

CHING-LUNG HSU

徐 經 倫

Curriculum Vitae, Feb 2022

Assistant Research Fellow
Institute of Biomedical Sciences (IBMS)
Academia Sinica

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Core Member
Neuroscience Program of Academia Sinica (NPAS)

Adjunct Assistant Professor
Department of Life Science
College of Life Science
National Taiwan University

No. 1, Sec. 4, Roosevelt Rd.
Taipei 10617, Taiwan

1. Personal Data

Date of Birth: July 31, 1983

2. Research Description

The long-term aim of my group is to provide mechanistic explanations for how neurons and neural circuits support memory, spatial navigation and goal-directed behavior on the basis of their biophysical and molecular properties. My current focus is put on a brain region called hippocampus, and I use rodents as the model system. To approach the challenging goal, I am integrating multiple methods in the lab, from electrophysiology *in vitro* and *in vivo*, virus-assisted neural circuit mapping, two-photon imaging, and computational modeling. Importantly, behavior in freely moving and head-restrained mice (virtual reality) is used to probe what the biological circuits might optimize. Acknowledging that the interdisciplinary endeavors cannot be accomplished without diverse inputs, we emphasize networking people with different backgrounds in the lab as well as collaborating locally and internationally.

3. Education

Sept 2006 - June 2011

National Taiwan University; Taipei, Taiwan

Ph.D. (Honors), Zoology, Division of Neurobiology

Thesis: "*Excitatory synaptic transmission and plasticity in the ventrobasal nucleus of rat thalamus*"

Advisor: Ming-Yuan Min

Sept 2001 - June 2006

National Taiwan University; Taipei, Taiwan
B.Sc., *Major*, Zoology (Life Science)
Minor, Electric Engineering

4. Professional Appointments

July 2021 – Present

Adjunct Assistant Professor
Department of Life Science
College of Life Science
National Taiwan University

Sept 2020 – Present

Assistant Research Fellow
Institute of Biomedical Sciences
Neuroscience Program of Academia Sinica (NPAS)
Academia Sinica; Taipei, Taiwan
(start date deferred by 1 year)

Oct 2016 - Aug 2020

Research Scientist
Janelia Research Campus
(formerly Janelia Farm Research Campus)
Howard Hughes Medical Institute; Ashburn, Virginia
Advisor: Nelson Spruston

Oct 2011 - Sept 2016

Postdoctoral Associate
Janelia Research Campus
(formerly Janelia Farm Research Campus)
Howard Hughes Medical Institute; Ashburn, Virginia
Advisor: Nelson Spruston

July 2011 - Sept 2011

Postdoc Fellow
Department of Neurobiology
(formerly Department of Neurobiology & Physiology)
Northwestern University; Evanston, Illinois

5. Special Topics Courses

June 2012

The NEURON Simulation Environment
University of California, San Diego; San Diego, CA

July 2011

Methods in Computational Neuroscience
Marine Biological Laboratory (MBL); Woods Hole, MA

Jan 2017 - Mar 2017

Scientists Teach Science (evidence-based pedagogical training)
STEM Education Solutions; Bellefonte, PA

June 2018

Grant Writing Workshop (for US grants)
Fresh Eyes Editing; Dayton, OH

6. Major Awards, Honors, and Fellowships

2010-11	Fellowship of the Graduate Student Study Abroad Program (National Science Council (now Ministry of Science and Technology), Taiwan)
2006-11	Long-term Scholarship for Talented Student (Xingtian Temple, Taiwan)
2008	Championship of the Scientific Poster Competition (Shieh and Feng Memorial Scholarship, Institute of Zoology, National Taiwan University)
2008	Dean Award, 2008 (College of Life Science, National Taiwan University)
2005-06	Award of the Undergraduate Research Project Program (National Science Council (now Ministry of Science and Technology), Taiwan) <i>Thesis: "Effects of adenosine on field excitatory postsynaptic potentials in the piriform cortex of rats and the underlying cellular mechanisms"</i>
2000	The 99 th percentile rank of the Taiwan area in the American Mathematics Competitions (AMC 12) (Mathematical Association of America, Washington, D.C.)
1999	Bronze Medal in the National Mathematics Competitions (Taiwan Regions Mathematics League (TRML), Taiwan)

** Due to the policy of Howard Hughes Medical Institute, Janelia postdoc associates/research scientists have been limited for receiving funding from external sources*

7. Teaching and Mentoring

Courses

2022	Neurobiology; Department of Life Science, National Taiwan University
2022	Molecular Medicine Seminar; Taiwan International Graduate Program (TIGP), Academia Sinica
2022	Neurotechnology Laboratory Rotation; National Taiwan University (台灣大學生命科學系領域專長模組)
2022	Neuroscience Seminar And Proposal Writing; National Taiwan University (台灣大學生命科學系領域專長模組)
2021	Modern Techniques in Neuroscience; National Taiwan University (台灣大學生命科學系領域專長模組)
2021	Introduction of Research Techniques in Neuroscience; Taiwan International Graduate Program-Interdisciplinary Neuroscience (TIGP-INS), Academia Sinica
2021	NPAS Summer Online Lecture (Basic Neuroscience Lecture); NPAS, Academia Sinica
2021	Neurobiology: Spatial Navigation; Department of Life Science, National Taiwan University
2021	Molecular Medicine Seminar; Taiwan International Graduate Program (TIGP), Academia Sinica

2020 Neuro-Imaging (Academia Sinica feature course); Taiwan International Graduate Program (TIGP), Academia Sinica

Mentoring

Currently mentoring 1 postdoc, 2 PhD students, 5 undergrad students, and 3 research assistants

Experiment coaching: external groups

Zhou Yu, Andrian Visiting Student Researcher (Harvard), Janelia Senior Scientist (Erin O'Shea Lab),
Gutu, Namssoo Kim Graduate Student (Duke)

Adina Buxbaum Janelia Graduate Scholar (Robert Singer Lab)

Kaspar Podgorski Janelia Fellow

8. Ongoing Collaborations

(1) Genetic algorithms for neuron model optimization

Collaborator(s): William Kath and Aushra Abouzeid (Northwestern University)

Manuscript in preparation

(2) Correlative electrophysiology and multiplexed protein labeling with expansion microscopy

Collaborator(s): Boaz Mohar and Paul Tillberg (Janelia Research Campus)

(3) Context-dependent roles of proprioception for memory-guided spatial navigation

Collaborator(s): Chih-Cheng Chen (Academia Sinica)

9. Invited Professional Talks

- 2021 “An efficient synaptic learning rule that facilitates goal-oriented behavior”
Cognitive Neuroscience Joint Seminar; National Central University, Graduate Institute of Cognitive Neuroscience and National Yang Ming Chiao Tung University, Institute of Neuroscience (Taoyuan City, Taiwan)
- 2021 “How does the brain represent high-order information of environments, and how could it be learned?”
Taiwan International Graduate Program-Bioinformatics (TIGP-BP); Academia Sinica, Institute of Information Science (Taipei, Taiwan)
- 2021 “Molecular and synaptic mechanisms for flexible memory-dependent spatial coding of the hippocampus”
Chang Gung University, Graduate Institute of Biomedical Sciences (Taoyuan City, Taiwan)
- 2021 “Does the brain-inspired deep learning help us learn about the brain? A neurophysiological perspective”
“大腦啟發的深度學習法則能讓我們更瞭解大腦嗎？一個神經生理學的觀點”
Academia Sinica Open House (Taipei, Taiwan)
- 2021 “Rapid plasticity mechanisms for flexible place-cell activity in the hippocampal memory system”

- Taiwan Neuroscience Society Annual Meeting (Taipei, Taiwan)
- 2021 “Neuron computation contributes to the rapid emergence of neural code supporting spatial navigation”
National Taiwan University, Center for Neurobiology and Cognitive Science (Taipei, Taiwan)
- 2021 “Rapid synaptic plasticity supporting prospective neural coding when mice navigate virtual space”
National Taiwan University, Department of Life Science (Taipei, Taiwan)
- 2021 “Neuron computation contributes to the rapid emergence of neural code supporting spatial navigation”
National Tsing Hua University, Interdisciplinary Ph.D. Seminar (Hsinchu, Taiwan)
- 2021 “Rapid synaptic plasticity contributes to the emergence of task-relevant place-cell firing in a visually guided behavioral task”
University College London, Institute of Behavioural Neuroscience (UCL BehavioNeuro Talks)
- 2020 “Cellular mechanisms for rapidly dynamic neural code in spatial navigation”
Neuromatch Conference, Neuromatch Academy
- 2020 “The physical substrates of neuron computations and the meaning of the research”
“神經細胞計算的物質基礎及其研究的意義”
National Yang-Ming University, Brain Research Center (Taipei, Taiwan)
- 2020 “Novel cellular mechanism supporting putative prospective coding in spatial navigation”
Taiwanese Society for Neuroscience Meeting (Taipei, Taiwan)
- 2019 “Nonlinear single-neuron computation in rapid coding of space in the brain”
Academia Sinica, Institute of Biomedical Sciences (Taipei, Taiwan)
- 2018 “Nonlinear single-neuron computation in rapid encoding of space in the brain”
Chinese Institute for Brain Research (Beijing, China)
- 2018 “Persistent sodium current mediates steep voltage dependence of spatial coding in hippocampal pyramidal neurons”
Hippocampus Consortium meeting (Ashburn, VA)
- 2017 “Cellular mechanisms for spatial coding in a memory system of the mammalian brain”
Howard Hughes Medical Institute, Janelia Research Campus (Ashburn, VA)
- 2017 “Beyond action potentials: roles of voltage-gated sodium channels in neuronal input-output transformation across multiple timescales for hippocampal memory system”
Chinese Academy of Sciences, Shenzhen Institutes of Advanced Technology, Institute of Brain Cognition and Brain Disease (Shenzhen, China)
- 2017 “Beyond action potentials: roles of voltage-gated sodium channels in neuronal input-output transformation across multiple timescales for hippocampal memory system”
The Chinese University of Hong Kong, School of Life Sciences (Hong Kong, China)
- 2017 “Beyond action potentials: roles of voltage-gated sodium channels in neuronal input-output transformation across multiple timescales for hippocampal memory system”

- The University of Hong Kong, School of Biomedical Sciences (Hong Kong, China)
- 2017 “Beyond action potentials: roles of voltage-gated sodium channels in neuronal input-output transformation across multiple timescales for hippocampal memory system”
Nanyang Technological University, Lee Kong Chian School of Medicine (Singapore)
- 2017 “Beyond action potentials: roles of voltage-gated sodium channels in neuronal input-output transformation across multiple timescales for hippocampal memory system”
National University of Singapore, Department of Physiology (Singapore)
- 2017 “Beyond action potentials: roles of voltage-gated sodium channels in neuronal input-output transformation across multiple timescales for hippocampal memory system”
National Tsing Hua University, Institute of Systems Neuroscience (Hsinchu, Taiwan)
- 2017 “Beyond action potentials: roles of voltage-gated sodium channels in neuronal input-output transformation across multiple timescales for hippocampal memory system”
National Yang-Ming University, Institute of Neuroscience (Taipei, Taiwan)
- 2017 “Beyond action potentials: roles of voltage-gated sodium channels in neuronal input-output transformation across multiple timescales for hippocampal memory system”
Academia Sinica, Institute of Biomedical Sciences (Taipei, Taiwan)
- 2017 “Beyond action potentials: roles of voltage-gated sodium channels in neuronal input-output transformation across multiple timescales for hippocampal memory system”
ShanghaiTech University, School of Life Science and Technology (Shanghai, China)
- 2017 “Voltage dependence of spatial coding in hippocampal pyramidal neurons supported by persistent sodium current”
Cold Spring Harbor Asia, Francis Crick Symposium–Transforming Neurosciences: Questions & Experiments (Suzhou, China)
- 2016 “Beyond action potentials: roles of voltage-gated sodium channels in neuronal input-output transformation on multiple timescales”
Howard Hughes Medical Institute, Janelia Research Campus (Ashburn, VA)
- 2016 “Beyond action potentials: roles of voltage-gated sodium channels in neuronal input-output transformation on multiple timescales”
National Taiwan University, Department of Life Science (Taipei, Taiwan)
- 2015 “Dendritic sodium spikes are required for long-term potentiation at distal synapses on hippocampal pyramidal neurons”
National Cheng Kung University, Department of Physiology (Tainan City, Taiwan)
- 2015 “Dendritic sodium spikes are required for long-term potentiation at distal synapses on hippocampal pyramidal neurons”
Chang Gung University, Graduate Institute of Biomedical Sciences (Taoyuan City, Taiwan)
- 2015 “Dendritic sodium spikes are required for long-term potentiation at distal synapses on hippocampal pyramidal neurons”
National Taiwan University, Graduate Institute of Brain and Mind Sciences (Taipei, Taiwan)
- 2015 “Dendritic sodium spikes are required for long-term potentiation at distal synapses on hippocampal pyramidal neurons”

National Taiwan University, Department of Life Science (Taipei, Taiwan)

- 2010 “Comparison of synaptic transmission and plasticity between sensory and cortical synapses on relay neurons in the ventrobasal nucleus of the rat thalamus”
Academia Sinica (Taiwan) and Tohoku University (Japan), Tohoku University-Taiwan Neuroscience Workshop for Young Scientists (Yilan, Taiwan)
- 2009 “The science of pain”
Rotary Club of Taipei Mu-Lan (Taipei, Taiwan)

10. Peer-Reviewed Publications

* *First authorship*

† *Corresponding authorship*

Zhao X*, **Hsu CL***, Spruston N. (2022). Rapid synaptic plasticity contributes to a learned conjunctive code of position and choice-related information in the hippocampus. *Neuron*, 110(1): 96-108.e4; DOI: 10.1016/j.neuron.2021.10.003.[#]

Featured in Preview by Michael Brecht “A Cellular Stapler for Memories”
(DOI: <https://doi.org/10.1016/j.neuron.2021.12.006>)

Wu J, Liang Y, Chen S, **Hsu CL**, Chavarha M, Evans SW, Shi D, Lin MZ, Tsia KK, Ji N. (2020). KiloHertz two-photon fluorescence microscopy imaging of neural activity *in vivo*. *Nature Methods*, 17: 287-290.

Piccolo FM, Liu Z, Dong P, **Hsu CL**, Stoyanova EI, Rao A, Tjian R, Heintz N. (2019). MeCP2 nuclear dynamics in live neurons results from low and high affinity chromatin interactions. *eLife* 2019; 8:e51449; DOI: 10.7554/eLife.51449.

Jin DZ, Zhao T, Hunt DL, Tillage RP, **Hsu CL**, Spruston N. (2019). ShuTu: Open-source software for efficient and accurate reconstruction of dendritic morphology. *Frontiers in Neuroinformatics*, 13:68.

Hsu CL*, Zhao X, Milstein AD, Spruston N. (2018). Persistent sodium current mediates the steep voltage dependence of spatial coding in hippocampal pyramidal neurons. *Neuron*, 99(1): 147-162.[#]

Featured in Cover

Kim Y*, **Hsu CL***, Cembrowski M, Mensh B, Spruston N. (2015). Dendritic sodium spikes are required for long-term potentiation at distal synapses on hippocampal pyramidal neurons. *eLife*, 4: e06414.[#]

Recommended by the Faculty of 1000 (F1000)

Hsu CL*†, Yang HW, Yen CT, Min MY†. (2012). A requirement of low-threshold calcium spike for induction of spike-timing-dependent plasticity at corticothalamic synapses on relay neurons in the ventrobasal nucleus of rat thalamus. *The Chinese Journal of Physiology*, 55(6): 380-389.

Hsu CL*, Yang HW, Yen CT, Min MY. (2010). Comparison of synaptic transmission and plasticity between sensory and cortical synapses on relay neurons in the ventrobasal nucleus of the rat thalamus. *Journal of Physiology*, 588(22): 4347-4363.[#]

Selected by the Faculty of 1000 (F1000) as the top 2% of published articles in biology and medicine

Min MY, Wu YW, Shih PY, Lu HW, Wu Y, **Hsu CL**, Li MJ, Yang HW. (2010). Role of A-type potassium currents in tuning spike frequency and integrating synaptic transmission in noradrenergic neurons of the A7 catecholamine cell group in rats. *Neuroscience*, 168(3): 633-645.

11. Journal Editorship/Review Activity

Review Editor

Frontiers in Aging Neuroscience

Invited Ad hoc Reviewer

eLife

Communications Biology

12. Conference Abstracts

Complete list available upon request.