

Kristen E. Whalen

Curriculum Vitae

Woods Hole Oceanographic Institution
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Education

- 2008 **Ph.D., Biological Oceanography**, Massachusetts Institute of Technology/ Woods Hole Oceanographic Institution.
Dissertation: *Functional characterization and expression of molluscan detoxification enzymes and transporters involved in dietary allelochemical resistance*.
Advisor: Dr. Mark E. Hahn
- 2001 **B.S., Marine Biology**, University of North Carolina-Wilmington. Honors in Biology, Summa cum laude. Thesis title: *Antifouling activity of Caribbean sponge extracts*.
Advisor: Dr. Joseph Pawlik

Research Experience

- 2013-present **Research Associate III**, Woods Hole Oceanographic Institution, Woods Hole, MA
Marine natural product drug discovery; metabolomics; multidrug resistance.
Mentor: Dr. Tracy Mincer
- 2010 – 2012 **Sempra Postdoctoral Fellow**, Scripps Institution of Oceanography, La Jolla, CA
Cell/Developmental Biology; Advisor: Dr. Amro Hamdoun
- 2008 – 2010 **National Science Foundation International Postdoctoral Fellow**, University of New South Wales, Sydney, Australia & University of California, Santa Barbara, Santa Barbara, CA
Ecological Genomics. Advisors: Drs. Peter Steinberg and Gretchen Hofmann
- 2008 – 2012 **Guest Investigator**, Biology Department, Woods Hole Oceanographic Institution
- 2006 – 2008 **Graduate Research Assistant**, MIT/WHOI Joint Program
- 2003-2006 **National Science Foundation Graduate Research Fellow**, MIT/WHOI Joint Program
- 2002 **Research Assistant**, Georgia Institute of Technology, Supervisor: Dr. Julia Kubanek
- 2001 **Summer Student Fellow**, Woods Hole Oceanographic Institution,
Supervisor: Dr. Mark Hahn

Fellowships

- 2010-12 Scripps Institution of Oceanography - Sempra Postdoctoral Fellowship
- 2008-10 National Science Foundation – International Postdoctoral Research Fellowship
- 2003-06 National Science Foundation - Graduate Research Fellowship

Grants Authored in Support of Research

- 2015 Co-Investigator; R21 – NIH, National Institute of Allergy and Infectious Disease (AI119311-01); “Discovery and development of RND pump inhibitors from marine microbial sources” – July 2015 – July 2017; **\$357,368.00**.

- i. Led the conceptual/experimental design, organization, proposal preparation and authorship of this NIH proposal with the consent of T. Mincer
- ii. Provides salary support for K. Whalen as a named Research Specialist for 12 months.
- iii. Based on this RFA (AI14-026), awardees have a 50% chance of being awarded the R33 grant if we are successful in completing our milestones we outlined in the R21 award.

2017 Co-Investigator; R33 - National Institutes of Health, National Institute of Allergy and Infectious Diseases (RFA-AI-14-026); Development of Novel Therapeutics for Select Pathogens – authored proposal with support of T. Mincer “Discovery and Development of RND Pump Inhibitors from Marine Microbial Sources” July 2017 – July 2020 (**\$1,627,170.00 pending**).

- i. Provides salary support for K. Whalen as a named Senior/Key Investigator for 33 months.

2013 Co-PI; WHOI Ignition Grant – “Ecological leads: Mining microbes for novel therapeutics to combat multidrug resistance in bacteria.” Co-PI with Tracy Mincer, WHOI; **\$50,000**

2008 National Science Foundation – International Postdoctoral Research Fellowship (NSF0754319) entitled “Profiling Marine Herbivore Gene Expression in Response to Algal Chemical Defenses”; **\$181,660.00**

2006 Lead PI.-Ocean Life Institute (WHOI) -Tropical Research Initiative Award, Grant entitled “Biochemical Ecology on Coral Reefs” (2006 – 2008); **\$74,923.00**

2005 Lead PI.-Ocean Ventures Fund, Grant entitled “Characterization of Detoxification Enzymes in the Marine Gastropod (*Cyphoma gibbosum*) in Response to a Gorgonian Diet (2005 – 2007); **\$14,960.00**

2004 Conchologists of America, Student award, Grant entitled “Detoxification and Transport of Dietary Metabolites in Marine Molluscs”; **\$1,476.04**

2004 SEASPACE Student Scholarship; **\$2,000.00**

2003 Lead PI.- Perry Institute of Marine Science/Caribbean Marine Research Center, National Undersea Research Center, Grant entitled “Physiological fate of dietary allelochemicals in generalist and specialist marine molluscs”; **\$7,520.00**

Awards

2012 ABC2012 Young Investigator Award, 4th FEBS Special Meeting – ATP-Binding Cassette Proteins, Innsbruck, Austria

2011 Best Poster Award, Developmental Biology of Sea Urchin Meeting XX, Woods Hole, MA

2001 UNC-Wilmington Undergraduate Student Research & Travel Award

2001 Biology Achievement Award, UNCW

2001, 2000 Charles and Kay Bolles Marine Biology Scholarship, UNCW

2000 DeLoach Scholarship – Excellence in Organic Chemistry, UNCW

2001 - 1998 Chancellor’s Achievement Award of Excellence, UNCW

2001 - 1999 Glaxo-Wellcome ‘Women in Science’ Scholarship

1999 Outstanding General Chemistry Student Award, UNCW

Patents

2014 - U.S. Provisional Patent by Mincer, T.J. and Whalen, K.E., entitled "Method for reducing antibiotic resistance through efflux pump inhibition" Application Serial No. 62/026,351 (Filed July 2015)

- Dr. Whalen conceived and performed all experiments described in the patent and assisted writing the provisional patent with members of the Office of Technology Transfer

Publications in Peer Reviewed Journals

- 2015 - Harvey, E.L. *, Deering, R.W., Rowley, D.C., El Gamal, A., Schorn, M., Moore, B.S., Johnson, M., Mincer, T., **Whalen, K.E. ***, A bacterial quorum-sensing precursor induces mortality in the marine coccolithophore, *Emiliana huxleyi* (accepted for consideration for publication in a special issue of *Frontiers in Microbiology* - submitted), *denotes shared lead authorship
- 2015 - El Gamal, A., Agarwal, V., Siethelm, S., Rahman, I., Schorn, M., Sneed, J.M., Louie, G.V., **Whalen, K.E.**, Mincer, T.J., Noel, J.P., Paul, V.J., and Moore, B. S. A biogenetic and structural basis for the synthesis of a highly brominated microbial coral chemical cue. *Proceedings of the National Academy of Sciences* (submitted).
- 2015 - **Whalen, K.E.**, Poulson, K.L., Deering, R.W., Rowley, D.C., Mincer, T.J., Enhancement of antibiotic activity against multidrug resistant bacteria by efflux pump inhibitor, 3,4-dibromo-2,5-dione, isolated from a *Pseudoalteromonas* sp. *Journal of Natural Products*. 73 (3): 402-412
- 2012 - **Whalen, K.E.**, Reitzel, A. and Hamdoun, A., Actin polymerization controls the activation of multidrug efflux at fertilization by translocation and fine-scale positioning of ABCB1a on microvilli. *Molecular Biology of the Cell*. 22(18):3663-3672.
 - Selected for consideration for MBoC Paper of the Year.
 - Awarded the journal cover for MBoC
- 2010 - **Whalen, K.E.**, Starczak, V.R., Nelson, D.R., Goldstone, J.V, and Hahn, M.E., Gorgonian host-inducible cytochrome P450s from the predatory gastropod *Cyphoma gibbosum*: evolution and function. *BMC Ecology* 10: 24 (doi:10.1186/1472-6785-10-24)
- 2010 - **Whalen, K.E.**, Sotka, E.E., Goldstone, J.V. and Hahn, M.E., The role of multixenobiotic transporters in molluscan predators as counter-defense mechanisms against dietary chemical stress. *Comparative Biochemistry and Physiology, Part C* 152(3): 288-300.
- 2010 - **Whalen, K.E.**, Lane, A.L, Kubanek, J. and Hahn, M.E., Biochemical warfare on the reef: the role of glutathione transferases in consumer tolerance of dietary prostaglandins. *PLoS One* 5(1): e8537.
- 2009 - Sotka, E.E. *, Forbey, J., Horn, M., Poore, A.G.B., Raubenheimer, D., and **Whalen, K.E. ***, The emerging role of pharmacology in aquatic plant-herbivore interactions. *Integrative and Comparative Biology* 49: 291-313. *denotes shared lead authorship
- 2008 - **Whalen, K.E.**, Morin, D., Lin, C.Y., Tjeerdema, R., Goldstone, J.V., Hahn, M.E., Proteomic characterization and cDNA cloning of glutathione S-transferases from the generalist marine gastropod, *Cyphoma gibbosum*. *Archives of Biochemistry and Biophysics* 478: 7-17.
- 2004 - **Whalen, K.E.**, Carvan, M.J., Hestermann, E.V., Jensen, B.A., Hahn, M.E., Structure-activity relationships for polychlorinated biphenyl binding to the aryl hydrocarbon receptor in a Dolphin kidney cell line. *Marine Environmental Research*. 58:131-141. (Abstract)
- 2003 - Hahn, M.E., Jensen, B.A., Kim, E-Y., Karchner, S.I., Franks, D.G., Lapsertis, J.M., **Whalen, K.E.**, Carvan, M.J., Molecular and cellular approaches to understanding the

sensitivity of marine mammals to persistent organic pollutants. *Organohalogen Compounds*. 62:253-256.

2001 - Kubanek, J., **Whalen, K.E.**, Engel, S., Kelly, S., Henkel, T.P., Fenical, W., and Pawlik, J.R., Multiple defensive roles for triterpene glycosides from two Caribbean sponges. *Oecologia*. 131:125-136.

Book Chapters

2008 - Sotka, E.E. and **Whalen, K.E.**, Herbivore offense in the sea: the detoxification and transport of secondary metabolites, *Algal Chemical Ecology*, Amsler, C.D. Editor, Springer, New York, pp. 203-221

Feature Articles

2008 - **Whalen, K.E.**, *Biochemical Warfare on the Reef*. *Oceanus Magazine*, Woods Hole Oceanographic Institution Vol 47, pp. 13-15.

Manuscripts in Preparation

Whalen, K.E., Botieau, R., Perry, E., Deering, R., Rowley, D., Mincer, T.J., Metabolomic tools for the targeted discovery of marine natural products (in prep).

Teaching & Outreach

- Graduate Teaching Assistant, Massachusetts Institute of Technology/Woods Hole Oceanographic Institution, Graduate course in Biological Oceanography, (Spring 2006)
- Guest Lecturer, Roger Williams University, NATSC 204 Principles of Oceanography, (Spring 2015)
- Course Instructor at High Tech Middle School, Chula Vista, CA for an afterschool program for 7-8th grade girls in Science Immersion Program (Spring 2012).
- Guest Lecturer, Chemical Ecology, San Diego State University, Course Biol 596, Lecture entitled – PharmEcology: a physiological understanding of marine consumer-prey interactions (Fall 2010)
- Instructor for the BE WiSE Education Program in Oncofertility, which engages young women in science, technology, engineering and math (STEM) learning experiences in collaboration with UC San Diego Health Sciences (Summer 2010)
- Guest Lecturer, Endangered Waters – Human Interaction with Ocean Ecosystems, Tufts University Experimental College, Medford, MA. Lecture – Emerging threats to coral reefs: are we already at the ‘tipping point’ (Fall 2007)
- Guest Lecturer, Biological Oceanography (Graduate Level), WHOI/MIT Course 7.47, Lecture entitled – Introduction to Coral Reefs: Biology, Ecology & Global Threats (Feb - June 2006)
- Ocean Sciences Enrichment Teacher (K-5), Mullen Hall Elementary, Falmouth, MA; participant in a educational outreach program funded by NSF in collaboration with the Centers of Ocean Sciences Education Excellence (COSEE) program of New England; developed lesson plans to promote ocean science literacy in the classroom (Feb – June 2006)
- Falmouth High School Science Fair Judge, Falmouth, MA (2006) and Lawrence Middle School Science Mentor, Falmouth, MA (2005)
- Volunteer for the Marine Mammal Standing Network, Wilmington, NC (1998-2001)

▪ **Mentoring of the following junior researchers:**

- Supervisor of Elena Perry, Yale University, WHOI Summer Student Fellow, 2014
 - Spearheaded project assessing antibiotic production from marine microbes under various growth conditions.
 - Dr. Whalen was responsible for supervising Ms. Perry within the laboratory on a daily basis, coordinating experiments, training Ms. Perry in library screening, and assisting in the preparation of a technical report and presentation.
- Supervisor for Caroline Collins, Connecticut College, Guest Student, 2014
 - Spearheaded project examining the molecular underpinnings of mercury degradation in salt marsh communities.
 - Dr. Whalen was responsible for coordinating the molecular-based experiments Ms. Collins performed in the laboratory on a daily basis. Dr. Whalen served as a technical advisor to Caroline and Dr. Carl Lamborg.
- Supervisor of Julia Roche, High school intern, High Tech High – Chula Vista, CA (Summer 2011). Presented summer research project at Scripps to Senior White House Officials in Washington, D.C.
 - Julia assisted in data collection and analysis for Whalen et al. 2012, MBoC paper.
- Supervisor of Amber Merril, UCSD undergraduate (Summer 2011).
- Supervisor of Annalisa Carson, Wheaton College graduate (Summer 2011).
- Supervisor of Kazuya Koda, Undergraduate Researcher, University of California, San Diego, contributed data to MBoC paper (2010-2011).
- Co-Supervisor of Sarah Graham, Honors Student, School of Biological, Earth and Environmental Sciences, UNSW, (2008-10). Thesis title: *Chemical defenses and metals: effects on feeding preferences of a common marine consumer.*

Presentations

2016 - Oral presentation at the 2016 Ocean Sciences Meeting/AGU, New Orleans, February 21-26, 2016. Entitled "Bacterial infochemicals are drivers of algal lysis."

2015 - Invited speaker, Woods Hole Oceanographic Institution Reception for Community Volunteers, - Highlighting my work in marine biology and drug discovery; September 24, 2015

Invited speaker, Science Made Public Lecture Series, Woods Hole Oceanographic Institution, July 28, 2015.

Interviewed on Living Lab on the Point with Heather Goldstone, WCAI, Cape and Islands NPR. May 19, 2015.

Invited presenter at the Early Stage Life Sciences Technology Conference XI. Merck Research Laboratories, April 8, 2015. A showcase of 16 life sciences technologies developed at research institutions and recently formed companies to an audience of angel investors, venture capitalists and corporate investors.

Invited speaker, Roger Williams University, Department of Biology, Marine Biology and Environmental Science, March 17, 2015.

Invited speaker, University of Rhode Island, College of Pharmacy, February 11, 2015.

- 2014 - Poster presentation at American Society of Microbiology, General Meeting, May 2014. Entitled "Identification of Novel Small Molecules Secreted by Marine Bacteria with Bactericidal Activity Against Multi-Drug Resistant Gram-Negative Pathogens."
Invited Speaker, Bigelow Laboratory for Ocean Sciences, February 12, 2014
- 2013 - Oral presentation, Marine Chemistry & Geochemistry, Woods Hole Oceanographic Institution, November 12, 2013. Entitled: "PharmEcology: Mining marine bugs for new drugs."
- 2012 - Oral presentation at the Developmental Biology of Sea Urchin XXI Meeting, Woods Hole, MA, October 24-27, 2012. Entitled: "Activation of multidrug efflux transport by microvillar tip localization."
Invited speaker, Webinar hosted by the journal *Cellular Signaling* on Sept. 20, 2012. Entitled: "Exploring cellular processes with super-resolution microscopy".
Invited speaker, Presentation at the 4th Federation of European Biochemical Society on ATP-Binding Cassette (ABC) Proteins: From Multidrug Resistance to Genetic Diseases, Innsbruck, Austria, March 3-9, 2012. Entitled: "Actin-dependent translocation of ABCB1a during early embryogenesis revealed by 3D-structured illumination microscopy."
- 2011 - Invited Speaker, Biology Department, San Diego State University, San Diego, CA, Sept. 26, 2011. Entitled: "Investigating chemical defense mechanisms in marine invertebrates: Merging genomics and cell biology"
Oral presentation at Pollution Response in Marine Organisms Meeting, Long Beach, CA, May 15-18, 2011. Entitled: "Cellular defense mechanisms: merging genomics and cell biology."
Invited Speaker, Director's Circle Gala, Scripps Institution of Oceanography, La Jolla, CA; May 12, 2011. Entitled: "Survival at Sea: Imaging embryo cellular defenses."
Poster presentation at the Developmental Biology of Sea Urchin XX Meeting, Woods Hole, MA, April 27-May 1, 2011. Entitled: "Just a few microns can make all the difference: implications of membrane reorganization on multidrug efflux activity at fertilization."
Invited Speaker, Scripps Institution of Oceanography 2011 Science Showcase, January 20, 2011. Entitled: "The Art of Chemical Conversation in the Sea."
- 2010 - Invited Speaker, Marine Biology Research Division, Scripps Institution of Oceanography/UC-San Diego, April 26, 2010. Entitled: "Ecological genomics of consumer-prey interactions: from genes to communities."
Invited Speaker, Environmental, Earth and Ocean Sciences, University of Massachusetts-Boston, April 6th, 2010. Entitled: "Ecological genomics of consumer-prey interactions: from genes to communities."
Invited Speaker; Interdepartmental Graduate Program in Marine Science, UC-Santa Barbara, Winter Colloquium, February 16, 2010. Entitled: "Consumer offense: biochemical strategies for coping in a chemical defended world."
- 2009 - Poster presentation at the Gordon Research Conference: Evolutionary and Ecological Functional Genomics, July 12-17, 2009, Tilton, NH. Entitled: "A transcriptomic fingerprint of life in the sea: understanding allelochemical tolerance in the sea urchin."
Invited Speaker; Society of Integrative and Comparative Biology (SICB) 2009 Meeting, January 3-7, 2009, Boston, MA. Entitled: "Transcriptome profiling in the sea urchin: understanding allelochemical modes of action and marine herbivore cellular defenses."

- 2007 - Poster presentation at 24th Annual Meeting of the New England Membrane Enzyme Group, October 14-16, 2007, Woods Hole, MA. Entitled: "Effects of gorgonian secondary metabolites on marine consumer detoxification enzymes."
- Oral presentation at the 36th Annual Benthic Ecology Meeting, March 21-25, 2007; Atlanta, GA. *Session Chair: Consumer-Prey Interactions*. Entitled: "A proteomic and molecular approach to chemical ecology: Identifying detoxification enzymes possibly involved in allelochemical resistance."
- 2006 - Oral presentation at the Woods Hole Oceanographic Institution, October 26, 2006, Woods Hole, MA. Entitled: "When corals leave a bad taste in your mouth: Understanding molluscan detoxification of gorgonian chemical defenses".
- 2005 - Poster presentation at 22nd Annual Meeting of the New England Membrane Enzyme Group, November 7-8, 2005, Sturbridge, MA. Entitled: "Detoxification enzymes and transporters in marine molluscs: An evolutionary answer to gorgonian chemical defenses?"
- Poster presentation at 34th Annual Benthic Ecology Meeting, April 6-10, 2005; Williamsburg, VA. Entitled: "Detoxification enzymes and transporters in marine molluscs: An evolutionary answer to gorgonian chemical defenses?"
- 2003 - Poster presentation at the Pollution Response in Marine Organisms Meeting, May, 2003; Tampa, Florida. Entitled: "Structure-activity relationships for polychlorinated biphenyl binding to the aryl hydrocarbon receptor in a dolphin kidney cell line."
- 2002 - Oral presentation at the 31st Annual Benthic Ecology Meeting, March 21- 24, 2002; Orlando, Florida. Entitled: "Localization of ecologically active secondary metabolites in two Caribbean sponges."
- 2001- Oral presentation of summer research project at Woods Hole Oceanographic Institution, Summer 2001, Entitled: "Are bottlenose dolphins (*Tursiops truncatus*) susceptible to polychlorinated biphenyls". Summer Student Fellowship, Woods Hole Oceanographic Institution
- Poster presentation at the 18th International Society of Chemical Ecology Meeting, July 7-12, 2001; North Lake Tahoe, CA. Entitled: "More bang for your buck: Multiple defenses roles of triterpene glycosides in marine sponges."
- 2000 - Oral presentation at the 29th Annual Benthic Ecology Meeting/ Marine Chemical Ecology Symposium, March 9-12, 2000; University of North Carolina at Wilmington. Entitled: "Antifouling activity of Caribbean sponge extracts."

Contributed presentations

- 2014 - Collins, C., **Whalen, K.**, Lamborg, C., Mincer, T., et al., Mercury speciation, retention and genomics in fertilized salt marsh sediments. American Geophysical Union, San Francisco, CA.
- 2012 - Hamdoun, A., Campanale, J., and **Whalen, K.** Membrane dynamics and the control of multidrug efflux transport activity in sea urchin development. American Society of Cell Biology.
- 2011 - Hamdoun, A., Campanale, J., Gokirmak, T., Shipp, L., **Whalen, K.** Ontogenetic switches in activity and location of multidrug efflux transporters during embryonic development. American Association for Cancer Research, San Francisco, CA.
- 2002 – Kubanek, J., **Whalen, K.**, Pawlik, J.R., Fenical, W., Naar, J., Weidner, A., Bourdelais, A.J., Baden, D.G., Steidinger, K., Felwelling, L. Multiple functions and ecological consequences of chemical signals in the sea. Gordon Research Conference on Marine Natural Products, Ventura, CA.

Scientific Cruises & Field Work

- 2008-2009 Principle Investigator, collection of invertebrates and macroalgae from Sydney Harbor and surrounding waters, Sydney Institute of Marine Science, Australia
- 2006, 2004 Principle Investigator studying natural product detoxification in coral reef invertebrates, Perry Institute for Marine Science, Lee Stocking Island, Bahamas
- 2005 SUNY-Buffalo/U of Miami cruise; Research Scientist aboard the R/V Walton Smith, Bahamas, investigating coral recruitment on Grand Bahama Bank, H. Lasker (lead PI.-SUNY Buffalo)
- 2004 Research Assistant under the direction of A. Tarrant (lead PI-WHOI), studying endocrine disruption in scleractinian corals, Perry Institute for Marine Science, Lee Stocking Island, Bahamas
- 2004 WHOI Research Scientist studying nudibranch and coral abundance at the Liquid Jungle Lab located on the island of Canales de Tierra, Veraguas province of Panama
- 2001, 2000 National Science Foundation – Chemical Ecology Cruise; Research Scientist and Dive Team Member aboard the R/V Seaward Johnson investigating chemical defense in coral reef invertebrates, Bahamas, J. Pawlik (lead PI.-UNCW)
- 1999-2001 Research Dive Team member, investigating sponge health and ecology in Key Largo, FL in conjunction with the National Undersea Research Center and Center for Marine Science, UNCW, J.Pawlik (lead PI.-UNCW)
- 2001-2003 Cape Cod Stranding Network Volunteer under the direction of M. Moore (WHOI); assisted in marine mammal necropsies
- 1999-2001 UNCW Stranding Team Member Volunteer under the direction of A. Pabst (UNCW); assisted in marine mammal necropsies

Professional Activities, Service & Certifications

- Reviewer for the following peer reviewed journals and funding agencies:
 - National Science Foundation - Integrative Organismal Systems, California Sea Grant, CalFed-Delta Science Program,
 - Environmental Microbiology, PLoS One, Aquatic Toxicology, Gene, Marine Biotechnology, Marine Drugs, Comparative Biochemistry and Physiology, Ecotoxicology, Developmental and Comparative Immunology, Molecular Ecology, Journal of Shellfish Research, Open Marine Biology Journal.
 - Invited Editor in Frontiers of Microbiology: Antimicrobials, Resistance and Chemotherapy
- Member of the Scientific diving team at the University of New South Wales, Sydney, Australia (2008-2010)
- American Academy of Underwater Sciences (AAUS) Diving Control Board Member for Woods Hole Oceanographic Institution (2004 – 2008)
- Science Judge, National Ocean Sciences Bowl, MIT, (January 2007)
- SCUBA certifications: PADI Open water certification; NAUI Nitrox and Dry Suit certification; AAUS scientific diving certification (1999 – present) Over 400 research dives logged.
- Advanced First Aid, CPR, and DAN oxygen administration certified

- Professional memberships: AAAS, American Chemical Society; Society for Integrative and Comparative Biology