



Lief Ericsson Fenno

Instructor, Psychiatry and Behavioral Sciences

CLINICAL OFFICES

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Bio

BIO

Dr. Fenno is a psychiatrist and Instructor at Stanford University School of Medicine.

Leveraging his strengths in neuroscience research and bioengineering, his goal is to design, construct, validate, and apply novel molecular and viral tools to understand the brain in health and disease for the benefit of diverse patient populations. His clinical interests include the treatment of substance use disorders and co-occurring mood disorders.

His specific research interests include the development and application of novel optogenetic tools that combine genetically encoded molecules and light to modulate neurons. Dr. Fenno directs a team focused on expanding the use of novel, intersectional viral targeting approaches, with the objective of precisely establishing links between neuron circuitry and behavior. He has patented advances for optically controlled CNS dysfunction and social dysfunction.

Dr. Fenno has co-written articles on optogenetic tools and other topics in the journals *Annual Review of Neuroscience*, *Neurobiology of Mental Illness*, *Molecular Psychiatry*, *Current Protocols in Neuroscience*, *Nature*, and *Cell*. He is also the co-author of articles on neural mechanisms of autism spectrum disorder, which have appeared in *Science Translational Medicine* and *Nature*.

Dr. Fenno has delivered presentations worldwide at events including the meeting of the National Science Foundation NeuroNex Program of Next Generation Networks for Neuroscience. He also has been an invited speaker at the Robarts Research Institute, a Canada-based facility accelerating medical discovery of treatments for some of the most debilitating diseases of our time, and the Gordon Research Conference on Molecular Pharmacology, an international forum for the presentation of pre-publication frontier research.

For his scholarship and teaching achievements, Dr. Fenno has won numerous honors. They include the Laughlin Fellowship from the American College of Psychiatrists, which honors individuals deemed likely to make a significant contribution to the field of psychiatry, and the Humanism and Excellence in Teaching

Award from the Arnold P. Gold Foundation, which honors exceptional teaching skills and commitment to the compassionate treatment of patients and families, students, and colleagues.

Dr. Fenno is a member of the Society for Neuroscience, The American Medical Association, and the American Society of Addiction Medicine.

CLINICAL FOCUS

- Psychiatry

ACADEMIC APPOINTMENTS

- Instructor, Psychiatry and Behavioral Sciences

HONORS AND AWARDS

- Psychiatry Career Development Institute Member, Psychiatry CDI (2020)
- Laughlin Fellow, American College of Psychiatry (2019)
- Humanism and Excellence in Teaching Award, Arnold P. Gold Foundation (2018)

PROFESSIONAL EDUCATION

- Medical Education: Stanford University School of Medicine (2016) CA
- Doctor of Philosophy Degree, Stanford University School of Medicine , Neuroscience
- Postdoctoral, Stanford University School of Medicine , Bioengineering
- Medical Degree, Stanford University School of Medicine
- Residency: Stanford University Psychiatry and Behavioral Sciences (2020) CA

Publications

PUBLICATIONS

- **Comprehensive Dual- and Triple-Feature Intersectional Single-Vector Delivery of Diverse Functional Payloads to Cells of Behaving Mammals.** *Neuron*
Fenno, L. E., Ramakrishnan, C., Kim, Y. S., Evans, K. E., Lo, M., Vesuna, S., Inoue, M., Cheung, K. Y., Yuen, E., Pichamoorthy, N., Hong, A. S., Deisseroth, K.
2020
- **Targeting cells with single vectors using multiple-feature Boolean logic** *NATURE METHODS*
Fenno, L. E., Mattis, J., Ramakrishnan, C., Hyun, M., Lee, S. Y., He, M., Tucciarone, J., Selimbeyoglu, A., Berndt, A., Grosenick, L., Zalocusky, K. A., Bernstein, H., Swanson, et al
2014; 11 (7): 763-U116
- **Neocortical excitation/inhibition balance in information processing and social dysfunction** *NATURE*
Yizhar, O., Fenno, L. E., Prigge, M., Schneider, F., Davidson, T. J., O'Shea, D. J., Sohal, V. S., Goshen, I., Finkelstein, J., Paz, J. T., Stehfest, K., Fudim, R., Ramakrishnan, et al
2011; 477 (7363): 171-178
- **The Development and Application of Optogenetics** *ANNUAL REVIEW OF NEUROSCIENCE, VOL 34*
Fenno, L., Yizhar, O., Deisseroth, K.
2011; 34: 389-412
- **Distinct Signaling by Ventral Tegmental Area Glutamate, GABA, and Combinatorial Glutamate-GABA Neurons in Motivated Behavior.** *Cell reports*
Root, D. H., Barker, D. J., Estrin, D. J., Miranda-Barrientos, J. A., Liu, B., Zhang, S., Wang, H., Vautier, F., Ramakrishnan, C., Kim, Y. S., Fenno, L., Deisseroth, K., Morales, et al
2020; 32 (9): 108094
- **Genetically targeted chemical assembly of functional materials in living cells, tissues, and animals.** *Science (New York, N.Y.)*
Liu, J., Kim, Y. S., Richardson, C. E., Tom, A., Ramakrishnan, C., Birey, F., Katsumata, T., Chen, S., Wang, C., Wang, X., Joubert, L. M., Jiang, Y., Wang, et al
2020; 367 (6484): 1372-76

- **Excitation of diverse classes of cholecystokinin interneurons in the basolateral amygdala facilitates fear extinction.** *eNeuro*
Rovira-Esteban, L., Gunduz-Cinar, O., Bukalo, O., Limoges, A., Brockway, E., Muller, K., Fenno, L., Kim, Y. S., Ramakrishnan, C., Andrasi, T., Deisseroth, K., Holmes, A., Hajos, et al
2019
- **Mapping Brain-Wide Afferent Inputs of Parvalbumin-Expressing GABAergic Neurons in Barrel Cortex Reveals Local and Long-Range Circuit Motifs.** *Cell reports*
Hafner, G., Witte, M., Guy, J., Subhashini, N., Fenno, L. E., Ramakrishnan, C., Kim, Y. S., Deisseroth, K., Callaway, E. M., Oberhuber, M., Conzelmann, K., Staiger, J. F.
2019; 28 (13): 3450
- **A hypothalamus-habenula circuit controls aversion.** *MOLECULAR PSYCHIATRY*
Lazaridis, I., Tzortzi, O., Weglage, M., Martin, A., Xuan, Y., Parent, M., Johansson, Y., Fuzik, J., Furth, D., Fenno, L. E., Ramakrishnan, C., Silberberg, G., Deisseroth, et al
2019; 24 (9): 1351–68
- **A hypothalamus-habenula circuit controls aversion.** *Molecular psychiatry*
Lazaridis, I., Tzortzi, O., Weglage, M., Martin, A., Xuan, Y., Parent, M., Johansson, Y., Fuzik, J., Furth, D., Fenno, L. E., Ramakrishnan, C., Silberberg, G., Deisseroth, et al
2019
- **Sono-optogenetics facilitated by a circulation-delivered rechargeable light source for minimally invasive optogenetics.** *Proceedings of the National Academy of Sciences of the United States of America*
Wu, X., Zhu, X., Chong, P., Liu, J., Andre, L. N., Ong, K. S., Brinson, K., Mahdi, A. I., Li, J., Fenno, L. E., Wang, H., Hong, G.
2019
- **Structural mechanisms of selectivity and gating in anion channelrhodopsins.** *Nature*
Kato, H. E., Kim, Y. S., Paggi, J. M., Evans, K. E., Allen, W. E., Richardson, C., Inoue, K., Ito, S., Ramakrishnan, C., Fenno, L. E., Yamashita, K., Hilger, D., Lee, et al
2018
- **Crystal structure of the natural anion-conducting channelrhodopsin GtACR1.** *Nature*
Kim, Y. S., Kato, H. E., Yamashita, K., Ito, S., Inoue, K., Ramakrishnan, C., Fenno, L. E., Evans, K. E., Paggi, J. M., Dror, R. O., Kandori, H., Kobilka, B. K., Deisseroth, et al
2018
- **The central amygdala controls learning in the lateral amygdala.** *NATURE NEUROSCIENCE*
Yu, K., Ahrens, S., Zhang, X., Schiff, H., Ramakrishnan, C., Fenno, L., Deisseroth, K., Zhao, F., Luo, M., Gong, L., He, M., Zhou, P., Paninski, et al
2017; 20 (12): 1680+
- **Distinct Thalamic Reticular Cell Types Differentially Modulate Normal and Pathological Cortical Rhythms.** *Cell reports*
Clemente-Perez, A., Makinson, S. R., Higashikubo, B., Brovarney, S., Cho, F. S., Urry, A., Holden, S. S., Wimer, M., Dávid, C., Fenno, L. E., Acsády, L., Deisseroth, K., Paz, et al
2017; 19 (10): 2130-2142
- **Next-generation probes, particles, and proteins for neural interfacing.** *SCIENCE ADVANCES*
Rivnay, J., Wang, H., Fenno, L., Deisseroth, K., Malliaras, G. G.
2017; 3 (6): e1601649
- **Thirst-associated preoptic neurons encode an aversive motivational drive.** *Science (New York, N.Y.)*
Allen, W. E., DeNardo, L. A., Chen, M. Z., Liu, C. D., Loh, K. M., Fenno, L. E., Ramakrishnan, C., Deisseroth, K., Luo, L.
2017; 357 (6356): 1149–55
- **A Guide to Creating and Testing New INTRSECT Constructs.** *Current protocols in neuroscience*
Fenno, L. E., Mattis, J., Ramakrishnan, C., Deisseroth, K.
2017; 80: 4.39.1–4.39.24
- **Modulation of prefrontal cortex excitation/inhibition balance rescues social behavior in CNTNAP2-deficient mice.** *Science translational medicine*
Selimbeyoglu, A., Kim, C. K., Inoue, M., Lee, S. Y., Hong, A. S., Kauvar, I., Ramakrishnan, C., Fenno, L. E., Davidson, T. J., Wright, M., Deisseroth, K.
2017; 9 (401)

- **Midbrain circuits for defensive behaviour** *NATURE*
Tovote, P., Esposito, M. S., Botta, P., Haudun, F. C., Fadok, J. P., Markovic, M., Wolff, S. B., Ramakrishnan, C., Fenno, L., Deisseroth, K., Herry, C., Arber, S., Luthi, et al
2016; 534 (7606): 206-?
- **Chronic Optogenetic Activation Augments A beta Pathology in a Mouse Model of Alzheimer Disease** *CELL REPORTS*
Yamamoto, K., Tanei, Z., Hashimoto, T., Wakabayashi, T., Okuno, H., Naka, Y., Yizhar, O., Fenno, L. E., Fukayama, M., Bitto, H., Cirrito, J. R., Holtzman, D. M., Deisseroth, et al
2015; 11 (6): 859-865
- **Mapping Anatomy to Behavior in Thy1:18 ChR2-YFP Transgenic Mice Using Optogenetics.** *Cold Spring Harbor protocols*
Fenno, L. E., Gunaydin, L. A., Deisseroth, K.
2015; 2015 (6): pdb prot075598-?
- **Optogenetic neuronal stimulation promotes functional recovery after stroke** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Cheng, M. Y., Wang, E. H., Woodson, W. J., Wang, S., Sun, G., Lee, A. G., Arac, A., Fenno, L. E., Deisseroth, K., Steinberg, G. K.
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- **Optogenetic neuronal stimulation promotes functional recovery after stroke.** *Proceedings of the National Academy of Sciences of the United States of America*
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- **Targeting cells with single vectors using multiple-feature Boolean logic.** *Nature methods*
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2014; 11 (7): 763-772
- **Natural neural projection dynamics underlying social behavior.** *Cell*
Gunaydin, L. A., Grosenick, L., Finkelstein, J. C., Kauvar, I. V., Fenno, L. E., Adhikari, A., Lammel, S., Mirzabekov, J. J., Airan, R. D., Zalocusky, K. A., Tye, K. M., Anikeeva, P., Malenka, et al
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- **Principles for applying optogenetic tools derived from direct comparative analysis of microbial opsins** *NATURE METHODS*
Mattis, J., Tye, K. M., Ferenczi, E. A., Ramakrishnan, C., O'Shea, D. J., Prakash, R., Gunaydin, L. A., Hyun, M., Fenno, L. E., Gradinaru, V., Yizhar, O., Deisseroth, K.
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- **The Microbial Opsin Family of Optogenetic Tools** *CELL*
Zhang, F., Vierock, J., Yizhar, O., Fenno, L. E., Tsunoda, S., Kianianmomeni, A., Prigge, M., Berndt, A., Cushman, J., Polle, J., Magnuson, J., Hegemann, P., Deisseroth, et al
2011; 147 (7): 1446-1457
- **SNCA Triplication Parkinson's Patient's iPSC-derived DA Neurons Accumulate alpha-Synuclein and Are Susceptible to Oxidative Stress** *PLOS ONE*
Byers, B., Cord, B., Ha Nam Nguyen, H. N., Schuele, B., Fenno, L., Lee, P. C., Deisseroth, K., Langston, J. W., Pera, R. R., Palmer, T. D.
2011; 6 (11)
- **A new mode of corticothalamic transmission revealed in the Gria4(-/-) model of absence epilepsy** *NATURE NEUROSCIENCE*
Paz, J. T., Bryant, A. S., Peng, K., Fenno, L., Yizhar, O., Frankel, W. N., Deisseroth, K., Huguenard, J. R.
2011; 14 (9): 1167-U225
- **Optogenetics in Neural Systems** *NEURON*
Yizhar, O., Fenno, L. E., Davidson, T. J., Mogri, M., Deisseroth, K.
2011; 71 (1): 9-34
- **Amygdala circuitry mediating reversible and bidirectional control of anxiety** *NATURE*
Tye, K. M., Prakash, R., Kim, S., Fenno, L. E., Grosenick, L., Zarabi, H., Thompson, K. R., Gradinaru, V., Ramakrishnan, C., Deisseroth, K.
2011; 471 (7338): 358-362
- **An Implantable Optical Stimulation Delivery System for Actuating an Excitable Biosubstrate** *IEEE JOURNAL OF SOLID-STATE CIRCUITS*
Paralakar, K., Cong, P., Yizhar, O., Fenno, L. E., Santa, W., Nielsen, C., Dinsmoor, D., Hocken, B., Munns, G. O., Giftakis, J., Deisseroth, K., Denison, T.

2011; 46 (1): 321-332

- **Global and local fMRI signals driven by neurons defined optogenetically by type and wiring** *NATURE*

Lee, J. H., Durand, R., Gradinaru, V., Zhang, F., Goshen, I., Kim, D., Fenno, L. E., Ramakrishnan, C., Deisseroth, K.

2010; 465 (7299): 788-792

- **Temporally precise in vivo control of intracellular signalling** *NATURE*

Airan, R. D., Thompson, K. R., Fenno, L. E., Bernstein, H., Deisseroth, K.

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