RICHARD C. SANDO, Ph.D.
Curriculum Vitae

Assistant Professor
The Department of Pharmacology
Vanderbilt Brain Institute
Vanderbilt University
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Nashville, TN 37240-7933

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EDUCATION

- Ph.D., 2014, Kellogg School of Science and Technology, The Scripps Research Institute, La Jolla, CA.
- B.S. in Behavioral Neuroscience awarded Summa Cum Laude/Minor in Chemistry, 2009, Rider University, Lawrenceville, NJ.

RESEARCH POSITIONS

2021-Present **Assistant Professor**
Investigating the networks of cell adhesion molecules and signaling pathways underlying synaptic circuit assembly in the mammalian central nervous system
Department of Pharmacology, Vanderbilt Brain Institute

2015-2020 **Postdoctoral Fellow**
Regulation of hippocampal synapse specificity by the adhesion GPCR Latrophilins
Department of Molecular and Cellular Physiology, Stanford University, Palo Alto, CA
Advisor: Dr. Thomas C. Südhof

2009-2015 **Graduate Student**
Activity-dependent mechanisms of synaptic plasticity
The Dorris Neuroscience Center, Department of Molecular and Cellular Biology, Kellogg School of Science and Technology, The Scripps Research Institute, La Jolla, CA
Advisor: Dr. Anton Maximov

2009 **Undergraduate Research Fellow**
Molecular mechanisms of circadian rhythms
Department of Neurobiology and Physiology, Northwestern University, Evanston, IL.
Advisor: Dr. Joseph Takahashi

2005-2009 **Undergraduate Research**
Molecular mechanisms of circadian rhythms
Department of Biology, Rider University, Lawrenceville, NJ.
Advisor: Dr. Phillip Lowrey

CURRENT FUNDING

Sloan Research Fellowship: Project Period 09/2022 – 09/2024

Brain and Behavior Research Foundation 2021 NARSAD Young Investigator Grant #30039: Project Period 01/15/2022 – 01/14/2025

Vanderbilt Brain Institute Faculty Fellowship, 03/2024-03/2026

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PREVIOUS FUNDING

NIH Pathway to Independence Award #K99/R00MH117235: Project Period 07/13/2018 – 01/31/2024

Trans-Institutional Program for Novel Ideas in Neuroscience Award, Project Period 02/15/2022 – 06/30/2022

NIH National Research Service Award #F32MH108230: Project Period 08/19/2015 – 07/09/2018

NIH National Research Service Award #F31MH094059: Project Period 4/01/2013 – 04/09/2014

RESEARCH SUMMARY

The assembly of synaptic connectivity into neural circuits requires the orchestration of numerous cellular processes, including axonal pathfinding, subcellular target recognition, synapse specification, synapse maintenance or elimination, and molecular organization and diversification of synaptic compartments. Aberrations in synaptic connectivity within neural circuits underlie neurological disorders. How are distinct synaptic subtypes formed in a specific and organized manner to generate functional neural circuits? What are the shared vs. distinct signal transduction cascades underlying the establishment and maintenance of discrete synapse subtypes? The molecular and cellular mechanisms underlying these processes remain poorly understood.

The central and long-term research goal of my independent research program at Vanderbilt University is to elucidate the signal transduction mechanisms of input-specific synapse formation and function in neural circuits. To begin addressing these questions in my independent research program, I will develop and utilize novel molecular strategies to modulate signaling pathways in specific synaptic compartments to identify the localized signal transduction cascades involved in input-specific synapse formation. Concurrently, I will pursue complementary studies that explore the signaling mechanisms of the understudied adhesion-class GPCRs and their role in synapse formation, maintenance, and specificity. Our scientific approach is broad and interdisciplinary and spans molecular and cellular biology, confocal and super-resolution microscopy, electrophysiology, and *in vivo* analysis of mouse models. These studies will provide mechanistic insights into neural circuit assembly and function in the mammalian brain.

TEACHING EXPERIENCE

• 2022-present, Lecturer, Fundamental of Neuroscience I, Topic: Synapse Formation and Trans-synaptic Signaling

• 2021-2022, Faculty Facilitator, Professional Development/Rigor and Reproducibility first-year graduate student course (IGP 8001-07 Bioregulation), Vanderbilt University.

• 2021, Lecturer, Signal Transduction in Disease graduate student course, Vanderbilt University.

• 2021-present, Faculty Reviewer, NRSA Grant Writing Course (NURO8326), Vanderbilt University.

STUDENTS AND TRAINEES

Postdoctoral Fellows

• Krassimira Garbett, PhD (Staff Scientist), June 2021 – present

• Baris Tosun, MD (Postdoctoral Scholar), February 2023 – present

Graduate Students

• Jaybree Lopez (Neuroscience Graduate Program), April 2022 – present

• Shane Watson (Neuroscience Graduate Program), April 2022 – present

• Tanner Shearer (Pharmacology Graduate Program), April 2022 – January 2024

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• Kelly Honkanen (Interdisciplinary Graduate Program), April 2023 – present
• Morgan Ottley (Interdisciplinary Graduate Program), April 2023 – present
• James Allen (Interdisciplinary Graduate Program), April 2023 – present (co-mentored with Dr. Qiangjun Zhou)
• Cassandra Smith (Neuroscience Graduate Program), April 2023 – present
• Fei Yang (MSTP Program), June 2023 – present

Research Assistants

• Huong Duy Lan Bui (RA1), January 2021 – present
• Elizabeth Orput (RA1), February 2021 – present

Undergraduates

• Andrew Roach (Vanderbilt Undergraduate), May 2021 – August 2022
• Qiaochu Jiang, (Vanderbilt Undergraduate), February 2021 – August 2022
• Ritika Raghavan (Student Intern), February 2021 – August 2021
• Fatima Roque (NSC3861 program for Vanderbilt Undergraduates), September 2022 – May 2023
• Mridul Sharma (Vanderbilt Undergraduate, Summer START program), January 2023 – present
• Dylan Conger (Vanderbilt Undergraduate), May 2023 – present
• Swarada Kulkarni (Vanderbilt Undergraduate), November 2023 - present

THESIS COMMITTEES

• Natalie Guzikowski (Kavalali lab), June 2021 – present (Chair)
• Elena Bagatelas (Kavalali lab), June 2022 – present (Chair)
• Abigael Weit (Monteggia lab), July 2022 – present
• Kirsty Erickson (Siciliano lab), June 2022 – present
• Benjamin Kleinfelter (Monteggia lab), June 2022 – present
• Brett Nabit (Winder lab), September 2022 – present
• Olivia Nunn (Suver lab), January 2023 – present
• Hye Jean Yoon (Calipari lab), May 2023 – present
• Anthony Ferranti (Niswender lab), March 2024 – present (Chair)

HONORS AND AWARDS

2022 – present, Sloan Research Fellowship
2022 – present, BBRF NARSAD Young Investigator Award
2018 – present, NIMH Pathway to Independence Award (K99/R00)
2015 – 2018, NIH National Research Service Award #F32MH108230
2013 – 2015, NIH National Research Service Award #F31MH094059
2013, Helen Dorris Research Travel Award, The Scripps Research Institute

2009, B.S. awarded Summa Cum Laude with honors, Rider University

2009, Outstanding Senior in Biology, Rider University

2008, Sigma Xi Research Presentation Award, Sigma Xi Research Conference

2007 – 2008, Undergraduate Research Scholar Award, Rider University

2008, Sigma Xi Grant-in-Aid of Research, Sigma Xi Scientific Research Society

2008, Howard Hughes Medical Institute Undergraduate Research Fellowship

2007, Sigma Xi Research Presentation Award, Sigma Xi Research Conference

2006, Outstanding Tutor Award, Rider University

MISCELLANEOUS SERVICE

• Pharmacology Department Seminar organizer, June 2021 – present

• Pharmacology Department New Faculty Search Committee, 2021 – present

• Vanderbilt Kennedy Center Science Day judge, October 2021

• MSTP mock study section reviewer, November 9th 2021

• Vanderbilt Kennedy Center Science Day judge November 2022

• IGP program interviewer, 2022 – present

• NGP program interviewer, 2022 – present

• QCB program interviewer, 2022 – present

• MSTP program interviewer, 2022 – present

AD HOC REVIEWER

Molecular Psychiatry, Nature Methods, PLOS Biology, Frontiers in Molecular Neuroscience, e-Life, Neuropsychopharmacology, Journal of Biological Chemistry, Cell Chemical Biology

STUDY SECTION SERVICE

• Neurodevelopment, Plasticity and Rhythmicity (NDPR) Study Section, Early Career Reviewer, October 2023

INVITED TALKS

Internal seminars

• Vanderbilt Brain Institute lunch seminar series, 09/2021

• Pharmacology retreat speaker, 10/2021

• Center for Structural Biology seminar speaker, 09/2022

• Vanderbilt Brain Institute retreat speaker, 09/2022

External seminars

• Invited Seminar Speaker, University of Toronto, Scarborough, Department of Biological Sciences, March 2023

• Invited Seminar Speaker, Rhode Island College, Department of Biology, April 2024

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Hosted Seminar Speakers

• David Anderson (CalTech), Stanford Molecular and Cellular Physiology series, 2015

• Naoshige Uchida (Harvard University), Stanford Molecular and Cellular Physiology series, 2018

• Cagla Eroglu (Duke University), Vanderbilt Brain Institute series, 10/2022

• Anton Maximov (Scripps Research Institute), Pharmacology series, 01/2024

• Demet Arac (The University of Chicago), Pharmacology series, 04/2024

• Randy Hall (Emory University), Pharmacology series, 09/2024

PUBLICATIONS

Bandekar SJ, Garbett K, Kordon SP, Dintzner E, Shearer T, **Sando R***, Arac D* (2024) Structure of the extracellular region of the adhesion GPCR CELSR1 reveals a compact module which regulates G protein coupling. BioRxiv. 2024.01.26.577439.
* co-corresponding authors

Matus D, Lopez J, **Sando R**, & Südhof TC (2024) Essential role of Latrophilin-1 adhesion GPCR nanoclusters in inhibitory synapses. ***J. Neuro.***

Bui H, Roach A, Li J, Bandekar SJ, Orput E, Raghavan R, Arac D, **Sando R**. (2023) The adhesion GPCRs CELSR1-3 and LPHN3 engage G-proteins via distinct activation mechanisms. ***Cell Reports****.* 42(6) 112552.

Sando R* , Ho ML , Liu X , Südhof TC* (2022) Engineered synaptic tools reveal localized cAMP signaling in synapse assembly. ***J. Cell Biol.*** 221(2) e202109111. PMID 34913963.
* co-corresponding authors

Sando R* & Südhof TC (2021) Latrophilin GPCR signaling mediates synapse formation. ***eLife***. e65717. doi: 10.7554/eLife.65717. PMID 33646123.
* corresponding author

Jiang X , **Sando R** , Südhof TC (2021) Multiple signaling pathways are essential for synapse formation induced by synaptic adhesion molecules. ***Proc. Natl. Acad. Sci. USA***. 118(3): e2000173118. doi: 10.1073. PMID 33431662.

Li J , Xie Y , Cornelius S , Jiang X , **Sando R** , Kordon SP , Pan M , Leon K , Sudhof TC , Zhao M , Arac D (2020) Alternative splicing controls teneurin-latrophilin interaction and synapse specificity by a shape-shifting mechanism. ***Nat. Commun***. 11(1): 2140. PMID 32358586.

Dong JX , Lee Y , Kirmiz M , Palacio S , Dumitras C , Moreno CM , **Sando R** , Santana LF , Südhof TC , Gong B , Murray KD , Trimmer JS (2019) A toolbox of nanobodies developed and validated for use as intrabodies and nanoscale immunolabels in mammalian brain neurons. ***eLife***. 8:e48750, doi: 10.7554/eLife.48750. PMID 31566565.

Sando R , Jiang X , Südhof TC (2019) Latrophilin GPCRs direct synapse specificity by coincident binding of FLRTs and teneurins. ***Science***. 363 (6429): eaav7969. PMID 30792275.

Li J , Shalev–Benami M , **Sando R** , Jiang X , Kibrom A , Wang J , Leon K , Katanski C , Nazarko O , Lu YC , Südhof TC , Skiniotis G , Arac D (2018) Structural basis for Teneurin function in circuit–wiring: A toxin motif at the synapse. ***Cell***. 173(3): 735–748. PMID 29677516.

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Anderson G* , Maxeiner S* , **Sando R** , Tsenesis T , Malenka R , Südhof TC (2017) Postsynaptic aGPCR Latrophilin–2 mediates target recognition in entorhinal–hippocampal synapse assembly. ***J. Cell. Biol.*** DOI: 10.1083/jcb.201703042.

Sando R , Bushong E , Zhu Y , Huang M , Considine C , Phan S , Ju S , Uytiepo M , Ellisman M , Maximov A (2017) Assembly of excitatory synapses in the absence of glutamatergic neurotransmission. ***Neuron***. 94(2): 312-321.

Kwon S, **Sando R**, Lewis TL , Hirabayashi Y , Maximov A, Polleux F (2016) LKB1 regulates mitochondria-dependent presynaptic calcium clearance and neurotransmitter release properties at excitatory synapses along cortical axons. ***PLoS Biol***.14(7): e1002516.

Lu YC* , Nazarko OV* , **Sando R*** , Salzman GS* , Südhof TC , Arac D (2015) Structural basis of latrophilin-FLRT-UNC5 interaction in cell adhesion. ***Structure***. 23(9): 1678-91.

Shimojo M, Courchet J, Pieraut S , Torabi-Rander N, **Sando R**, Polleux F, Maximov A (2015) SNAREs controlling vesicular release of BDNF and development of callosal axons. ***Cell Rep***. 11(7): 1054-66.

Pieraut S, Gounko N, **Sando R**, Dang W , Rebboah E , Panda S, Madisen L , Zeng H , Maximov A (2014) Experience-dependent remodeling of basket cell networks in the dentate gyrus. ***Neuron***. 84(1): 107-22.

Sando R, Baumgaertel K, Pieraut S, Wandless T, Mayford M, Maximov A (2013) Inducible control of gene expression with destabilized Cre. ***Nature Methods*.** 10(11): 1085-8.

Sando R*, Gounko N*, Pieraut S, Liao L, Yates J, Maximov A (2012) HDAC4 governs a transcriptional program essential for synaptic plasticity and memory. ***Cell***. 151(4):821-834.

Liao L, **Sando R**, Farnum J, Vanderklish P, Maximov A, Yates J (2012) 15N-labeled brain enables quantification of proteome and phosphoproteome in cultured primary neurons. ***J Proteome Res*** 11(2):1341-53.

* denotes equal first-author contribution