

## CURRICULUM VITAE

### Ann-Shyn Chiang (江安世)

#### AFFILIATION

- Tsing Hua Distinguished Chair Professor (清華特聘講座教授)  
Dean, College of Life Science (生命科學院院長)  
Director, Brain Research Center (腦科學研究中心主任)  
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- International Faculty, Kavli Institute for Brain and Mind (KIBM) at the University of California, San Diego; E-mail: [a6chiang@ucsd.edu](mailto:a6chiang@ucsd.edu)



#### FIELDS OF SPECIALTY

Brain, Behavior, Bioimaging

#### ACADEMIC POSITION

- |              |   |
|--------------|---|
| 2016-present | Adjunct Investigator, Institute of Physics, Academia Sinica, Taiwan   |
| 2016-present | Adjunct Distinguished Investigator, National Synchrotron Radiation Research Center, Taiwan                        |
| 2016-present | Adjunct Distinguished Chair Professor, China Medical University, Taiwan   |
| 2014-present | Adjunct Chair Professor, Kaohsiung Medical University, Taiwan   |
| 2014-present | Tsing Hua Distinguished Chair Professor, National Tsing Hua University, Taiwan                                    |
| 2014-present | Adjunct Chair Professor, Kaohsiung Medical University, Taiwan   |
| 2013-present | Scientific Advisory Board member, Center for Brain Activity Mapping at UCSD                                       |
| 2013-present | Scientific Advisory Board member, Cold Spring Harbor Conferences Asia, China                                      |
| 2011-present | International Faculty, Kavli Institute for Brain and Mind (KIBM) at the University of California, San Diego, USA. |
| 2010-present | Adjunct Chair Professor, National Chiao Tung University, Taiwan   |
| 2008-present | Adjunct Research Fellow, Genomics Research Center, Academia Sinica  |
| 2007-2014    | Tsing Hua Chair Professor, National Tsing Hua University, Taiwan  |
| 2006-2008    | Adjunct Professor, Cold Spring Harbor Laboratory, USA   |
| 2005         | Chair of Biological Science Panel, National Science Council, Taiwan   |
| 2005-present | Adjunct Professor, Department of Life Science, National Central University, Taiwan                                |
| 2004-present | Director, Brain Research Center, National Tsing Hua University, Taiwan  |
| 2002-2008    | Director, Institute of Biotechnology, National Tsing Hua University, Taiwan                                       |
| 2001-2002    | Visiting Scientist, Cold Spring Harbor Laboratory, USA  |
| 1997         | Visiting Professor, Neurobiology Laboratory, CNRS, France   |
| 1997-present | Professor, Department of Life Science, National Tsing Hua University, Taiwan                                      |
| 1992-1997    | Associate Professor, Department of Life Science, National Tsing Hua University                                    |

#### HONOR







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|------|---------------------------|
| 2016 | TWAS Fellow (發展中世界科學會 院士) |
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2016	Presidential Special Lecturer, The Society for Neuroscience 2016 Annual Meeting (>35,000 participants)
2015	National Professorship, Ministry of Education (教育部國家講座)
2014	Academician, Academia Sinica (中央研究院 院士)
2013, 2010, 2004	Outstanding Research Award, National Science Council, Taiwan. (國科會 傑出獎)
2012	Published Taiwanese first " <b>Science</b> " full article.
2012	AEARU Distinguished Lecture (東亞研究型大學協會 傑出講座)
2012	TWAS Prize in Biology (發展中世界科學會TWAS 生物學類獎)
2012	Hou Jindui Distinguished Honor Award (侯金堆傑出榮譽獎—基礎科學生物類)
2013-2017	Academic Summit Project, MOST (自由型卓越學研計畫, 科技部)
2011-2013	Academic Summit Project, NSC (攻頂計畫, 國科會)
2009	The Fifty Scientific Achievements, NSC 50 <sup>th</sup> anniversary (國科會50週年慶「50科學成就」)
2008	Teco Award of Teco Technology Foundation (東元科技獎 化工/生物/醫工領域)
2008	HuiSun Chair of National Chung Hsing University (中興大學 蕙蓀講座)
2007	Distinguished Alumnus of National Chung Hsing University (中興大學 傑出校友)
2007	Outstanding Scholar Award, Foundation for the Advancement of Outstanding Scholarship (傑出人才基金會 傑出人才講座)
2007	Sun Yat-sen Academic Award (中山學術獎)
2007	Outstanding Contributions in Science & Technology, Executive Yuan (行政院 傑出科技貢獻獎)
2007	Academic Award of Ministry of Education (教育部學術獎)
2007	Published Taiwanese first " <b>Cell</b> " paper

## SELECTED PUBLICATIONS (\*: corresponding author)

- Lo CC\*, **Chiang AS\*** (2016) Toward whole-body connectomics. *J Neurosci* 36, 11375–11383. (This review article is based on a Presidential Lecture at the Neuroscience 2016 Annual Meeting)
- Shih HW, Wu CL, Chang SW, Liu TH, Lai JSY, Fu TF, Fu CC, **Chiang AS\*** (2015) Parallel circuits control temperature preference in *Drosophila* during aging. *Nature Communications* 6, 7775.
- Shih CT\*, Sporns O, Yuan SL, Su TS, Lin YJ, Chuang CC, Wang TY, Lo CC, Greenspan RJ, **Chiang AS\*** (2015) Connectomics-based analysis of information flow in the *Drosophila* brain. *Curr Biol* 25, 1249-1258.
- Wu MC, Chu LA, Hsiao PY, Lin YY, Chi CC, Liu TH, Fu CC\*, **Chiang AS\*** (2014) Optogenetic control of selective neural activity in multiple freely moving *Drosophila* adults. *Proc Natl Acad Sci USA* 111, 5367-5372.
- Wu CL, Shih MFM, Lee PT, **Chiang AS\*** (2013) An octopamine-mushroom body circuit modulates the formation of anesthesia-resistant memory in *Drosophila*. *Curr Biol* 23, 1-9.
- Lin HH, Chu LA, Fu TF, Dickson BJ, **Chiang AS\*** (2013) Parallel neural pathways mediate CO<sub>2</sub>

avoidance responses in *Drosophila*. Science 340, 1338-1341. (This article has been reviewed in the “PERSPECTIVES” of the same *Science* issue, p1295-1297)

7. Lin CY, Chuang CC, Hua TE, Chen CC, Dickson BJ, Greenspan RJ, **Chiang AS\*** (2013) A comprehensive wiring diagram of the protocerebral bridge for visual information processing in the *Drosophila* brain. Cell Rep 3, 1739-1753.
8. Pai TP, Chen CC, Lin HH, Chin AL, Lai JSY, Lee PT, Tully T, **Chiang AS\*** (2013) *Drosophila* ORB protein in two mushroom body-output neurons is necessary for long-term memory formation. Proc Natl Acad Sci USA 110, 7898-7903.
9. Chen CC, Wu JK, Lin HW, Pai TP, Fu TF, Wu CL, Tully T, **Chiang AS\*** (2012) Visualizing long-term memory formation in two neurons of the *Drosophila* brain. Science 335, 678–685. [101 年大學指考試題 39-41] (This article has been reviewed in the “PERSPECTIVES” of the same *Science* issue, p664-665; this article has been introduced by the Science Editor in the “EDITOR’S CHOICE” of the Science Signaling 14, ec50) 
10. Lai JSY, Lo SJ, Dickson BJ and **Chiang AS\*** (2012) Auditory circuit in the *Drosophila* brain. Proc Natl Acad Sci USA 109, 2607-2612.
11. Lee PT, Lin HW, Chang YH, Fu TF, Dubnau J, Hirsh J, Lee T and **Chiang AS\*** (2011) Serotonin-mushroom body circuit modulating the formation of anesthesia-resistant memory in *Drosophila*. Proc Natl Acad Sci USA 108, 13794–13799. 
12. Wu CL, Shih MF, Lai SY, Yang HT, Turner GC, Chen L, **Chiang AS\*** (2011) Heterotypic gap junctions between two neurons in the *Drosophila* brain are critical for memory. Curr Biol 21, 848-854. (This article has been reviewed in the “Dispatch” of the *Current Biology* 21, R394-R395) 
13. **Chiang AS\***, Lin CY, Chuang CC, Chang HM, Hsieh CH, Yeh CW, Shih CT, Wu JJ, Wang GT, Chen YC, Wu CC, Chen GY, Ching YT, Lee PC, Lin CY, Lin HH, Wu CC, Hsu HW, Huang YA, Chen JY, Chiang HJ, Lu CF, Ni RF, Yeh CY, Hwang JK (2011) Three-dimensional reconstruction of brainwide wiring networks in *Drosophila* at single cell resolution. Curr Biol 21, 1-11. (Article, cover story) (This article has been reviewed in the “Dispatch” of the *Current Biology* 21, R19-R20) 「紐約時報」專欄報導 
14. Wu CL, Xia S, Fu TF, Wang H, Chen YH, Leong D, **Chiang AS\***, Tully T\* (2007) Specific requirement of NMDA receptors for long-term memory consolidation in *Drosophila* ellipsoid body. Nature Neurosci 10, 1578-1586.
15. Lin HH, Lai JSY, Chin AL, Chen YC, **Chiang AS\*** (2007) A map of olfactory representation in the *Drosophila* mushroom body. Cell 128, 1205-1218. 
16. Zhu S, Lin S, Kao CF, Awasaki T, **Chiang AS**, Lee T (2006) Gradients of the *Drosophila* chinmo BTB-zinc finger protein govern neuronal temporal identity. Cell 127, 409-422. 

17. Xia S, Miyashita T, Fu TF, Lin WY, Wu CL, Pyzocha L, Lin IR, Saitoe M, Tully T, **Chiang AS\*** (2005) NMDA receptors mediate olfactory learning and memory in *Drosophila*. *Curr Biol* 15, 603-615. (This article has been reviewed in the “**Dispatch**” of the *Current Biology* 15, R414-R419) 

## BIO-SKETCH

Received Ph.D. (1990) and trained as a postdoctoral fellow (1992) in Rutgers University, Ann-Shyn Chiang joined Department of Life Science, National Tsing Hua University as an associate professor (1992), promoted as professor (1997), took sabbatical to study *Drosophila* memory at Cold Spring Harbor Laboratory (2001) and became the adjunct International Faculty of Kavli Institute for Brain and Mind (KIBM) at the University of California, San Diego (2011). For his contribution to our understanding of memory formation using a connectomics approach, Chiang was elected as an Academician of Academia Sinica (2014).

Chiang reconstructed a brain-wide wiring diagram in *Drosophila* (the New York Times reported this discovery as the first step toward mapping human brain) and published the first *Cell* (2007) paper from Taiwanese scientists. Guiding by this connectomics map, he and his colleagues discovered that long-term memory formation requires new protein synthesis only in few brain neurons and published the first full article in *Science* (2012) from Taiwanese scientists. He received many awards, including: Outstanding Research Award, National Science Council (2004, 2009, 2012), Outstanding Scholar Award, Foundation for the Advancement of Outstanding Scholarship (2007), Academic Award of Ministry of Education (2007), Outstanding Contributions in Science and Technology of Executive Yuan (2008), TWAS Prize in Biology (2012), and National Chair Award of Ministry of Education (2015). Chiang is currently the Dean of College of Life Science, the Director of Brain Research Center, and the Distinguished Chair Professor of National Tsing Hua University.

## RESEARCH INTEREST

We aim to understand the genetic and neural basis of brain functions using *Drosophila* as a model system. We take two main approaches: (i) to construct a wiring diagram of information flows in the entire brain, and (ii) to manipulate target neurons for understanding the computation process in specific neural circuits orchestrating complex behaviors. Major achievements in our attempts to reach these goals include:

### A. Invent the world-first tissue clearing technology.

We developed an optical tissue clearing solution, called *FocusClear* (*J Comp Neurol* 2001, 440:1-11; *Methods* 2003, 30:86-93), compatible to GFP for the visualization of gene expressions in an intact brain at single cell resolution. Making biological tissue transparent allows efficient excitation and detection of fluorescence signals at the depth hundreds of micron beneath the surface. Combining with confocal microscopy, our tissue clearing technology has revolutionized traditional anatomy by allowing high-resolution 3D imaging of large biological tissues without physical sectioning. The invention has received patents from Taiwan (Patent No: 206390), UAS (Patent No: US 6472216 B1), France (Patent No: 2830323) and United Kingdom (Patent No: GB237757).

- B. **Discover odor representation in the higher brain centers via a circuit shunting mechanism.** We discovered neuronal temporal identity and stereotyped neural connections in the 3<sup>rd</sup> order olfactory center of the *Drosophila* brain (published in [Cell](#) 2006, 127:409-422; [Cell](#) 2007, 128:1205-1217) and a shunting mechanism for gating CO<sub>2</sub> information flow in parallel neural circuits ([Science](#) 2013, 340:1338-1341). Our findings extend the understanding of olfactory representations to the 3<sup>rd</sup> order brain center and show that information routing is context dependent.
- C. **Locate long-term memory storage sites in only few brain neurons.** Forming long-term memory requires new protein synthesis in all animals. We found that learning-induced new proteins occur in only few brain neurons for the formation of long-term memory ([Science](#) 2012, 335:678-685; [Proc Natl Acad Sci USA](#) 2013, 110:7898-7903). Previously, we have established fly models for studying long-term memory formation ([Current Biology](#) 2003, 13:286-296), intermediate-term memory consolidation ([Current Biology](#) 2011, 21:848-854; [Proc Natl Acad Sci USA](#) 2011, 108:13794-13799), aging dependent memory defect ([Neuron](#) 2003, 40:1003-1011), Alzheimer's diseases ([Proc Natl Acad Sci USA](#) 2004, 101:6623-6628), Huntington's diseases ([Proc Natl Acad Sci USA](#) 2005, 102:3777-3781), and IBMPFD disease model ([PLoS Genetics](#) 2011, 7:e1001288). Importantly, we discovered the first functional NMDA receptors in insects ([Proc Natl Acad Sci USA](#) 2002, 99:37-42; [Current Biology](#) 2005, 15:603-615; [Nature Neuroscience](#) 2007, 10:1578-1586). This series of studies suggest a unified cellular model for learning and memory and extend our understanding of memory formation from molecular to systems consolidation. ([Curr Opin Neurobiol](#) 2013, 23:84-91).
- D. **Construct the world-first 3D fly brain database at single neuron resolution.** We created the first brain-wide wiring map in *Drosophila* ([Current Biology](#) 21:1-11, 2011). The study managed to bar code 16,000 neurons in the fly brain, an advance that is comparable to the sequencing of the fly genome and considered as the first step toward decoding the human brain by [The New York Times](#). The breakthrough paves the way for a comprehensive analysis of information processing within and between neurons and ultimately a deeper understanding of control and causality in fly behavior ([Current Biology](#) 2011, 21:R19-20; [Proc Natl Acad Sci USA](#) 2014, 111:5367-5372). Guided by this brain circuit map, we have mapped auditory circuit ([Proc Natl Acad Sci USA](#) 2012, 109:2607-2612; [Neuron](#) 2013, 77:115-128), temperature circuits ([Nature Communications](#) 2015, 6:7775) and established a comprehensive map of the central complex indicating the direction of information flow at single cell resolution ([Cell Reports](#) 3:1739-1753, 2013). For his contribution in connectomics, Chiang was invited as one of the Presidential Special Lecturers at the Neuroscience 2016 Annual Meeting where he demonstrated the first effort toward whole body connectomics (reviewed in [J Neurosci](#) 2016, 36:11375-11383).

