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Nathan E. Schoppa, Ph.D.

Curriculum Vitae

Current Position

Professor, Physiology and Biophysics
University of Colorado, Anschutz Medical Campus
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Education History

B.A., Biology, 1987
University of Chicago, Chicago, IL

Ph.D., 1995
Yale University, New Haven, CT
Cellular and Molecular Physiology (mentor: Dr. Fred Sigworth)

Postdoctoral training, 1995-2001
Oregon Health Sciences University, Portland, OR
Vollum Institute (mentor: Dr. Gary Westbrook)

Academic appointments

2002	Research Assistant Professor Vollum Institute, Oregon Health Sciences University, Portland, OR
2003-2008	Assistant Professor, tenure-track Department of Physiology and Biophysics University of Colorado School of Medicine (UCSOM), Aurora, CO
2008-2013	Associate Professor, tenured Department of Physiology and Biophysics, UCSOM
2013-pr	Professor, tenured Department of Physiology and Biophysics, UCSOM

Leadership and Service, National and International

2003-pr	Ad hoc manuscript reviewer for *Science, Nature, Nature Communications, Nature Neuroscience, Neuron, Cell Reports, eLife, Journal of Neuroscience, Journal of Neurophysiology, Learning and Memory, PLoS Biology, Journal of Computational Neuroscience, Cerebral Cortex, Chemical Senses, Trends in Neuroscience, Journal of Comparative Neurology, Journal of Experimental Neurology, Frontiers in Neuroscience, Frontiers in Computational Neuroscience*
2005-2011	NSF Collaborative Research Grants Review Panel, ad hoc reviewer
2006	NIH, NIGMS Fellowship Review Panel, ad hoc reviewer

2007-2011	British Medical Research Council Fellowship Review panel, ad hoc reviewer
2008-2015	NIH, NIDCD Fellowship Program Review Panel, ad hoc reviewer
2010-2011	Israel Science Foundation Multi-PI Grant Review Panel, ad hoc reviewer
2012-2018	NIH Somatosensory and Chemosensory Systems (SCS) Study Section that reviews R01 proposals, ad hoc reviewer
2013-2014	NIH, NIDCD Small Grants (R03, R13) Study Section, ad hoc reviewer
2014	Wellcome Trust, Sir Henry Dale Fellowship Review Panel, ad hoc reviewer
2015	Member, Grant Review Panel for NSF Integrative Organismal System Cluster
2017	NIH Integrative, Functional, and Cognitive Neuroscience (IFCN) Study Section, ad hoc reviewer
2018	NSF, Division of Environmental Biology, ad hoc grant reviewer
2018-2024	Reviewing Editor, *Journal of Physiology*
2019	NIH F03A Fellowship Review panel, ad hoc reviewer
2020-2021	NIH, NIDCD CDRC Review panel that reviews fellowship applications, ad hoc reviewer
2021	NIH F03A Fellowship Study Section, ad-hoc reviewer
2021-2022	NIH ZRG1 IFCN-J Special Emphasis Panel for Pain, Chemosensation, and Sensory Motor Neurobiology, ad-hoc reviewer
2023	NIH ZRG1 AN H55 Special Emphasis Panel for Research on Alzheimer's Disease and its Related Dementias, ad-hoc reviewer
2024-pr	Chair, NIH Z46 Chemical Senses Fellowship Review panel
2024	NIH ZNS1 SRB4 Advanced T32 Review panel (for NINDS), ad hoc reviewer
2024-pr	Senior Editor, *Journal of Physiology*

Leadership and Service, University of Colorado Anschutz Medical Campus

2004-2006	Chair, Neuroscience Graduate Program (NSP) Retreat Committee
2008-2012	Chair, NSP Curriculum Committee
2008-2018	Six Faculty Search Committees, Department of Physiology and Biophysics; Chair of four of the Committees
2009-2014	Chair, Mentoring Committees for three Research Assistant Professors or Instructors in Physiology and Biophysics
2011-pr	Chair, Faculty Promotions Committee, Department of Physiology and Biophysics
2011-2012	Chair, Training Subcommittee for Basic Neuroscience Advanced Training Program
2012-2014	MSTP Admissions Committee
2012-2020	Member, UCSOM Medical Student Promotions Committee
2015-pr	Member, UCSOM Faculty Affairs Liaison Committee
2015-2020	Chair, Graduate Training Committee for Neuroscience Program
2016-pr	Vice-Chair, Department of Physiology and Biophysics
2020-2024	Co-Director, Neuroscience Graduate Program
2025	Member, UCSOM Rules and Governance Committee

Professional Memberships and Honors

1986-1987	Phi Beta Kappa, University of Chicago.

1986-1987	Barton Scholarship for Excellence in Biological Sciences, University of Chicago.
1988-1990	National Science Foundation fellowship for graduate students.
1995-pr	Member of Society for Neuroscience
1996-1999	NIH National Research Service Award fellowship for postdoctoral research.
2005-pr	Member of Association for Chemoreception Sciences

Didactic Teaching Activities

UCAMC

2004-pr	Lecturer and discussion leader for Cellular and Molecular Neurobiology course, (NRSC 7600); two sessions on Synaptic Integration
2005-2016	Lecturer in the Cardiovascular/Pulmonary/Renal course (IDPT 5005) for first-year medical students; 7-9 lectures/year on pulmonary physiology
2005-2016	Lecturer in Physiology Course for dental and physical therapy students (DSBS 5508 and DPTR 5006); six lectures/year on pulmonary physiology
2005-2008	Sub-block Co-Director for Medical School Curriculum Committee, Pulmonary sub-block of Cardiovascular/Pulmonary/Renal block
2006-2010	Course Director of Cellular and Molecular Neurobiology course (NRSC 7600)
2006-2013	Course Director for Advanced Topics in Cell Signaling course (PHSL 7840)
2010-2013	Lecturer for Neuroscience Course for Bioengineering students (BIOE 5011)
2017-pr	Lecturer in Nervous System Block for medical students; two lectures/year on temperature sensing and pain
2018-pr	Lecturer and discussion leader for Fundamentals of Neurobiology (NRSC 7610); one session on olfaction

International Courses

2015	Instructor, Optogenetics Workshop, University of Santiago, Chile

Mentoring Activities at University of Colorado Anschutz Medical Campus

Past and current full-time PhD students in lab

David Gire, Neuroscience Graduate Program (NSP; supported by NRSA F31)
Ph.D. awarded in 2009

Tom McTavish, Computational Bioscience Program (supported by NRSA F31)
Ph.D. awarded in 2009 (co-advised with Dr. Diego Restrepo)

Sruthi Pandipati, Medical Scientist Training Program (MSTP; supported by NRSA F30)
Ph.D. awarded in 2011

Jennifer Whitesell, NSP (supported by NRSA F31)
Ph.D. awarded in 2012

Joseph Zak, NSP (supported by NRSA F31)
Ph.D. awarded in 2015

Shelly Jones, NSP (supported by NRSA F31)
Ph.D. awarded in 2020

Past and current post-doctoral fellows in lab

Dr. Victor Luna, Ph.D. 2006-2008
Dr. David Sheridan, Ph.D. (supported by NRSA F32) 2008-2012
Dr. Frederic Pouille, Ph.D. 2012-pr
Dr. Jennifer Bourne, Ph.D. 2012-2021
Dr. Praveen Kuruppath, Ph.D. 2018-pr
Dr. Lin Xin, Ph.D. 2022-2023

Rotation students (name, program, year)
David Gire, NSP, 2004
Sruthi Pandipati, MSTP, 2007
Rinaldo D'Souza, Physiology and Biophysics, 2007
Mandolyn Vendela, NSP, 2008
Jennifer Whitesell, NSP, 2008
Joseph Zak, Physiology and Biophysics, 2009
Pirooz Parsa, Physiology and Biophysics, 2010
Britni Sanchez, Biomedical Sciences Graduate Program, 2012
Jeffrey Forte, NSP, 2012
Jacki Essig, NSP, 2014
Noah Goodson, NSP, 2015
Shelly Jones, NSP, 2016

Ph.D. thesis advisory committees (name, program, role on committee)
Silvio Rizzoli, Physiology and Biophysics, member
Neal Beeman, Physiology and Biophysics, member
Brian Gulbransen, NSP, member
David Gire, NSP, member
Anthony Oliva, MSTP and NSP, member
Kartik Sivaraaman, Physiology and Biophysics, **chair**
Audrey Brumback, MSTP and NSP, member
Chris Dulla, NSP, member
Michael Gaffield, Physiology and Biophysics, member
Wilder Doucette, MSTP and NSP, **chair**
Clint Perry, Physiology and Biophysics, member
Sruthi Pandipati, MSTP and NSP, member
Tom Mctavish, Computational Bioscience, member
Arun Pores-Fernando, Physiology and Biophysics, member
Elizabeth Stubblefield, Pharmacology, member
Kurt Davies, Pharmacology, member
Jonah Scott-McKean, NSP, member
Arisa Oshimoto, NSP, **chair**
Jennifer Whitesell, NSP, member
Heath Jones, NSP, member
Rinaldo D'Souza, Physiology and Biophysics, **chair**
Jennifer Thornton, NSP, **chair**

Otto Albrecht, Physiology and Biophysics, **chair**
Tara Martin, MSTP and NSP, member
Pirooz Parsa, Physiology and Biophysics, **chair**
Christy Beitzel, NSP, member
Ted Doykos, NSP, **chair**
Ethan Guthman, NSP, **chair**
Shelly Jones, NSP, member
Justin Losacco, NSP, **chair**
Matthew Becker, MSTP and NSP, **chair**
Britni Sanchez, NSP, member
Andrew Mecca, NSP, member
Nicholas George, NSP, **chair**
Jungmin Kim, NSP, member
Keenan Kuschner, NSP, **chair**
Rebecca Roth, NSP, **chair**
Karlin Rufenacht, Integrated Physiology, member
Dean Kareemo, Pharmacology, member

Invited extramural lectures and presentations (since becoming faculty member at UCSOM)

July 2003	Gordon Conference on Chemical Senses
October 2003	University of Göttingen, Germany
October 2003	Max Planck Institute for Medical Research, Heidelberg, Germany
April 2004	Association for Chemoreception Sciences Conference, Sarasota, FL
January 2005	Conference on Chemosensory Modulation, Jackson, WY
February 2006	Ultimate Colorado Mid-Winter Meeting, Vail, CO
April 2006	Association for Chemoreception Sciences Conference, Sarasota, FL
January 2007	Florida State University, Department of Biology
January 2007	Florida State University Howard Baker Research Seminar
October 2007	National Institute of Neurological Disorders and Stroke, NIH, Bethesda
December 2007	Colorado State University, Molecular, Cellular, and Integrative Neurosciences Program
February 2008	University of Wyoming, Neuroscience Program
April 2009	Boston University, Symposium on Active Sensing and Brain Rhythms
January 2010	Janelia Farms, Cellular and Synaptic Physiology Seminar Series, Ashburn, VA
April 2010	West Virginia University, Center for Neuroscience Seminar Series
December 2010	University of Pittsburgh, Speaker at Annual Retreat of the Neuroscience Graduate Program
March 2011	Annual Meeting of the Physiological Society of Japan, Yokohama
April 2011	Association for Chemoreception Sciences Conf, St. Petersburg, FL
December 2011	Tufts University, Center for Neuroscience
December 2014	Florida State University, Neuroscience Program, Student-invited speaker.
November 2015	University of Santiago, Chile, Neuroscience Department

November 2015	University of Valparaiso, Chile, Center Interdisciplinary for Neuroscience of Valparaiso
April 2016	Regis University, Neuroscience Department
September 2016	University of Colorado, Boulder, Neuroscience Graduate Program
April 2022	Florida State University, Neuroscience Program, Student-invited speaker

Grant support

Current Research Support

1. NIH R01 DC006640 (Schoppa, N. E., **PI**); Mechanisms of olfactory signal processing; 04/01/05–03/31/26.

Completed

1. NIH R01 DC000566 (Schoppa, N. E. **PI**; Multi-PI grant with Dr. Diego Restrepo, UCAMC); Complex Odor Recognition in the Main Olfactory Bulb; 10/01/07–08/31/17

2. Collaborative Pilot Grant (Schoppa, N. E., **PI**; Multi-PI with Dr. Molly Huntsman, UCAMC); Olfactory Dysfunction in a Fragile X Mouse Model; 02/01/18–1/30/19.

Bibliography

Peer-reviewed original research articles

33. Bourne, J.N., and Schoppa, N. (2025) Ultrastructural contributions to extrasynaptic glutamatergic signaling in olfactory bulb glomeruli. *J. Comp. Neurol.* 533, e70034
32. Kuruppath, P., Xue, L., Pouille, F., Jones, S.T., and Schoppa, N.E. (2023) Hyperexcitability in the olfactory bulb and impaired fine odor discrimination in the Fmr1 KO mouse model of fragile X syndrome. *J Neuroscience* 43, 8243-8258.
31. Zak, J.D. and Schoppa, N.E. (2022) Neurotransmitter regulation rather than cell-intrinsic properties shape the high-pass filtering properties of olfactory bulb glomeruli. *J Physiol* 600, 393-417.
30. Zak, J.D. and Schoppa, N.E. (2021) Optical manipulations reveal strong reciprocal inhibition but limited recurrent excitation within olfactory bulb glomeruli. *eNeuro* 8(6), ENEURO.0311-21.2021
29. Jones, S., Zylberberg, J., and Schoppa, N. E. (2020) Cellular and synaptic mechanisms that differentiate mitral and tufted cells into parallel output channels in the olfactory bulb. *Frontiers in Cellular Neuroscience* 14, 6144377. PMCID: PMC7782477
28. Gire, D.H.*, Zak, J.D.*, Bourne, J.N., Goodson, N.B., and Schoppa, N.E. (2019) Balancing extrasynaptic excitation and synaptic inhibition within olfactory bulb glomeruli. *eNeuro* 6, 4. PMCID: PMC6709216. *Co-first authors.
27. Pouille, F. and Schoppa, N. E. (2018) Cannabinoid receptors modulate an olfactory bulb local circuit by cortical feedback. *Frontiers in Cellular Neuroscience* 12, 47. PMID: 29551963
26. Pouille, F.*, McTavish, T.S.*, Hunter, L.E., Restrepo, D., and Schoppa, N. E. (2017) Intraglomerular gap junctions enhance interglomerular synchrony in a sparsely-connected olfactory bulb network. *J. Physiol.* 595, 5965-5986. PMCID: PMC5577541. *Co-first authors.

**Manuscript was highlighted in a Perspectives article: Lowe, G. The symphony of smell. A

role for electrical synapses. *J. Physiol.* 595, 5725-5726.

25. Bourne, J.N. and Schoppa, N.E. (2017) Three-dimensional synaptic analyses of mitral cell and external tufted cell dendrites in rat olfactory bulb glomeruli. *J. Comp. Neurol.* 525, 592-609. PMID: 27490056
24. Shen C., Rathore S.S., Yu H., Gulbranson D.R., Hua R., Zhang C., Schoppa N.E., and Shen J. (2015) The trans-SNARE-regulating function of Munc18-1 is essential to synaptic exocytosis. *Nature Communications* 6: 8852. PMCID: PMC4668942
23. Zak, J. D., Whitesell, J. D., and Schoppa, N. E. (2015) Metabotropic glutamate receptors promote disinhibition of olfactory bulb glomeruli that scales with input strength. *J. Neurophysiol.* 113, 1907-1920. PMCID: PMC4359998
22. Sheridan, D. C., Hughes, A. R., Erdelyi, F., Szabo, G., Hentges, S. T., and Schoppa, N. E. (2014) Matching of feedback inhibition with excitation ensures fidelity of information flow in the anterior piriform cortex. *Neuroscience* 275, 519-530. PMCID: PMC4467689
21. Whitesell, J. D., Sorensen, K. A., Jarvie, B. C., Hentges, S. T., and Schoppa, N. E. (2013) Inter-glomerular lateral inhibition targeted on external tufted cells in the olfactory bulb. *J. Neurosci.*
20. Pandipati, S. and Schoppa, N. E. (2012) Age-dependent adrenergic actions in the main olfactory bulb that could underlie an olfactory sensitive period. *J. Neurophysiol.* 108, 1999-2007.
19. Gire, D. H., Franks, K. M., Zak, J. D., Tanaka, K. F., Whitesell, J. D., Mulligan, A. A., Hen, R., Schoppa, N. E. (2012) Mitral cells in the olfactory bulb are mainly excited through a multistep signaling path. *J. Neurosci.* 32, 2964-2975. PMID: 22378870. Noted as a “Must-Read” by the Faculty of 1000.
18. Pandipati, S., Gire, D. H., and Schoppa, N. E. (2010) Adrenergic receptor-mediated disinhibition of mitral cells triggers long-term enhancement of synchronized oscillations in the olfactory bulb. *J. Neurophysiol.* 104, 665-674 PMID: 20538781.
17. Gire, D. H. and Schoppa, N. E. (2009) Control of on/off glomerular signaling by a local GABAergic microcircuit in the olfactory bulb. *J. Neurosci*. 29: 13454-13464 PMID: 19864558
16. Luna, V. M. and Schoppa, N. E. (2008) GABAergic interneurons control input-spike coupling in the piriform cortex. *J Neurosci*. 28, 8851-8859. “Recommended” by the Faculty of 1000.
15. Gire, D. H. and Schoppa, N. E. (2008) Long-term enhancement of synchronized oscillations by adrenergic receptor activation in the olfactory bulb. *J Neurophysiol* 99: 2021-2025.
14. Schoppa, N. E. (2006) AMPA/kainate receptors drive rapid output and precise synchrony in olfactory bulb granule cells. *J. Neuroscience* 26: 12996-13006.
13. Schoppa, N. E. (2006) Synchronization of olfactory bulb mitral cells by precisely-timed inhibitory inputs. *Neuron* 49: 271-283.
12. Schoppa, N. E. and Westbrook, G. L. (2002) AMPA autoreceptors drive correlated spiking in olfactory bulb glomeruli. *Nature Neurosci.* 5: 1194-1202.
11. Schoppa, N. E. and Westbrook, G. L. (2001) Glomerulus-specific synchronization of mitral cells in the olfactory bulb. *Neuron* 31, 639-651.
10. Christie, J. M., Schoppa, N. E., and Westbrook, G. L. (2001) Tufted cell dendrodendritic inhibition in the olfactory bulb is dependent on NMDA receptor activity. *J. Neurophysiol.* 85: 169-173.
9. Schoppa N. E. and Westbrook G. L. (1999) Regulation of synaptic timing in the olfactory bulb by an A-type potassium current. *Nature Neurosci.* 2: 1106-1113.

8. Schoppa, N. E., Kinzie, J. M., Sahara, Y., Segerson, T. P., and Westbrook, G. L. (1998) Dendrodendritic inhibition in the olfactory bulb is driven by NMDA receptors. *J. Neurosci.* 18(17): 6790-6802.
7. Schoppa, N. E. and Sigworth, F. J. (1998) Activation of Shaker potassium channels. III. An activation gating model for wild-type and V2 mutant channels. *J. Gen Physiol.* 111(2): 313-342.
6. Schoppa, N. E. and Sigworth, F. J. (1998) Activation of Shaker potassium channels. II. Kinetics of the V2 mutant channel. *J. Gen Physiol.* 111(2): 295-311.
5. Schoppa, N. E. and Sigworth, F. J. (1998) Activation of Shaker potassium channels. I. Characterization of voltage-dependent transitions. J*. Gen Physiol.* 111(2): 271-294.
4. Schoppa, N. E. and Westbrook, G. L. (1997) Modulation of mEPSCs in olfactory bulb mitral cells by metabotropic glutamate receptors. *J. Neurophysiol.* 78(3): 1468-1475.
3. Cascio, M., Schoppa, N. E., Grodzicki, R. L., Sigworth, F. J., and Fox, R. O. (1993) Functional expression and purification of a homomeric human alpha1 glycine receptor in baculovirus-infected insect cells. *J. Biol. Chem.* 268: 22135-22142.
2. Schoppa, N. E., McCormack, K., Tanouye, M. A., and Sigworth, F. J. (1992) The size of the gating charge in wild-type and mutant Shaker potassium channels. *Science* 255: 1712-1715.
1. Schoppa, N. E., Shorofsky, S., Jow, F., Fozzard, H., and Nelson, D. J. (1989) Voltage-gated chloride currents in canine tracheal epithelial cells. *J. Mem. Biol.* 108: 73-90.

Invited reviews and book chapters

9. Schoppa, N. E. (2013) One in a thousand: defining the limits of olfactory perception. News and Views in *Nature Neuroscience* 16, 1516-1517.
8. Schoppa, N. E. (2010) Spike timing improves olfactory capabilities in mammals. Preview in *Neuron* 68, 329-331.
7. Schoppa, N. E. (2009) Inhibition acts globally to shape olfactory cortical tuning. Preview in *Neuron* 62, 750-752.
6. Schoppa, N. E. (2009) Making scents out of how olfactory neurons are ordered in space. News and Views in *Nature Neuroscience* 12, 103-104.
5. Schoppa, N. E. (2006) A novel local circuit in the olfactory bulb involving an old short-axon cell. Preview in *Neuron* 49: 783-784.
4. Schoppa, N. E. (2005) Neurotransmitter mechanisms at dendrodendritic synapses in the olfactory bulb, Chapter in *Dendritic Transmitter Release* (M. Ludwig, ed., Kluwer Academic/Plenum Publisher).
3. Schoppa, N. E. and Urban, N. N. (2003) Dendritic processing within olfactory bulb circuits. *Trends in Neuroscience* 26: 501-506.
2. Schoppa, N. E. and Westbrook, G. L. (2001) NMDA receptors turn to another channel for inhibition. Preview in *Neuron* 31: 877-879.
1. Schoppa, N. E., Yang, Y., and Sigworth, F. J. (1997) How is voltage coupled to channel opening in Shaker K^+ channels? *Prog. Cell Research* 6: 99-109.