

Curriculum Vitae

Professor Richard H. Kramer

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ACADEMIC DEGREES

Ph.D. Neurobiology University of California, Berkeley, 1985
B. Sci. Biology, Psychology State University of New York, Albany, 1978

PROFESSIONAL EXPERIENCE

2009-present C.H. and Annie Li Chair in Molecular Biology of Diseases, Department of Molecular and Cell Biology, University of California, Berkeley.
2007-present: Professor, Department of Molecular and Cell Biology, University of California, Berkeley
2007-present: Director, UC Berkeley NIH Vision Science CORE
2006-2016: Associate Director, UC Berkeley Nanomedicine Center: Optical Control of Biological Function
2010: Visiting Professor, Magendie Neuroscience Institute, University of Bordeaux, France
2004-2011: Professor, Physical Biosciences Division, Lawrence Berkeley National Laboratory
2001-2007: Associate Professor, Department of Molecular and Cell Biology, University of California, Berkeley
1999-2000: Associate Professor, Department of Molecular and Cellular Pharmacology, University of Miami School of Medicine
1993-1999: Assistant Professor, Department of Molecular and Cellular Pharmacology, University of Miami School of Medicine
1989-1992: Associate Research Scientist, Howard Hughes Medical Institute, and Center for Neurobiology and Behavior, Columbia University College of Physicians and Surgeons
1985-1988: Post-doctoral fellow, Graduate Dept. of Biochemistry, Brandeis University

TEACHING AND EDUCATION EXPERIENCE

2017-present Core Molecular and Cell Biology graduate course (MCB 200), Neurobiology section
2017 Organizer, Society of General Physiology Annual Meeting,
The Optical Revolution in Physiology: From Membrane to Brain, MBL, Woods Hole, MA
2014-2015 Chair, Admissions Committee, Dept. of Molecular and Cell Biology, UC Berkeley
2011-2012 Founding Director, UC Berkeley Neuroscience Graduate Bootcamp Program
2002-2014 Course Director, Undergraduate Neurobiology Core Course (MCB 160), UC Berkeley
2004-2014 Advanced Cell and Molecular Neurobiology (MCB 261)
2001-2012 Undergraduate Neurobiology Lab (MCB 160L), UC, Berkeley
2011-2012 Ion Channels Course, Cold Spring Harbor Laboratory
2006-2008 Founding Director, Biophysics Evening Research Presentations (BERPs)
2000-2005 Neuromodulation, Graduate Seminar Course (MCB 290)
1999-2000 Director, Neuroscience Program Core Graduate Course, Univ. of Miami
1998-2000 Co-Director, Interdisciplinary Biomedical Studies Course, Univ. of Miami
1995-1999 Instructor, Medical Pharmacology Course, Univ. of Miami
1995-1999 Co-Director, Integrative Neurobiology Course, Univ. of Miami
1994-1998 Director, Cell Signaling Course, Univ. of Miami
1989-1994 Instructor, Marine Biological Laboratory, Woods Hole: Neurobiology Course

ACADEMIC HONORS AND AWARDS

2017-2020 Gund-Harrington Scholar Award, Foundation Fighting Blindness
2015-2017 Thome Award, Foundation for Biomedical Research
2014-2017 Wynn-Gund Research Grant, Foundation Fighting Blindness

2013 Peder Sather Award Berkeley/Norway Award
 2012 Mary Elizabeth Rennie Endowment Award
 2011-2012 Beckman Institute for Macular Research Award
 2009-present C.H. and Annie Li Chair in Molecular Biology of Diseases, MCB Department,
 University of California, Berkeley.
 2009-2013 NIH Eureka Award (NIMH)
 2010 Berkeley-France Fund Award
 2008 Grass Lectureship, University of Nebraska Medical Center
 2005-2008 Grass Foundation Faculty Award, Marine Biological Laboratory, Woods Hole, MA
 2004-2006 LDRD Research Award, US Dept. of Energy, Lawrence Berkeley National Laboratory
 2003 Fight-for-Sight, Inc. Research Award
 2003 Mary Elizabeth Rennie Endowment Award
 2003 Plum Foundation Research Award
 1999-2001 American Heart Association, Florida Affiliate, Grant-in Aid,
 1999 University of Miami Dean's Research Award
 1998-1999 Stanley Glaser Research Foundation Award
 1996-1998 Pharmaceutical Research and Manufacturers of America (PhRMA) Faculty Development Award
 1995-1998 American Heart Association, Florida Affiliate Initial Investigator Award
 1993-1998 NIH R29 First Award Research Grant, NINDS
 1989-1992 Howard Hughes Medical Institute Associate Research Scientist
 1985-1987 National Research Service Award (NIH) (2 sequential awards)
 1978-1983 NIH Predoctoral Traineeship
 1978 Magna Cum Laude, SUNY Albany

FEDERAL GRANTS

Active grants

R01EY024334 NIH/NEI 08/01/2015-07/31/2020

Understanding How Photoswitches Restore Visual Function In Blindness

The goal is to elucidate the mechanisms whereby photoswitch chemicals impart light-sensitivity onto blind retina to better engineer and exploit these as potential vision-restoring drugs.

Role: PI

R01NS100911 NIH/NINDS

04/15/2017 – 01/31/2021

Probing GABA_A Function and Plasticity with Light

The goal is to employ photochemical tools to understand the role of different GABA_A receptor isoforms in the brain.

Role: PI

R24 EY023937 NIH/NEI 06/01/2014 – 012/31/2019

Photoswitchable channel blockers for treatment of blindness

The goal is to test the efficacy and safety of two photoswitch compounds in restoring visual sensitivity to animal models of retinitis pigmentosa.

Role: Subcontract awardee (R. Van Gelder, PI, University of Washington, Department of Ophthalmology).

P30 EY003176 NIH/NEI 08/01/2018 –07/31/2023

TITLE: CORE Grant for Vision Research

The UC Berkeley CORE Grant provides shared services for supporting the research of the ~20 NEI-funded Vision Science laboratories on the UC Berkeley campus.

Role: PI

Completed grants

2014-2017 NIH Brain Initiative U01 Grant, "Optical Control of Synaptic Transmission for *in vivo* Analysis of Brain Circuits and Behavior"

2006-2016 NIH P30 Nanomedicine Development Center for the Optical Control of Biological Function

2004-2015 NIH R01 Research Grant, National Eye Institute "Optical studies of the cone photoreceptor synapse"

2009-2013 NIH EUREKA Award, National Institute of Mental Health "A universal photoswitch system for optical control of neuronal receptors"

2008-2012 NIH R01 Research Grant, National Eye Institute "Light-activated ion channels for remote control of neuronal activity"

2005-2007 NIH R21 Research Grant, National Eye Institute "Light-activated ion channels for remote control of neural activity"

2004 NIH R01 Research Supplement, National Eye Institute

1999-2004 NIH R01 Research Grant, National Eye Institute "Modulation of Retinal Function by IGF-1"

1998-2003 NIH R01 Research Grant, National Eye Institute "Synaptic Function of CNG Channels"

1993-1999 NIH R29 First Award Research Grant, NINDS "Real-Time Detection of Cyclic GMP in Intact Neurons"

EDITORIAL BOARDS, ADVISORY COMMITTEES, AND STUDY SECTIONS

2018-present Bioelectricity (Associate Editor)

2009-2016 Chair, Scientific Advisory Board, Center of Advanced European Studies and Research, Max-Planck Institute, Bonn, Germany

2006-2016 ACS Chemical Biology (Scientific Advisory Board)

2006-present Board of Directors and co-founder, Photoswitch Biosciences, Inc., San Francisco, CA

2004-2012 CellScience (Editorial Board)

2010-present Frontiers in Neural Circuits (Editorial Board)

2003-2010 Ad hoc member, NIH Study Section (Neurogenetics and neuroimaging:MDCN-K)

2008-2011 Ad hoc member, NIH Study Section (Neurotechnology: NT)

2011 Ad hoc member, NIH Study Section (Molecular Neuropharmacology and Signaling: MNPS)

2010 Presidential Scientific Advisory Board, Max-Planck Institute, Munich, Germany (Member)

2005-2010 Regular Member, NIH Study Section (Neurotransporters, receptors, and calcium signaling: NTRC)

PROFESSIONAL MEMBERSHIPS

Society for Neuroscience

Biophysical Society

Society for General Physiologists

Association for Research in Vision and Ophthalmology (ARVO)

ARVO Nanotechnology Section Organizing Committee (2007-2012)

American Chemical Society

International Society for Eye Research (ISER)

American Association for the Advancement of Science (AAAS)

PUBLICATIONS

Peer Reviewed Papers

Davenport CM, Rajappa R, Taylor CR, Arnold DB, Tsai M-C, Lammel S, and Kramer RH (2020). Activity-dependent migration of GABA receptors to inhibitory synapses freezes excitatory synaptic plasticity and consolidates memory. **Neuron** (in press).

Denlinger, B, Helft, Z, Telias, M, Lorach, H, Palanker, D, and Kramer, RH (2020). Focal photoreceptor degeneration causes local pathophysiological remodeling of retinal neurons. **Journal of Clinical Investigation** (in press).

Telias, M, Denlinger, B, Helft, Z, Beckwith-Cohen, B, Thornton, C, and Kramer, RH (2019). Retinoic acid is the trigger for neural hyperactivity in retinal degeneration and blocking its receptor unmasks light responses and augments vision. **Neuron** 102:574-586.

Beckwith-Cohen B, Holzhausen L, Wang, T-M, Rajappa R, and Kramer, RH (2019). Localizing proton-mediated inhibitory feedback at the retinal horizontal cell-cone synapse with genetically-encoded pH probes. **Journal of Neuroscience** 39:651-662.

Durand-de Cuttoli R, Mondoloni S, Marti F, Lemoine, D Naudé, J, d'Izarny-Gargas T, Pons S, Maskos U, Trauner D, Kramer RH, Faure, P, Mouro, A (2018). Manipulating midbrain dopamine neurons and reward-related

behaviors with light-controllable nicotinic acetylcholine receptors. **eLIFE**. 7. pii: e37487. doi: 10.7554/eLife.37487. PMID:30176987

- Tochitsky, I, Kienzler, MA, Isacoff, E, and and Kramer RH (2018). Restoring Vision to the Blind with Chemical Photoswitches. **Chemistry Reviews** 118:10748-10773. PMID: 29874052.
- Mourot A, Herold C, Kienzler MA, Kramer RH (2018). Understanding and improving photo-control of ion channels in nociceptors with azobenzene photo-switches. **British Journal of Pharmacology** 175:2296-2311. PMID:28635081
- Lin WC and Kramer RH (2018). Light-Switchable Ion Channels and Receptors for Optogenetic Interrogation of Neuronal Signaling. **Bioconjugation Chemistry** 29:861-869. PMID:29465988
- Lin WC, Tsai MC, Rajappa R, Kramer RH. (2018). Design of a Highly Bistable Photoswitchable Tethered Ligand for Rapid and Sustained Manipulation of Neurotransmission. **Journal of the American Chemical Society** 140:7445-7448. PMID:29874068
- Laprell, L, Tochitsky, I, Kaur, K, Stein, M, Barber, DM, Schoen, C, Michalakakis, S, Biel, M, Kramer, RH, Sumser, MP, Van Gelder, RN, and Trauner, D (2017). Chemical photosensitization of bipolar cells enables the restoration of visual function in blind mice. **Journal of Clinical Investigation** 127:2598-2611. PMID:28581442
- Lin, W-C, Tsai, M-C, Davenport, CM, and Kramer, RH (2017). Optogenetic Interrogation of neural inhibition with light-regulated GABA_A receptors. **Journal of General Physiology**. 149:889
- Tochitsky I, Trautman J, Gallerani N, Malis JG, Kramer RH. (2017) Restoring visual function to the blind retina with a potent, safe and long-lasting photoswitch. **Scientific Reports**. 7:45487.
- Berry MH, Holt A, Levitz J, Broichhagen J, Gaub BM, Visel M, Stanley C, Aghi K, Kim YJ, Cao K, Kramer RH, Trauner D, Flannery J, Isacoff EY. (2017). Restoration of patterned vision with an engineered photoactivatable G protein-coupled receptor. **Nature Communications** 8:1862.
- Ko, KW, Meseguer, V, Kramer, RH, and Golding, NL (2016). Serotonin modulates spike probability in the axon initial segment through hyperpolarization and cyclic nucleotide-gated (HCN) channels. **Nature Neuroscience** 19:826-34.
- Tochitsky I, Helft Z, Meseguer V, Fletcher RB, Vessey KA, Teliás M, Denlinger B, Malis J, Fletcher EL, Kramer RH. (2016) How Azobenzene Photoswitches Restore Visual Responses to the Blind Retina. **Neuron**. 92:100-113.
- Lin, W-C, Tsai, MC, Davenport, C, Smith, C, Veit, J, Wilson, N, Adesnik, H, and Kramer, RH (2015). A comprehensive optogenetic pharmacology toolkit for in vivo control of GABA_A receptors and synaptic inhibition. **Neuron**. 88:879-891.
- Kramer, R.H. and Davenport, C. (2015). Lateral inhibition in the retina: The case of the missing neurotransmitter. **PLoS Biology** 13:e1002322.
- Tochitsky, I., and Kramer, R.H. (2015). Optopharmacological tools for restoring visual function in degenerative retinal diseases. **Current Opinion in Neurobiology** 34C:74-78.
- Groynom, R., Shoffstall, E., Wu, L.S., Kramer, R.H., , and Lavik, E.B. (2015). Controlled release of photoswitch drugs by PLGA microspheres. **Journal of Drug Targeting** 23:710-715.
- Tochitsky, I., Polosukhina, P, Degtyar, V.E., Gallerani, N, Friedman, A., Van Gelder, R.N., Trauner, D., Kaufer, D. and Kramer, R.H. (2014). Restoring visual function to blind mice with a photoswitch that exploits electrophysiological remodeling of retinal ganglion cells. **Neuron** 81:800-813.
- Lin, W-C., Davenport, C., Mourot, A., Vytla, D., Smith, C., Medeiros, K., Chambers, J., Kramer, R.H. (2014). Engineering a light-regulated GABA_A receptor for optical control of neural inhibition. **ACS Chemical Biology** 9:1414-1419.
- Dany, S.A., Lemire, J.M., Kramer, R.H., and Levin, M. (2014). Optogenetics in Developmental Biology: using light to control ion flux-dependent signals in *Xenopus* embryos. **International Journal of Developmental Biology** 58:851-861.
- Wang, T-M. , Hozhausen, L., and Kramer, R.H. (2014) Imaging of an optogenetic pH sensor reveals that protons mediate lateral inhibition in the retina. **Nature Neuroscience** 17:262-268.
- Tochitsky, I., Polosukhina, P, Degtyar, V.E., Gallerani, N, Friedman, A., Van Gelder, R.N., Trauner, D., Kaufer, D. and Kramer, R.H. (2014). Restoring visual function to blind mice with a photoswitch that exploits electrophysiological remodeling of retinal ganglion cells. **Neuron** 81:800-813.

- Kramer, RH, Mouroto, A, and Adesnik H (2013) Optogenetic pharmacology for control of native neuronal signaling proteins. **Nature Neuroscience** 16:816-823.
- Kramer, R.H. (2013). Horizontal cells: lateral interactions at the first synapse in the retina. *In* **The New Visual Neurosciences**, Eds: Jack Werner and Leo Chalupa MIT Press, MA.
- Mouroto A, Tochitsky I, Kramer RH. (2013). Light at the end of the channel: optical manipulation of intrinsic neuronal excitability with chemical photoswitches. **Frontiers in Molecular Neuroscience** 6:5.
- Tian M, Xu CS, Montpetit R, Kramer RH. (2012). Rab3A mediates vesicle delivery at photoreceptor ribbon synapses. **Journal of Neuroscience** 32:6931-6936.
- Donato L, Mouroto A, Davenport CM, Herbivo C, Warther D, Léonard J, Bolze F, Nicoud JF, Kramer RH, Goeldner M, Specht A. (2012). Water-soluble, donor-acceptor biphenyl derivatives in the 2-(o-nitrophenyl)propyl series: highly efficient two-photon uncaging of the neurotransmitter γ -aminobutyric acid at $\lambda = 800$ nm. **Angewandte Chemie** 51:1840-1843.
- Mouroto A, Fehrentz T, Le Feuvre Y, Smith CM, Herold C, Dalkara D, Nagy F, Trauner D, Kramer RH. (2012) Rapid optical control of nociception with an ion-channel photoswitch. **Nature Methods**. 9:396-402.
- Tochitsky I, Banghart MR, Mouroto A, Yao JZ, Gaub B, Kramer RH, Trauner D. (2012) Optochemical control of genetically engineered neuronal nicotinic acetylcholine receptors. **Nature Chemistry** 4:105-11.
- Sandoz, G., Levitz, J., Kramer, RH, and Isacoff, EY (2012) Optical control of endogenous proteins with a photoswitchable conditional subunit reveals a role for TREK1 in GABA_B signaling. **Neuron** 74:1005-1014.
- Polosukhina A., Litt, J. Tochitsky, I, Nemargut, J., Sychev, Y., De Kouchkovsky, I., Huang, T., Borges, K., Trauner, D. Van Gelder, R.N., and Kramer, R.H. (2012). Photochemical restoration of visual responses in blind mice. **Neuron** 75:271-282.
- Bartoletti TM, Jackman SL, Babai N, Mercer AJ, Kramer RH, Thoreson WB. (2011) Release from the cone ribbon synapse under bright light conditions can be controlled by the opening of only a few Ca₂₊ channels. **Journal of Neurophysiology** 106:2922-2935.
- Fortin DL, Dunn TW, Fedorchak A, Allen D, Montpetit R, Banghart MR, Trauner D, Adelman JP, Kramer RH. (2011) Optogenetic photochemical control of designer K⁺ channels in mammalian neurons. **Journal of Neurophysiology** 106:488-496.
- Mouroto, A., Kienzler, MR, Fehrentz, T, Huber, FME, Stein, M, Kramer, RH, and Trauner, D (2011). Tuning photochromic ion channel blockers. **ACS Chemical Neurobiology** 2: 536–543.
- Jackman SL, Babai N, Chambers JJ, Thoreson WB, and Kramer RH. (2011) A positive feedback synapse from retinal horizontal cells to cone photoreceptors. **PLoS Biology** 9:e1001057.
- Fortin DL, Dunn TW, Kramer RH. (2010) Engineering light-regulated ion channels. **Cold Spring Harbor Protocols** 2011:579-585.
- Fortin, D.L., and Kramer R.H. (2010). Photoswitchable Voltage-Gated Ion Channels. *In* **Photosensitive Molecules for Controlling Biological Function**, Eds: James J. Chambers and Richard H. Kramer. Humana Press, Totawa, NJ.
- Jackman, S., Choi, S.Y., Rabl, K., Bartoletti, T.M., Thoreson, W.B., and Kramer, R.H. (2009). Role of the synaptic ribbon in transmitting the cone light response. **Nature Neuroscience** 12:303-310.
- Chambers, J.J., Kramer, R.H. (2009). Light-activated ion channels for remote control of neural activity. **Methods in Cell Biology** 90, 217-232.
- Fortin, D.L., Dunn, T.W., and Kramer R.H. (2009). Engineering Light-Regulated Ion Channels. *In* **Optical Imaging in Neuroscience: A Laboratory Manual**. Eds: Arthur Konnerth and Fritjof Helmchen. Cold Spring Harbor Laboratory Press.
- Kramer, R.H. Fortin, D.L., and Trauner, D. (2009). New photochemical tools for controlling neural activity. **Current Opinion in Neurobiology** 19:544-552.
- Banghart, M.R., Mouroto, A., Fortin, D.L., Yao, J.Z., Kramer, R.H., and Trauner, D. (2009). Photochromic blockers of voltage-gated potassium channels. **Angewandte Chemie** 48:9097-9101.
- Fortin, D.L., Banghart, M.R., Dunn, T.W, Borges, K., Karakossian, M.H., Otis, T.S., Kristan, W.B., Trauner, D., and Kramer, R.H. (2008). Photocontrol of endogenous ion channels and cellular excitability. **Nature Methods** 5:331-338.

- Choi, S.Y., Jackman, S., Thoreson, W.B., and Kramer, R.H. (2008). Light regulation of Ca₂₊ in the cone photoreceptor synaptic terminal. **Visual Neuroscience** 25:1-8.
- Szobota, S., Gorostiza, P., Numano, R., Volgraf, M., Kolstad, K., Aaron, H., Ruzin, S., Flannery, J., Kramer, R.H., Trauner, D., and Isacoff, E. (2007). Remote control of neuronal activity with a light-gated glutamate receptor. **Neuron** 54:535-45.
- Sheng, Z., Choi, S.Y., Dharia, A. Li, J., Sterling, P., and Kramer, R.H. (2007). Synaptic Ca₂₊ in darkness is lower in rods than cones causing slower tonic release of vesicles. **Journal of Neuroscience** 27: 5033-5042.
- Mourot, A. and Kramer, R.H. (2007). Staples, tape measures, and bungee cords: a variety of bifunctional reagents for understanding and controlling ion channels. **ACS Chemical Biology** 2:451-453.
- Volgraf, M., Gorostiza, P., Numano, R., Kramer, R.H., Isacoff, E.Y., and Trauner, D. (2006). Allosteric control of an ionotropic glutamate receptor with an optical switch. **Nature Chemical Biology** 2:47-52.
- Chambers, J.J., Banghart, M., Trauner, D., and Kramer, R.H. (2006). Light-induced depolarization of neurons using a modified Shaker K⁺ channel and a molecular photoswitch. **Journal of Neurophysiology** 96:2792-2796.
- Choi, S.Y., Rea, R., Borghuis, B., Levitan, E.S., Sterling, P., and Kramer, R.H. (2005). Synaptic coding of steady light intensity at the cone photoreceptor synapse. **Neuron** 48:555-562.
- Choi, S.Y., Sheng, Z., and Kramer, R.H. (2005). Imaging light-modulated release of synaptic vesicles in the intact retina: Retinal physiology at the dawn of the post-electrode era. **Vision Research** 45:3487-3495.
- Kramer, R.H., Chambers, J.J., and Trauner, D. (2005). Photochemical tools for remote control of ion channels in excitable cells. **Nature Chemical Biology** 1:360365
- Thompson, S.M., Kao, J.P., Kramer, R.H., Poskanzer, K.E., Silver, R.A., Digregorio, D., Wang, S.S. (2005). Flashy science: controlling neural function with light. **Journal of Neuroscience** 25:10358-10365.
- Rea, R., Li, J., Dharia, A., Levitan, E.S., Sterling, P., and Kramer, R.H. (2004). Streamlined synaptic vesicle cycle in cone photoreceptor terminals. **Neuron** 41:755-766.
- Banghart, M., Borges, K., Isacoff, E., Trauner, D., and Kramer, R.H. (2004). Light-activated ion channels for remote control of neuronal firing. **Nature Neuroscience** 12:1381-1386.
- Trauner, D., and Kramer, R.H. (2004). Metabolic modulation of potassium channels. *Science STKE* 2004,20-24.
- Molokanova, E., Krajewski, J.L., Satpaev, D, Luetje, CW, and Kramer, RH (2003). Subunit contributions to phosphorylation-dependent modulation of rod cyclic nucleotide-gated channels. **Journal of Physiology** 552: 345-356.
- Krajewski, J.L, Luetje, C.W., and Kramer, R.H. (2003) Tyrosine phosphorylation switches off Ca₂₊/calmodulin inhibition in rod cyclic nucleotide-gated channels. **Journal of Neuroscience** 23, 10100-10106.
- Trivedi, B. and Kramer, R.H. (2002) Patch cramming reveals the mechanism of long-term suppression of cyclic nucleotides in intact neurons. **Journal of Neuroscience** 22: 8819-8826
- Molokanova, E., and Kramer, R.H. (2001). Mechanism of inhibition of cyclic nucleotide-gated channel by protein tyrosine kinase probed with genistein. **Journal of General Physiology** 117: 219-234.
- Savchenko, A., Kraft, T.W., Molokanova, E. and Kramer, R.H. (2001). Growth factors regulate phototransduction in retinal rods by modulating cyclic nucleotide-gated channels through dephosphorylation of a specific tyrosine residue. **Proceedings of the National Academy of Sciences, USA** 98:5880-5885.
- Kramer, R.H. and Molokanova, E. (2001). Modulation of cyclic nucleotide-gated channels and regulation of phototransduction. **Journal of Experimental Biology** 204:2921-2931.
- Kramer, R.H. (2001) Patch-cram detection of cyclic GMP in intact cells. In **Neuromethods** (W.Walz, ed.) Humana Press, Totawa, NJ.
- Molokanova, E., Savchenko, A., and Kramer, R.H. (2000) Interactions of cyclic nucleotide-gated channel subunits and protein tyrosine kinase probed with genistein. **Journal of General Physiology** 115: 685-696.
- Molokanova, E., Maddox, F., Luetje, C.W., and Kramer, R.H. (1999). Activity-dependent modulation of rod photoreceptor cyclic nucleotide-gated channels mediated by phosphorylation of a specific tyrosine residue. **Journal of Neuroscience** 19:4786-4795.
- Molokanova, E., Savchenko, A., and Kramer, R.H. (1999). Non-catalytic inhibition of cyclic nucleotide-gated channels by tyrosine kinase induced by genistein. **Journal of General Physiology** 113:45-56.

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- Nawy, S., Kramer, R.H., and Walters, R.J. (1998). Regulation of the cGMP-dependent current in On-bipolar cells by calcium/calmodulin-dependent kinase. **Visual Neuroscience** 15:257-263.
- Kramer, R.H. and Karpen, J. (1998) Spanning binding sites on allosteric proteins with polymer-linked ligand dimers. **Nature** 395: 710-713. [See commentary by Peters, R., and Sikorski, R., 1998. *Science* 282: 1439.]
- Trivedi, B. and Kramer, R.H. (1998). Real-time patch-clamp detection of intracellular cGMP reveals long-term suppression of responses to NO and muscarinic agonists. **Neuron** 21:895-906.
- Savchenko, A., Barnes, S.A., and Kramer, R.H. (1997). Cyclic nucleotide-gated channels mediate synaptic modulation by nitric oxide. **Nature** 390:694-698.
- Molokanova, E., Trivedi, B., Savchenko, A. and Kramer, R.H. (1997). Modulation of rod photoreceptor cyclic nucleotide-gated channels by tyrosine phosphorylation. **Journal of Neuroscience** 17:9068-9076.
- Kramer, R.H., and Tibbs, G (1996). Antagonists of retinal and olfactory cyclic nucleotide-gated channels and molecular mapping of their site of action. **Journal of Neuroscience** 15:1285-1293.
- Kramer, R.H., Mokkalatti, R., and Levitan, E.S. (1994). Effects of caffeine on Ca₂₊ current, Ca₂₊-activated K⁺ current, and secretion in anterior pituitary (GH3) cells. **Pflugers Archiv.** 426:12-20.
- Kramer, R.H., Goulding, E., and Siegelbaum, S.A. (1994). Potassium channel inactivation peptide blocks cyclic nucleotide-gated channels by binding to the conserved pore domain. **Neuron** 12:655-662.
- Kramer, R.H., Kaczmarek, L.K., and Levitan, E.S. (1991). Neuropeptide inhibition of voltage-gated calcium channels mediated by mobilization of intracellular calcium. **Neuron** 6:557-563.
- Goulding, E., Ngai, J., Kramer, R.H., Colicos, S., Siegelbaum, S.A., Axel, R., and Chess, A. (1992). Molecular cloning and single channel properties of a cyclic nucleotide-gated cation channel from catfish olfactory receptor neurons. **Neuron** 8:45-58.
- Kramer, R.H. and Siegelbaum, S.A. (1992). Intracellular Ca₂₊ regulates sensitivity of cyclic- nucleotide-gated channels in olfactory receptor neurons. **Neuron** 9:897-906.
- Levitan, E.S. and Kramer, R.H. (1990). Neuropeptide modulation of single Ca₂₊ and K⁺ channels detected with a new patch clamp configuration. **Nature** 348:545-547.
- Kramer, R.H. (1990) Patch cramming: monitoring intracellular messengers in intact cells with membrane patches containing detector ion channels. **Neuron** 2:335-341.
- Kramer, R.H. and Levitan, I.B. (1990). Activity-dependent neuromodulation in Aplysia neuron R15: intracellular calcium antagonizes neurotransmitter responses mediated by cyclic AMP. **Journal of Neurophysiology** 63:1075-1088.
- Kramer, R.H. and Levitan, I.B. (1988). Calcium-dependent inactivation of a potassium current in the Aplysia neuron R15. **Journal of Neuroscience** 8:1796-1803.
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- Kramer, R.H., Levitan, E.S., Carrow, G.M., and Levitan, I.B. (1988). Modulation of a subthreshold calcium current by the neuropeptide FMRFamide in the Aplysia neuron R15. **Journal of Neurophysiology** 60:1728-1738.
- Kramer, R.H., Levitan, E.S., and Levitan, I.B. (1988). Physiological interaction between calcium and cyclic AMP in an Aplysia bursting pacemaker neuron. *in* **Ion Channel Modulation** (A.D. Grinnell, D.L. Armstrong, and M.B. Jackson, eds.) Plenum, New York.
- Levitan, E.S., Kramer, R.H., and Levitan, I.B. (1988). Complex modulation of a bursting pacemaker neuron by cyclic nucleotides. *in* **Cellular Basis of Neuronal Plasticity** (A.M. Bulloch, ed.) Manchester University Press.
- Levitan, I.B., Kramer, R.H., and Levitan, I.B. (1988). Regulation of the electrical activity of an identified neurosecretory cell. *in* **Molecular Mechanisms in Secretion** (N. Thorn, M. Treisman, O. Petersen, and J.H. Thaysen, eds.) Munksgaard.
- Levitan, E.S., Kramer, R.H., and Levitan, I.B. (1987). Augmentation of bursting pacemaker activity in Aplysia neuron R15 is mediated by a cyclic AMP-dependent increase in Ca₂₊ and K⁺ currents. **Proceedings of the National Academy of Sciences, USA** 84:6307-6311.

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Title of Application/Patent: **Photoreactive Regulator of Protein Function and Methods of Use Thereof**

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