Kelsie Ann Eichel, Ph.D.

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Education and Training

Stanford University 2017-present
HHMI Hanna H. Gray Fellow, Damon Runyon Postdoctoral Fellow
Advisor: Dr. Kang Shen

University of California, San Francisco 2011-2017
Ph.D. in Biochemistry & Molecular Biology, NSF Graduate Fellowship
Advisor: Dr. Mark von Zastrow

Northwestern University 2006-2010
BA, Program Honors Biological Sciences
Honors Thesis Advisor: Dr. Richard Morimoto

Research Experience

Postdoctoral Fellow, **Kang Shen Lab**, Stanford University 2017-present

- Discovered a conserved endocytic clearance mechanism in the axon initial segment that is critical for neuronal polarity in *C. elegans*, mouse, rat, and human neurons
- Established the first *in vivo,* genetic, and developmental model to study axon initial segment biology by demonstrating that *C. elegans* neurons have an axon initial segment
- Developed a *C. elegans* to human neuron cross-translational platform to leverage the strengths of an intact animal and a cultured human neuron system to dissect cell biological mechanisms

Graduate Student, **Mark von Zastrow Lab**, UCSF 2013-2017

- Discovered an unexpected cellular mechanism of β-arrestin function, critical regulators of G protein-coupled receptors (GPCRs), that suggests novel drug development targets
- Delineated a discrete β-arrestin activation cycle, in which the GPCR is a catalyst for β-arrestin activation instead of a co-scaffold, and elucidated its cellular signaling consequences
- Initiated and managed cross-university collaborations to gain structural, biophysical, and biochemical insight into β-arrestin activation

Research Technician*,* **Ilya Ruvinsky Lab**, University of Chicago 2010-2011

- Elucidated principles of transcriptional regulatory logic indicating that only simpler aspects, such as an on-off heat shock response, are retained over evolutionary time
- Identified a genetic modifier of a toxic single neonatal diabetes mutation in the insulin gene

Peer-Reviewed Publications

Eichel K, Uenaka T, Belapurkar V, Lu R, Cheng S, Pak J, Taylor CA, Südhof T, Malenka R, Wernig M, Özkan E, Perrais D, and Shen K. Endocytosis in the axon initial segment maintains neuronal polarity. *Nature* (2022), doi:10.1038/s41586-022-05074-5.

Eichel K[#] and Shen K. Axon initial segment function in neuronal polarity. *Dev Bio* (2022) 489, 47-54.
[#]corresponding author

Eichel K, Jullié D, Barsi-Rhyne B, Latorraca LR, Masureel M, Sibarita JB, Dror RO, von Zastrow M. Catalytic activation of β-arrestin by GPCRs. *Nature* (2018) 557(7705), 381–386.

- Previewed in *Nature* 'News and Views:' B. Krumm and B. Roth. Activation mechanisms for a universal signalling protein. *Nature* 557, 318-319 (2018).

- Highlighted in *Cell Research* 'Research Highlight:' A. Kahsai, B. Pani, and RJ Lefkowitz. GPCR signaling: conformational activation of arrestins. *Cell Research* (2018).

Eichel K and von Zastrow M. Subcellular organization of GPCR signaling. *Trends Pharmacol Sci* (2018), 39(2), 200-208.

Liang SI, van Lengerich B, **Eichel K**, Cha M, Patterson, DM, Yoon, TY, von Zastrow M, Jura N, Gartner ZJ. Phosphorylated EGFR Dimers Are Not Sufficient to Activate Ras. *Cell Rep* (2018), 22(10), 2593-2600.

O'Hayre M, **Eichel K***, Avino S*, Zhao X, Feng, X, Kawakami K, Aoki J, Inoue A, von Zastrow M, and Gutkind JS. Genetic evidence that β-arrestins are dispensable for the initiation of β2-adrenergic receptor signaling to ERK. *Sci Signal* (2017), 484(10).

Lobingier BT*, Hüttenhain R*, **Eichel K**, Miller KB, Ting AY, Krogan NJ, von Zastrow M. A method for spatially and temporally resolved protein network interrogation in living cells. *Cell* (2017), 169(2), 350-360.

Eichel K, Jullié D, and von Zastrow M. β-arrestin drives MAP kinase signaling from clathrin-coated structures after GPCR dissociation. *Nat Cell Bio* (2016), 18(3), 303-10.

- Highlighted in *Current Biology* in 'Dispatch' section: Ranjan, R et al. GPCR Signaling: β-arrestins Kiss and Remember. *Curr Bio* (2016), 26(7), 285-288.
- Faculty of 1000 evaluations: Rated as an 'Excellent' article in F1000 Prime Review

He Z, **Eichel K**, and Ruvinsky I. Functional conservation of *cis*-regulatory elements of heat-shock genes over long evolutionary distances. *PLoS ONE* (2011), 6(7), e22677

*denotes equal contribution

Preprints

Suzuki N, Zou Y, Sun H, **Eichel K**, Shao M, Shen K, Chang C. Two intrinsic timing mechanisms set start and end times for dendritic arborization of a nociceptive neuron (in review at *PNAS*). https://www.biorxiv.org/content/10.1101/2021.08.31.458402v2

Fellowships

2020-present Howard Hughes Medical Institute (HHMI) Hanna H. Gray Fellowship
- $1.44 million over 8 years: $360,0000 postdoctoral & $1.08 million faculty phase

2018-2020 Damon Runyon Postdoctoral Fellowship (ended early for Hanna H. Gray Fellowship)
2018 Jane Coffin Childs Postdoctoral Fellowship (declined for Damon Runyon Fellowship)
2013-2016 National Science Foundation Graduate Research Fellowship

Awards and Honors

2022 Stanford Postdoc Justice, Equity, Diversity, and Inclusion Champion Nominee
2022 Henry Grass Foundation Rising Stars in Neuroscience Trustee Recognition Award
2021 Henry Grass Foundation Rising Stars in Neuroscience Achievement Award
2021 Intersections Science Fellow
2020 Yale University Kavli Neuroscience Institute SYNAPSES Seminar Series selection
2018 Merton Bernfield Memorial Award of the American Society for Cell Biology
2017 Harold M. Weintraub Graduate Student Award
2015 American Society for Cell Biology (ASCB) Travel Award
2013 Outstanding Teaching Assistant Award, UCSF Tetrad Program
2013 Outstanding Teaching Assistant Award, UCSF Tetrad Program
2010 Irving M. Klotz Prize in Basic Research, Northwestern University

Teaching & Mentoring Experience

Teaching Assistant Experience

Responsibilities include developing new class materials, leading class discussions, and meeting with students individually

- NIH NRSA Writing Bootcamp (BIOS 242), Fall 2021, Stanford University, 15 students
- NIH Diversity Supplement Workshop, Fall 2020, Stanford University, 20 students, co-developed
- HHMI Hanna Gray Fellowship Workshop, Fall 2019 & 2021, Stanford University, 30 students
- NSF Graduate Research Program Fellowship Writing Course, Fall 2013, 7 students
- Bioregulatory Mechanisms Course, Winter 2013, UCSF, 15 students, awarded outstanding TA

Lab-based Mentoring Experience

Responsibilities include teaching lab techniques, advising on projects, providing feedback on science writing and oral presentations

- Jamie Marsal – Stanford Undergraduate, 2021-present. Project: Molecular assembly mechanisms of the axon initial segment. Currently an undergraduate at Stanford.
- Linda Liu – Northwestern Undergraduate, Summer 2022. Project: Motor protein transport of ankyrinG to the axon initial segment. Currently an undergraduate at Northwestern.
- Shawn Dhillon – Stanford Neuroscience PhD student, Winter Rotation 2021. Project: Mechanisms of somatic synaptic vesicle biogenesis. Currently a Stanford PhD candidate
- Ben Barsi-Rhyne, UCSF Tetrad PhD student, 2014-2016. Project: Role of GPCR phosphorylation in arrestin activation and receptor endocytosis. Currently a postdoc at UCSF
- Kathleen Beilsmith - University of Chicago Genetics PhD student, 2011. Project: Genetic modifiers of a misfolded protein in *C. elegans.* Currently a postdoc at Argonne National Labs.

Pedagogical and Mentor Training

- Entering Mentoring Bootcamp, Stanford Biology Department, Summer 2022, 8 hours
- Mentoring the Individual: A Needs-Based Approach to Inclusive Mentorship, Stanford Postdoc Office, May 2022, 8 hours
- Stanford Postdoc Teaching Certificate, 2020-2021, 100 hours
- HHMI Hanna H. Gray Fellows Mentor Training Program, 2020, 8 hours
- HHMI Inclusive Learning Series, 2020, 12 hours
- Stanford Postdoc Teacher Training, 2020, 8 hours
- Center for the Integration of Research Teaching & Learning Course: Introduction to Evidence-Based Undergrad STEM Teaching Course, 2020, 32 hours

Diversity-Related Activities & Community Service

Program-based Mentoring Experience

- Stanford Medical Youth Sciences Program, Stanford University, 2022-present
- Biology Department Graduate Preview Program, Stanford University, 2020-present
- Stanford Black Postdoc Association's High School Mentorship Program Volunteer, 2021
- First-Generation Mentorship Program, Stanford University, 2020-present
- Women in Science and Engineering Peer Group, Stanford University, 2019-2020

Leadership Experience

- Co-developed NIH Diversity Supplement Writing Workshop, Stanford University, Fall 2020
- Co-chair for Molecular Pharmacology Gordon Research Seminar, 2016-2017
- Co-organizer of Bay Area Trafficking Symposium, Fall 2014

Community Involvement

- ASCB Abstract Programming Task Force, 2020, 2022
- Graduate Women in Science (GWIS) National Fellowship Program Reviewer, 2021

- Stanford Postdoc Association Diversity Advisory Committee, 2020
- Independent Reviewer: Journal of Cell Biology, 2020-present
- Bay Area Science Festival Volunteer, 2012-2014
- Science and Health Education Partnership, San Francisco Public Schools, 2011-2015

Invited Talks

***C. elegans* Cell and Developmental Biology Conference**
2022 Receptor endocytosis in the axon initial segment maintains neuronal polarity

Cell Biology of the Neuron Gordon Research Conference
2022 Receptor endocytosis in the axon initial segment maintains neuronal polarity

ASCB (American Society for Cell Biology) Annual Conference
2021 In the neuron minisymposium: Neuronal polarity requires endocytosis in the axon initial segment.
2020 Cell polarity signaling in neurons subgroup: Neuronal polarity requires endocytosis in the axon initial segment.
2018 Organelle homeostasis minisymposium (Bernfield Award): Activation cycle of β-arrestin allowing independent trafficking and signaling functions.
2016 Membrane organization, dynamics, traffic, and regulation minisymposium: Mechanism and signaling consequences of independent β-arrestin and receptor trafficking.
2015 Membrane regulation and signaling microsymposium: β-arrestin drives MAP kinase signaling from clathrin-coated structures after GPCR dissociation.

Yale University Kavli Neuroscience Institute SYNAPSES Seminar Series
2020 Neuronal polarity requires endocytosis in the axon initial segment.

GRKs and Arrestins: From Structure to Disease FASEB Conference
2017 Activation cycle of β-arrestin allowing independent trafficking and signaling functions.

Lysosomes & Endocytosis Gordon Research Seminar
2016 Mechanism & signaling consequences of independent β-arrestin & receptor trafficking.

Invited Talks (Regional Meetings)

2020 **Stanford University Superworm Meeting**: Neuronal polarity requires an endocytic clearance mechanism in the axon initial segment.
2020 **Stanford University Bass Biology Floor Meeting**: Endocytosis of dendritic proteins in the axon initial segment safeguards neuronal polarity.
2016 **Bay Area Trafficking Symposium**: Mechanism and signaling consequences of independent β-arrestin and receptor trafficking.

Select Poster Presentations

ASCB Annual Conference
2019 Endocytosis of dendritic proteins in the axon initial segment safeguards neuronal polarity.
2017 Activation cycle of β-arrestin allowing independent trafficking and signaling functions.
2015 β-arrestin drives MAP kinase signaling from clathrin-coated pits after GPCR dissociation.

HHMI Molecular and Cellular Neuroscience Science Meeting
2021 Neuronal polarity requires an endocytic clearance mechanism in the axon initial segment.

Cold Spring Harbor Laboratories Molecular Mechanisms of Neuronal Connectivity
2020 Endocytosis of dendritic proteins in the axon initial segment safeguards neuronal polarity.

Cell Biology of the Neuron and Circuits II
2019 Endocytosis of dendritic proteins in the axon initial segment safeguards neuronal polarity.

Cell Biology of the Neuron Gordon Research Conference
2018 Mechanisms of polarized membrane trafficking in *C. elegans.*

GRKs & Arrestins: Structure to Disease FASEB
2017 Activation cycle of β-arrestin allowing independent trafficking and signaling functions.

Molecular Pharmacology Gordon Research Conference
2017 β-arrestin drives MAP kinase signaling from clathrin-coated pits after GPCR dissociation.
2015 GPCR mediated control of clathrin-coated pit dynamics.

Bay Area Trafficking Symposium
2016 β-arrestin drives MAP kinase signaling from clathrin-coated pits after GPCR dissociation.
2013 GPCR mediated control of clathrin-coated pit dynamics.