

CURRICULUM VITAE

CONTACT INFORMATION

Name: Hoonkyo Suh, Ph. D.

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PROFESSIONAL APPOINTMENT

Position: **Associate Staff (2016 -)**

Assistant Staff (Oct 19, 2009 - 2016)

Department of Stem Cell Biology and Regenerative Medicine

Lerner Research Institute

Cleveland Clinic, Cleveland, OH

Assistant Professor (2011 -): Molecular Medicine in

Cleveland Clinic Lerner College of Medicine of

Case Western Reserve University, Cleveland, OH

EDUCATION

1994 **B. S.** Biochemistry, Yonsei University, Seoul, Korea.

1996 University of Utah, Salt Lake City, Utah, Neuroscience Program.

(Transferred to University of Michigan, Ann Arbor, Michigan because it offered my wife's educational opportunities)

2002 **Ph. D.** Neuroscience, University of Michigan, Ann Arbor, Michigan.

(Ph. D. Advisor: Dr. Sally A. Camper, Department of Human Genetics)

POST-GRADUATE TRAINING

2002 Research Associate, University of Michigan, Ann Arbor, Michigan.

(Advisor: Dr. Sally A. Camper)

2003-2009 Postdoctoral Fellow, The Salk Institute, La Jolla, California

(Advisor: Dr. Fred H. Gage)

HONORS AND AWARDS

2005-2007 ASPET-Merck Postdoctoral Fellowship in Integrative Pharmacology

2005 *Molecular Endocrinology* Student Award for an Outstanding Publication

- 2004 The Keystone Symposia Scholarship Award (Stem Cells)
- 2003-2005 Research Grant from Pritzker Neurogenesis Consortium (with two other postdoctoral fellows)
- 2001 Duncan McCarthy Award (Pfizer), Michigan Chapter Society for Neuroscience
- 2000-2001 Rackham Predoctoral Fellowship, University of Michigan
- 1994 Graduation with High Honors, Yonsei University, Seoul, Korea

CHAPTERS IN BOOKS

- 2004 **Suh H**, Martin DM, Charles MA, Nasonkin IO, Gage PJ, **Camper SA**. Role of PITX2 in the pituitary gland. IN: *Molecular Mechanisms of Rieger Syndrome*. (Amendt B, ed.) Landes Bioscience, Georgetown, TX.
- 2002 Camper SA, **Suh H**, Raetzman L, Douglas K, Cushman L, Nasonkin I, Burrows H, Gage P, Martin D. Pituitary Gland Development. (Rossant J, Tam PPL, eds.) Academic Press, NY, 2002, Chapter 20, pp. 499-518.

PUBLICATIONS

1. Zhou, QG., Ro, E., and **Suh, H**. Mapping distinct neural circuits formed by hippocampal newborn neurons located in the dorsal and ventral hippocampus (2016). *Submitted*
2. Zhou, QG., Nemes, A., Ro, E., Najm, N., and **Suh, H**. Aberrant neural circuits formed by neurogenesis underlies epileptogenesis (2016), *Manuscript in preparation*
3. **Suh, H***, Zhou, QG., Carles, C., Ro, E., Marti, F. I., Marti M., Raya A., Gage, F. H., and Consiglio, A* (*, co-corresponding authors) (2016). Long-term labeling and characterization of self-renewing neural stem cells in the adult hippocampus. *Manuscript in preparation*
4. Zhou, QG., Liu, MY., Lee, HW., Ishikawa F, Devkot, Sushil., Han Z., Zhu, LJ., Wu, HY., Shen, XR., Kim WC., Chen C., Jin X., Liu, X., Ro E., Li, H., Zhou HH., Neme A., Hu Y., Luo, CX., **Suh, H***, Zhu DY* (co-corresponding authors) (2016). Hippocampal TERT regulates neural development and spatial memory formation. *In revision in Scientific Reports*.
5. Zhou, QC., Lee, D., Ro, EJ., and **Suh, H** Regional-specific effect of fluoxetine on rapidly dividing progenitors in the dorsoventral axis of the hippocampus. **Sci Rep**, 2016 Oct 19;6:35572 PMID: 27759049
6. Zhou, QC., Wu, HY., Zhou, H., Liu, MY., Lee HW, Liu X, Devkota, S., Ro EJ., Zhu DY., and **Suh, H**. Reactivation of Tert in the medial prefrontal cortex and hippocampus rescues aggression and depression of *Tert*^{-/-} mice. **Translational Psychiatry**. 2016 Jun 14;6(6):e836 PMID:PMC4931604
7. Tashiro A, Zhao C, **Suh H**, Gage FH. Purification and Injection of Retroviral Vectors. *Cold Spring Harb Protoc*. 2015;2015(10):pdb prot086371.
8. Tashiro A, Zhao C, **Suh H**, Gage FH. Imaging Newborn Granule Cells in Fixed Sections. *Cold Spring Harb Protoc*. 2015;2015(10):pdb prot086389.
9. Tashiro A, Zhao C, **Suh H**, Gage FH. Analysis of Spine Motility of Newborn Granule Cells in Acute Brain Slices. *Cold Spring Harb Protoc*. 2015;2015(10):pdb prot086397.

10. Tashiro A, Zhao C, **Suh H**, Gage FH. Preparation and Use of Retroviral Vectors for Labeling, Imaging, and Genetically Manipulating Cells. *Cold Spring Harb Protoc.* 2015;2015(10):pdb top086363.
11. Golub HM, Zhou QG, Zucker H, McMullen MR, Kokiko-Cochran ON, Ro EJ, Nagy LE, **Suh H**. Chronic Alcohol Exposure is Associated with Decreased Neurogenesis, Aberrant Integration of Newborn Neurons, and Cognitive Dysfunction in Female Mice. *Alcohol Clin Exp Res.* Oct 2015;39(10):1967-1977.
12. Zhu LJ, Liu MY, Li H, Liu X, Chen C, Han Z, Wu HY, Jing X, Zhou HH, **Suh H**, Zhu DY, Zhou QG. The different roles of glucocorticoids in the hippocampus and hypothalamus in chronic stress-induced HPA axis hyperactivity. *PLoS One.* 2014;9(5):e97689.
13. Pao GM, Zhu Q, Perez-Garcia CG, Chou SJ, **Suh H**, Gage FH, O'Leary DD, Verma IM. Role of BRCA1 in brain development. *Proc Natl Acad Sci U S A.* Apr 1 2014;111(13):E1240-1248.
14. Vivar C, Potter MC, Choi J, Lee JY, Stringer TP, Callaway EM, Gage FH, **Suh H***, van Praag H*. (*, co-corresponding authors) Monosynaptic inputs to new neurons in the dentate gyrus. *Nat Commun.* 2012;3:1107.
15. Shimozaki K, Zhang CL, **Suh H**, Denli AM, Evans RM, Gage FH. SRY-box-containing gene 2 regulation of nuclear receptor tailless (Tlx) transcription in adult neural stem cells. *J Biol Chem.* Feb 17 2012;287(8):5969-5978.
16. Bracko O, Singer T, Aigner S, Knobloch M, Winner B, Ray J, Clemenson GD, Jr., **Suh H**, Couillard-Despres S, Aigner L, Gage FH, Jessberger S. Gene expression profiling of neural stem cells and their neuronal progeny reveals IGF2 as a regulator of adult hippocampal neurogenesis. *J Neurosci.* Mar 7 2012;32(10):3376-3387.
17. Zhu Q, Pao GM, Huynh AM, **Suh H**, Tonnu N, Nederlof PM, Gage FH, Verma IM. BRCA1 tumour suppression occurs via heterochromatin-mediated silencing. *Nature.* Sep 8 2011;477(7363):179-184.
18. Mira H, Andreu Z, **Suh H**, Lie DC, Jessberger S, Consiglio A, San Emeterio J, Hortiguuela R, Marques-Torrejon MA, Nakashima K, Colak D, Gotz M, Farinas I, Gage FH. Signaling through BMPRII regulates quiescence and long-term activity of neural stem cells in the adult hippocampus. *Cell Stem Cell.* Jul 2 2010;7(1):78-89.
19. Zhao C, **Suh H**, Gage FH. Notch keeps ependymal cells in line. *Nat Neurosci.* Mar 2009;12(3):243-245.
20. **Suh H**, Deng W, Gage FH. Signaling in adult neurogenesis. *Annu Rev Cell Dev Biol.* 2009;25:253-275.
21. **Suh H**, Consiglio A, Ray J, Sawai T, D'Amour KA, Gage FH. In vivo fate analysis reveals the multipotent and self-renewal capacities of Sox2+ neural stem cells in the adult hippocampus. *Cell Stem Cell.* Nov 2007;1(5):515-528.
22. Charles MA*, **Suh H***, Hjalt TA, Drouin J, Camper SA, Gage PJ. PITX genes are required for cell survival and Lhx3 activation. (*,co-first authors) *Mol Endocrinol.* Jul 2005;19(7):1893-1903.
23. Suszko MI, Lo DJ, **Suh H**, Camper SA, Woodruff TK. Regulation of the rat follicle-stimulating hormone beta-subunit promoter by activin. *Mol Endocrinol.* Mar 2003;17(3):318-332.
24. **Suh H**, Gage PJ, Drouin J, Camper SA. Pitx2 is required at multiple stages of pituitary organogenesis: pituitary primordium formation and cell specification. *Development.* Jan 2002;129(2):329-337.
25. Gage PJ, **Suh H**, Camper SA. The bicoid-related Pitx gene family in development. *Mamm Genome.* Feb 1999;10(2):197-200.

26. Gage PJ, **Suh H**, Camper SA. Dosage requirement of Pitx2 for development of multiple organs. *Development*. Oct 1999;126(20):4643-4651.

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INVITED PRESENTATION

- 2014 **Tulane University**, New Orleans, LA. "Understanding hippocampal neural circuits and function"
- 2014 **Cleveland State University**, Cleveland, OH. "Understanding hippocampal neural circuits and function"
- 2013 **Mayo Clinic**, Rochester, MN. "Mapping neural circuits formed by hippocampal newborn neurons: building the information superhighway"
- 2011 **University of Illinois at Urbana-Champaign**, Urbana, IL. "Mapping Neurogenesis induced neural circuits in the adult hippocampus"
- 2011 **National Center for Regenerative Medicine**, Cleveland OH. "Neurogenesis-induced neural circuit formation in the adult hippocampus"
- 2010 **The University of Michigan**, Ann Arbor, Neuroscience Program. "Neurogenesis-induced neural circuit formation".
- 2010 **Cleveland Clinic**, Cleveland, Department of Neurology, "Adult neurogenesis in the hippocampus"
- 2009 **New York Neural Stem Cell Institute**, Albany, NY, "Fate analyses of hippocampal neural stem cells"
- 2009 **Rutgers University**, NJ, "Fate analyses of hippocampal neural stem cells"
- 2008 **University of Iowa**, Iowa City, IA, "Fate analyses of neural stem cells in the adult brain"
- 2008 **University of Texas**, Houston, TX, "Fate analyses of neural stem cells in the adult brain"
- 2008 **Baylor College of Medicine**, Houston, TX, "Fate analyses of adult neural stem cells in the hippocampus"
- 2007 **Society for Neuroscience**, San Diego, CA. 4th Annual Chris Reeve "Hot Topics in Stem Cell Biology" Symposium. In vivo fate analysis reveals the multipotent and self-renewal capacities of Sox2+ neural stem cells in the adult hippocampus
- 2002 **Molecular Mouse Genetics meeting in Cold Spring Harbor**, New York. Variation in PITX2 levels affects pituitary development by influencing expression of lineage specific transcription factors
- 2001 **Great Lakes Mammalian Development Meeting**, Toronto, Ontario, Canada. Pituitary gland development and hormone production are sensitive to Pitx2 dosage.
- 2001 **Michigan Chapter Society for Neuroscience**. East Lansing, Michigan. Pitx2 is required at multiple stages of pituitary organogenesis: formation of the pituitary primordium and cell specification.

SELECTED MEETING ABSTRACTS

- H. M. Golub, Q. Zhou, H. Zucker, M. R. McMullen, O. N. KokikoCochran, E. Ro, L.E. Nagy, and **H. Suh**. 2015. The effect of chronic alcohol exposure on hippocampal neurogenesis and cognitive function. Research society on Alcoholism, San Antonio, TX
- Carmen Vivar, Jiwon Choi, Edward M. Callaway, Fred H. Gage, **Hoonkyo Suh**, Henriette van Praag. 2012. Afferent input integrates newborn dentate granule cells into the existing adult network. **Society for Neuroscience**, Washington DC, *Poster presentation*.
- Hoonkyo Suh**, Antonella Consiglio, Jasodhara Ray, Toru Sawai, Kevin A. D'Amour, and Fred H. Gage. 2007. *In vivo* fate analysis reveals the multipotent and self-renewal capacities of *Sox2*⁺ neural stem cells in the adult hippocampus. **Society for Neuroscience**, San Diego, CA. *Poster presentation*.
- Hoonkyo Suh**, Jasodhara Ray, Kevin A. D'Amour, and Fred H. Gage. 2004. *Sox2* as an indicator of adult neural stem cells. **Stem Cells Keystone Symposia**, Keystone, CO. *Poster presentation*.
- Sandrine Thuret, **Hoonkyo Suh**, Jasodhara Ray, Kevin A. D'Amour and Fred H. Gage. 2004. *In vivo* and *in vitro* characterization of *Sox2* expressing cells in the mouse adult spinal cord. **Society for Neuroscience**, San Diego, CA.
- Sally A. Camper, Robert D. Ward, Michelle L. Brinkmeier, Igor O. Nasonkin, Amanda H. Vesper, Mary Anne Potok, Brandon M. Stone, Felix Beuschlein, **Hoonkyo Suh**, Gary D. Hammer, Lori T. Raetzman. 2004. Molecular Basis of Pituitary Dysfunction: Mechanism of PROP1 Action. **International Mouse Genome Conference**, Seattle, WA.
- Robert D. Ward, Lori T. Raetzman, **Hoonkyo Suh**, Brandon M. Stone, Igor O. Nasonkin, Sally A. Camper. 2004. Growth of the pituitary anterior lobe. **Annual Meeting of the Endocrine Society**, New Orleans, Louisiana.
- Sally A. Camper, Robert D. Ward, Michelle L. Brinkmeier, Igor O. Nasonkin, Amanda H. Vesper, Mary Anne Potok, Brandon M. Stone, Felix Beuschlein, **Hoonkyo Suh**, Gary D. Hammer, Lori T. Raetzman. 2004. Genetic Causes of Hypopituitarism: Molecular Basis of Pituitary Dysfunction: Mechanism of PROP1 action. **International Congress of Endocrinology**, Lisbon, Portugal.
- Sally A Camper, Michelle L Brinkmeier, Kelly B Cha, Michael Charles, Philip J Gage, Donna M Martin, Igor Nasonkin, Mary Anne Potok, Lori T Raetzman, Thomas L Saunders, Jennifer Skidmore 1, **Hoonkyo Suh**, Amanda Vesper, Robert D Ward. 2003. Transcription Factors and Pituitary Development. **Annual Meeting of the Endocrine Society**, Philadelphia, PA
- Hoonkyo Suh**, Philip J. Gage, Jacques Drouin, and Sally A. Camper. 2001. *Pitx2* is required at multiple stages of pituitary organogenesis: pituitary primordium formation and cell specification. **Developmental Biology Gordon Conference**, Andover, NH. *Poster presentation*.
- Hoonkyo Suh**, Philip J. Gage, and Sally A. Camper. 2000. Pituitary gland development and hormone production are sensitive to *Pitx2* dosage. **Society for Developmental Biology Annual Meeting**, Denver, Co. *Poster presentation*.

Hoonkyo Suh, Philip J. Gage, and Sally A. Camper. 1999. Genetic analysis of a bicoid related homeobox gene, *Pitx2*. **Hormone Action Gordon Conference**, Meriden, NH. *Poster presentation*.

Hoonkyo Suh, Philip J. Gage, and Sally A. Camper. 1999. Genetic analysis of the bicoid-related homeobox gene *Pitx2* in pituitary gland development. **Annual Great Lakes Mammalian Development Meeting**, Toronto, Canada. *Poster presentation*.

Philip J. Gage, **Hoonkyo Suh**, Lisa J. Cushman, Igor O. Nasonkin, and Sally A. Camper. 1999. Genetic analysis of the bicoid-related homeobox gene *Pitx2* in pituitary development. **Annual Meeting of the Endocrine Society**, San Diego, CA.

Philip J. Gage, **Hoonkyo Suh**, and Sally A. Camper. 1999. Genetic analysis of the bicoid-related homeobox gene *Pitx2*. **Society of Developmental Biology Annual Meeting**, Charlottesville, Virginia. *Poster presentation*.

Sally A. Camper, Dawn E. Watkins-Chow, Heather L. Burrows, Kristin R. Douglas, Michelle L. Brinkmeirer, **Hoonkyo Suh**, Lisa J. Cushman, and Philip J. Gage. 1998. Homeobox genes in pituitary development. **Annual Meeting of the Endocrine Society**, New Orleans, Louisiana.

Sally A. Camper, Dawn E. Watkins-Chow, Heather L. Burrows, Kristin R. Douglas, Michelle L. Brinkmeirer, **Hoonkyo Suh**, Lisa J. Cushman, and Philip J. Gage. 1998. Homeobox genes in pituitary development. **Mouse Molecular Genetics meeting**, Cold Spring Harbor, New York.

Professional Service

Ad Hoc Peer reviewer for the following journals:

- Cell Stem Cell
- WIREs Developmental Biology
- Brain Structure and Function
- Journal of American Physiology
- Journal of Visualized Experiments
- Cell and Tissue Research
- Stem Cells
- PLOS One
- Brain Research
- Journal of Neural Transmission
- Neuroscience Letter

Grant Review/ Study Section Membership

- Louisiana Board of Regent's Reserch Competitiveness Subprogram (2014)
- Grant Review Committee, American Heart Association (2011)
- MRC Career Development Award (March 2011)

Committee Service

- LRI postdoctoral Steering Committee (2010-)
- Department of Cellular and Molecular Medicine, Reviewer for Departmental 2014 Elsa Albrecht Research Achievement Award for Research Associates/Project Staff/Scientists

Educational/Teaching Activities

Thesis Committee:

- Daniel Margevicius, Molecular Medicine, 2012- 2015

Postdoctoral Fellows

- Hai Zhang, Ph. D. 2016 - current
- Daehoon Lee, Ph. D. 2015 - current
- Qi-Gang Zhou, Ph. D., 2013 – 2016, Current Position: Associate Professor at Nanjing Medical School, China
- Ji-Young Lee, Ph. D. 2010 - 2013, Current Position: Research Scientist at KIST, Seoul Korea

Technicians

- Eun Jeoung Ro, 2014 - current
- Haleigh Golub, 2010 – 2013, Current Position: Master Student in Ohio State University, Nutrition

Volunteer mentor for students:

Graduate Students

- Sidra Speaker: CCLCM of CWRU, 2016
- Katie Sears, Molecular Medicine, CCF, 2014 (Co PI with Dr. Jan Jensen)
- Nadia Lachkar, University of Twente, Netherland, 2012 (June-August)
- Fabrizio Galimberti: CCLCM of CWRU, 2011
- Kristin Park: University of California at San Diego, Department of Biological Sciences, 2008

Undergraduate Students

- Yuna Jung, CWRU, 2016 - current
- Hannah Zucker: Hamilton University, 2013 summer
- Hannah Zucker: Hamilton University, 2012 summer
- Sharvari Dharmaiah: CWRU, 2011 to 2013
- Sean Dwijendra: CWRU, 2010 to 2012, Current Position: Teach For America (Chicago)
- Ki-Dan Kim: CWRU, 2010
- Rachel Belzer: Duke University, 2008

- Colleen Stinson: University of California at San Diego, 2006-2007
- Stephanie See: Wellesley College, 2007
- Sally Liu: Duke University, 2006
- Leigh Fritz: Harvard University, 2005
- Firouz Mohsenian: San Diego State University, 2004

Volunteers

- Eun Jeoung Ro, 2013 - 2014

Research Support

Ongoing

- **R01AA022377-01** 09/01/14-08/31/19
National Institutes of Health
Alcohol induced neurogenesis
Role: **Principal investigator**
Total Direct Costs: \$225,000; Sept 1, 2014 – Aug 30, 2019,
PI: Hoonkyo Suh
- **Hartwell Foundation**
Total Direct Cost: \$100,000/year; May, 2016 – Apr, 2019
Role: Principal investigator
Title: Hippocampal nerve cell networks in autism spectrum disorder

Completed

- **American Federation for Aging Research**
Total Direct Costs: \$100,000; Oct 1, 2012 – Sept 30, 2014, PI: Hoonkyo Suh
Title: Determine neurogenesis-induced neural circuits in the aged mice
- **Whitehall Foundation**
2014-2017, \$75,000 (This contract had a contingency: the fund is available until I receive a major fund (>\$200,000). Since R01 was awarded, this fund was awarded only for first year)
Title: Functional heterogeneity of adult hippocampal neurogenesis
Role: PI