

**BIOGRAPHICAL SKETCH**

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NAME: Juan Song

eRA COMMONS USER NAME (credential, e.g., agency login): JUAN\_SONG

POSITION TITLE: Associate Professor (with tenure)

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	YEAR(s)	FIELD OF STUDY
Nankai University (China)	B.S.	2001	Biology
University of California, Berkeley	Ph.D	2007	Neuroscience
Johns Hopkins University	Postdoctoral	2007-2013	Adult Neurogenesis

**Personal Statement**

The overarching goal of my research is to understand how the healthy adult brain regenerates from endogenous neural stem cells and apply basic learned principles to the degenerated brain to promote regeneration. Over the past 6 years, we have been focusing our research to identify neuronal circuitry and signaling mechanisms that regulate distinct stages of adult hippocampal neurogenesis and investigate how circuit- and behavior-level information-processing properties are remodeled by the integration of new neurons into the existing circuits. More recently, we start to investigate the mechanisms regulating hippocampal dependent learning and memory in health and Alzheimer's disease at the circuit and network level. Our goal is to gain better understanding of how the dentate gyrus, the first input region of the hippocampal formation, integrates synaptic inputs from the subcortical regions to modulate cortical inputs and memory process. We have established multifaceted approach to investigate these directions, including circuit-based optogenetic/chemogenetic manipulation, in vivo multi-fiber photometry recording, retrograde/anterograde tracing, and patch-clamp electrophysiology.

**B. Positions, Honors and Professional Experiences****Positions and Employment**

2019- Jeffery Houpt Distinguished Investigator  
 2019- Associate Professor, Department of Pharmacology, University of North Carolina, Chapel Hill  
 2018-present Associate Director, Neuroscience Curriculum, University of North Carolina, Chapel Hill  
 2018-present Faculty member, Intellectual and Developmental Disabilities Research Center, University of North Carolina, Chapel Hill  
 2013-present Faculty member, Neuroscience Center, University of North Carolina, Chapel Hill  
 2013-2019 Assistant professor, Department of Pharmacology, University of North Carolina, Chapel Hill  
 2007- 2013 Postdoctoral fellow, Johns Hopkins University School of Medicine  
 2001- 2007 Graduate Student Researcher, University of California, Berkeley

**Honors**

2019- Jeffery Houpt Distinguished Investigator Award (UNC)  
 2018 Philip and Ruth Hettleman Prizes (UNC)  
 2016 American College of Neuropsychopharmacology (ACNP) Travel Award  
 2015 Junior Faculty Career Development Award (UNC)  
 2014 Janett Rosenberg Trubatch Career Development Award (Society for Neuroscience)  
 2014-2018 American Heart Association Scientist Development Award

2014-2017 Whitehall Foundation Award  
2014-2016 NARSAD Young Investigator Award (Brain and Behavioral Research Foundation)  
2013 Alfred Blalock Young Investigator Award (Johns Hopkins University)  
2012 Julius Axelrod Postdoctoral Travel Award (Society for Neuroscience)  
2011-2013 Maryland Stem Cell Research Foundation Postdoctoral Fellowship  
2011 Keystone Symposia Scholarship (Adult Neurogenesis)  
2008-2011 Life Sciences Research Foundation Postdoctoral Fellowship  
2004-2006 Graduate Student Travel Grant, University of California, Berkeley  
2004-2006 Merit-based Predoctoral Training Fellowship, University of California, Berkeley

#### **Mentor Award:**

2019 Outstanding Postdoctoral Mentor Award (UNC)  
2019 Mentor of the Year (UNC Neuroscience Curriculum)

#### **Peer-reviewed publications**

##### **Original Research: (\*: corresponding author, #: equal contribution)**

1. Bao H, Hu Z, Lee SH, Kolagani R, Chao TH, Luo Y, Ban W, Sullivan HA, Gamero-Alameda S, Yu Y, Hsieh J, Wickersham I, Brenner SE, Shih YY, **Song J\***. Dysregulation of hippocampal adult-born immature neurons disrupts a brain-wide network for spatial memory. (***under review at Neuron***).
2. Asrican B<sup>#</sup>, Wooten J<sup>#</sup>, Li Y, Quintanilla L, Zhang F, Bao H, Yeh CY, Wander C, Luo YJ, Olsen RHJ, Lim SA, Jin P, **Song J\*** (2020). Neuropeptides modulate local astrocytes to regulate adult hippocampal neural stem cells. **Neuron** (*in press*)
3. Li Y, Bao H, Luo Y, Yoan C, Sullivan HA, Quintanilla L, Wickersham IR, Lazarus M, Shin YY, **Song J\*** (2020). Supramammillary nucleus synchronizes with dentate gyrus to regulate spatial memory retrieval through glutamate release. **eLife** doi: 10.7554/eLife.53129.
4. Kang E<sup>#</sup>, **Song J\* (co-first author)**, Lin Y, Park J, Lee JH, Hussani Q, Gu Y, Ge S, Li W, Berninger B, Hsu K, Christina K, Song H, Ming GL (2019). Interplay between a mental disorder risk gene and developmental polarity switch of GABA action leads to excitation-inhibition imbalance. **Cell Reports** 28(6):1419-1428
5. Yeh CY<sup>#</sup>, Asrican B<sup>#</sup>, Moss J, Quintanilla L, He T, Mao X, Cassé F, Gebara E, Bao H, Lu W, Toni N, **Song J\*** (2018). Mossy cells control adult neural stem cell quiescence and maintenance through a dynamic balance between direct and indirect pathways. **Neuron** 99(3):493-510 (**Featured article, issue highlights**)
6. Crowther A<sup>#</sup>, Lim SA<sup>#</sup>, Asrican B, Albright B, Wooten J, Yeh CY, Bao H, Cerri DH, Hu J, YY Ian Shin, Asokan A, **Song J\*** (2018). An adeno-associated virus-based toolkit for preferential targeting and manipulating quiescent neural stem cells in the adult hippocampus. **Stem Cell Reports** 10(3):1146-1159 (**Cover Article**)
7. Chen X, Wang S, Zhou Y, Han Y, Li S, Xu Q, Xu L, Zhu Z, Deng L,Y, Yu L, Song L, Chen P, **Song J**, Takahashi E, He G, He L, Li W, Chen CD (2018). PHF8 histone demethylase deficiency causes cognitive impairments through the mTOR pathway. **Nature Communication** 9(1):114
8. Bao H<sup>#</sup>, Asrican B<sup>#</sup>, Li W<sup>#</sup>, Gu B, Wen ZX, Lim ZA, Haniff I, Ramakrishnan C, Deisseroth K, Philpot B, **Song J\*** (2017). Long-range GABAergic inputs regulate neural stem cell quiescence and control adult hippocampal neurogenesis. **Cell Stem Cell** 21(5):604-617 (**Cover article, featured article, issue highlights, recommended by F1000, selected as Best Articles in 2017 in Cell Stem Cell**)
9. Liu K, Kim J, Zhang YS, Bao H, Denaxa M, Lim SA, Kim E, Liu C, Wickwesham IR, Pachinis V, Hatter S, **Song J**, Brown SP, Blackshaw S (2017). Lhx6-positive GABA-releasing neurons of the zona incerta promote sleep. **Nature** 548(7669): 582-587
10. Winkle C, Olsen RHJ, Kim H, Moy S, **Song J\***, Gupton S\* (2016). TRIM9 deletion alters developing and adult born hippocampal neuron morphogenesis and impairs spatial learning and memory. **J. Neuroscience** 4;36(18):4940-58 (**Cover Article**)
11. Murlidharan G, Crowther A, Reardon RA, **Song J**, Asokan A (2016). Glymphatic fluid transport controls paravascular clearance of AAV vectors from the brain. **JCI insights** 1(14):e88034

12. Shin J, Berg DA, Zhu Y, Shin JY, **Song J**, Bonaguidi MA, Enikolopov G, Nauen DW, Christian KM, Ming GL, and Song H (2015). Single-cell RNA-seq with Waterfall reveals molecular cascades underlying adult neurogenesis. **Cell Stem Cell** 17(3):360-72
13. Vardy E, Robinson JE, Li C, Olsen, R.H.J., DiBerto, J.F., Sassano F.M., Huang X.P., Zhu, H., Urban DJ, Rittiner JE, Crowley(Capik) NA, **Song J**, Kash T.L., Malanga C.J., Krashes M., Roth B.L. (2015). A DREADD for multiplexing chemogenetic interrogation of neural circuits. **Neuron** 20;86(4):936-46.
14. Duan Y, Wang SH, **Song J**, Mironova Y, Ming GL, Kolodkin A, and Giger RJ (2014). Semaphorin 5A inhibits synaptogenesis in early postnatal- and adult-born hippocampal dentate granule cells. **eLife** Oct 14;3 doi: 10.7554/eLife.04390
15. Jang M, Kitabatake Y, Bonaguidi, MA, Sun J, **Song J**, Kang E, Jun H, Zhong C, Su Y, Guo J, Wang M, Sailor K, Kim JY, Gao Y, Christian KM, Ming GL, Song H (2013). Secreted frizzled-related protein 3 regulates activity-dependent adult hippocampal neurogenesis. **Cell Stem Cell** 12(2):215-23
16. Zhou M, Li W, Huang S, **Song J**, Kim JY, Tian X, Kang E, Liu C, Balaji J, Zhou Y, Parivash SN, Zhou Y, Ehninger D, He L, Song H, Ming GL, Silva AJ (2013) mTOR inhibition ameliorates cognitive and affective deficits caused by Disc1 knockdown specifically in adult-born dentate granule neurons. **Neuron** 77(4):647-54
17. **Song J**, Sun J, Moss J, Wen Z, Sun G, Hsu D, Zhong C, Davoudi H, Christian K, Toni N, Ming GL, Song H (2013). Parvalbumin interneurons mediate neuronal circuitry-neurogenesis coupling in the adult hippocampus. **Nature Neuroscience** 16(12):1728-30
18. **Song J**, Zhong C, Bonaguidi MA, Sun G, Hsu D, Gu Y, Meletis K, Huang J, Ge S, Enikolopov G, Deisseroth K, Luscher B, Christian K, Ming GL, Song H (2012). Neuronal circuitry mechanism regulating adult quiescent neural stem-cell fate decision. **Nature** 489: 150-154 (**Featured in Cell Stem Cell, Nat Rev Neurosci, BioEssays, F1000 must read**)
19. Lee DA, Bedont JL, Pak T, Wang H, **Song J**, Miranda-Angulo A, Takiar V, Charubhumi V, Balordi F, Takebayashi H, Aja S, Ford E, Fishell G, Blackshaw S (2012). Tanycytes of the hypothalamic median eminence form a diet-responsive neurogenic niche. **Nature Neuroscience** 15(5):700-2
20. Kim JY, Liu CY, Zhang F, Duan X, Wen Z, **Song J**, Feighery E, Lu B, Rujescu D, St Clair D, Christian K, Callicott JH, Weinberger DR, Song H, Ming GL (2012). Interplay between DISC1 and GABA signaling regulates neurogenesis in mice and risk for schizophrenia. **Cell** 148(5):1051-64
21. **Song J\***, Parker L, Hormozi L and Tanouye M (2008). DNA topoisomerase I inhibitors ameliorate seizure-like behaviors and paralysis in a *Drosophila* model of epilepsy. **Neuroscience** 156(3):722-728.
22. **Song J\***, and Tanouye M (2007). Role for *para* sodium channel gene 3' UTR in the modification of *Drosophila* seizure susceptibility. **Dev Neurobiol** 67(14):1944-56.
23. **Song J\***, Hu J and Tanouye M (2007). Seizure suppression by *top1* mutations in *Drosophila*. **J. Neuroscience** 27 (11): 2927-2937.
24. **Song J\*** and Tanouye M (2006). Seizure suppression by *shakB*<sup>2</sup>, a gap junction mutation in *Drosophila*. **J. Neurophysiology** 95 (2): 627-635.

**Reviews and book chapters: (\*: corresponding author, #: equal contribution)**

1. Bao H and **Song J\*** (2018). Treating brain disorders by targeting adult neural stem cells. **Trends in Molecular Medicine**. 24(12): 991-1006 (**Cover article; Featured article of the issue**)
2. Catavero C, Bao H, **Song J\*** (2017). Neural mechanisms underlying GABAergic regulation of adult hippocampal neurogenesis. **Cell and Tissue Research** pp1-14
3. **Song J\***, Olsen RHJ, Sun J, Ming GL, and Song H (2016). Neuronal circuitry mechanisms regulating adult neurogenesis. **Neurogenesis**, **Cold Spring Harbor Press**, edited by Fred Gage, Gerd Kempermann, and Hongjun Song
4. Crowther AJ and **Song J\*** (2014). Activity-dependent signaling mechanisms regulating adult hippocampal neural stem cells and their progeny. **Neuroscience Bulletin** 30(4):542-56

5. **Song J\***, Crowther AJ, Olsen RHJ, Song H, and Ming GL (2014) A diametric mode of neuronal circuitry-neurogenesis coupling in the adult hippocampus via parvalbumin interneurons. *Neurogenesis* 1:e29949
6. **Song J**, Christian K, Ming GL, Song H (2012). Life or death: developing cortical interneurons make their own decision. *EMBO J* 31(23):4373-4
7. Bonaguidi MA<sup>#</sup>, **Song J<sup>#</sup>**, Ming GL, Song H (2012). A unifying hypothesis on mammalian neural stem cell properties in the adult hippocampus. *Curr Opin Neurobiol.* 22(5):754-61
8. **Song J\***, Christian K, Ming GL, Song H (2012). Modification of hippocampal circuitry by adult neurogenesis. *Dev Neurobiol.* 72(7):1032-43
9. **Song J** and Tanouye M (2009). The genetics and molecular biology of seizure-susceptibility in *Drosophila*. In: S Baraban (ed.) *Animal Models of Epilepsy: Methods and Innovations*. Humana Press, Totowa, NJ.
10. **Song J** and Tanouye M (2008). From bench to drug: Human seizure modeling using *Drosophila*. *Progress in Neurobiology* 84(2):182-191.