

# Matthew James Kennedy

Assistant Professor

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## Education and Positions:

**Current:** August 2011-present; Assistant Professor, Dept. Pharmacology, University of Colorado, Denver

**Postdoctoral:** June 2005-2011; Dept. Neurobiology, Duke University, Durham, NC

Advisor: Dr. Michael Ehlers

Project: Molecular mechanisms of neuronal synaptic plasticity

**Postdoctoral:** October 2004-May 2005; Dept. Biochemistry and Biophysics, University of California, San Francisco, CA

Advisor: Dr. Graeme Davis

Project: Mechanisms of homeostatic synaptic plasticity

**Ph.D.:** March 2003; Dept. Biochemistry, University of Washington, Seattle, WA

Advisor: Dr. James B. Hurley

Thesis: Turning off the photoresponse in rod and cone photoreceptors

**B.S.:** June 1996; St. John's University, Collegeville, MN

Major field of study: Chemistry

## Teaching Experience

1994-96	Teaching Assistant, Organic Chemistry Lab, St. John's University, Collegeville, MN
1995-96	Teaching Assistant, Organic Chemistry Lab, St. John's University, Collegeville, MN
1999-00	Teaching Assistant, Advanced Biochemistry, University of Washington, Seattle, WA
1999-00	Teaching Assistant, Basic Biochemistry, University of Washington, Seattle, WA
2000-01	Teaching Assistant, Biochemistry Lab Course, University of Washington, Seattle, WA
2011-current	Frontiers in Pharmacology
2012-current	NRSC7600
2012-current	NRSC7610
2012-current	PHCL7620
2015	Course lecturer, "Neural Circuit Development and Plasticity" University of Utrecht, Netherlands
2015-current	NRSC7501

## Honors and Awards

1995	Summer Undergraduate Research Fellowship, Mayo Clinic, Rochester, MN
1996	Graduated from St. John's University Magna cum laude
1999	Molecular and Cellular Biology Training Grant, University of Washington, Seattle, WA
2001	National Eye Institute Travel Fellowship
2004	Postdoctoral Training Grant, University of California, San Francisco

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## **Honors and Awards (Cont.)**

2005	Ruth Kirschstein National Research Service Award (Declined upon moving to Ehlers lab)
2011	Brain and Behavior Research Foundation NARSAD Young Investigator award
2012	Boettcher/Webb-Waring Early Investigator award
2013	Linda Crnic Institute for Down syndrome seed grant award
2013	Brain Research Foundation seed grant award
2013	McKnight Foundation Innovations in Neuroscience award
2014	Pew Charitable Trust Biological Scholars award
2015	Brain Research Foundation Fay/Frank Seed Grant recipient
2015	Linda Crnic Institute for Down Syndrome Grand Challenges Grant recipient
2017	Dean's Doctoral Mentoring Award, University of Colorado School of Medicine

## **Service**

- Reviewer for Journal of Neuroscience, Neuron, Trends in Biotechnology, Frontiers in Neuroscience, Journal of Comparative Neurology, Cell Reports, eLife, Nature Methods, Developmental Cell
- ad hoc member NDPR study section (Oct. 2014)
- Reviewer for Neurological Foundation of New Zealand Grants Program (2013, 2016)
- co-Chair Neuroscience program retreat planning committee (2012)
- Chair Neuroscience program retreat planning committee (2013-15)
- Ad hoc faculty mentor for pharmacology program journal club (2014-2017)
- Medical Scientist Training Program admissions committee (2013-2014)
- UC Denver Pharmacology faculty search committees (2014-2015; 2017)
- Neuroscience preliminary exam committee (spring, 2015)
- UC Denver Pharmacology Training Program GTC member (2015-present)
- Linda Crnic Institute Grant review panel member (2016-2017)
- Faculty liaison for Pharmacology Graduate Program (2014-present)
- Faculty Mentor for graduate student NSF fellowship applications (2016)
- Panel organizer and Chair, Winter Brain Meeting (Jan. 2017)
- ad hoc member of SYN study section (June, 2017)
- Pharmacology program student journal club mentor (2016-present)
- Currently serving on 12 thesis committees and Chair of 2 thesis committees

## **Recent and upcoming invited seminars:**

- Gordon Conference: Excitatory synapses, invited speaker summer 2018
- Max Planck Institute, Jupiter FL, Postdoc invited speaker May, 2018
- University of California, Davis Dept. Neuroscience Graduate Program student invited speaker, May 2018
- University of British Columbia, Dept. of Cellular and Physiological Sciences, April 2018
- University of Southern California Dept. of Neuroscience Seminar series, April 2018
- National Institutes of Health, Postdoc invited speaker, Feb. 2018
- University of Utah, Dept. Physiology seminar series January 2018
- University of New Mexico Dept. of Neuroscience Seminar series, November 2017
- Emerging Concepts of the Neuronal Cytoskeleton, Puerto Varas, Chile April 2017
- Winter Conference for Brain Research, Big Sky, MT January 2017
- Molecular Bioengineering Annual Conference, Big Island Hawaii January 2017
- Annual Brain Initiative Investigator's Meeting, Washington DC, Dec. 2016
- Decoding Synapses National Institute for Physiology Symposium Okazaki Japan October 2016
- University of Wisconsin Madison, Department of Neurobiology March, 2016
- Linda Crnic Institute annual symposium Denver CO October 2015
- University of Utrecht, *Neural Circuit Development and Plasticity Summer Course* July 2015
- Keystone meeting "*Optogenetics*" Denver CO March 2015
- University of Washington, Department of Biochemistry March 2015
- Pew Scholars Annual Meeting, Vieques, PR March 2015
- HHMI Janelia Farm Research Campus February 2014

- Linda Crnic Institute annual symposium Denver CO October 2013
- Winter Brain Meeting, Breckenridge CO January 2013
- Colorado State University Fort Collins Neuroscience Program October 2012
- University of Colorado Boulder Department of Molecular and Cellular Biology March 2012
- University of Utah Department of Neurobiology and Anatomy February 2012
- National Institute for Childhood Health and Human Disorders March 2011
- Yale University Department of Cellular and Molecular Physiology March 2011
- University of Minnesota, Department of Cell Biology March 2011
- University of North Carolina Chapel Hill Department of Pharmacology March 2011
- UT Southwestern Department of Neuroscience February 2011
- National Institutes of Health Steadman Scholars Program December 2010
- Northwestern Department of Neurobiology December 2010
- University of Colorado School of Medicine Department of Pharmacology December 2010
- University of North Carolina Chapel Hill Department of Physiology December 2010
- Keystone meeting "Synapses: Formation, Function and Misfunction" Snowbird, Utah April 2010

## **Funding**

### **Current:**

**Pew Scholars in the Biomedical Sciences Award** (08/15/14-08/14/18): "*A novel optogenetic approach for real-time control of synapses in vivo*" (PI: Matthew J. Kennedy). The major goal of this project is to implement new optical technologies for controlling synaptic function *in vivo*.

**National Institute for Neurological Disorders and Stroke RO1** (06/15/13-06/14/18): "Mechanisms of Dendritic Exocytosis" (PI: Matthew J. Kennedy). This project focuses on the mechanisms governing addition and subtraction of neurotransmitter receptors from synapses, a process required for central forms of plasticity that govern learning and memory.

**National Institute for Mental Health R21EY026363** (09/30/15-09/29/17) "Optical tools for extended neural silencing" (coPIs: Matthew J. Kennedy, Chandra L. Tucker). This project focuses on developing tools to shut down neurotransmission with a brief light exposure.

### **Completed:**

**McKnight Foundation Technology Innovation Grant** (08/01/13-07/31/16) "Optical Control of Synapses and Circuits" (coPIs: Matthew J. Kennedy, Chandra L. Tucker). This project focuses on developing tools to manipulate neural circuitry with light.

**National Alliance for Research on Schizophrenia and Depression (NARSAD) Young Investigator Award** (07/15/2011-07/14/2013): "*Mechanisms of Postsynaptic Exocytosis Underlying Synaptic Plasticity*" (PI: Matthew J. Kennedy). The goals of the project are to examine the postsynaptic SNARE proteins involved in postsynaptic membrane trafficking for plasticity and to begin to identify the full range of postsynaptic factors that are mobilized to the dendritic plasma membrane by potentiating stimuli.

**Brain Research Foundation Technology Seed Grant** (06/15/13-06/14/14): "Optical control of synaptic function" (coPIs: Matthew J. Kennedy, Chandra L. Tucker). This project is directed toward developing tools to block synaptic transmission with light.

**Linda Crnic Center for Down Syndrome Seed Grant** (03/21/13-03/20/15): “Mechanisms of beta-amyloid induced synapse elimination” (PI: Matthew J. Kennedy). The major goal of this project is to characterize the molecular mechanisms by which secreted beta amyloid triggers synapse elimination.

**Boettcher Foundation/Webb Waring Investigator Award** (06/01/12-05/31/2015): “Mechanisms of beta-amyloid secretion and role in Alzheimer’s pathology” (PI: Matthew J. Kennedy). The major goal of this project is to characterize the molecular mechanisms by which beta amyloid is secreted from neurons.

## **Current Trainees**

Brian Hiester, Postdoc  
William Buchta, Postdoc  
Brooke Sinnen, Pharmacology training program student  
Ashley Bourke, Pharmacology training program student

## **Past Trainees**

Aaron Bowen MSTP (thesis advisor) graduated 2017, currently completing clinical rotations  
Daniel Chen, PRA, currently graduate student at UCSD  
Abigail Godec, Summer undergraduate fellow, Washington University, St. Louis  
Jeffrey Forte, Neuroscience program student, Masters degree, Feb. 2015  
Adam Hall, Post-baccalaureate trainee

## **Publications:**

Hiester, B.G., Bourke, A.M., Sinnen, B.L., Cook S.G., Gibson, E.S., Smith, K.R., Kennedy, M.J. (2017) L-Type voltage gated  $Ca^{2+}$  channels regulate synaptic activity-triggered recycling endosome fusion in neuronal dendrites. *Cell Reports*, 21:2134-2146.

Bowen, A.B., Bourke, A.M., Hiester, B.G., Hanus, C., **Kennedy, M.J.** (2017) Golgi-independent secretory trafficking through recycling endosomes in neuronal dendrites and spines. *eLife* Sep. 6, e27362.

Sinnen, B.L., Bowen, A.B., Forte, J.S., Hiester, B.G., Crosby, K.C., Gibson, E.S., Dell’Acqua, M.L., **Kennedy, M.J.** (2017) Optogenetic control of synaptic composition and function. *Neuron* 93:646-660  
PMID: 28132827

*Featured in Faculty of 1000*

Sinnen, B.L., Bowen, A.B., Gibson, E.S., **Kennedy, M.J.** (2016) Local and Use Dependent Effects of  $\beta$ -Amyloid Oligomers on NMDA Receptor Function Revealed by Optical Quantal Analysis. *Journal of Neuroscience* 36:11532-43 PMID: 27911757

*Featured paper in editorial highlights section*

Zimmerman, S.P., Hallett, R.A, Bourke, A.M., Bear, J.E., **Kennedy, M.J.**, Kuhlman, B. (2016) Tuning the Binding Affinities and Reversion Kinetics of a Light Inducible Dimer Allows Control of Transmembrane Protein Localization. *Biochemistry* 55:5264-71 PMID: 27529180

Taslimi, A., Vrana, J.D., Chen, D., Borinskaya, S., Mayer, B.J., **Kennedy, M.J.**, Tucker, C.L. (2014) An Optimized Optogenetic Clustering Tool for Probing Protein Interaction and Function. *Nature Communications* 5:4925. doi 10.1038/ncomms5925

Carroddus, N.L., Teng, K., Munro, K.M., **Kennedy, M.J.**, Gunnensen, J.M. (2014) Differential Labeling of Cell-surface and Internalized Proteins after Antibody Feeding of Live Cultured Neurons. *J. Vis. Exp.*(84)

Tucker, C.L., Vrana, J.D., **Kennedy, M.J.** (2014) Tools for controlling protein interactions with light. *Current Protocols in Cell Biology* 64:17.16.1-17.16.20. PMC4181358.

Chen, D., Gibson, E.S., **Kennedy, M.J.** (2013) A light-triggered protein secretion system. *Journal of Cell Biology*, 201:631-40v. PMC3653365  
*Featured in Faculty of 1000*

**Kennedy, M.J.**, Ehlers, M.D. (2011) Mechanisms of Dendritic Exocytosis *Neuron*, 69:856-75 invited review.

**Kennedy, M.J.\***, Hughes, R.M\*. Petaya, L.A., Schwartz, J.W., Ehlers, M.D., Tucker, C.L. (2010) Rapid blue light induction of protein interactions in living cells. *Nature Methods*. 7: 973-5.  
\*equally contributing authors

**Kennedy, M.J.**, Davison, I.G., Robinson, C.G., Ehlers, M.D. (2010) Syntaxin-4 Defines a Domain for Activity-Dependent Exocytosis in Dendritic Spines. *Cell*, 141: 524-535.  
*Faculty of 1000 recommended article*

Vishnivetskiy S.A., Raman D., Wei J., **Kennedy M.J.**, Hurley J.B., Gurevich V.V. (2007) Regulation of arrestin binding by rhodopsin phosphorylation level. *Journal of Biological Chemistry*. 282: 32075-83.

**Kennedy, M.J.**, Ehlers, M.D. (2006) Organelles and trafficking machinery for postsynaptic plasticity. *Annual Reviews Neuroscience* 29: 325-362.

Frank, C.A.\*, **Kennedy, M.J.\***, Goold, C.P., Marek, K.W., Davis, G.W. (2006) Mechanisms underlying the rapid induction and sustained expression of synaptic homeostasis. *Neuron*. 52:663-677.  
\* equally contributing authors

Strissel, K.J., Lishko, P.V., Trieu, L.H., **Kennedy, M.J.**, Hurley, J.B., Arshavsky, V.Y. (2005) Recoverin undergoes light-dependent intracellular translocation in rod photoreceptors. *Journal of Biological Chemistry*. 280:29250-5.

Nair, K.S., Hanson, S.M., Mendez, A., Gurevich, E.V., **Kennedy, M.J.**, Shestopalov, V.I., Vishnivetskiy, S.A., Chen, J., Hurley, J.B., Gurevich, V.V., Slepak, V.Z. (2005) Light-dependent redistribution of arrestin in vertebrate rods is an energy-independent process governed by protein-protein interactions. *Neuron*. 46: 555-67.

Nair, K. S., Hanson, S.M., **Kennedy, M.J.**, Hurley, J.B., Gurevich, V.V., Slepak, V.Z. (2004) Direct binding of visual arrestin to microtubules determines the differential subcellular localization of its splice variants in rod photoreceptors. *Journal of Biological Chemistry*. 279: 41240 –41248.

**Kennedy, M.J.**, Dunn, F., Hurley, J.B. (2004) Visual pigment phosphorylation but not transducin translocation can contribute to light adaptation in zebrafish cones. *Neuron*. 41: 915-928.

**Kennedy, M.J.**, Sowa, M., Wensel, T. Hurley, J.B. (2003) Acceleration of key reactions as a strategy to elucidate the rate-limiting chemistry underlying phototransduction inactivation. *Investigative Ophthalmology and Visual Science*. 44: 1016-22.

Saari, J.C., Nawrot, M., Garwin, G.G., **Kennedy, M.J.**, Hurley, J.B., Ghyselinck, N.B., Chambon, P. (2002) Intercellular diffusion of all-trans-retinol and retinyl ester synthesis are impaired in the retinas of

cellular retinol-binding protein type I (CRBPI) knockout mice. *Investigative Ophthalmology and Visual Science*. 43: 1730-5.

**Kennedy, M.J.**, Lee, K.A., Niemi, G.A., Craven, K.B., Garwin, G.G., Saari, J.C. and Hurley, J.B. (2001) Multiple phosphorylation of rhodopsin and the in vivo chemistry underlying rod photoreceptor dark adaptation. *Neuron*. 31: 87-101.

Ramulu, P., **Kennedy, M.J.**, Xiong, W.H., Williams, J., Cowan, M., Blesh, D., Yau, K.W., Hurley, J.B., Nathans, J. (2001) Normal Light Response, Photoreceptor Integrity, and Rhodopsin Dephosphorylation in Mice Lacking Both Protein Phosphatases with EF Hands (PPEF-1 and PPEF-2). *Molecular and Cellular Biology*. 21: 8605-8614.

Taylor, M.R., Van Epps, H.A., **Kennedy, M.J.**, Saari, J.C., Hurley, J.B. and Brockerhoff, S.E. (2000) Biochemical analysis of phototransduction and visual cycle in zebrafish larvae. *Methods in Enzymology*. 316: 536-557.

Wengenack N.L., Lopes H., **Kennedy M.J.**, Tavares P., Pereira A.S., Moura I., Moura J.J., Rusnak F. (2000) Redox potential measurements of the Mycobacterium tuberculosis heme protein KatG and the isoniazid-resistant enzyme KatG(S315T): insights into isoniazid activation. *Biochemistry*. 39(37):11508-13.

**Kennedy, M.J.**, Yu, L., Lima, M.J., Ascenso, C.S., Czaja, C., Moura, I., Moura, J.J.G, Rusnak, F. Metal Binding to the Tetrathiolate Motif of Desulfiredoxin. and Related Polypeptides. (1998) *Journal of Biological Inorganic Chemistry*. 3:643-649.

Goodfellow, B.J., Lima, M.J., Ascenso, C., **Kennedy, M.J.**, Sikkink, R., Rusnak, F., Moura, I., Moura, J.J.G. (1998) The use of Chemical Shifts as a Structural Probe in Tetrathiolate Metalloproteins. *Inorganica Chimica Acta*. 273:279-287.

Yu, L., **Kennedy, M.J.**, Czaja, C., Tavares, P., Moura J.J., Moura I., Rusnak F. (1997) Conversion of desulfiredoxin into a rubredoxin center. *Biochem. Biophys. Res. Commun*. 231(3):679-82.