



## Karl Deisseroth

D. H. Chen Professor, Professor of Bioengineering and of Psychiatry and of Behavioral Sciences

 NIH Biosketch available Online

### CLINICAL OFFICES

- **Psychiatry and Behavioral Sciences**

401 Quarry Rd

MC 5795

Stanford, CA 94305

**Tel** (650) 498-9111

**Fax** (650) 725-7799

### ACADEMIC CONTACT INFORMATION

- **Alternate Contact**

Cynthia Delacruz - Executive Assistant

**Email** cdelacruz@stanford.edu

### Bio

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#### BIO

Deisseroth focuses on developing molecular and cellular tools to observe, perturb, and re-engineer brain circuits. His laboratory is based in the James H. Clark Center at Stanford and employs a range of techniques including neural stem cell and tissue engineering methods, electrophysiology, molecular biology, neural activity imaging, animal behavior, and computational neural network modeling. Also a clinician in the psychiatry department, Dr. Deisseroth employs novel electromagnetic brain stimulation techniques in human patients for therapeutic purposes.

#### CLINICAL FOCUS

- Psychiatry

#### ACADEMIC APPOINTMENTS

- Professor, Bioengineering
- Professor, Psychiatry and Behavioral Sciences
- Member, Bio-X
- Member, Wu Tsai Neurosciences Institute

#### HONORS AND AWARDS

- Outstanding Resident, National Institute of Mental Health (2002)
- Culpeper Scholar Award, Rockefeller Brothers Fund, Goldman Philanthropic Partnerships (2004)
- Early Career Translational Research Award, Coulter Foundation (2005)
- Director's Pioneer Award, National Institutes of Health (2005)
- Klingenstein Fellowship, Klingenstein Foundation (2005)
- McKnight Foundation Technological Innovations in Neuroscience Award, McKnight Foundation (2005)
- Presidential Early Career Award in Science and Engineering (PECASE), NIH (2006)
- McKnight Foundation Scholar Award, McKnight Foundation (2007)

- Schuetze Prize in Neurobiology, Columbia University (2008)
- Lawrence C. Katz Prize in Neurobiology, Duke University (2008)

## **BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS**

- Member, Institute of Medicine (2011 - present)
- Member, National Academy of Sciences (2012 - present)

## **PROFESSIONAL EDUCATION**

- Residency: Stanford University Adult Psychiatry Residency (2004) CA
- Internship: Stanford University Adult Psychiatry Residency (2001) CA
- Medical Education: Stanford University School of Medicine Registrar (2000) CA
- Board Certification: Psychiatry, American Board of Psychiatry and Neurology (2006)
- Ph.D., Stanford University , Neuroscience (1998)
- M.D., Stanford University (2000)
- A.B., Harvard , Biochemical Sciences (1992)

## **LINKS**

- Deisseroth Lab Website: <http://www.stanford.edu/group/dlab/>
- optogenetics technology portal: <http://optogenetics.org>
- CLARITY technology portal: <http://clarityresourcecenter.org>

## **Research & Scholarship**

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### **CURRENT RESEARCH AND SCHOLARLY INTERESTS**

Research in Dr. Deisseroth's laboratory focuses on developing optical, molecular and cellular tools to observe, perturb, and re-engineer brain circuits. His laboratory is based in the James H. Clark Center at Stanford and has developed optogenetic and tissue engineering methods, employing techniques spanning electrophysiology, molecular biology, optics, neural activity imaging, animal behavior, and computational neural network modeling. Also a physician in the psychiatry department, Professor Deisseroth employs novel electromagnetic brain stimulation techniques in human patients for therapeutic purposes.

## **Teaching**

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### **COURSES**

#### **2019-20**

- Principles and Practice of Optogenetics for Optical Control of Biological Tissues: BIOE 291 (Aut)
- Systems Physiology and Design: BIOE 103 (Spr)

#### **2018-19**

- Principles and Practice of Optogenetics for Optical Control of Biological Tissues: BIOE 291 (Aut)
- Systems Physiology and Design: BIOE 103 (Spr)
- Systems Physiology and Design: BIOE 103B (Spr)

#### **2017-18**

- Principles and Practice of Optogenetics for Optical Control of Biological Tissues: BIOE 291 (Aut)
- Systems Physiology and Design: BIOE 103 (Spr)
- Systems Physiology and Design: BIOE 103B (Spr)

## 2016-17

- Principles and Practice of Optogenetics for Optical Control of Biological Tissues: BIOE 291 (Aut)
- Systems Physiology and Design: BIOE 103 (Spr)
- Systems Physiology and Design: BIOE 103B (Spr)

## STANFORD ADVISEES

### Doctoral Dissertation Reader (AC)

Molly Lucas

### Postdoctoral Faculty Sponsor

Siavash Ahrar, Claire Bedbrook, Eamon Byrne, Ritche Chen, Yiming Chen, Jiayi Dou, Antonia Drinnenberg, Linlin Fan, Felicity Gore, Joshua Jennings, Tim Machado, Longzhi Tan, Huiliang(Evan) Wang

### Doctoral Dissertation Advisor (AC)

Tyler Benster, Brian Hsueh, YoungJu Jo, Isaac Kauvar, John Kochalka, Kang Yong Loh, Marija Pavlovic, Misha Raffiee, Sam Vesuna, Noah Young

### Doctoral Dissertation Co-Advisor (AC)

Ethan Richman

### Postdoctoral Research Mentor

Claire Bedbrook, Jiayi Dou, Antonia Drinnenberg

### Doctoral (Program)

Saurabh Vyas

## GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Bioengineering (Phd Program)
- Neurosciences (Phd Program)
- Psychiatry and Behavioral Science (Fellowship Program)

## Publications

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### PUBLICATIONS

- **Structural and molecular interrogation of intact biological systems.** *Nature*  
Chung, K., Wallace, J., Kim, S., Kalyanasundaram, S., Andalman, A. S., Davidson, T. J., Mirzabekov, J. J., Zalocusky, K. A., Mattis, J., Denisin, A. K., Pak, S., Bernstein, H., Ramakrishnan, et al  
2013; 497 (7449): 332-337
- **Diverging neural pathways assemble a behavioural state from separable features in anxiety** *NATURE*  
Kim, S., Adhikari, A., Lee, S. Y., Marshel, J. H., Kim, C. K., Mallory, C. S., Lo, M., Pak, S., Mattis, J., Lim, B. K., Malenka, R. C., Warden, M. R., Neve, et al  
2013; 496 (7444): 219-223
- **Dopamine neurons modulate neural encoding and expression of depression-related behaviour** *NATURE*  
Tye, K. M., Mirzabekov, J. J., Warden, M. R., Ferenczi, E. A., Tsai, H., Finkelstein, J., Kim, S., Adhikari, A., Thompson, K. R., Andalman, A. S., Gunaydin, L. A., Witten, I. B., Deisseroth, et al  
2013; 493 (7433): 537-?
- **A prefrontal cortex-brainstem neuronal projection that controls response to behavioural challenge** *NATURE*  
Warden, M. R., Selimbeyoglu, A., Mirzabekov, J. J., Lo, M., Thompson, K. R., Kim, S., Adhikari, A., Tye, K. M., Frank, L. M., Deisseroth, K.  
2012; 492 (7429): 428-432

- **Crystal structure of the channelrhodopsin light-gated cation channel** *NATURE*  
Kato, H. E., Zhang, F., Yizhar, O., Ramakrishnan, C., Nishizawa, T., Hirata, K., Ito, J., Aita, Y., Tsukazaki, T., Hayashi, S., Hegemann, P., Maturana, A. D., Ishitani, et al  
2012; 482 (7385): 369-U115
- **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
- **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
- **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
- **Optogenetics** *NATURE METHODS*  
Deisseroth, K.  
2011; 8 (1): 26-29
- **The Development and Application of Optogenetics** *ANNUAL REVIEW OF NEUROSCIENCE, VOL 34*  
Fenno, L., Yizhar, O., Deisseroth, K.  
2011; 34: 389-412
- **Cholinergic Interneurons Control Local Circuit Activity and Cocaine Conditioning** *SCIENCE*  
Witten, I. B., Lin, S., Brodsky, M., Prakash, R., Diester, I., Anikeeva, P., Gradinaru, V., Ramakrishnan, C., Deisseroth, K.  
2010; 330 (6011): 1677-1681
- **Parvalbumin neurons and gamma rhythms enhance cortical circuit performance** *NATURE*  
Sohal, V. S., Zhang, F., Yizhar, O., Deisseroth, K.  
2009; 459 (7247): 698-702
- **Driving fast-spiking cells induces gamma rhythm and controls sensory responses** *NATURE*  
Cardin, J. A., Carlen, M., Meletis, K., Knoblich, U., Zhang, F., Deisseroth, K., Tsai, L., Moore, C. I.  
2009; 459 (7247): 663-U63
- **Phasic Firing in Dopaminergic Neurons Is Sufficient for Behavioral Conditioning** *SCIENCE*  
Tsai, H., Zhang, F., Adamantidis, A., Stuber, G. D., Bonci, A., de Lecea, L., Deisseroth, K.  
2009; 324 (5930): 1080-1084
- **Temporally precise in vivo control of intracellular signalling** *NATURE*  
Airan, R. D., Thompson, K. R., Fenno, L. E., Bernstein, H., Deisseroth, K.  
2009; 458 (7241): 1025-1029
- **Optical Deconstruction of Parkinsonian Neural Circuitry** *SCIENCE*  
Gradinaru, V., Mogri, M., Thompson, K. R., Henderson, J. M., Deisseroth, K.  
2009; 324 (5925): 354-359
- **Neuronal activity regulates neurotransmitter switching in the adult brain following light-induced stress** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Meng, D., Li, H., Deisseroth, K., Leutgeb, S., Spitzer, N. C.  
2018; 115 (20): 5064-71

- **Phasic Dopamine Signals in the Nucleus Accumbens that Cause Active Avoidance Require Endocannabinoid Mobilization in the Midbrain** *CURRENT BIOLOGY*  
Wenzel, J. M., Oleson, E. B., Gove, W. N., Cole, A. B., Gyawali, U., Dantrassy, H. M., Bluett, R. J., Dryanovski, D. I., Stuber, G. D., Deisseroth, K., Mathur, B. N., Patel, S., Lupica, et al  
2018; 28 (9): 1392-+
- **A Critical Role for the Globus Pallidus in Cocaine-Triggered Plasticity Revealed Byrabies Activity Screen**  
Beier, K., Kim, C., Hoerbel, P., Hung, L., Heifets, B., DeLoach, K., Mosca, T., Neuner, S., Deisseroth, K., Luo, L., Malenka, R.  
ELSEVIER SCIENCE INC.2018: S235-S236
- **Development of an optogenetic toolkit for neural circuit dissection in squirrel monkeys** *SCIENTIFIC REPORTS*  
O'Shea, D. J., Kalanithi, P., Ferenczi, E. A., Hsueh, B., Chandrasekaran, C., Goo, W., Diester, I., Ramakrishnan, C., Kaufman, M. T., Ryu, S. I., Yeom, K. W., Deisseroth, K., Shenoy, et al  
2018; 8: 6775
- **Brain-wide Electrical Spatiotemporal Dynamics Encode Depression Vulnerability** *CELL*  
Hultman, R., Ulrich, K., Sachs, B. D., Blount, C., Carlson, D. E., Ndubizu, N., Bagot, R. C., Parise, E. M., Vu, M. T., Gallagher, N. M., Wang, J., Silva, A. J., Deisseroth, et al  
2018; 173 (1): 166+
- **Hierarchical neural architecture underlying thirst regulation** *NATURE*  
Augustine, V., Gokce, S., Lee, S., Wang, B., Davidson, T. J., Reimann, F., Gribble, F., Deisseroth, K., Lois, C., Oka, Y.  
2018; 555 (7695): 204+
- **Hydrogel-Tissue Chemistry: Principles and Applications** *ANNUAL REVIEW OF BIOPHYSICS, VOL 47*  
Gradinaru, V., Treweek, J., Overton, K., Deisseroth, K., Dill, K. A.  
2018; 47: 355-76
- **An interactive framework for whole-brain maps at cellular resolution** *NATURE NEUROSCIENCE*  
Furth, D., Vaissiere, T., Tzortzi, O., Xuan, Y., Martin, A., Lazaridis, I., Spigolon, G., Fisone, G., Tomer, R., Deisseroth, K., Carlen, M., Miller, C. A., Rumbaugh, et al  
2018; 21 (1): 139+
- **Vasopressin excites interneurons to suppress hippocampal network activity across a broad span of brain maturity at birth** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Spoljaric, A., Seja, P., Spoljaric, I., Virtanen, M. A., Lindfors, J., Uvarov, P., Summanen, M., Crow, A. K., Hsueh, B., Puskarjov, M., Ruusuvuori, E., Voipio, J., Deisseroth, et al  
2017; 114 (50): E10819-E10828
- **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+
- **Long-Range GABAergic Inputs Regulate Neural Stem Cell Quiescence and Control Adult Hippocampal Neurogenesis** *CELL STEM CELL*  
Bao, H., Asrican, B., Li, W., Gu, B., Wen, Z., Lim, S., Haniff, I., Ramakrishnan, C., Deisseroth, K., Philpot, B., Song, J.  
2017; 21 (5): 604+
- **Modular organization of the brainstem noradrenaline system coordinates opposing learning states** *NATURE NEUROSCIENCE*  
Uematsu, A., Tan, B., Ycu, E. A., Cuevas, J., Koivumaa, J., Junyent, F., Kremer, E. J., Witten, I. B., Deisseroth, K., Johansen, J. P.  
2017; 20 (11): 1602+
- **Brain-Derived Neurotrophic Factor in the Mesolimbic Reward Circuitry Mediates Nociception in Chronic Neuropathic Pain** *BIOLOGICAL PSYCHIATRY*  
Zhang, H., Qian, Y., Li, C., Liu, D., Wang, L., Wang, X., Liu, M., Liu, H., Zhang, S., Guo, X., Yang, J., Ding, H., Koo, et al  
2017; 82 (8): 608-18
- **Whole-tissue biopsy phenotyping of three-dimensional tumours reveals patterns of cancer heterogeneity** *NATURE BIOMEDICAL ENGINEERING*  
Tanaka, N., Kanatani, S., Tomer, R., Sahlgren, C., Kronqvist, P., Kaczynska, D., Louhivuori, L., Kis, L., Lindh, C., Mitura, P., Stepulak, A., Corvigno, S., Hartman, et al  
2017; 1 (10): 796-806

- **In Vivo Fiber Photometry Reveals Signature of Future Stress Susceptibility in Nucleus Accumbens.** *Neuropsychopharmacology : official publication of the American College of Neuropsychopharmacology*  
Muir, J., Lorsch, Z. S., Ramakrishnan, C., Deisseroth, K., Nestler, E. J., Calipari, E. S., Bagot, R. C.  
2017
- **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
- **Global Representations of Goal-Directed Behavior in Distinct Cell Types of Mouse Neocortex** *NEURON*  
Allen, W. E., Kauvar, I. V., Chen, M. Z., Richman, E. B., Yang, S. J., Chan, K., Gradinaru, V., Deverman, B. E., Luo, L., Deisseroth, K.  
2017; 94 (4): 891-?
- **Integration of optogenetics with complementary methodologies in systems neuroscience** *NATURE REVIEWS NEUROSCIENCE*  
Kim, C. K., Adhikari, A., Deisseroth, K.  
2017; 18 (4): 222-235
- **A Brainstem-Spinal Cord Inhibitory Circuit for Mechanical Pain Modulation by GABA and Enkephalins.** *Neuron*  
François, A., Low, S. A., Sypek, E. I., Christensen, A. J., Sotoudeh, C., Beier, K. T., Ramakrishnan, C., Ritola, K. D., Sharif-Naeini, R., Deisseroth, K., Delp, S. L., Malenka, R. C., Luo, et al  
2017; 93 (4): 822-839 e6
- **Gamma oscillations organize top-down signalling to hypothalamus and enable food seeking** *NATURE*  
Carus-Cadavieco, M., Gorbati, M., Ye, L., Bender, F., van der Veldt, S., Kosse, C., Borgers, C., Lee, S. Y., Ramakrishnan, C., Hu, Y., Denisova, N., Ramm, F., Volitaki, et al  
2017; 542 (7640): 232-236
- **Cognitive neuroscience: In search of lost time.** *Nature*  
Young, N. P., Deisseroth, K.  
2017; 542 (7640): 173-174
- **Coordination of Brain-Wide Activity Dynamics by Dopaminergic Neurons** *NEUROPSYCHOPHARMACOLOGY*  
Decot, H. K., Namboodiri, V. M., Gao, W., McHenry, J. A., Jennings, J. H., Lee, S., Kantak, P. A., Kao, Y. J., Das, M., Witten, I. B., Deisseroth, K., Shih, Y. I., Stuber, et al  
2017; 42 (3): 615-627
- **Molecular interrogation of hypothalamic organization reveals distinct dopamine neuronal subtypes** *NATURE NEUROSCIENCE*  
Romanov, R. A., Zeisel, A., Bakker, J., Girach, F., Helysaz, A., Tomer, R., Alpar, A., Mulder, J., Clotman, F., Keimpema, E., Hsueh, B., Crow, A. K., Martens, et al  
2017; 20 (2): 176-188
- **Dopaminergic dynamics underlying sex-specific cocaine reward** *NATURE COMMUNICATIONS*  
Calipari, E. S., Juarez, B., Morel, C., Walker, D. M., Cahill, M. E., Ribeiro, E., Roman-Ortiz, C., Ramakrishnan, C., Deisseroth, K., Han, M., Nestler, E. J.  
2017; 8
- **Bidirectional Control of Generalized Epilepsy Networks via Rapid Real-Time Switching of Firing Mode.** *Neuron*  
Sorokin, J. M., Davidson, T. J., Frechette, E., Abramian, A. M., Deisseroth, K., Huguenard, J. R., Paz, J. T.  
2017; 93 (1): 194-210
- **The need for calcium imaging in nonhuman primates: New motor neuroscience and brain-machine interfaces** *EXPERIMENTAL NEUROLOGY*  
O'Shea, D. J., Tiautmann, E., Chandrasekaran, C., Stavisky, S., Kao, J. C., Sahani, M., Ryu, S., Deisseroth, K., Shenoy, K. V.  
2017; 287: 437-451
- **A radial axis defined by semaphorin-to-neuropilin signaling controls pancreatic islet morphogenesis.** *Development (Cambridge, England)*  
Pauerstein, P. T., Tellez, K., Willmarth, K. B., Park, K. M., Hsueh, B., Efsun Arda, H., Gu, X., Aghajanian, H., Deisseroth, K., Epstein, J. A., Kim, S. K.  
2017; 144 (20): 3744-54
- **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)

- **Ancestral Circuits for the Coordinated Modulation of Brain State.** *Cell*  
Lovett-Barron, M., Andalman, A. S., Allen, W. E., Vesuna, S., Kauvar, I., Burns, V. M., Deisseroth, K.  
2017; 171 (6): 1411–23.e17
- **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
- **Molecular and Circuit-Dynamical Identification of Top-Down Neural Mechanisms for Restraint of Reward Seeking.** *Cell*  
Kim, C. K., Ye, L., Jennings, J. H., Pichamoorthy, N., Tang, D. D., Yoo, A. W., Ramakrishnan, C., Deisseroth, K.  
2017; 170 (5): 1013–27.e14
- **The form and function of channelrhodopsin.** *Science (New York, N.Y.)*  
Deisseroth, K., Hegemann, P.  
2017; 357 (6356)
- **Patterned photostimulation via visible-wavelength photonic probes for deep brain optogenetics.** *Neurophotonics*  
Segev, E., Reimer, J., Moreaux, L. C., Fowler, T. M., Chi, D., Sacher, W. D., Lo, M., Deisseroth, K., Tolias, A. S., Faraon, A., Roukes, M. L.  
2017; 4 (1): 011002-?
- **In Vivo Interrogation of Spinal Mechanosensory Circuits.** *Cell reports*  
Christensen, A. J., Iyer, S. M., François, A., Vyas, S., Ramakrishnan, C., Vesuna, S., Deisseroth, K., Scherrer, G., Delp, S. L.  
2016; 17 (6): 1699-1710
- **Locus coeruleus and dopaminergic consolidation of everyday memory** *NATURE*  
Takeuchi, T., Duzskiewicz, A. J., Sonneborn, A., Spooner, P. A., Yamasaki, M., Watanabe, M., Smith, C. C., Fernandez, G., Deisseroth, K., Greene, R. W., Morris, R. G.  
2016; 537 (7620): 357-?
- **Pontomesencephalic Tegmental Afferents to VTA Non-dopamine Neurons Are Necessary for Appetitive Pavlovian Learning.** *Cell reports*  
Yau, H., Wang, D. V., Tsou, J., Chuang, Y., Chen, B. T., Deisseroth, K., Ikemoto, S., Bonci, A.  
2016; 16 (10): 2699-2710
- **Serotonin engages an anxiety and fear-promoting circuit in the extended amygdala** *NATURE*  
Marcinkiewicz, C. A., Mazzone, C. M., D'Agostino, G., Halladay, L. R., Hardaway, J. A., DiBerto, J. F., Navarro, M., Burnham, N., Cristiano, C., Dorrier, C. E., Tipton, G. J., Ramakrishnan, C., Kozicz, et al  
2016; 537 (7618): 97-101
- **Sustained Attentional States Require Distinct Temporal Involvement of the Dorsal and Ventral Medial Prefrontal Cortex** *FRONTIERS IN NEURAL CIRCUITS*  
Luchicchi, A., Mnie-Filali, O., Terra, H., Bruinsma, B., de Kloet, S. F., Obermayer, J., Heistek, T. S., de Haan, R., De Kock, C. P., Deisseroth, K., Pattij, T., Mansvelder, H. D.  
2016; 10
- **The need for calcium imaging in nonhuman primates: New motor neuroscience and brain-machine interfaces.** *Experimental neurology*  
O'Shea, D. J., Trautmann, E., Chandrasekaran, C., Stavisky, S., Kao, J. C., Sahani, M., Ryu, S., Deisseroth, K., Shenoy, K. V.  
2016
- **Segregated cholinergic transmission modulates dopamine neurons integrated in distinct functional circuits** *NATURE NEUROSCIENCE*  
Dautan, D., Souza, A. S., Huerta-Ocampo, I., Valencia, M., Assous, M., Witten, I. B., Deisseroth, K., Tepper, J. M., Bolam, J. P., Gerdjikov, T. V., Mena-Segovia, J.  
2016; 19 (8): 1025-?
- **Competition between engrams influences fear memory formation and recall** *SCIENCE*  
Rashid, A. J., Yan, C., Mercaldo, V., Hsiang, H. (., Park, S., Cole, C. J., De Cristofaro, A., Yu, J., Ramakrishnan, C., Lee, S. Y., Deisseroth, K., Frankland, P. W., Josselyn, et al  
2016; 353 (6297): 383-387
- **Dysregulation of Prefrontal Cortex-Mediated Slow-Evolving Limbic Dynamics Drives Stress-Induced Emotional Pathology** *NEURON*

- Hultman, R., Mague, S. D., Li, Q., Katz, B. M., Michel, N., Lin, L., Wang, J., David, L. K., Blount, C., Chandy, R., Carlson, D., Ulrich, K., Carin, et al  
2016; 91 (2): 439-452
- **Phototactic guidance of a tissue-engineered soft-robotic ray** *SCIENCE*  
Park, S., Gazzola, M., Park, K. S., Park, S., Di Santo, V., Blevins, E. L., Lind, J. U., Campbell, P. H., Dauth, S., Capulli, A. K., Pasqualini, F. S., Ahn, S., Cho, et al  
2016; 353 (6295): 158-162
  - **LSPS/Optogenetics to Improve Synaptic Connectivity Mapping: Unmasking the Role of Basket Cell-Mediated Feedforward Inhibition.** *eNeuro*  
Brill, J., Mattis, J., Deisseroth, K., Huguenard, J. R.  
2016; 3 (4)
  - **Wiring and Molecular Features of Prefrontal Ensembles Representing Distinct Experiences** *CELL*  
Ye, L., Allen, W. E., Thompson, K. R., Tian, Q., Hsueh, B., Ramakrishnan, C., Wang, A., Jennings, J. H., Adhikari, A., Halpern, C. H., Witten, I. B., Barth, A. L., Luo, et al  
2016; 165 (7): 1776-1788
  - **Endocannabinoid Modulation of Orbitostriatal Circuits Gates Habit Formation** *NEURON*  
Gremel, C. M., Chancey, J. H., Atwood, B. K., Luo, G., Neve, R., Ramakrishnan, C., Deisseroth, K., Lovinger, D. M., Costa, R. M.  
2016; 90 (6): 1312-1324
  - **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-?
  - **Hilar somatostatin interneuron loss reduces dentate gyrus inhibition in a mouse model of temporal lobe epilepsy** *EPILEPSIA*  
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