



Julia Kaltschmidt

Professor of Neurosurgery

CONTACT INFORMATION

- **Administrative Contact**

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Bio

BIO

Julia Kaltschmidt PhD is a Wu Tsai Neurosciences Institute Faculty Scholar, a Firmenich Next Generation Faculty Scholar and a Professor in the Department of Neurosurgery at Stanford Medical School. She received her undergraduate degree in Molecular Biology and Biochemistry from the University of Madison, Wisconsin, and completed her PhD at the University of Cambridge in the UK, where she trained as a developmental biologist and studied the *Drosophila* nervous system. During her postdoc at Columbia University, Dr. Kaltschmidt began working with mouse as a model system and became interested in mechanisms that underlie circuit connectivity in the spinal cord. At the Memorial Sloan Kettering Cancer Center, her laboratory identified and manipulated spinal neuronal circuits that underly locomotion. Since moving to Stanford, the focus of her lab has expanded to include the enteric nervous system (ENS), also called the “second brain”. The ENS is a network of enteric neurons that surrounds the gastrointestinal tract and controls its functions. The Kaltschmidt lab has adapted and developed state-of-the-art means to map the organization of ENS circuits, and has built collaborations with clinical gastroenterologists, surgeons and bioengineers to devise means to understand how ENS circuit organization influences gastrointestinal tract function in health and disease states.

ACADEMIC APPOINTMENTS

- Professor, Neurosurgery
- Member, Bio-X
- Member, Maternal & Child Health Research Institute (MCHRI)
- Member, Stanford Medicine Children’s Health Center for IBD and Celiac Disease
- Member, Wu Tsai Neurosciences Institute

ADMINISTRATIVE APPOINTMENTS

- Professor, Department of Neurosurgery, Stanford University, (2026- present)
- Wu Tsai Neurosciences Institute Faculty Scholar, Wu Tsai Neurosciences Institute, (2017- present)
- Associate Professor, Department of Neurosurgery, Stanford University, (2017-2025)
- Assistant Professor, Cell and Developmental Biology Program, Weill Cornell Graduate School of Medical Sciences, (2008-2017)

- Assistant Professor, Developmental Biology Program, Sloan Kettering Institute, Memorial Sloan Kettering Cancer Center, (2008-2017)

HONORS AND AWARDS

- Big Ideas in Neuroscience Grant, Wu Tsai Neurosciences Institute (2025-2027)
- MCHRI Pediatric IBD and Celiac Disease Research Seed Grant, Stanford Maternal and Child Health Research Institute (2025-2027)
- Firmenich Next Generation Faculty Scholar, Firmenich Next Generation Faculty Fund (2024-2027)
- Developmental Project Grant, Stanford Alzheimer's Disease Research Center (2023-2025)
- Transdisciplinary Initiatives Program, Stanford Maternal and Child Health Research Institute (2023-2025)
- Interdisciplinary Initiatives Program Seed Grant, Bio-X (2022-2024)
- Neurosurgery Research Seed Grant, Stanford Dept of Neurosurgery (2022-2024)
- Early Career Award, Carol and Eugene Ludwig Family Foundation (2022-2023)
- MCHRI Pilot Grant, Stanford Maternal and Child Health Research Institute (2022-2022)
- Firmenich Next Generation Faculty Scholar, Firmenich Next Generation Faculty Fund (2021-2024)
- Beckman Technology Development Seed Grant, Beckman Foundation (2021-2023)
- Research Grant, Shurl and Kay Curci Foundation (2020-2021)
- Louis V. Gerstner, Jr. Young Investigator Award, Gerstner Family Foundation (2009-2012)
- Whitehall Research Grant, Whitehall Foundation (2009-2012)
- Wellcome Prize Traveling Research Fellowship, Wellcome Trust (2001-2003)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Editorial Board Member, Neural Development (2023 - present)
- Co-Editor-in-Chief, Neural Development (2019 - 2022)

PROFESSIONAL EDUCATION

- Postdoc, Columbia University , Neurobiology (2008)
- PhD, University of Cambridge (UK) , Developmental Biology (2002)

LINKS

- Kaltschmidt Lab website: <http://med.stanford.edu/kaltschmidt-lab.html>
- X: https://x.com/kaltschmidt_lab

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

The lab's goal is to understand the molecular basis of neuronal circuit formation. We are particularly interested in circuits that underlie locomotion and gut motility.

Spinal circuits underlying locomotor function:

Local inhibitory microcircuits have a fundamental role in shaping animal behavior. In the mammalian spinal cord inhibitory interneurons modulate the sensory-motor signaling that controls locomotion. We are using a specific interneuron circuit to understand (i) how distinct neuronal populations are generated, (ii) how these distinct neuronal populations recognize and choose their correct synaptic partners from among different available targets, and (iii) how postsynaptic signals induce the differentiation of presynaptic terminals in service of balanced circuit function.

Enteric nervous system structure and function:

The enteric nervous system (ENS) in the gut contains more neurons than the spinal cord and presents a translational model relevant to many human illnesses. However, relatively little is known about the development, connectivity and function of ENS circuitry. The mouse ENS is experimentally tractable and allows application of molecular genetic and high-resolution imaging techniques, as well as innovative in vivo experimental approaches. We aim to (i) map ENS circuit connectivity and (ii) explore functional consequences of ENS circuit abnormalities.

Teaching

COURSES

2025-26

- Cellular/Molecular Neuroscience Laboratory: NEPR 288 (Sum)

2024-25

- Neurosciences Development Core: NEPR 202 (Win)

2023-24

- Neurosciences Development Core: NEPR 202 (Win)

2022-23

- Neurosciences Development Core: NEPR 202 (Win)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

URee Chon, Josh Head, Ashley Moses, Cindy Shi, Kathryn Wu, Blake Zhou

Doctoral Dissertation Advisor (AC)

Jacqueline Bendrick, Cheyanne Lewis, Jack Marciano, Adarsh Tantry, Ashley Yeh

Postdoctoral Research Mentor

Eric Zhao

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Neurosciences (Phd Program)

Publications

PUBLICATIONS

- **Abnormal enteric nervous system organization and gastrointestinal motility in mice with valproic acid-induced neural tube defects.** *bioRxiv : the preprint server for biology*
Barsh, G. R., Banducci, K., Kaltschmidt, J. A.
2026
- **High-density soft bioelectronic fibres for multimodal sensing and stimulation.** *Nature*
Khatib, M., Zhao, E. T., Wei, S., Park, J., Abramson, A., Bishop, E. S., Thomas, A. L., Chen, C. H., Emengo, P., Xu, C., Hamnett, R., Root, S. E., Yuan, et al
2025; 645 (8081): 656-664
- **Gpr37 modulates the severity of inflammation-induced GI dysmotility by regulating enteric reactive gliosis.** *iScience*
Robertson, K., Hahn, O., Tantry, A., Robinson, B. G., Faruk, A. T., Janakiraman, M., Namkoong, H., Kim, K., Ye, J., Bishop, E. S., Hall, R. A., Wyss-Coray, T., Becker, et al
2025; 28 (7): 112885

- **Engrafted nitrergic neurons derived from hPSCs improve gut dysmotility in mice.** *Nature*
Majd, H., Samuel, R. M., Cesiulis, A., Ramirez, J. T., Kalantari, A., Barber, K., Farahvashi, S., Ghazizadeh, Z., Majd, A., Chemel, A. K., Richter, M. N., Das, S., Bendrick, et al
2025
- **Synaptic cell adhesion molecule Cdh6 identifies a class of sensory neurons with novel functions in colonic motility.** *eLife*
Gomez-Frittelli, J., Devienne, G. F., Travis, L., Kyloh, M. A., Duan, X., Hibberd, T. J., Spencer, N. J., Huguenard, J. R., Kaltschmidt, J. A.
2025; 13
- **Enteric glutamatergic interneurons regulate intestinal motility.** *Neuron*
Hamnett, R., Bendrick, J. L., Saha, Z., Robertson, K., Lewis, C. M., Marciano, J. H., Zhao, E. T., Kaltschmidt, J. A.
2025
- **Achieving optical transparency in live animals with absorbing molecules.** *Science (New York, N.Y.)*
Ou, Z., Duh, Y. S., Rommelfanger, N. J., Keck, C. H., Jiang, S., Brinson, K., Zhao, S., Schmidt, E. L., Wu, X., Yang, F., Cai, B., Cui, H., Qi, et al
2024; 385 (6713): eadm6869
- **Gut Analysis Toolbox: Automating quantitative analysis of enteric neurons.** *Journal of cell science*
Sorensen, L., Humenick, A., Poon, S. S., Han, M. N., Mahdavian, N. S., Rowe, M. C., Hamnett, R., Gómez-de-Mariscal, E., Neckel, P. H., Saito, A., Mutunduwe, K., Glennan, C., Haase, et al
2024
- **Synaptic cell adhesion molecule Cdh6 identifies a class of sensory neurons with novel functions in colonic motility.** *bioRxiv : the preprint server for biology*
Gomez-Frittelli, J., Devienne, G., Travis, L., Kyloh, M. A., Duan, X., Hibberd, T. J., Spencer, N. J., Huguenard, J. R., Kaltschmidt, J. A.
2024
- **Spontaneous enteric nervous system activity generates contractile patterns prior to maturation of gastrointestinal motility.** *Neurogastroenterology and motility*
Dershowitz, L. B., Bueno Garcia, H., Perley, A. S., Coleman, T. P., Kaltschmidt, J. A.
2024: e14890
- **Temperature-dependent differences in mouse gut motility are mediated by stress.** *Lab animal*
Han, A., Hudson-Paz, C., Robinson, B. G., Becker, L., Jacobson, A., Kaltschmidt, J. A., Garrison, J. L., Bhatt, A. S., Monack, D. M.
2024
- **Enteric nervous system striped patterning and disease: unexplored pathophysiology.** *Cellular and molecular gastroenterology and hepatology*
Dershowitz, L. B., Kaltschmidt, J. A.
2024
- **Loss of ASD-related molecule Cntnap2 affects colonic motility in mice.** *Frontiers in neuroscience*
Robinson, B. G., Oster, B. A., Robertson, K., Kaltschmidt, J. A.
2023; 17: 1287057
- **Comparison of wholemount dissection methods for neuronal subtype marker expression in the mouse myenteric plexus.** *Neurogastroenterology and motility*
Gomez-Frittelli, J., Hamnett, R., Kaltschmidt, J. A.
2023: e14693
- **Spiral NeuroString: High-Density Soft Bioelectronic Fibers for Multimodal Sensing and Stimulation.** *bioRxiv : the preprint server for biology*
Khatib, M., Zhao, E. T., Wei, S., Abramson, A., Bishop, E. S., Chen, C., Thomas, A., Xu, C., Park, J., Lee, Y., Hamnett, R., Yu, W., Root, et al
2023
- **Loss of ASD-Related Molecule Cntnap2 Affects Colonic Motility in Mice.** *bioRxiv : the preprint server for biology*
Robinson, B. G., Oster, B. A., Robertson, K., Kaltschmidt, J. A.
2023
- **Spontaneous enteric nervous system activity precedes maturation of gastrointestinal motility.** *bioRxiv : the preprint server for biology*
Dershowitz, L. B., Garcia, H. B., Perley, A. S., Coleman, T. P., Kaltschmidt, J. A.
2023

- **Anatomical and functional maturation of the mid-gestation human enteric nervous system.** *Nature communications*
Dershowitz, L. B., Li, L., Pasca, A. M., Kaltschmidt, J. A.
2023; 14 (1): 2680
- **Single-cell transcriptomic landscape of the developing human spinal cord.** *Nature neuroscience*
Andersen, J., Thom, N., Shadrach, J. L., Chen, X., Onesto, M. M., Amin, N. D., Yoon, S. J., Li, L., Greenleaf, W. J., Müller, F., Paşca, A. M., Kaltschmidt, J. A., Paşca, A. M.,
2023
- **Single-cell multiome sequencing clarifies enteric glial diversity and identifies an intraganglionic population poised for neurogenesis.** *Cell reports*
Guyer, R. A., Stavely, R., Robertson, K., Bhave, S., Mueller, J. L., Picard, N. M., Hotta, R., Kaltschmidt, J. A., Goldstein, A. M.
2023; 42 (3): 112194
- **Regional cytoarchitecture of the adult and developing mouse enteric nervous system.** *Current biology : CB*
Hamnett, R., Dershowitz, L. B., Sampathkumar, V., Wang, Z., Gomez-Frittelli, J., De Andrade, V., Kasthuri, N., Druckmann, S., Kaltschmidt, J. A.
2022
- **Transcription factor gene Pea3 regulates erectile function during copulation in mice.** *PLoS one*
Weinrich, J. A., Tyagi, A., Kenney, M. C., DiCasoli, R. J., Kaltschmidt, J. A.
2022; 17 (10): e0276069
- **Unraveling the complex genetics of neural tube defects: From biological models to human genomics and back.** *Genesis (New York, N.Y. : 2000)*
Wolujewicz, P., Steele, J. W., Kaltschmidt, J. A., Finnell, R. H., Ross, M. E.
2021: e23459
- **COUNTEN, an AI-Driven Tool for Rapid and Objective Structural Analyses of the Enteric Nervous System.** *eNeuro*
Kobayashi, Y., Bukowski, A., Das, S., Espenel, C., Gomez-Frittelli, J., Wagle, N., Bakshi, S., Saha, M., Kaltschmidt, J. A., Venkataraman, A., Kulkarni, S.
2021
- **Proprioception revisited: where do we stand?** *Current opinion in physiology*
Shadrach, J. L., Gomez-Frittelli, J., Kaltschmidt, J. A.
2021; 21: 23-28
- **Single-cell transcriptomic analysis of the adult mouse spinal cord reveals molecular diversity of autonomic and skeletal motor neurons.** *Nature neuroscience*
Blum, J. A., Klemm, S., Shadrach, J. L., Guttenplan, K. A., Nakayama, L., Kathiria, A., Hoang, P. T., Gautier, O., Kaltschmidt, J. A., Greenleaf, W. J., Gitler, A. D.
2021
- **Commissural axon guidance in the developing spinal cord: from Cajal to the present day.** *Neural development*
Comer, J. D., Alvarez, S., Butler, S. J., Kaltschmidt, J. A.
2019; 14 (1): 9
- **Chandelier Cells Swipe Right for L1CAM NEURON**
Hamnett, R., Kaltschmidt, J. A.
2019; 102 (2): 267–70
- **Sensory and descending motor circuitry during development and injury.** *Current opinion in neurobiology*
Plant, G. W., Weinrich, J. A., Kaltschmidt, J. A.
2018; 53: 156–61
- **A Role for Dystonia-Associated Genes in Spinal GABAergic Interneuron Circuitry.** *Cell reports*
Zhang, J. n., Weinrich, J. A., Russ, J. B., Comer, J. D., Bommareddy, P. K., DiCasoli, R. J., Wright, C. V., Li, Y. n., van Roessel, P. J., Kaltschmidt, J. A.
2017; 21 (3): 666–78
- **Satb2 Stations Neurons along Reflex Arcs NEURON**
Hantman, A. W., Kaltschmidt, J. A.

2016; 91 (4): 711-713

- **Sensory-Derived Glutamate Regulates Presynaptic Inhibitory Terminals in Mouse Spinal Cord** *NEURON*
Mende, M., Fletcher, E. V., Belluardo, J. L., Pierce, J. P., Bommareddy, P. K., Weinrich, J. A., Kabir, Z. D., Schierberl, K. C., Pagiazitis, J. G., Mendelsohn, A. I., Francesconi, A., Edwards, R. H., Milner, et al
2016; 90 (6): 1189-1202
- **Normal Molecular Specification and Neurodegenerative Disease-Like Death of Spinal Neurons Lacking the SNARE-Associated Synaptic Protein Munc18-1** *JOURNAL OF NEUROSCIENCE*
Law, C., Profes, M. S., Levesque, M., Kaltschmidt, J. A., Verhage, M., Kania, A.
2016; 36 (2): 561-576
- **Sensory and spinal inhibitory dorsal midline crossing is independent of Robo3** *FRONTIERS IN NEURAL CIRCUITS*
Comer, J. D., Pan, F. C., Willet, S. G., Haldipur, P., Millen, K. J., Wright, C. V., Kaltschmidt, J. A.
2015; 9
- **Misexpression of Ptf1a in Cortical Pyramidal Cells In Vivo Promotes an Inhibitory Peptidergic Identity** *JOURNAL OF NEUROSCIENCE*
Russ, J. B., Borromeo, M. D., Kollipara, R. K., Bommareddy, P. K., Johnson, J. E., Kaltschmidt, J. A.
2015; 35 (15): 6028-6037
- **From induction to conduction: how intrinsic transcriptional priming of extrinsic neuronal connectivity shapes neuronal identity** *OPEN BIOLOGY*
Russ, J. B., Kaltschmidt, J. A.
2014; 4 (10)
- **Neuronal Ig/Caspr Recognition Promotes the Formation of Axoaxonic Synapses in Mouse Spinal Cord** *NEURON*
Ashrafi, S., Betley, J. N., Comer, J. D., Brenner-Morton, S., Bar, V., Shimoda, Y., Watanabe, K., Peles, E., Jessell, T. M., Kaltschmidt, J. A.
2014; 81 (1): 120-129
- **Corticospinal tract insult alters GABAergic circuitry in the mammalian spinal cord** *FRONTIERS IN NEURAL CIRCUITS*
Russ, J. B., Verina, T., Comer, J. D., Comi, A. M., Kaltschmidt, J. A.
2013; 7
- **Wnt7A identifies embryonic γ -motor neurons and reveals early postnatal dependence of γ -motor neurons on a muscle spindle-derived signal.** *journal of neuroscience*
Ashrafi, S., Lalancette-Hébert, M., Friese, A., Sigrist, M., Arber, S., Shneider, N. A., Kaltschmidt, J. A.
2012; 32 (25): 8725-8731
- **Stringent Specificity in the Construction of a GABAergic Presynaptic Inhibitory Circuit** *CELL*
Betley, J. N., Wright, C. V., Kawaguchi, Y., Erdelyi, F., Szabo, G., Jessell, T. M., Kaltschmidt, J. A.
2009; 139 (1): 161-174
- **Gamma and alpha motor neurons distinguished by expression of transcription factor Err3** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Friese, A., Kaltschmidt, J. A., Ladle, D. R., Sigrist, M., Jessell, T. M., Arber, S.
2009; 106 (32): 13588-13593
- **Conditional rhythmicity of ventral spinal interneurons defined by expression of the Hb9 homeodomain protein** *JOURNAL OF NEUROSCIENCE*
Wilson, J. M., Hartley, R., Maxwell, D. J., Todd, A. J., Lieberam, I., Kaltschmidt, J. A., Yoshida, Y., Jessell, T. M., Brownstone, R. M.
2005; 25 (24): 5710-5719
- **Polar transport in the Drosophila oocyte requires Dynein and Kinesin I cooperation** *CURRENT BIOLOGY*
Januschke, J., Gervais, L., Dass, S., Kaltschmidt, J. A., Lopez-Schier, H., St Johnston, D., Brand, A. H., Roth, S., Guichet, A.
2002; 12 (23): 1971-1981
- **Planar polarity and actin dynamics in the epidermis of Drosophila** *NATURE CELL BIOLOGY*
Kaltschmidt, J. A., Lawrence, N., Morel, V., Balayo, T., Fernandez, B. G., Pelissier, A., Jacinto, A., Arias, A. M.
2002; 4 (12): 937-944
- **A new dawn for an old connection: development meets the cell** *TRENDS IN CELL BIOLOGY*

Kaltschmidt, J. A., Arias, A. M.
2002; 12 (7): 316-320

● **Asymmetric cell division: microtubule dynamics and spindle asymmetry** *JOURNAL OF CELL SCIENCE*

Kaltschmidt, J. A., Brand, A. H.
2002; 115 (11): 2257-2264

● **Frizzled regulates localization of cell-fate determinants and mitotic spindle rotation during asymmetric cell division** *NATURE CELL BIOLOGY*

Bellaïche, Y., Gho, M., Kaltschmidt, J. A., Brand, A. H., Schweisguth, F.
2001; 3 (1): 50-57

● **Rotation and asymmetry of the mitotic spindle direct asymmetric cell division in the developing central nervous system** *NATURE CELL BIOLOGY*

Kaltschmidt, J. A., Davidson, C. M., Brown, N. H., Brand, A. H.
2000; 2 (1): 7-12