

Ph.D.

PI: Hailan Hu **2016-2022**

Zhejiang University, Hangzhou, P.R. China.

- Set up the freely moving cellular level one-photon calcium imaging system in lab
- Explored the roles and dynamics of different mPFC cell types in social competition behavior

- Deciphered the relationship within mPFC microcircuits via *in vivo* optrodes recording and miniature two-photon microscope
- Deciphering the mPFC coding pattern in different dominance behaviors via miniature two-photon microscope

Summer Scholar

2016

PI: Minmin Luo

National institute of Biological Sciences (NIBS), Beijing, P.R. China

- Explored the roles of dopamine neurons and serotonin neurons in reward behavior via fiber photometry recording and optogenetics
- Learned how to use MATLAB to analyze data

Undergraduate Research Assistant

2013-2016

PI: Hongyu Zhang, Xiaokun Li

- Validated the repair function of the basic fibroblast growth factor (bFGF) on the blood brain barrier after brain injury on mice model via western blot and immunohistochemical staining
- Led a team in “Challenge Cup” National Undergraduate Extracurricular Academic Science and Technology Works Competition

SKILLS

Experimental skills

Single cell level calcium imaging via GRIN lens
 Two-photon imaging
In vivo optrodes recording
 Multi-channel fiberphotometry
 Optogenetics and Chemogenetics
 Cannula infusion experiment
 Common social behavior tests and analysis
 Immunostaining and Western blot

Computer skills

MATLAB
 Python
 Adobe Illustrator
 Adobe Photoshop
 Graphpad
 ImageJ
 BORIS (Behavior annotation software)
 Microsoft works

PUBLICATIONS

Zhang, C.* , H. Zhu*, Z. Ni*, Q. Xin, T. Zhou, R. Wu, G. Gao, Z. Gao, H. Ma, H. Li, M. He, J. Zhang, H. Cheng and H. Hu (2021). "Dynamics of a disinhibitory prefrontal microcircuit in controlling social competition." *Neuron*. (Cover story, Co-first author)

Fan Z, Chang J, Liang Y, Zhu H, Zhang C, Zheng D, Wang J, Xu Y, Li Q, Hu H*.(2023). Neural mechanism underlying depressive-like state associated with social status loss. *Cell*. 186: 1–17

ZHANG Chao, XIANG Li-na, CHEN De-pei, LÜ Xin-xin, ZHAO Yi-tong, WANG Lu-yao, XIAO Jian, ZHANG Hong-yu. The Development of the Study on bFGF Promote the Nerve Injury Repair. *China Biotechnology*, 2015, 35(6): 75-79.

TALKS AND POSTERS

- **NBO Webinar: Reading the brain activity via calcium imaging** 2022

Invited lecture in NBO (Nanjing Brain Observatory), Online

- **Brainnews Online lecture: The role of mPFC microcircuit in social competition** 2022

Invited talk in Brainnews, one of most popular neuroscience media platform in China

- **Nanjing international symposium on “Brain–Mind–Intelligence” (2021)** 2021

Oral presentation; Online

- **NeuReport: an online Neuroscience Seminar Series** 2021

Invited talk in iBrainTalk, one of most popular neuroscience popularization media platform in China ([link of the YouTube video](#))

- **“Brain and Psychology” National Doctoral Forum** 2020

Oral presentation (Outstanding lecture award); Hangzhou, China

- **Cold Spring Harbor Asia Conferences --** 2019

Francis Crick Symposium: Transforming Neurosciences

Poster; Suzhou, China

TEACHING EXPERIENCE

Teaching Assistant 2020

General Education Course: Exercise and Brain

Zhejiang University, Hangzhou, China

- Organized and led tutorials on topics about neuroscience and sports

Guest Lecturer and Consultant

2019

National single-cell resolution *in vivo* calcium imaging technology workshop

Hangzhou, China

- lecture title: Reading the brain activity via calcium imaging
- Surgery and freely moving single-cell resolution calcium imaging demonstration

AWARDS, SCHOLARSHIPS, HONORS (selected)

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| ● Excellent Doctoral Dissertations of Zhejiang University | 2023 |
| ● Ray Wu Prize | 2022 |
| ● Excellent graduate of Zhejiang Province | 2022 |
| ● Ten Students of the year in school of medicine, Zhejiang University | 2021 |
| ● Funding for Excellent Doctoral Dissertations, Zhejiang University | 2021 |
| ● Dean's Scholarship | 2021 |
| ● National scholarship | 2020 |
| ● Student Leadership Award, Zhejiang University | 2019 |
| ● Excellent graduate of Zhejiang Province | 2016 |

CONTRIBUTIONS TO SCIENCE

The role of mPFC in social competition behaviors (2016-2022, Dr. Hailan Hu lab, Zhejiang University)

The health and quality of life of animals strongly depend on their dominant status, which is acquired through repeated bouts of social competition. Our lab previous studies have confirmed the key role of the medial prefrontal cortex (mPFC) in controlling how the mice performed in social competition (*Wang et al. 2011, Science; Zhou et al. 2017, Science*). However, it has remained unexplored how different mPFC cell types engage in social competition. Approximately 80% of cortical neurons are excitatory pyramidal (PYR) neurons, which are generally responsible for the processing and transmitting information. However, the other 20% diversity inhibitory interneurons (such as PV+, SST+ and VIP+ neurons), form microcircuits with pyramidal neurons, also highly involved in the precise control of information processing within the brain. In the past 6 years, I am using a multidisciplinary approach, combining optogenetics, chemogenetics, fiber photometry, cutting-edge miniature

two-photon endoscope calcium imaging and *in vivo* optrodes recording to elucidate the organization and function of mPFC underlying social competition behaviors.

In my first project, I identified the VIP-PV-PYR disinhibitory motif forming the core of a dynamic dmPFC microcircuit to control social competition. My study revealed that VIP neurons, a subset of interneurons that targets other inhibitory cells, play “VIP” roles in mPFC microcircuits. VIP neurons initiated sequential activities, followed by PYR and PV neurons in winning behaviors and they regulated PYR neurons activity through “pull-push” mechanism. In addition, I found the unappreciated role of PV neurons in mediating VIP neuronal disinhibition in mPFC microcircuits. My study further elucidated that how mPFC processes social information and regulates social behavior (*Zhang et al. 2021 Neuron; Cover story*).

We know that high-ranking individuals have superiority in various social behaviors in the social group, but whether the same neural circuit mechanism accounts for different dominance behaviors is still unclear. **In my second project**, I was studied the difference coding pattern of mPFC neurons in different dominance behaviors. I found in mice courting behavior, the regulatory effect of mPFC microcircuits is not strong as it in competition behavior. Using freely moving cellular resolution calcium imaging, I uncovered that the mPFC neurons have different coding pattern during these two different dominance behaviors (*Still in preparation*).

I also participated the project to illustrating the organization and function of mPFC projecting circuits underlying social competition behaviors. Based on the finding of PFC-DRN and PFC-BLA projecting neurons play opposite roles in competition behaviors regulation from my collaborator Qihong Xin. I am trying to decipher how these two projection neurons subtypes coding in social competition via dual-color miniature two-photon microscope (*Xin et al. In preparation*).