CURRICULUM VITA

Ginger S. Withers, Ph.D.
Dr. Robert F. Welty Associate Professor of Biology
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EDUCATION AND DEGREES

Ph.D., Neuroscience, Univ. Illinois, Champaign, IL 1993
A.M., Psychology, Univ. Illinois, Champaign, IL 1986
B.A., Cum Laude, Muskingum College, New Concord, OH 1983

ACADEMIC APPOINTMENTS

Whitman College
Associate Professor of Biology, 2007 – present
Chair, Biology Department, 2007 - 2010
Assistant Professor of Biology, 2001 - 2007
Oregon Health and Science University
Staff Scientist, 2007 – 2010
Research Assistant Scientist, 1998 – 2006
National Science Foundation Nanobiotechnology Center
Faculty Member, 2005 - 2010
Postdoctoral Advisor
Dr. Gary Banker, Univ. Virginia 1993 - 1997
Doctoral Thesis Advisors
Dr. Susan Fahrbach and Dr. Gene Robinson Univ. Illinois 1989 - 1993
Master's Thesis Advisor
Dr. William Greenough, Univ. Illinois 1983 - 1988

RESEARCH INTERESTS

Understanding the cellular mechanisms that control brain cell development. Specific interests focus on the development of the dendritic arbor (the receiving part of the neuron). My research investigates how new branches form, and how the growth of the dendritic arbor is regulated by extrinsic cues. The regulation of dendritic growth profoundly affects the pattern of connections that are formed between neurons, and is correlated with cognitive function. It is my goal to relate these basic findings to dendritic development in humans to further our understanding of neurodevelopmental and neurodegenerative disorders like mental retardation and Alzheimer's disease.

EDUCATION GOALS

My goal in science education is to bring transformative research that is changing the life sciences today to the classroom and to create a research-rich environment for undergraduates. As examples, digital microscopy, and live cell imaging are both techniques that are revolutionizing our understanding of the function of living organisms. With funding from the Keck Foundation and the NSF, I have built student digital microscopy workstations and a Live Cell Imaging Center that enable students to record images and movies of living cells, and to develop skills needed to treat these images as primary data.

CURRENT and PENDING FUNDING

NIH 1R15HD061831-01, Glia as a source of signals for neuron development. ($225,000, 09/09 – 09/13) PI, G.S. Withers, CoPI, C.S. Wallace.

NSF MRI: Acquisition of a laser scanning confocal microscope to build an integrative life sciences imaging program and create new research opportunities at Whitman College. ($549,000, 09/10 – 08/13) PI, G.S. Withers, CoPIs, C. Wallace, L. Knight, D. Vernon, D. Juers

COMPLETED FUNDING

NSF MRI: Acquisition of an environmental scanning electron microscope for multidisciplinary research and undergraduate research training at Whitman College. ($407,932, 8/1/09-7/31/12) PI, K. Jackson, coPIs, K. Nicolaysen, G. Rollefson, D. Vernon, G.S. Withers

NSF, Career Award #0135985: Imaging Mechanisms of Dendritic Development in Living Neurons ($549,995, 2002 - 2008)

NSF, Research Experience for Undergraduates (REU, $24,000, summers 2004, 2005, 2006)

NSF Nanobiotechnology Center Program, Design of a "Spatial Trap" To Selectively Control Dendritic Development In Neurons, PI, Withers ($100,000, 1/2006 -12/ 2007).

Columbia Genome Consortium/Teagle Foundation, "Teaching Big Science at Small Colleges: Combining anatomical and genomics tools to engage intermediate and upper level Biology and Neuroscience undergraduates in an integrative analysis of nervous system evolution" coPIs, G.S. Withers, C.S. Wallace, Whitman College, and K. Susman, Vassar College (2008-9, $9,000)

WHITMAN INTRAMURAL FUNDING

Abshire award: The Role of the Actin Cytoskeleton in the Development of Dendrite and Axon Phenotypes in Neurons SP 2011, Withers and D. Brandner ('12)

Perry summer award: Analysis of the effects of glial cells on the development of cultured hippocampal neurons, 2008, Withers, J. Hanson (09) and A.D. Bachellor ('09)

Whitman College Innovation in Teaching Award, "Building new science courses and labs around discovery: integrated inquiry-based instructional units and 'clabinar' courses" coPIs, G.S. Withers, C.S. Wallace and D. Vernon (2008, $12,220)

ACADEMIC AWARDS and OTHER DISTINCTIONS

2010 Whitman College G. Thomas Edwards Award, Excellence in Scholarship and Teaching
2007 – present, Dr. Robert F. Welty Chaired Associate Professorship
1996 - 1998 Spinal Cord Research Foundation Grant
1997 Analytical and Quantitative Microscopy, Woods Hole, MA
1996 Paralyzed Veterans of America Young Investigator Award
1994 Finalist, Donald B. Lindsley Prize for Outstanding PhD Thesis in Behavioral Neuroscience
1994-1996 NIH National Research Service Award
1993 Capranica Prize for Outstanding Publication in Neuroethology by a Young Scientist
1992 Grass Travel Award, International Congress of Neuroethology
1992 University of Illinois Sigma Xi Travel Award
1992 Society for Neuroscience, Women in Neuroscience Travel Award
1991 University of Illinois Neuroscience Student Research Grant

1990 University of Illinois School of Life Sciences Excellence in Teaching Award
1989 University of Illinois Neuroscience Merit Award

PROFESSIONAL ACTIVITY

Editor (Annotator and Reviewer) 2009-12, American Society for Cell Biology Image Library position funded by the NIGMS Grand Opportunities Grant to the ASCB, www.cellimage library.org

Memberships in: Soc. for Neuroscience, Int'l Brain Research Organization, American Soc. for Cell Biology, Sigma Xi, Faculty in Undergraduate Neuroscience (FUN), Council on Undergraduate Research

COURSES TAUGHT

Developmental Biology, 2002 – 10
Developmental Biology Seminar, 2012
Neurobiology, 2002 – present
Principles of Biology, Lab, 2013
Guest lecturer, Principles of Biology, 2002 - present
Instructor, Neurobiology Course, Marine Biology Laboratories, Woods Hole, MA 1996
Principles of Biology Laboratory, I & II, Univ. Illinois 1989 – 1990

PEER REVIEW ACTIVITY

National Science Foundation, Panel Reviewer for the Biology Directorate, FA 2005, SP 2006, FA 2006, SP 2007, FA 2007; SP 2011 (x2), 2012, 2013; Division of Undergraduate Education, 2004, 2005

National Science Foundation, ad hoc reviewer for Integrative and Organizational Biology, Developmental Neuroscience Cluster and Behavioral Neuroscience Program, 2003, 2004, 2005, 2007, 2008, 2009; 2011

Other agencies: Alzheimer's Foundation, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2011, Murdock Foundation, 2004, 2012; Indo-US Science and Technology Forum, 2009; Netherlands Organization for Scientific Research, 2010, 2012, 2013; Pennsylvania Department of Health, 2010; Israel Science Foundation, 2013

Journals: The Journal of Neuroscience; FASEB (The Journal for the Society for Experimental Biology); European Journal of Neuroscience; Cytoskeleton; Nanomedicine; Developmental Neurobiology; Trends in Biotechnology; Journal of Neuroscience Methods; PLOSone; Brain Cell Biology, Neuroscience Letters; JoVE (Journal of Visualized Experiments); Journal of Experimental Biology

Educational publications: Nature Education (Online Biology Textbook, reviewer of multiple chapters)

PUBLICATIONS (undergraduate co-authors indicated with *)

SCIENCE EDUCATION PUBLICATIONS

Banta, L.M., Crespi, E.J., Nehm, R.H., Singer, S., Schwarz, J.A., Manduca, C.A., Bush, E.C., Collins, E., Constance, C.M., Dean, D., Esteban, D., Fox, S., Paul, C.A., Quinan, G., Raley-Susman, K.M., Smith, M.L., Wallace, C.S., Withers, G.S., Caporale, L. (2012). *Letter to the Editor:* Integrating Genomics Research throughout the Undergraduate Curriculum: A Collection of Inquiry-Based Genomics Lab Modules. J. Cell Biol. Education 11:1-5, **republished as a feature in "CBE Highlights of the Year" 2012.**

Detweiler-Bedell, J.B., Withers, G.S. 2010. Using transformative research to enrich science curricula and enhance experiential learning, in K. Karukstis and N. Hensel (Eds.) Transformative Research at Predominantly Undergraduate Institutions, CUR Press, p 35-45.

Withers, G.S., Wallace, C.S. 2007. Inexpensive Digital Microscopy Workstations Engage Students in Integrative Biology. in A. Mendez-Vilas, J. Diaz (Eds.) Modern Research and Educational Topics in Microscopy, 3rd Ed. Vol 2, p. 1028-1033.

INVITED COMMENTARY

Withers, G.S. 2006. New ways to print living cells promise breakthroughs for engineering complex tissues *in vitro.* Biochemical Journal **394**, e1-2.

PEER-REVIEWED RESEARCH PAPERS

Withers, G.S., Wallace, C.S., Gibbs, E.M.*, Emery, I.R.*, Applegate, M.L.* 2011. Synapses on demand require dendrites at the ready: How defining stages of dendritic development in culture could inform studies of brain information storage. Developmental Psychobiology, 53(5):443-55.

Wallace, C.S., Withers, G.S., Farnand, A.*, Lobinger, B.T.*, McCleery, E.J.* 2011. Evidence that angiogenesis lags behind neuron and astrocyte growth in experience dependent plasticity. Developmental Psychobiology, 53(5):435-42.

Kollins, K.M., Bell, R.L.*, Butts, M.*, Withers, G.S. 2009. Dendrites differ from axons in patterns of microtubule stability and polymerization during development. Neural Development 4(1):26 (epub ahead of print, 14 July 4:26, doi:10.1186/1749-8104-4-26). **Awarded a "highly accessed" designation by the journal, 2013.**

Withers, G.S., Day, N.F.*, Talbot, E.*, Dobson, H.E.M., Wallace, C.S. 2008. Experience-dependent plasticity in the mushroom bodies of the solitary bee *Osmia lignaria* (Megachilidae). Developmental Neurobiology, **68 (1)** 73-82, epub ahead of print in October 2007.

Withers, G.S., James, C.D., Kingman, C.E., Craighead, H.G., Banker, G.A. 2006. Effects of substrate geometry on growth cone behavior and axon branching, Journal of Neurobiology, **66,** 1183-1194.

Wallace, C.S., Reitzenstein, J*. Withers, G.S. 2003. Diminished experience-dependent neuroanatomical plasticity: Evidence for an improved biomarker of subtle neurotoxic damage to the developing rat brain. Environmental Health Perspectives, **111**, 1294 – 1298.

Withers, G.S., Higgins, D., Charette, M., Banker, G. 2000. Bone morphogenetic protein osteogenic protein-1 (OP-1) stimulates dendritic growth and synaptogenesis in cultured hippocampal neurons. European Journal of Neuroscience, **12**, 106-116.

Grewal, S.S., Horgan, A.M., York, R.D., Withers, G.S., Banker, G.A., Stork, P.J. 2000. Neuronal calcium activates a rap1 and B-Raf signaling pathway via the cyclic adenosine monophosphate-dependent protein kinase. Journal of Biological Chemistry, **275**, 3722-3728.

James, C.D., Davis, R.C., Meyer, M., Perez, A., Turner, S. Withers, G., Kam, L., Banker, G., Craighead, H.G., Isaacson, M., Turner, J.N., Shain, W. 2000. Aligned microcontact printing of micrometer-scale poly-L-lysine structures for controlled growth of cultured neurons on planar microelectrode arrays. IEEE Transactions in Biomedical Engineering, **47**, 17-21.

Withers, G.S., George, J.M., Banker, G.A., Clayton, D.F. 1997. Delayed localization of synelfin (synuclein, NACP) to presynaptic terminals in cultured rat hippocampal neurons. Developmental Brain Research, **99**, 87-94.

Wallace, C.S., Withers, G.S., Weiler, I.J., George, J.M., Clayton, D.F., Greenough, W.T. 1995. Correspondence between sites of NGFI-A induction and sites of morphological plasticity following exposure to environmental complexity. Molecular Brain Research, **32**, 211-220.

Withers, G.S., Fahrbach, S.E., Robinson, G.E. 1995. Effect of experience on the organization of the mushroom bodies of honey bees. Journal of Neurobiology, **26,** 130-144.

Withers, G.S., Fahrbach, S.E., Robinson, G.E. 1993. Selective neuroanatomical plasticity and division of labour in the honey bee. Nature, **364**, 238-240.

Wallace, C.S., Kilman, V.L.*, Withers, G.S., Greenough, W.T. 1992. Increases in dendritic length following a brief period of differential housing in weaning rats. Behavioral and Neural Biology, **58**, 64-68.

Withers, G.S., Greenough, W.T. 1989. Reach training selectively alters dendritic branching in subpopulations of layer II-III pyramids in rat motor-somatosensory forelimb cortex. Neuropsychologia, **27**, 61-69.

Camel, J.E., Withers, G.S., Greenough, W.T. 1986. Persistence of visual cortex dendritic alterations induced by postweaning exposure to a "superenriched" environment in rats. Behavioral Neuroscience, **100**, 810-813.

Greenough, W.T., Larson, J.R., Withers, G.S. 1985. Effects of unilateral and bilateral training in a reaching task on dendritic branching of neurons in the rat motor-sensory forelimb cortex. Behavioral and Neural Biology, **34**, 301-314.

BOOK CHAPTERS

Withers, G.S. and Banker, G. 1998. Characterizing and studying neuronal cultures. In Banker, G. and Goslin, K. (Eds.) *Culturing Nerve Cells 2nd Edition*, The MIT Press:Cambridge, pp113-151.

Greenough, W.T., Wallace, C.S., Alcantara, A.A., Anderson, B.J., Hawrylak, N., Sirevaag, A.M., Weiler, I.J., Withers, G.S. 1992. Development of the brain: Experience affects the structure of neurons, glia and blood vessels. In Anastasiow, N.& Harel, S. (Eds.), *Proceedings from the 3rd International Workshop on the At Risk Infant*, Paul H. Brooks:Baltimore, pps. 173–185.

Greenough, W.T., Withers, G.S., Anderson, B.A. 1991. Experience-dependent synaptogenesis as a plausible memory mechanism. In Harvey, J.A. & Gormezano, I. (Eds.), *Learning and Memory: The Biological Substrates*, Lawrence Earlbaum Assoc.:Hillsdale.

Greenough, W.T., Withers, G.S., Wallace, C.S. 1990. Morphological changes in the nervous system arising from behavioral experience: What is the evidence that they are involved in learning and memory? In Squire, L.R. & Lindenlaub, E. (Eds.), *The Biology of Memory, Symposia Medica Hoescht 23*, F.K. Schattauder Verlag:Stuttgart-New York, pp 159-183.

PUBLISHED IMAGES, INVITED, OR PEER-REVIEWED

Brandner, D. and Withers, G. (2010) Developmental series: neurons in vitro. The Cell: An Image Library, www.cellimagelibrary.org, 283 published images, ASCB, contributor link: http://cellimagelibrary.org/contributors/37047

Withers, G. (2010) Dendritic development of neurons in vitro. The Cell: An Image Library, www.cellimagelibrary.org, 60 published images, ASCB; contributor link: http://cellimagelibrary.org/contributors/36879

Withers, G. (2011) Tubulin staining in neurons. Figure 11.7 from Lewin's Cells, 2nd Ed., L. Cassimeris, G. Plopper, p. 25, 3rd edition in press.

Withers, G. (2008) Neurons finding their way? Image featured in the NSF Performance Highlights FY 2007. www.**nsf**.gov/pubs/2008/**nsf**0803/highlights_complete.pdf

SELECTED RECENT ABSTRACTS

Withers, G.S., Farley, J. *, Sterritt, J. R.*, Chory, K.*, Guggenheim, J.*, and C.S. Wallace (2013). Contact-dependent and independent effects by astroglia on cultured hippocampal neuron development. International Soc. Neurochemistry Satellite Meeting, Emerging Topics in Synapse Function: Molecular Mechanisms, Circuit Function and Disease, Playa del Carmen, Mexico, April 2013.

Bell, R. L., Bargava, A., Liao, M., Withers, G., Kuypers, F., Stehr, W. (2013). Corticotropin-releasing factor promotes necrotizing enterocolitis in formula fed neonatal rats. American College of Surgeons' 99th Clinical Congress (October 6-10, 2013, Washington, DC).

Brandner, D.D.*, Withers, G.S. (2012). Developmental timing determines effects of actin on neuronal process formation. American Society for Cell Biology Meeting Abstracts, ID # 1989.

Brandner, D.D.*, Sterne, G.R.*, Withers, G.S. (2011) A role for dynamic actin in the development and maintenance of the dendritic arbor. International Brain Research Organization Meeting Abstracts, C011

Withers, G.S., Chory, K.*, Sterritt, J.R.*, Guggenheim, J.*, Wallace, C.S. (2011). Synapse formation and dendritic development in vitro are influenced by astrocytes in a contact dependent manner. International Brain Research Organization Meeting Abstracts, C013

Brandner, D.D.*, Withers, G.S. (2010). The role of actin in the development of neuron polarity. Murdock Undergraduate Research Conference, Pacific Lutheran College, McMinnville, OR, 10/12-10/13, 2010.

Sterne, G.*, Withers, G.S. (2010). The role of actin in the development of dendrite and axon phenotypes. Soc. for Neuroscience Meeting Abstracts, 333.20.

Sterne, G.,* Withers, G.S. (2009). Actin stability and morphological commitment in developing neurons. Undergraduate Poster Session, Annual Society for Neuroscience Meeting, Chicago, IL, Oct., 2009.

Withers, G.S., Applegate, M.*, Emery, I. *, Brian, E.Z.*, Wallace, C.S. (2009). Defining stages of dendritic maturation in cultured hippocampal neurons. Poster at the NW Society for Developmental Biology, Friday Harbor, WA, March 18-21, 2009

Withers, G.S., Lambruschi, L.*, Brown, L.*, Wallace, C.S. (2008). The absence of glia leads to increased dendritic growth in cultured hippocampal neurons. Soc. for Neuroscience Meeting Abstracts, 524.17.

Withers, G.S., Mumford, M.C.*, Pounds, J.* (2006). Selective patterning of N-cadherin orients the formation of the dendritic arbor in cultured hippocampal neurons. J. Neurochem. 96 (S1) 117.

Changstrom, B.G.*, Gibbs, E.M.*, Withers, G.S. (2005). Disruption of Actin Polymerization Suggests Two Mechanisms of Dendritic Branch Formation in Neurons. American Society for Cell Biology Meeting Abstracts, p. 678a.

Day, N.F.*, Talbot, E.* Dobson, H.E.M., Wallace, C.S., Withers, G.S. (2005). Separating experience-expectant organization from experience-expectant plasticity in the mushroom bodies of the solitary bee Osmia lignaria. Annual Society for Neuroscience Meeting Undergraduate Poster Session, Washington DC, Nov. 11- 15.

Wallace, C.S., Withers, G.S. (2004). Affordable digital microscopy workstations engage students in integrative biology. Crossing Boundaries: Innovations in Undergraduate Research, the 10th National Conference Proceedings, Council on Undergraduate Research, p 23.

Withers, G.S. Wallace, C.S. (2003). An affordable imaging system introduces undergraduates to digital microscopy. Society for Neuroscience Abstracts, **33**, 25.7.

INVITED SEMINAR AND SYMPOSIUM PRESENTATIONS

Whitman College, G. Thomas Edwards Lecture, Feb. 22, 2011, "Looking for answers to big questions in small spaces: Imaging neurons at Whitman"

University of Illinois, Champaign-Urbana, Symposium honoring the retirement of Professor W.T. Greenough, June 6-7, 2009. Invited presentation: Defining Stages of the Developing Dendritic Arbor.

CROET Seminar Series, Oregon Health and Science University, Nov. 20, 2006: "Engineering the dendritic arbor of neurons: New approaches to study the regulation of dendritic growth"

University of Illinois, Symposium: Growth Points in the Study of Genes, Brain and Behavior, September 16, 2005, "Design of a spatial trap and other tricks to study neuron development"

Cornell University Nanobiotechnology Seminar Series, March 15, 2005, "Engineering the dendritic arbor of neurons through nanobiotechnology"

U. Maryland, Neuroscience and Cognitive Science Program, Sept. 17, 2004 "Building the dendritic arbor: New views from living neurons"

Lake Forest College, Department of Biology and Summer Research Program, Lake Forest, IL, July 7, 2004 "A model of how new dendritic branches form in neurons"

U. Idaho, Department of Biology, March 26, 2004, "New views of dendritic development in living neurons"