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Louie L. Wurch, Ph.D.

Woods Hole Oceanographic Institution

EDUCATION

MIT-WHOI Joint Program in Oceanography/Applied Ocean Science and Engineering

Ph.D. Biological Oceanography

Dissertation title: Molecular insights into the niche of harmful brown tides.

During my Ph.D. thesis work I employed sequencing-based transcriptome profiling combined with targeted gene expression assays to study nutrient acquisition strategies in non-model organisms. I have complemented this research with quantitative proteomics and examined the interplay between a microbe's genome and the expression of that genome at the level of both RNA and protein under distinct environmental conditions. This work required detailed manipulative culture experiments in both the laboratory and at sea. I have also worked on two eukaryotic algal genomes where I was specifically tasked with annotation of nitrogen and phosphorus metabolic pathways.

Humboldt State University

B.S. Biology (*summa cum laude*), 2005
Emphasis in Marine Biology and Cellular/Molecular Biology
Thesis title: Using molecular diagnostics to detect nutrient stress in the coccolithophore *Emiliania huxleyi*

Shasta College

A.A. General Education, 2002

APPOINTMENTS

Woods Hole Oceanographic Institution

Postdoctoral Investigator 2011-present

Woods Hole Oceanographic Institution and Massachusetts Institute of Technology Graduate Student Researcher 2006-2011

Woods Hole Oceanographic Institution

Summer Student Fellow 2004

HONORS AND FELLOWSHIPS

Sixth Symposium on Harmful Algae Travel Award 2011 -Award to support travel and present research at a national meeting EPA Science to Achieve Results (STAR) Graduate Fellow 2007-2010 - Competitive fellowship paying stipend and tuition costs for three years

- WHOI Coastal Oceans Institute Student Research Award 2008 -Competitive research grant for work in the coastal ocean, awarded to support advanced proteomics and transcriptional profiling in algae
- WHOI Coastal Oceans Institute Student Research Award 2007 -Competitive research grant for work in the coastal ocean, awarded to support transcriptome sequencing of the marine eukaryote *A. anophagefferens*
- WHOI Summer Student Fellow Travel Award 2005
 -Competitive award to support travel to a national meeting (ASLO Advancing the Science of Limnology and Oceanography)

PUBLICATIONS

Louie L. Wurch, Christopher J. Gobler, Elyse Walker, and Sonya T. Dyhrman (2011) TRANSCRIPTIONAL PROFILING OF FIELD POPULATIONS OF *AUREOCOCCUS ANOPHAGEFFERENS*: PATTERNS IN NITROGEN AND PHOSPHORUS METABOLISM OVER A BLOOM CYCLE. *In prep.*

Betsy A. Read, Igor V. Grigoriev, Alan Kuo, Sonya T. Dyhrman, Joel B. Dacks, Louie L. Wurch and others (2011) THE RAPIDLY EVOLVING PAN GENOME OF THE GLOBALLY DISTRIBUTED COCCOLITHOPHORE *EMILIANIA HUXLEYI. In prep.*

Louie L. Wurch, Erin T. Bertrand, Mak A. Saito, Benjamin A.S. van Mooy, and Sonya T. Dyhrman (2011) PROTEOME CHANGES DRIVEN BY PHOSPHORUS DEFICIENCY AND RECOVERY IN THE BROWN TIDE-FORMING ALGA, *AUREOCOCCUS ANOPHAGEFFERENS. PLoS ONE* 6(12): e28949. doi:10.1371/journal.pone.0028949

Christopher J. Gobler, Dianna L. Berry, Sonya T. Dyhrman, Steven W. Wilhelm, Asaf Salamov, Vadim Gladyshev, Alexei Lobanov, Yan Zhang, Jackie L. Collier, **Louie L. Wurch**, Adam B. Kustka, Alan Kuo, Astrid Terry, Jasmyn Pangilinan, Erika Lindquist, Susan Lucas, Ian Paulsen, Theresa K. Hattenrath, Stephanie C. Talmage, Elyse Walker, Florian Koch, Amanda Burson, Maria Alejandra Marcoval, YingZhong Tang, Gary R. LeCleir, G. Mine Berg, Kathy J. Coyne, Erin Bertrand, Mak A. Saito, and Igor V. Grigoriev (2011) ECOLOGICAL NICHE OF HARMFUL ALGAL *AUREOCOCCUS ANOPHAGEFFERENS*, REVEALED IN GENOME. *Proc. Nat. Acad. Sci.* 108: 4352-4357.

Louie L. Wurch, Sheean T. Haley, Elizabeth D. Orchard, and Sonya T. Dyhrman (2011) NUTRIENT REGULATED TRANSCRIPTIONAL RESPONSES IN THE BROWN TIDE FORMING ALGA *AUREOCOCCUS ANOPHAGEFFERENS*. *Environ*. *Microbiol*. 13: 468-481. Sonya T. Dyhrman, Sheean T. Haley, Shanda Birkeland, **Louie L. Wurch**, Mike Cipriano, and Andrew McArthur (2006) LONG-SAGE (SERIAL ANALYSIS OF GENE EXPRESSION) FOR GENE DISCOVERY AND TRANSCRIPTOME PROFILING IN THE COCCOLITHOPHORE *EMILIANIA HUXLEYI. Appl. Environ. Microbiol.* 72: 252-260.

PRESENTATIONS and ABSTRACTS

Louie L. Wurch, Erin M. Bertrand, Mak A. Saito, Benjamin A.S. Van Mooy, and Sonya T. Dyhrman (2011) Abstract and Presentation. *Sixth Symposium on Harmful Algae in the US*, Austin, TX.

Louie L. Wurch (2011) MOLECULAR INSIGHTS INTO THE PHYSIOLOGY OF THE PELAGOPHYTE *AUREOCOCCUS ANOPHAGEFFERENS* UNDER NUTRIENT DEFICIENCY. Invited Speaker. *Synthetic Genomics*, La Jolla, CA.

Louie L. Wurch (2011) MOLECULAR INSIGHTS INTO THE NICH OF HARMFUL BROWN TIDES. Ph.D. Thesis Defense. Woods Hole Oceanographic Institution. Woods Hole, MA.

Louie L. Wurch (2010) MOLECULAR INSIGHTS INTO THE NICHE OF THE HARMFUL ALGAL SPECIES RESPONSIBLE FOR BROWN TIDES. Invited speaker. *BGSA seminar series*. Humboldt State University. Arcata, CA.

Louie L. Wurch (2010) MOLECULAR INSIGHTS INTO THE NICHE OF BROWN TIDE FORMING AUREOCOCCUS ANOPHAGEFFERENS. Invited speaker. WHOI Biology Department Seminar Series. Woods Hole, MA.

Louie L. Wurch, Sheean T. Haley, Elizabeth D. Orchard and Sonya T. Dyhrman (2009) NUTRIENT-REGULATED TRANSCRIPTOME PROFILING IN THE BROWN TIDE FORMING ALGA *AUREOCOCCUS ANOPHAGEFFERENS*. Abstract and presentation. *Advancing the Science of Limnology and Oceanography Aquatic Sciences Meeting*. Nice, France.

Sonya T. Dyhrman, Sheean T. Haley, **Louie L. Wurch**, Justin Ossolinski, and Benjamin Van Mooy (2009) EXPRESSION OF A NITRATE TRANSPORTER IN CULTURES AND FIELD POPULATIONS OF THE COCCOLITHOPHORE *EMILIANIA HUXLEYI*. Abstract and presentation. *Advancing the Science of Limnology and Oceanography Aquatic Sciences Meeting*. Nice, France.

Sonya T. Dyhrman and Louie L. Wurch (2008) PHOSPHORUS METABOLIC PATHWAYS IN THE GENOME OF *EMILIANIA HUXLEYI*. *Emiliania huxleyi Genome Jamboree*. Presentation. Walnut Creek, CA.

Sonya T. Dyhrman and Louie L. Wurch (2007) SAGE ANALYSIS IN THE GENOME BROWSER. *Aureococcus Genome Consortium Jamboree*. Presentation. Southhampton, NY.

Louie. L. Wurch and Sonya T. Dyhrman (2007) TRANSPORTER ANNOTATION EFFORTS. *Aureococcus Genome Consortium Jamboree*. Presentation. Southhampton, NY.

Louie L. Wurch, Sheean T. Haley, Elizabeth D. Orchard, and Sonya T. Dyhrman (2007) NUTRIENT-REGULATED TRANSCRIPTOME PROFILING IN THE BROWN-TIDE FORMING ALGA, *AUREOCOCCUS ANOPHAGEFFERENS*. Abstract and poster. *Fourth US Harmful Algal Bloom Symposium*, Woods Hole, MA.

Sonya T. Dyhrman, Sheean T. Haley, **Louie L. Wurch**, and Elizabeth D. Orchard (2006) NUTRIENT-REGULATED TRANSCRIPTIONAL CHANGES IN *AUREOCOCCUS ANOPHAGEFFERENS* IDENTIFIED WITH LONG-SAGE (SERIAL ANALYSIS OF GENE EXPRESSION). Abstract and presentation. *12th Meeting of the International Society for the Study of Harmful Algae*. Copenhagen, Denmark.

Louie L. Wurch, Sheean T. Haley and Sonya T. Dyhrman (2005) USING MOLECULAR DIAGNOSTICS TO DETECT NUTRITIONAL PHYSIOLOGY IN THE COCCOLITHOPHORE *EMILIANIA HUXLEYI*. Abstract and presentation. *American Society of Limnology and Oceanography, Ocean Sciences Meeting*. Salt Lake City, UT.

Louie L. Wurch, Sheean T. Haley and Sonya T. Dyhrman (2005) USING MOLECULAR DIAGNOSTICS TO DETECT NITROGEN AND PHOSPHORUS STRESS IN *EMILIANIA HUXLEYI*. Invited speaker. *Shasta College Science Colloquium*, Redding, CA.

Louie L. Wurch, Sheean T. Haley and Sonya T. Dyhrman (2004) USING MOLECULAR DIAGNOSTICS TO DETECT NITROGEN STRESS IN *EMILIANIA HUXLEYI*. Presentation. *SSF WHOI Conference*, Woods Hole, MA.

RESEARCH CRUISES

Quantification of *Trichodesmium* spp. vertical and horizontal abundance patterns and nitrogen fixation in the western North Atlantic. (RV Oceanus)

October 2010. Western North Atlantic

Chief Scientist: Dr. Dennis McGillicuddy

My role:

- 1) Sampled for metagenomic and transcriptomic profiling of marine microbial communities at the surface and deep chlorophyll maximum
- 2) Assayed microbial enzyme activity at discreet depths throughout the water column
- 3) Sampled for dissolved organic nitrogen, dissolved organic phosphorus, nitrate + nitrite, ammonia, and phosphate concentrations to characterize the microbial community's geochemical environment
- 4) Picked *Trichodesmium* trichomes for single cell enzyme activity assays

Sampling to determine microbial lipid concentrations and turnover rates. (RV Oceanus)

April 2008. North Atlantic and Sargasso Sea.

Chief Scientist: Dr. Benjamin Van Mooy

My role:

- 1) Sampled RNA for the purpose of targeted gene expression assays to determine nutrient stress in coccolithophores across a large spatial gradient
- 2) Sampled inorganic nutrients at discrete depths to characterize geochemical environment
- 3) Assayed microbial enzyme activity at multiple depths through out the water column

4) Performed *in situ* nutrient amendment experiments to complement targeted gene expression work

TEACHING

- MIT Course 7.47: Biological Oceanography (Graduate) Guest lecturer 2010
- MIT Course 7.47: Biological Oceanography (Graduate) Teacher's Assistant 2009
- Humboldt State University Invertebrate Zoology (Undergraduate) Teacher's Assistant 2004
- Shasta College Organic Chemistry (Undergraduate) Teacher's Assistant 2003-2004

OUTREACH

- Volunteer: Falmouth High School Science Fair. Utilized C-MORE Science Kits to teach students about core concepts in microbial oceanography (2011)
- Volunteer: Lectured on "indirect methods of observation for marine microbes" and guided laboratory tours for visiting Thayer Academy High School class taught by Don Donovan (2011)
- Volunteer: Lectured on "harmful algal blooms" and guided laboratory tours for visiting Thayer Academy High School class taught by Don Donovan (2010)
- Volunteer: Lectured on "ocean acidification" and guided laboratory tours for visiting Thayer Academy High School class taught by Don Donovan (2009)
- Guest lecturer and assistant: "The Artistic Oceanographer: Encouraging ocean literacy through multidisciplinary learning," a WHSTEP-funded mini-course run by Sheean Haley for 5th graders in Pat Keoughan's class, Morse Pond School, Falmouth, 2006

RESEARCH MENTORING

Falmouth Academy Science Fair Mentor (Brianna Feldman, 2011)

"What is the effect of different nitrogen compounds on the growth and physiology of *Aureococcus anophagefferens*: the harmful alga responsible for brown tides?"

Falmouth High School Science Fair Mentor (Jessica Freedman, 2011) "Interaction of light, temperature, and nutrients on the growth of brown tide"

- WHOI Summer Student Fellow Mentor (Analissa Sarno, 2010)
 - "Cellular responses to phosphorus deficiency in the brown tide-forming alga, *Aureococcus anophagefferens*"
- Thayer Academy Mentor for Internship (Liz Lyons, 2010) -Assisted me with algal culture work and cell counting
- Thayer Academy Mentor for Internship (Leigh Collins, 2009) -Assisted me with algal culture work and cell counting
- Thayer Academy Mentor for Internship (Richard Lyons, 2009) -Assisted me with algal culture work and cell counting
- Falmouth Academy Science Fair Mentor (Nathaniel Haycock, 2009) "Growth and acclimation of brown tide on different phosphorus compounds"
- Falmouth Academy Science Fair Mentor (Nathaniel Haycock, 2008) "The role of various inorganic and organic nitrogen compounds on growth of brown tide."
- Falmouth Academy Science Fair Mentor (Sonja Swanbeck, 2007) "Semi-continuous growth of coccolithophores on different phosphorus concentrations"