**Robert O’Hagan, Ph.D.**

Assistant Professor

Montclair State University

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**Education:**

**Doctor of Philosophy**, **Columbia University, NY, NY,** October, 2005

Awarded with Distinction, Biological Sciences. Advisor: Dr. Martin Chalfie, Ph.D.

Thesis: *Components Of A Mechanotransduction Complex In C. elegans Touch Receptor Neurons: An In Vivo Electrophysiological Study*

**Bachelor of Arts**, **Wesleyan University, Middletown, CT**

December, 1989, Film Studies Major.

**Awards:**

**N. J. Commission on Spinal Cord Research, Individual Research Grant**,2015-2018

I was awarded a three year $600k grant entitled, “Enhancement of Cytoskeletal Dynamics and Motor Transport By Manipulation of Post-Translational Microtubule Glutamylation to Maximize Neuroregeneration” (Award number CSCR15IRG014)

**N. J. Commission on Spinal Cord Research Fellowship**, 2010-2014

My postdoctoral research in Dr. Maureen Barr’s lab on microtubule modification by a carboxypeptidase was supported by a fellowship entitled, “The NNA-1 Carboxypeptidase and *C. elegans* Neuroregeneration” (Award number 10-2951-SCR-E-0).

**Ruth L. Kirschstein National Research Service Award,** 2007-2010

My research on modification of microtubules by a carboxypeptidase in cilia was supported by this three-year postdoctoral fellowship (Award number 5F32NS056540).

**American Heart Association Postdoctoral Fellowship**, 2006

My research on dopaminergic signaling in *C. elegans* in Dr. H. Robert Horvitz’s laboratory was supported by this postdoctoral fellowship,.

**Howard Hughes Medical Institute Predoctoral Fellowship,** 2001-2005

**Peter Sajovic Memorial Prize,** 2005

Awarded to a graduate student doing outstanding work in biology at Columbia.

**Teaching Experience:**

**Instructor, Genetics (BIOL380),** Spring 2019, Montclair State University, I currently teach lecture and labs for two sections of this upper level course in genetics.

**Instructor, Principles of Biology (BIOL112),** Fall 2018, Montclair State University

I currently teach lecture and labs for two sections of this introductory course in biology.

**Lecturer, Human Genetics (16:681:535:01),** Fall, 2016. Rutgers University. In this foundational graduate course in human genetics, led by Dr. Maureen Barr and Dr. Linda Brzustowicz, I taught a section on regulation of gene expression.

**Lecturer, Developmental Genetics (01:447:370),** Spring 2016, Rutgers University. In this undergraduate class, led by Dr. Maureen Barr, I lectured on the genetics of sensation.

**Co-Instructor, The Cilium, Organelle Of The 21st Century (16:695:628)**, Spring 2015. Graduate Programs in Molecular Biosciences, Rutgers University. With Dr. Maureen Barr, I created the syllabus, readings, homework, and final exam. I led discussions based on our readings of seminal and current publications on the broad topic of ciliary biology. I critiqued student presentations and graded homework and exams.

**Research Mentor for Undergraduate and Graduate Students**, 2012-2018. Barr Laboratory, Rutgers University. I trained students in experimental design, molecular biology, microscopy, as well as forward and reverse genetics and behavior in *C. elegans*. I had great success supervising a team of three undergraduates—Winnie Zhang, Margaret Morash, and Sebastian Bellotti—who conducted a forward genetic screen for suppressors of ciliary microtubule degeneration in *ccpp-1* mutant nematodes. Under my guidance, Maggie Morash won a prestigious Goldwater Scholarship. I am currently mentoring one undergraduate (Amanda Gu, who is working towards and honors thesis and publication), one graduate student (Katlin Power, currently rotating in our lab) and one technician (Yasmin Ramadan, recent Rutgers University graduate). I have also previously mentored post-baccalaureate researchers Malan Silva, now a PhD candidate in biology, and Joshua Weiss, now in medical school.

**Training in *In Vivo* Electrophysiology in *C. elegans****,* 2008-Present.

I train other researchers in electrophysiological recording from *C. elegans* neurons *in vivo.* Recording from *C. elegans* neurons is a challenging but powerful technique for observing the function of neurons in living animals, currently practiced by only a few laboratories in the world.

**Guest Lecturer,** BIOL200 Introduction to Biology; Cell Structure and Function

Haverford College, Spring 2017. I lectured on my research in *C. elegans* genetics and cell biology.

**Guest Lecturer**, Neurogenetics 335, Bowdoin College, Fall 2011, and Molecular Genetics 314, Middlebury College, Fall 2014. I lectured on my research in *C. elegans* genetics and neuroscience.

**Teaching Assistant, Neurobiology Course,** Summer 2009, Marine Biological Laboratory, Woods Hole, Massachusetts. I provided instruction in both molecular genetics and electrophysiology techniques for graduate students and postdocs.

**Teaching Assistant**,Fall 2001 and Spring 2002, Biology C2005, Introduction to Molecular and Cellular Biology, Part I, and Part II. I taught weekly undergraduate recitation for biology and pre-med students. I conducted lessons and devised and graded weekly quizzes.

**Research Experience:**

**O’Hagan Laboratory**, Montclair State University,2018-present. Using genetics and *in vivo* cell biology techniques in *C. elegans,* I have identified the deglutamylase CCPP-1 as a key regulator of cytoskeletal stability and motor traffic in sensory neuronal cilia. Glutamylation is one of a plethora of post-translational modifications that can be reversibly added to microtubules; such post-translational modifications in combination are proposed to act as a “Tubulin Code” that regulates microtubule stability and motor traffic (Verhey and Gaertig, 2007). I found that, consistent with the Tubulin Code hypothesis, loss of the deglutamylase CCPP-1 causes dramatic cytoskeletal instability in a subset of sensory neurons and abnormally fast kinesin-2 motility in another subset (reported in O’Hagan, *et al,* 2011 and O’Hagan *et al,* 2017).

In the O’Hagan Lab, I plan to guide a team of undergraduate researchers to further understand the genetic underpinnings of the Tubulin Code in *C. elegans* neurons. We are using genetics, molecular biology, cell biology, and ultrastructural techniques to elucidate the pathways by which glutamylation affects neurons, intracellular traffic, and their microtubule cytoskeleton.

**Independent Research and Postdoctoral Research*,*** Rutgers University, 2008-2018.

 With a team of undergraduates, I conducted a forward genetic screen for mutations that suppress the microtubule instability defect of *ccpp-1* mutants and have isolated fifteen independent mutations. In mammals, the CCPP-1 homolog is implicated in both neurodegeneration and regeneration after injury, highlighting the importance of the Tubulin Code. Therefore, I hope that my *ccpp-1* suppressors will identify novel molecular targets for treatment of neurodegeneration or spinal cord injury in humans.

**Postdoctoral Research,** Massachusetts Institute of Technology, 2005-2007. In Nobel Laureate Dr. H. Robert Horvitz’s laboratory, I studied the genetics of feeding and locomotion behavior mediated by dopamine signaling in *C. elegans*.

**Doctoral Research**, Columbia University, 2000-2005. In the laboratory of Nobel Laureate Dr. Martin Chalfie, I used in vivo electrophysiology techniques in *C. elegans* neuronsto demonstrate that the DEG/ENaC ion channels MEC-4 and MEC-10 form the core of a mechanotransduction complex in touch receptor neurons. Mechanotransduction underlies the senses of touch, hearing, and proprioception, but the molecules that mediate these senses were unknown. My work provided the first demonstration of the molecular identity of any metazoan mechanotransduction complex.

**Post-baccalaureate Research**, Columbia University, 1998-1999. In the laboratory of Dr. Darcy Kelley, I studied vocal communication and behavior of male *Xenopus laevis* frogs. In this work, published in 2004, we identified a new vocalization that we called “chirping” and described vocal dominance and suppression of other males.

**Publications:**

**O'Hagan, R.**, Silva, M., Nguyen, K. C. Q., Zhang, W., Bellotti, S., Ramadan, Y. H., Hall, D. H., and Barr, M. M. The Glutamylase TTLL-11 Regulates Ciliary Microtubule Structure, Polycystin Trafficking, and Extracellular Vesicle Release in *C. elegans* Sensory Neurons. Curr. Biol. Nov 20;27(22):3430-3441, (2017)

Lockhead, D., Schwarz, E. M., **O’Hagan, R,** Bellotti, S., Krieg, M., Barr, M. M., Dunn, A. R., Sternberg, P. W., and Goodman, M. B. The tubulin repertoire of *Caenorhabditis elegans* sensory neurons and its context‑dependent role in process outgrowth. Mol. Biol. Cell 27:23 3717-3728, (2016)

**O'Hagan R**, Barr MM. Kymographic Analysis of Transport in an Individual Neuronal Sensory Cilium in *Caenorhabditis elegans*. Methods Mol Biol. 1454:107-22, (2016)

Chen, Y., Bharill, S., **O’Hagan, R.**, Isacoff, E. Y., and Chalfie, M. MEC-10 and MEC-19 reduce the neurotoxicity of the MEC-4(d) DEG/ENaC channel in *Caenorhabditis elegans***.**  G3: Genes, Genomes, GeneticsApril 1, (6): 41121-1130 (2016)

Chen, Y, Bharill, S, Altun, Z, **O'Hagan, R**, Coblitz, B, Isacoff, EY, Chalfie, M.

*C. elegans*paraoxonase-like proteins control the functional expression of DEG/ENaC mechanosensory proteins. Mol Biol Cell. Mar 3, (2016)

**O'Hagan, R.** and Barr, M. M. A motor relay on ciliary tracks. An invited “News & Views” commentary in Nat Cell Biol. Nov 27;17(12):1517-1519 (2015)

**O'Hagan, R.**, Wang, J. and Barr, M. M. Mating Behavior, Male Sensory Cilia, and Polycystins in *C. elegans.* Invited Review in *Semin Cell Dev Biol*. Sept; **33C**:25-33 (2014)

**O'Hagan, R.**, and Barr, M. M. Regulation of Tubulin Deglutamylation Plays Cell-Specific Roles in the Function and Stability of Sensory Cilia. *Worm* July/Aug/Sept; **1** (3):155-159 (2012)

**O'Hagan, R.**, Piasecki, B. P., Silva, M., Phirke, P., Nguyen, C. Q., Hall, D. H., Swoboda, P. and Barr, M. M. The Tubulin Deglutamylase CCPP-1 Regulates the Function and Stability of Sensory Cilia in *C. elegans*. *Curr Biol.* Oct. 25; **21** (20): 1685-1694(2011)

Árnadóttir, J., **O'Hagan, R.**, Chen, Y., Goodman, M.B., and Chalfie, M. The DEG/ENaC protein MEC-10 regulates the transduction channel complex in *Caenorhabditis elegans* touch receptor neurons. *J Neurosci*. Aug 31; **31** (35):12695-12704 (2011)

Vansteenhouse, H.C., Horton, Z.A., **O'Hagan, R.**, Tai, M.H., Zipser, B. Phylogenetic conservation of the cell-type-specific Lan3-2 glycoepitope in *Caenorhabditis elegans*. *Dev Genes Evol*. Sep; **220** (3-4): 77-87 (2010)

Bounoutas, A, **O'Hagan, R.**, Chalfie, M. The multipurpose 15-protofilament microtubules in *C. elegans* have specific roles in mechanosensation. *Curr Biol.* Aug 25; **19** (16): 1362-1367 (2009)

**O’Hagan, R.** and Chalfie, M. “Mechanosensation In *C. elegans.”*  A chapter in a thematic volume from Elsevier Press entitled The Neurobiology of *C. elegans,* Vol. 69 (2006), edited by Eric Aamodt and Cindy Minor.

**O’Hagan, R.**, Chalfie, M., and Goodman, M.B. The MEC-4 DEG/ENaC channel of *Caenorhabditis elegans* touch receptor neurons transduces mechanical signals. *Nat Neurosci.* **8** (1), 43-50 (2005)

Tobias, M.L., Bernard, C., **O’Hagan, R.**, Horng, S., Rand, M., and Kelley, D. B. Vocal communication between male *Xenopus laevis*.*Animal Behaviour,* **67**, Issue 2, 353-365 (2004)

Goodman, M.B., Ernstrom, G., Chelur, D.S., **O’Hagan, R.**, Yao, C., and Chalfie, M. MEC-2 regulates *C. elegans* DEG/ENaC channels needed for mechanosensation. *Nature* **415**, 1039-1042 (2002)

Chelur, D.S., Ernstrom, G., Goodman, M.B., Yao, C., Chen, L., **O’Hagan, R.** and Chalfie, M. The mechanosensory protein MEC-6 is a subunit of the *C. elegans* touch-cell degenerin channel. *Nature* **420**, 669-673 (2002)

**Inventions:**

**Translation/Rotation Stage and Perfusion System for Electrophysiology of Small Preparations.** I used this invention for *in vivo* electrophysiology experiments described in my *Nature Neuroscience* (2005) publication. This invention provides ease of movement of small preparations (such as mounted *C. elegans*) and steady perfusion that travels with the preparation. Columbia University secured a provisional patent on this device.

**Miniature “Wand” Hydrophone.** I used this invention in male *Xenopus laevis* vocal behavior experiments described in my *Animal Behaviour* (2004) publication. Xenopus is completely aquatic and does not produce any visible sign of vocalization, and if several animals are present, identifying the calling frog is impossible using traditional underwater microphones (“hydrophones”). The wand hydrophone can be placed directly aside the larynx of a behaving frog to confirm that it is vocalizing.

**Scientific Presentations:**

(\* indicates MSU undergraduate student)

International *C. elegans* Meeting, 2019**,** UCLA, Oral Presentation, The Tubulin Code: Writers, erasers, and readers specialize cilia. **O'Hagan**, **R.**, Power, K., Gu, A., Morash, M.,Bellotti, S., Zhang, W., De Stasio, E.A., Smith, H., Golden, A., Nguyen, K.C., Hall, D.H. Barr, M. M.

International *C. elegans* Meeting, 2019**,** UCLA, Poster Presentation, Effects of Microtubule Glutamylation on Motor Localization and Function in Axons and Dendrites. Zadeh\*, A. and **O’Hagan, R.**

Sigma Xi Research Symposium, 2019, MSU, Poster Presentation, Genetic Studies of Microtubule Stability and Cellular Trafficking in the Nematode *C. elegans*, Zadeh\*, A., Barraza\*, S., Candemir\*, D.G., Ross, N., Avrutis\*, A., and **O’Hagan, R.**

BHI Symposium 2018, Nokia Bell Labs, Murray Hill, NJ, Poster Presentation, Identification of Evolutionarily Conserved Regulators of Microtubule Stability and Function in Neurons, Ramadan, Y., Gu, A., Akella, J. S., Firestein, B. L., **O’Hagan, R.**, and Barr, M. M.

New York Area Worm Meeting 2018, New York, NY, Oral Presentation, Signposts regulate traffic on microtubule highways of neuronal cilia**, O’Hagan, R.**, Silva, M., Morsci, N., Bellotti, S., Ramadan, Y., Zhang, W., Rongo, C., Nguyen, K., Wang, J., Hall, D., and Barr, M. M.

FASEB Science Research Conference, Biology of Cilia and Flagella, 2017, Scottsdale AZ, Oral Presentation, The Tubulin Code specializes the form and function of cilia by regulating transport and sculpting the axoneme, **O’Hagan, R.**, Silva, M., Morsci, N., Bellotti, S., Ramadan, Y., Rongo, C., Nguyen, K., Wang, J., Hall, D., and Barr, M. M.

International *C. elegans* Meeting, 2017**,** UCLA, Poster Presentation, Pathways that regulate ciliary stability, structure, and transport in response to microtubule post-translational modifications, Ramadan,Y., **O’Hagan, R.**, Gu, A., De Stasio, E., Smith, H., Golden, A., and Barr, M. M.

Waksman Retreat, 2017, Rutgers University Conference Center, Poster Presentation, Pathways that regulate ciliary stability, structure, and transport in response to microtubule post-translational modifications, Ramadan,Y., **O’Hagan, R.**, Gu, A., De Stasio, E., Smith, H., Golden, A., and Barr, M. M.

International *C. elegans* Meeting, 2015**,** UCLA, OralPresentation. Post-translational microtubule glutamylation levels control ciliary motor transport, microtubule structure, and cytoskeletal stability, **O’Hagan, R.**, Silva, M., Nguyen, K., Morash, M., Bellotti, S., Hall, D., Barr, M. M.

International *C. elegans* Meeting, 2015**,** UCLA, Poster Presentation. Finding mutations that suppress the ciliary degeneration defect of *ccpp-1* mutants in *C. elegans,* Bellotti, S., Morash, M., Winnie Zhang, **O’Hagan, R.**, Barr, M. M.

International *C. elegans* Meeting, 2015**,** UCLA, Poster Presentation.

Identification of pathways by which post-translational microtubule glutamylation regulates ciliary maintenance in *C. elegans*, Morash, M., Bellotti, S., Zhang, W., **O’Hagan, R.,** Barr, M. M.

FASEB Conference: The Biology of Cilia & Flagella, 2015, Snowmass, CO; Poster Presentation. How to specialize a cilium: Alpha-tubulin TBA-6 regulates axonemal ultrastructure, Silva, M., **O’Hagan, R.**, Nguyen, K., Hall, D., Barr, M. M.

*C. elegans* Neuronal Development, Synaptic Function and Behavior Meeting, 2014, Madison, Wisconsin, Poster Presentation. A Screen to Identify Regulators of Ciliary Cytoskeleton Stability and Function in Response to Polyglutamylation of Axonemal Microtubules, **O’Hagan, R.,** Zhang, W., Bellotti, S., Morash, M. and Barr, M. M.

FASEB Conference: The Biology Of Cilia & Flagella, 2013, Niagara Falls, New York, Oral Presentation. Molecules That Regulate The Post-Transational Glutamylation Of Axonemal Microtubules Are Required For The Function And Stability Of Neuronal Sensory Cilia In *C. elegans,* **O’Hagan, R.,** Silva, M., Weiss, S., Zhang, W. and Barr, M. M.

Biology of Cilia and Relationship to Human Disease Research Retreat, 2012, U. Penn., Philadelphia, PA, Oral Presentation. The Tubulin Deglutamylase CCPP-1 Regulates the Function and Stability of Sensory Cilia in *C. elegans,* **O'Hagan, R.**, Piasecki, B. P., Silva, M., Phirke, P., Nguyen, C. Q., Hall, D. H., Swoboda, P. and Barr, M. M.

International *C. elegans* Meeting, 2011, U.C.L.A., Los Angeles, CA, Oral presentation, Plenary Session. CCPP-1 Is A Putative Tubulin Deglutamylase That Regulates The Function And Stability Of Neuronal Sensory Cilia, **O'Hagan, R.**, Piasecki, B. P., Silva, M., Phirke, P., Nguyen, C. Q., Hall, D. H., Swoboda, P. and Barr, M. M.

Society for Developmental Biology Regional Meeting, 2011, U. Penn., Philadelphia, PA, How to specialize a cilium: TRPs, KLPs, and tracks, Oral presentation, Morsci, N., **O’Hagan, R.**, Piasecki, B., Silva, M., Phirke, P., Nguyen, K., Hall, D., Swoboda, P., and Barr, M. M.

Biology of the *C. elegans* Male Meeting, 2010; Madison, WI, U. W., Poster Presentation, The Role of NNA-1, a Putative Cytosolic Carboxypeptidase, in Ciliary Function of Male Specific Neurons, **O’Hagan, R.**, Silva, M., and Barr, M. M.

Neuronal Circuits and Behavior in *C. elegans*: Towards the Ultimate Model II, 2009, Janelia Farm, HHMI, Ashburn, VA; Poster presentation, A Neuronal TRPP Complex in Male Mating Behavior, **O’Hagan, R.**, Barr, M. M.

International *C. elegans* Meeting, 2009, U.C.L.A., Los Angeles, CA, Poster presentation, A Neuronal TRPP Complex in Male Mating Behavior, **O’Hagan, R.**, Barr, M. M.

Nanomedicine Consortium Meeting 2005, Harriman, NY; Slide presentation, Investigation of Mechanotransduction in *C. elegans*, **O’Hagan, R.** and Chalfie, M. This meeting, chaired by Michael Sheetz (Columbia University), was created to foster international collaborations among researchers in applied physics, biophysics, and genetics with the goal of developing nanomedicine techniques.

Society for Neuroscience 2004 Conference, San Diego, CA; Slide presentation, The MEC-4 DEG/ENaC channel of *Caenorhabditis elegans* touch receptor neurons transduces mechanical signals, **O’Hagan, R.**, Chalfie, M., and Goodman, M.B. This presentation was part of a minisymposium chaired by Ellen A. Lumpkin (Stanford University) entitled:Molecules and Mechanisms of Mechanotransduction

Gordon Research Conference 2003, Mechanotransduction and Gravity Signalling in Biological Systems, Connecticut College, CT; Poster presentation, *In vivo* recordings of sensory transduction currents in *C. elegans* touch cells, **O’Hagan, R.**, Goodman, M.B., and Chalfie, M.

International *C. elegans* Meeting 2003, Los Angeles, CA, Slide presentation, *In vivo* Electrophysiology of *C. elegans* Touch Cells, **O’Hagan, R.,** Goodman, M.B., and Chalfie, M.

**Service and Volunteer Work:**

**Research Mentor, Montclair State University, 2018-Present** I currently mentor four MSU undergraduates and a recent MSU graduate as a technician. At least one more student will join my lab group in Fall 2019. I am helping my students develop skills, such as critical thinking, rigor, professional integrity, experimental design, as well as hone research techniques used in genetics, molecular biology, cell biology, and epifluorescence microscopy and transmission electron microscopy. Additionally, under my guidance, undergraduate Adam Zadeh received a Wehner Fellowship for his research proposal.

**Panelist, iJobs Career Event, Rutgers University/RWJ Medical School, June, 2019**

I discussed my career path, other career options I considered, and described my current job as an Assistant Professor of Biology at Montclair State University, for an audience of graduate students, postdocs, and undergraduate students in STEM.

**Poster Judge, International *C. elegans* Meeting 2019, 2015.** I evaluated poster presentations to help determine GSA poster awards.

**Search Committee Member, Montclair State University, Fall 2018**, Evaluated applicants for a planned faculty position Assistant Professor of Biology/Science Education (V-F7).

**Poster Judge, Rutgers University, Spring 2017 for Effective Communication Skills in Genetics (01:447:430).** I evaluated student poster presentations to assist course instructor Dr. Gary Heiman in assigning grades.

**Undergraduate Honors Thesis Committee Member, Rutgers University, Spring 2017.**  I served on Caitlin Monahan’s thesis committee and provided constructive criticism of her thesis.

**Reviewer**, Current Biology, PLOS Genetics, Journal of Cell Biology, Journal for Cell Science, American Journal of Physiology: Renal Physiology, and micropublication:biology (http://www.micropublication.org/)

**Cycling Coach**, Team in Training/Leukemia and Lymphoma Society, 2010 to 2016. I have trained dozens of people from diverse backgrounds to complete 100-mile (“Century”) bicycling endurance events. In return, these participants raise money to support research by the Leukemia and Lymphoma Society.

**Fundraising,** Leukemia and Lymphoma Society, 2008 to Present. I regularly both donate and raise money for blood cancer research and patient services.

**Scientific Society Membership,** Genetics Society of America, American Society of Cell Biologists