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## BIOGRAPHICAL SKETCH

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NAME <b>Anirvan Ghosh</b>	POSITION TITLE <b>Stephen Kuffler Professor of Biology</b>		
eRA COMMONS USER NAME aghost1			
EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)</i>			
INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	YEAR(s)	FIELD OF STUDY
California Inst. of Technology, Pasadena CA	B. S	1981-1985	Physics
Stanford University, Stanford, CA	Ph. D	1985-1991	Neuroscience Advisor: C.J. Shatz
Harvard Medical School, Boston, MA	Postdoc	1991-1995	Mol. Neuroscience Advisor: M.E. Greenberg

### A. Personal Statement

Research in our lab is directed at understanding the development and function of neural circuits. Our research interests include the identification and characterization of genes that regulate synapse formation, function, and stability, and the investigation of molecular mechanisms underlying the activity-dependent development of neuronal connections. We use a combination of cellular, molecular, and electrophysiological approaches to address these questions. The lab has made several major contributions to the understanding of mechanisms that underlie neuronal connectivity, which are reflected in a rich publication record, including papers in *Science*, *Nature*, *Neuron*, *Nature Neuroscience*, and *Journal of Neuroscience*.

### B. Positions and Honors

#### Academic Positions

9/95-2/00: Assistant Professor, Department of Neuroscience,  
Johns Hopkins University School of Medicine  
3/00-6/03 Associate Professor, Department of Neuroscience,  
Johns Hopkins University School of Medicine  
7/03-present Stephen Kuffler Professor of Neurobiology  
University of California San Diego

#### University/Professional Service

2002-2003 Chair, Johns Hopkins Medical School Council  
1999-2002 Society for Neuroscience Annual Meeting Program Committee  
2003-2004 Admissions Committee, UCSD/Salk Neurosciences Graduate Program  
2001-2005 Member of NIH study section NDPR  
2004-2010 Director, UCSD/Salk Neurosciences Graduate Program  
2004-2010 Associate Editor, *Journal of Neuroscience*  
2006, 2008 Co-chair, CSHL meeting on Axon Guidance, Synaptogenesis, and Neural Plasticity  
2007, 2009 Co-chair, Gordon Conference on Dendrites  
7/08-present Chair, Neurobiology Section, Division of Biological Sciences, UCSD  
9/09-present Co-Director, Center for Neural Circuits and Behavior, UCSD

#### Honors

1984-1985: Caltech Prize Scholarship; Graduated with honor in Physics  
1990-1991: Giannini Foundation Postdoctoral Research Fellowship  
1991-1994: Damon Runyon-Walter Winchell Cancer Research Fund Postdoctoral Fellowship  
1994-1995: Medical Foundation Postdoctoral Fellowship  
1995-1997: Damon Runyon Scholar Award

1996-1999:	EJLB Foundation Scholar Research Award
1996-1999:	Klingenstein Fellowship Award in Neuroscience
1996-1998:	Alfred P. Sloan Research Fellow
1997-2001:	Pew Scholar Award
1997:	Presidential Early Career Award for Scientists and Engineers
2000:	John Merck Scholar Award
2001:	Society for Neuroscience Young Investigator Award
2003:	Stephen Kuffler Professorship, University of California San Diego
2008:	UCSD Revelle College Outstanding Faculty Award

### C. Publications

1. McConnell, S.K., **A. Ghosh** and C.J. Shatz (1989). Subplate neurons pioneer the first axon pathway from the cerebral cortex. **Science** 245: 978-982.
2. **Ghosh, A.**, A. Antonini, S.K. McConnell and C.J. Shatz (1990). Requirement for subplate neurons in the formation of thalamocortical connections. **Nature** 347: 179-181
3. Shatz, C.J., **A. Ghosh**, S.K. McConnell, K.L. Allendoerfer, E. Friauf and A. Antonini (1991). Pioneer neurons and target selection in cerebral cortical development. in **Cold Spring Harbor Symp. Quant. Biol.** 55: 469-480.
4. Shatz, C.J., **A. Ghosh**, S.K. McConnell, K.L. Allendoerfer, E. Friauf and A. Antonini (1991). Subplate neurons and the development of neocortical connections. in **Development of the Visual System**, D.M. Lam and C.J. Shatz, eds (MIT Press).
5. **Ghosh, A.** and C.J. Shatz (1992). Pathfinding and target selection by developing geniculocortical axons. **J. Neurosci.** 12:39-55.
6. **Ghosh, A.** and C.J. Shatz (1992). Involvement of subplate neurons in the formation of ocular dominance columns. **Science** 255:1441-1443.
7. **Ghosh, A.** and C.J. Shatz (1993). A role for subplate neurons in the patterning of connections from thalamus to cortex. **Development** 117:1031-1047.
8. McConnell, S.K., **A. Ghosh** and C. J. Shatz (1994). Subplate pioneers and the formation of descending connections from cerebral cortex. **J. Neurosci.** 14:1892-1907
9. Dalva, M.B., **A. Ghosh** and C.J. Shatz (1994). Independent control of dendritic and axonal form in the developing lateral geniculate nucleus. **J. Neurosci.** 14:3588-3602
10. **Ghosh, A.** and C.J. Shatz (1994). Segregation of geniculocortical afferents during the critical period: a role for subplate neurons. **J. Neurosci.** 14:3862-3880
11. **Ghosh, A.**, J. Carnahan and M.E. Greenberg (1994). Requirement for BDNF in activity-dependent survival of cortical neurons. **Science** 263:1618-1623.
12. **Ghosh, A.**, D.D.Ginty, H. Bading and M.E. Greenberg (1994). Calcium regulation of gene expression in neuronal cells. **J. Neurobiol.** 25:294-303.
13. Farnsworth, C.L., N.W. Freshney, L.B. Rosen, **A. Ghosh**, M.E. Greenberg and L.A. Feig (1995). Calcium activation of Ras mediated by neuronal exchange factor Ras-GRF. **Nature** 376:524-527.
14. **Ghosh, A.** and M.E. Greenberg (1995). Distinct roles for bFGF and NT3 in the regulation of cortical neurogenesis. **Neuron** 15:89-103.
15. **Ghosh, A.** (1995). Subplate neurons and the patterning of thalamocortical connections. **Proceedings of the Ciba Foundation Symposium on Cortical Development**
16. **Ghosh, A.** and Greenberg, M.E. (1995). Calcium signaling in neurons: molecular mechanisms and cellular consequences. **Science** 268:239-247.
17. **Ghosh, A.** (1996). Cortical development: With an eye on neurotrophins. **Current Biology** 6:130-133.
18. Threadgill, R., Bobb, K. and **A. Ghosh** (1997). Regulation of dendritic growth and remodeling by Rho, Rac, and Cdc42. **Neuron** 19:625-634.
19. **Ghosh, A.** (1997). Axons follow Reelin routes. **Nature** 385:23-24.
20. Shieh, P. B. and **A. Ghosh** (1997). Neurotrophins: New roles for a seasoned cast. **Current Biology** 7:627-630.

21. Shieh, P.B., Hu, S.-C., Timmusk, T., and **A. Ghosh** (1998). Identification of a signaling pathway involved in calcium regulation of BDNF expression. **Neuron** 20:727-740.
22. Polleux, F., R.J. Giger, D.D. Ginty, A.L. Kolodkin, and **A. Ghosh** (1998). Patterning of cortical efferent projections by semaphorin-neuropilin interactions. **Science** 282:1904-1906.
23. **Ghosh, A.** and A.L. Kolodkin (1998). Specification of neuronal connectivity: ETS marks the spot. **Cell** 95:303-306.
24. Hu, S.-C., J. Chrivia and **A. Ghosh** (1999). Regulation of CBP-mediated transactivation by neuronal calcium signaling. **Neuron** 22:799-808.
25. Shieh, P. B. and **Ghosh, A.** (1999). Molecular mechanisms underlying activity-dependent regulation of BDNF expression. **J. Neurobiol.** 41:127-134.
26. Redmond, L.J., S.-R. Oh, C. Hicks, G. Weinmaster, and **A. Ghosh** (2000). Nuclear Notch1 signaling and the regulation of dendritic development. **Nature Neuroscience** 3:30-40.
27. Polleux, F., T. Morrow and **A. Ghosh** (2000). Semaphorin 3A is a chemoattractant for developing cortical dendrites. **Nature (research article; cover)** 404:567-573.
28. **Ghosh, A.** (2000). Dendritic Growth: Don't go says Flamingo. **Neuron** 28:3-4.
29. Dickson, B.J., H.Cline, F. Polleux and **A. Ghosh** (2001). New directions in axon guidance. **EMBO Reports** 2:182-186.
30. Redmond, L. and **A. Ghosh** (2001). The role of Notch and Rho GTPase signaling in the control of dendritic development. **Curr. Opin. Neurobiology** 11:111-117.
31. Morrow, T., M.-R. Song and **A. Ghosh** (2001). Sequential specification of neurons and glia by developmentally regulated extracellular factors. **Development** 128:3585-3594.
32. Whitford, K.L. and **A. Ghosh** (2001). Plexin signaling via Off-track and Rho family GTPases. **Neuron** 32:1-8.
33. Whitford, K.L., V. Marillat, E. Stein, C. S. Goodman, M. Tessier-Lavigne, A. Chedotal and **A. Ghosh** (2002). Regulation of cortical dendrite development by Slit-Robo interactions. **Neuron** 33:47-61.
34. **Ghosh, A.** (2002) Learning more about NMDA receptor regulation. **Science** 295:449-451.
35. Whitford, K.L., P. Dijkhuizen, F. Polleux, and **A. Ghosh** (2002). Molecular control of cortical dendrite development. **Ann. Rev. Neurosci.** 25:127-149.
36. Polleux, F., Whitford, K.L., Dijkhuizen, P.A., Vitalis, T., and **A. Ghosh** (2002) Control of cortical interneuron migration by neurotrophins and PI 3-kinase signaling. **Development** 129:3147-3160.
37. Redmond, L., Kashani, A., and **A. Ghosh** (2002). Calcium regulation of dendritic growth via Cam kinase IV and CREB-mediated transcription. **Neuron** 34:999-1010.
38. Polleux, F. and **A. Ghosh** (2002) The Slice Overlay Assay: A Versatile Tool to Study the Influence of Extracellular Signals on Neuronal Development. **Science's STKE** | 11 June 2002
39. Wong, R. O. L. and **A. Ghosh** (2002) Activity-dependent regulation of dendritic growth and patterning. **Nature Reviews Neurosci.** 3:803-812.
40. Aizawa, H., Hu, S-C, Bobb, K., Balakrishnan, K., Ince, G., Gurevich, I., Cowan, M., and **A. Ghosh** (2004). Dendrite development regulated by CREST, a calcium-regulated transcription activator. **Science (research article; cover)** 303:197-202.
41. Fenstermaker V, Chen Y, **Ghosh A**, R. Yuste (2004). Regulation of dendritic length and branching by semaphorin 3A. **J Neurobiol** 58(3):403-412.
42. Song, M.-R. and **A. Ghosh** (2004). FGF2-induced chromatin remodeling regulates CNTF-mediated gene expression and astrocyte differentiation. **Nature Neuroscience** 7(3):229-235
43. Dijkhuizen, P.A. and **A. Ghosh** (2005) BDNF regulates primary dendrite formation in cortical neurons via the PI3-Kinase and MAP Kinase signaling pathways **J. Neurobiol.** 62(2):278-288..
44. Chen, Y. and **A. Ghosh** (2005). Regulation of cortical dendrite development by Rap1 signaling. **Mol. Cell. Neurosci.** 28(2):215-228
45. Dijkhuizen, P.A. and **A. Ghosh** (2005). Regulation of dendritic growth by calcium and neurotrophin signaling. In "Development, dynamics, and pathology of neuronal networks: from molecules to functional circuits". (J. van Pelt, ed., Elsevier)
46. Kim, P.M., Aizawa, H., Kim, P.S., Huang, A.S., Wickramasinghe, S.R., Kashani, A.H., Barrow, R.K., Haganir, R.H., **Ghosh, A.**, and S.D. Snyder (2005). Serine Racemase: Activation by glutamate neurotransmission via GRIP and mediation of neuronal migration. **PNAS** 102:2105-2110.

47. Redmond, L. and **A. Ghosh** (2005) Regulation of dendritic development by calcium signaling. **Cell Calcium** 37:411-416.
48. Konur, S. and **A. Ghosh** (2005) Calcium signaling and the control of dendritic development. **Neuron** 48:401-405.
49. Chen, Y. and **A. Ghosh** (2005). Regulation of dendritic development by neuronal activity. **J. Neurobiol.** 64:4-10.
50. Ince-Dunn, G., Hall, B.H., Hu, S-C., Ripley, B., Hugarir, R.L., Olson, J.M., and **A. Ghosh** (2006). Regulation of thalamocortical patterning and synaptic maturation by NeuroD2. **Neuron (cover)** 49:683-695.
51. Kashani, A.H., Qiu, Z., Jurata, L., Lee, S.-K., Pfaff, S, Goebbels, S., Nave, K.-A., and **A. Ghosh** (2006). Calcium activation of the LMO4 transcription complex and its role in the patterning of thalamocortical connections. **J. Neurosci.** 26:8398-8408.
52. Polleux, F., Ince-Dunn, G., and **A. Ghosh** (2007). Transcriptional regulation of axon guidance and synapse formation. **Nature Reviews Neuroscience** 8:331-340.
53. Davis, E.K. and **A. Ghosh** (2007). Should I stay or should I go: Wnt signals at the synapse. **Cell** 130:593-596.
54. Wu JI, Lessard J, Olave IA, Qiu Z, **Ghosh A**, Graef IA, Crabtree GR (2007). Regulation of dendritic development by neuron-specific chromatin remodeling complexes. **Neuron.** 56(1):94-108.
55. Hall, BJ, Ripley B, **A. Ghosh** (2007). NR2B signaling regulates the development of synaptic AMPA receptor current. **J Neurosci.** 27(49):13446-56
56. Ultanir SK, Kim JE, Hall BJ, Deerinck T, Ellisman M, **A. Ghosh** (2007). Regulation of spine morphology and spine density by NMDA receptor signaling in vivo. **Proc Natl Acad Sci U S A.** 104(49):19553-8.
57. Polleux, F., **A. Ghosh** (2008). Molecular determinants of dendrite and spine development. In **Dendrites**, 2<sup>nd</sup> Ed. Oxford University Press.
58. Cline, H., **Ghosh, A.**, Jan, Y-N. (2008) Dendritic Development. In **Fundamental Neuroscience**, 3<sup>rd</sup> Ed. Elsevier
59. Hall, B.J. and **A. Ghosh** (2008) Regulation of AMPA receptor recruitment at developing synapses. **Trends in Neurosci.** 31(2):82-89.
60. Qiu, Z. and **A. Ghosh** (2008) A brief history of neuronal gene expression: regulatory mechanisms and cellular consequences. **Neuron** 60:451-455.
61. Davis, E.K., Zou, Y., and **A. Ghosh** (2008) Wnts acting through canonical and non-canonical pathways exert opposite effects on hippocampal synapse formation. **Neural Development** 3:32
62. Qiu, Z. and **A. Ghosh** (2008) A calcium-dependent switch in a CREST-BRG1 complex regulates activity-dependent gene expression. **Neuron** 60:775-787.
63. Yuan, S.H., Qiu, Z. and **A. Ghosh** (2009). TOX3 regulates calcium-dependent transcription in neurons. **Proc Natl Acad Sci USA** 24;106(8):2909-14.
64. Scobie KN, Hall BJ, Wilke SA, Klemenhausen KC, Fujii-Kuriyama Y, **Ghosh A**, Hen R, Sahay A. (2009) Krüppel-like factor 9 is necessary for late-phase neuronal maturation in the developing dentate gyrus and during adult hippocampal neurogenesis. **J Neurosci.** 29(31):9875-87.
65. de Wit, J., Sylwestrak, E., O'Sullivan, M., Otto, S., Tiglio, K., Savas, JN, Yates III, J., Comoletti, D., Taylor, P., **A. Ghosh**, (2009) LRRTM2 interacts with Neurexin1 and Regulates Excitatory Synapse Formation. **Neuron** 64:799-806.
66. Williams, ME, de Wit, J, and **A. Ghosh** (2010). Molecular Mechanisms of Synaptic Specificity in Developing Neural Circuits. **Neuron** 68:9-18.
67. Ripley\*, B., S. Otto\*, Tiglio, K., Williams, M., and **A. Ghosh** (2010) Regulation of presynaptic stability by AMPA receptor reverse signaling. **Proc. Natl Acad Sci USA** (in press)
68. J-E Kim, M O'Sullivan, C. A. Sanchez, M. Hwang, M. Israel, K. Brennand, T. Deerinck, L. S. B. Goldstein, F. H. Gage, M. H. Ellisman, and **A. Ghosh** (2010) Investigating Synapse Formation and Function Using Human ES and iPS Cell-derived Neurons. **Proc. Natl. Acad Sci USA** (in press)