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Research Interests

My scientific goals center on characterizing the functional and morphological changes associated with neuronal plasticity. I currently employ both electrophysiological and histological/immunocytochemical techniques to investigate these changes. Uncovering the mechanisms that regulate circuitry reorganization will elucidate not only the processes underlying learning and memory but also the processes underlying pathogenesis, especially for disease states such as epilepsy. Additionally, my research program is designed to be both engaging and accessible to undergraduate students.

Current Position (since 2007)

Assistant Professor
Department of Biology
Whitman College
345 Boyer Ave.
Walla Walla, WA 99362

Previous Positions Held

Post-doctoral Research & Teaching Fellow Biology Department, Whitman College	2006-7
Alexander von Humboldt Post-doctoral Fellow Max Planck Institute for Medical Research, Heidelberg, Germany	2005-6

Education

1998 – 2005: University of Washington, Seattle, WA
Doctorate (Ph.D.) in **Neurobiology & Behavior**

Thesis: Functional changes in pyramidal neurons surviving an excitotoxic injury in mouse organotypic hippocampal slice cultures

1994 – 1998: University of Illinois, Chicago, IL
Bachelor of Science (B.S.) in Biochemistry
Minor in French
Minor in Mathematics

Certifications, Internships & Professional Courses

“Intracellular In-vivo Recording” - Otto Loewi Minerva Center in Eilat, Israel – September 2006

“Quantitative Fluorescence Microscopy” at the Mount Desert Island Biological Laboratories in Bar Harbor, ME - June 2003

“Marine Models in Biological Research” at the Marine Biological Laboratories in Woods Hole, MA – Summer 1997

Emergency Medical Technician Certification/Licensing for Level II Trauma at the GlenOaks Medical Center in Glen Ellyn, IL – 1996 through 1999.

Awards, Scholarships & Fellowships

A.E. Lange Award for Distinguished Science Teaching – Whitman College, 2012

Suzanne L. Martin Award for Excellence in Mentoring – Whitman College, 2012

Alexander von Humboldt Research Fellowship – Alexander von Humboldt Foundation, Germany, 2006

Young Investigator’s Award – American Epilepsy Society & the Epilepsy Foundation, Landover, MD, 2005

Pre-doctoral Research Training Fellowship – American Epilepsy Society & the Epilepsy Foundation, Landover, MD, 2004

NIH Neuroscience Training Grant – Dept. of Physiology & Biophysics, University of Washington, Seattle, WA, 2000-2004

Achievement Reward for College Scientists – ARCS Foundation Seattle Chapter, Seattle, WA, 1998-2000

University Scholars Award - University of Illinois at Chicago, Honors College, Chicago, IL, 1994-1998

Undergraduate Research Assistant Award, University of Illinois at Chicago – Honors College, Chicago, IL

Excellence in Science Award, Loyola Medical School - Department of Pharmacology, Chicago, IL

National Conference of Undergraduate Research 1997 & 1998 Sponsorship - University of Texas, Austin, TX & Salisbury University, Salisbury, MA

Medical Scholars Symposium Sponsorship – University of Illinois at Urbana-Champaign, Champaign, IL

Honors Council & Freshman Achievement Award, University of Illinois at Chicago – Honors College, Chicago, IL

Research Experience

2006-2007: Whitman College, Walla Walla, WA

Post-doctoral researcher and teaching fellow in the laboratory of Dr. G.S. Withers utilizing nanofabrication techniques to uncover the role of cell adhesion molecules in neuronal development.

2005-2006: Max Planck Institute for Medical Research, Heidelberg, Germany

Alexander von Humboldt Post-doctoral Fellow in the labs of Dr. T.A. Kuner, Dr. B. Sakmann and Dr. W. Denk fabricating novel optical biosensors to monitor inhibitory signaling in cortical pyramidal neurons *in vivo*.

2001-2005: University of California, Davis, CA

Graduate research in the laboratory of Dr. Philip A. Schwartzkroin identifying electrophysiological changes in neurons surviving an excitotoxic injury.

1998-2001: University of Washington, Seattle, WA

Graduate research in the laboratory of Dr. Philip A. Schwartzkroin characterizing feedback excitation in mouse dentate granule cells using an animal model of temporal lobe epilepsy and neuronal migration disorder.

1997-1998: University of Illinois, Chicago, IL

Research technician for the Dept of Anatomy under Dr. Edward H. Polley monitoring rates of development and differentiation of ganglion cells in the skate retina using electron microscopy and retrograde, lipophilic markers.

Summer 1997: Marine Biological Laboratory, Woods Hole, MA

Research internship in the BioCurrents facility with Dr. Robert Malchow & Dr. Peter Smith utilizing a self-referencing, oxygen sensitive electrode to monitor rates of cellular metabolism in isolated retinal photoreceptors.

1995-1997: University of Illinois, Chicago, IL

Undergraduate research in the laboratory of Dr. Robert Paul Malchow characterizing quinine and quinidine sensitivity of GABA transporters in skate retinal horizontal cells.

Teaching Experience

2007-present: Assistant Professor of Biology at Whitman College

BIOL 305: Cellular Physiology & Signaling (August 2007 – present)

BIOL 306: Cellular Physiology & Signaling Lab (August 2007 – present)

BIOL 330: Pathophysiology (Spring 2008 – present)

BIOL 330L: Pathophysiology Lab (Spring 2008 – present)

BIOL 111: Biological Principles (Fall 2008 – present)

BIOL 111L: Biological Principles Lab (Fall 2008 – present)
BBMB 400: Biochemistry, Biophysics and Molecular Biology Senior Seminar (Spring 2008 – present)
BIOL 489, 490, 498: Senior Research and Thesis (Fall 2007 – present)
BBMB 490: Senior Research and Thesis (Fall 2007 – present)

2006-2007: Postdoctoral & Teaching fellow at Whitman College

Biol 320L: Neurobiology Laboratory (Fall 2006)
Biol 471L: Physiology and behavior of animals Laboratory (Fall 2006)
BBMB 400: Biochemistry, Biophysics and Molecular Biology Senior Seminar (Spring 2007)
BIOL 489, 490, 498: Senior Research and Thesis (Fall 2006 – Spring 2007)
BBMB 490: Senior Research and Thesis (Fall 2006 – Spring 2007)

2000 & 2001: Teaching Assistant at the University of Washington

NBIO 402: Neuropathophysiology with Dr. Wayne Crill in the Dept. of Physiology and Biophysics at the University of Washington (Spring 2000 and Spring 2001).

Supervised Senior Thesis Students & Projects:

- Calvin Atkins (2011-present; Honors) – Changes in insulin signaling in the piriform cortex with the ketogenic diet.
- Haley McLeod (2012-present; Honors) – The role of insulin signaling in the ketogenic diet.
- Lori Mendelsohn (2012-present; Honors) – Elucidating the role of cytoplasmic p27 in HER2+ breast cancer.
- Andrew Terrell (2012-present) – Utilization of gastric bypass surgery to reverse systemic inflammation, obesity and immune-related Type 2 Diabetes Mellitus.
- Hannah Lewis (2011-12; Honors) – Electrophysiological influence of insulin receptor activation on hippocampal neurons.
- Stephanie Foster (2010-11; Honors) – Investigating the role of the Locus Coeruleus in Parkinson's Disease.
- Kelsie Butts (2010-11) – Insulin receptor expression in the hippocampus of mice maintained on the ketogenic diet.
- Brian Wakefield (2010-11; Honors) – Targeting pharmacotherapy in the treatment of pancreatic ductal carcinoma.
- Tiffany Choe (2010-11) – Manipulating cell signaling machinery to influence the progression of cancer growth and metastasis.
- Claire Johnson (2010-11) – Quantifying cell death in the subiculum of the hippocampal formation following fetal exposure to alcohol.
- Lauren Bolkovatz (2009-10) – Identifying the role of insulin receptor signaling in the use of the ketogenic diet to treat epilepsy.
- Kelsi Evans (2009-10) – Characterizing the pharmacokinetics of a novel drug used to modulate the activity of high-affinity acetylcholine receptor.
- Barbara Mantilla (2009-10) – Assessing neuronal loss in fetuses after recovery from binge exposure to alcohol.
- Kristen Mittelsteadt (2008-9; Honors) – Substance P signaling alterations in an animal model for post-traumatic stress disorder (PTSD).

- Samuel Moulton (2008-9) – Ketogenic diet and the role of insulin signaling in mediating anti-seizure effects.
- Ysbrand Nusse (2008-9) – Characterizing the Wnt signaling pathway in retinal tissue repair following laser injury.
- Simon Quay (2008-9) – Using a novel marker, channelrhodopsin, to characterize the physiological and anatomical connectivity underlying audition.
- Christoph Fuchs (2008-9; Honors) – The role of estrogen receptor phosphorylation in determining hormone therapy efficacy in breast cancer patients.
- Eduardo Duquez (2007-8) – Modulating PEA15, an adaptor protein for ERK1/2 signaling, using site-directed mutagenesis to identify its role in cellular proliferation.
- Loren Schmidt (2007-8) – Differentiating the role of caspases in cell death pathway and in inflammatory pathways in the lung epithelium.
- Matthew Zekan (2007-8) – Characterizing alterations in Norepinephrine and Substance P signaling in a novel animal model for post-traumatic stress disorder.
- Elliot Z. Brian (2006-7) – Insight into neuronal dendrite maturation through analysis of the developmental expression of Ribosomal S6 protein.
- Benjamin W. Gabriel (2006-7) – A stereological approach to identifying the effects of alcohol abuse on neuronal cell loss in the thalamic nucleus.
- Daryl Gasca (2006-7) – The role of glial-deprived protein, thrombospondin, in neuronal synapse formation in cultured hippocampal neurons.
- Robert W. Munday (2006-7; Honors) – Identification and characterization of a novel gene candidate for the regulation of neuronal axon myelination.

Professional Societies

Society for Neuroscience – an international organization of scientists and physicians dedicated to neuroscience research, member since 1999.

American Epilepsy Society – a professional organization dedicated to the prevention, treatment and cure of epilepsy, member since 2000.

Sigma Xi – The Scientific Research Society, Chapter 519 (Whitman College and Walla Walla University), member since 2008.

Faculty for Undergraduate Neuroscience (FUN) – an international organization promoting neuroscience education and research, member since 2008.

Professional Activity

Electrophysiology of neurons expert for DuPont USA, Inc. working with collaborator Dr. Paul Yancey at Whitman College and Stuart Craig at Dupont on a project “testing of osmolyte effect of betaine on neurons.” The project includes a \$5,000 support fund.

Electrophysiology Consultant for a Program Project Grant to develop a core facility for the investigation of “Cholinergic mechanisms in defective glucose homeostasis in diabetes and obesity” involving the Program Project PIs (Drs. Lattemann, Taborsky, and Blevins) and Core Director, Dr. Salwa Al-Noori, at the Seattle VA Puget Sound Health Care System.

Subject Expert and Consultant for the “Principles of Science” project for *Nature Education* (a division of the Nature Publishing Group) working with the Series Editor for Nature Education, Sara Tenney, and the Project Administrator for Words & Numbers, Nicholas Bonnet (<http://www.nature.com/principles/acknowledgements>).

Co-Director (with Dr. Thomas Knight) of the Murdock College Science Program at Whitman College from fall 2007 through 2009.

Peer Review Activity

Peer reviewer for *Epilepsia* (Journal of the International League Against Epilepsy) and for *Nu Rho Psi* (National Honor Society in Neuroscience)

Grant Applications and Funded Awards

National Science Foundation, CAREER Award, submitted July 2012. “Investigation of insulin-based modulation of neural circuits and plasticity in the hippocampus.” PI on \$621,026 grant application that is currently under review.

Howard Hughes Medical Institute Student-Faculty Life Science Research Grant. 2012. “Uncovering the role of insulin in the efficacy of the ketogenic diet, part II.” I have been awarded a \$13,000 extension for continued work on this project with a student team (two seniors Calvin Atkins and Haley McLeod).

Howard Hughes Medical Institute Student-Faculty Life Science Research Grant. 2011. “Uncovering the role of insulin in the efficacy of the ketogenic diet, part II.” I was awarded a \$13,000 summer research grant to cover salary and research for a student team (a junior Calvin Atkins and a senior Hannah Lewis).

National Science Foundation, Major Research Instrumentation Grant. 2010. “Acquisition of a Laser Scanning Confocal Microscope to Build an Integrative Life Sciences Imaging Program and Create New Research Opportunities at Whitman College.” Co-PI on a \$549,446 grant for a new confocal microscope system. This proposal was funded in 2010.

Abshire Research Scholar Award, Whitman College. 2010-2011. “What’s Locus got to do with it? Establishing the role of the Locus Coeruleus in the onset and progression of neurodegenerative disorders.” I was awarded \$3,200 to cover the stipend for a senior student, Stephanie Foster and for research supplies.

Howard Hughes Medical Institute Student-Faculty Life Science Research Grant. 2009. “Uncovering the role of insulin in the efficacy of the ketogenic diet.” I was awarded a \$13,000 summer research grant to cover salary and research for a student team (a junior Johanna Robertson and a senior Lauren Bolkovatz).

Louis B. Perry Summer Research Scholarship, Whitman College. 2008. “Diet and mental fitness: modulating brain activity using gut hormones.” I was awarded \$7,920 to cover stipend and expenses for a summer research with a senior student, Samuel Moulton.

Department of Defense – Post-traumatic Stress Disorder and Traumatic Brain Injury (PTSD/TBI) Research Program. 2007. “Altered inhibition in the traumatized brain: a predictor of post-traumatic outcome and a potential target for therapy.” I requested \$170,301 – for an 18-month project to support research and salary for 2 summer students. This proposal was not funded.

Manuscripts in Preparation (identifies an undergraduate student)*

Knight, L.S., H.J. Wenzel & P.A. Schwartzkroin. “Functional changes in pyramidal neurons surviving an excitotoxic injury in mouse organotypic hippocampal slice cultures.” In preparation for submission to *Journal of Neuroscience*, winter 2012.

Knight, L.S., K.L. Mittelsteadt*, M.S. Zekan*, S. White, M.A. Raskind, V.G. Olson, P. Szot and T.A. Knight. “Altered Substance P signaling in a rodent model for Post-Traumatic Stress Disorder.” In preparation for submission to *Neuroscience Letters*, spring 2013.

Peer-Reviewed Publications (identifies an undergraduate student)*

Knight, L.S. H. J. Wenzel, and P.A. Schwartzkroin (2012). “The role of altered inhibition and interneuron distribution in the dentate of an animal model for temporal lobe epilepsy.” *Epilepsia* 53 (Suppl. 1):161-170.

Szot, P., **L. Knight**, A. Franklin, C. Sikkema, S. Foster*, C.W. Wilkinson, S.S. White and M.A. Raskind (2012). “Lesioning locus coeruleus noradrenergic neurons with unilateral 6-hydroxydopamine: Evidence for bilateral forebrain innervation.” *Neuroscience* 216; 143-157.

Patel, L.S. (2005). “Functional changes in pyramidal neurons surviving an excitotoxic injury in mouse organotypic hippocampal slice cultures.” Ph.D. Thesis. University Microfilms, Ann Arbor, MI.

Patel, L.S., H.J. Wenzel & P.A. Schwartzkroin (2004). “Physiological and morphological characterization of dentate granule cells in the p35 knock-out mouse hippocampus; evidence for an epileptic circuit.” *J. Neuroscience*, 24(42).

H.J. Wenzel, **L.S. Patel**, C.S. Robbins, A. Emmi, R.S. Yeung & P.A. Schwartzkroin (2004). “Morphology of cerebral lesions in the Eker rat model of tuberous sclerosis.” *ACTA Neuropathologica*, 108: 97-108.

Ghatan, S., S. Larner, Y. Kinoshita, **L.S. Patel**, R.J. Youle & R.S. Morrison (2000). “p38 Mitogen-activated protein kinase mediates bax translocation and caspase induction in nitric oxide-induced apoptosis in neurons.” *J. Cell Biology* 150(2): 335-47.

Malchow, R.P., S.C. Land, **L.S. Patel** & P. Smith (1997). “Consumption of Oxygen by Isolated Skate Retinal Photoreceptors.” *Biological Bulletin*, 193:33-34

Select Presentations

*(peer-review of abstract submission; *identifies an undergraduate student)*

- Mittelsteadt, K.L.*, V.G. Olson, P. Szot, T.A. Knight, M.A. Raskind, **L.S. Knight** (2010) "Altered Substance P signaling in a rodent model for Post-Traumatic Stress Disorder." Society for Neuroscience Meeting in San Diego, CA. 162.15.
- Aegerter, E.R.*, Stoehr, K.R.*, Bhatt, E.M.*, **L.S. Knight**, and T.A. Knight (2010) "Mapping the brainstem projections of the physiologically defined cortical eye field in the mouse using stereotaxically guided microstimulation and tracer injection." Society for Neuroscience Meeting in San Diego, CA. 676.6.
- Zekan, M.S.*, **Knights, L.S.**, White, S.S., Murray, A.R., Olson, V.G. and P. Szot (2008) "Changes in substance P mRNA expression associated with Posttraumatic Stress Disorder." Accepted for presentation at the Society for Neuroscience Meeting in Washington, D.C. 845.23.
- Knights, L.S.**, H.J. Wenzel & P.A. Schwartzkroin (2005) "Synaptic alterations in hippocampal pyramidal neurons in organotypic slice cultures following excitotoxic insult." American Epilepsy Society Meetings – Washington, D.C. *Epilepsia* 46 (Suppl. 8):118.
- Patel, L.S.**, H.J. Wenzel & P.A. Schwartzkroin (2003) "Altered inhibition and interneuron distribution in the dentate of p35 knockout mice." American Epilepsy Society Meetings – Boston, MA. *Epilepsia* 44(S9):65-66.
- Wenzel, H.J., **L.S. Patel**, M. Wenzel, P.B. Crino & P.A. Schwartzkroin (2003) "Pathological cell features in cerebral lesions in the Eker rat model of Tuberous Sclerosis Complex – an immunocytochemical and electron microscopic study." American Epilepsy Society Meetings – Boston, MA. *Epilepsia* 44(S9):66-67.
- Patel, L.S.**, H.J. Wenzel & P.A. Schwartzkroin (2003). "The mouse organotypic hippocampal slice culture – characterization of an *in vitro* model for the longitudinal study of neuronal function." Society for Neuroscience Abstract 584.20.
- Patel, L.S.**, H.J. Wenzel & P.A. Schwartzkroin (2002) "Electrophysiological Characterization of Dentate Granule cells in p35 Knockout Mice." American Epilepsy Society Meetings – Seattle, WA. *Epilepsia* 43(S7):25-66.
- Wenzel, H.J., **L.S. Patel**, C.A. Robbins, N. Anderson & P.A. Schwartzkroin (2002) "Electron Microscopic Analysis of Recurrent Excitatory Circuitry in the Dentate Granule cells of the p35 Knockout Mouse – A model for cortical dysplasia and epilepsy." American Epilepsy Society Meetings – Seattle, WA. *Epilepsia* 43(S7):27.
- Schwartzkroin, P. A., C.A. Robbins, **L.S. Patel**, A. Emmi, R. Yeung, H. J. Wenzel (2002) "Morphology of Cerebral Lesions in the EKER Rat Model of Tubersclerosis." American Epilepsy Society Meetings – Seattle, WA. *Epilepsia* 43(S7):25-26
- Malchow, R.P., S.C. Land, **L.S. Patel** & P. Smith (1998). "Measurement of oxygen consumption by isolated skate photoreceptors using a self-referencing microelectrode." Investigative Ophthalmology & Visual Science, 39:s1056.

Malchow, R.P., S.C. Land, **L.S. Patel** & P. Smith (1998). "Consumption of Oxygen by Isolated Photoreceptors of the tiger salamander." *Society for Neuroscience* 24:p.644.

Invited Lectures

Knight, L.S. 2012. Unraveling the mysteries of the Ketogenic Diet – a high fat diet used in the treatment of pediatric epilepsy. Joseph G. Galusha Lecture at Walla Walla University, February 2012.

Knight, L.S. 2011. Exploring Mechanisms of Neuropathology using Novel Animal Models. Mount Holyoke College, December 2011.

Knight, L.S. 2011. Exploring Mechanisms of Neuropathology using Novel Mouse Models. University of Puget Sound, March 2011.

Knight, L.S. 2007. Engineering a trellis to study the role of cell adhesion molecules on dendritic growth in neurons. Cell Surface Interactions Meeting through web-conferencing, hosted by Cornell University, Ithaca, New York.

Knight, L.S. 2007. Functional changes in pyramidal neurons surviving an excitotoxic challenge. Whitman College, February 27th, 2007.

Knight, L.S. 2006. Investigating mechanisms of epilepsy using *in vitro* models. Skidmore College, November 28th, 2006.

Knight, L.S. 2006. Investigating mechanisms of epilepsy using *in vitro* models. Whitman College, April 11th, 2006.

Knight, L.S. 2005. Excitotoxicity and its functional implications on surviving pyramidal neurons. Max Planck Institute for Medical Research, Heidelberg, Germany, January 28th, 2005.

Knight, L.S. 2005. Investigating mechanisms underlying temporal lobe epilepsy using *in vitro* models. Max Planck Institute for Medical Research, Munich, Germany, January 2005.

Knight, L.S. 2005. Characterizing the functional features of abnormal dentate granule cells in the p35 knockout animal. University of Freiberg, Freiberg, Germany, January 2005.

Patel, L.S. 2004. Recurrent excitation in an *in vitro* model of temporal lobe epilepsy. Stanford University, December 3rd, 2004.

Patel, L.S. 2003. "Recovery from TBI: Neuronal Function in an *In-Vitro* Model of Excitotoxicity." 4th Annual University of California Neurotrauma Meeting – La Jolla, CA.