

FRANK JAMES STEWART

ADDRESS

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PROFESSIONAL

Assistant Professor, School of Biology, Georgia Institute of Technology, Jan. 2011
Postdoctoral associate, Massachusetts Institute of Technology, 2008-2010

EDUCATION

Ph.D. Harvard University, Biology, 2008
A.M. Harvard University, Biology, 2005
M.S. University of Nevada-Reno, Environmental Science, 2002
B.A. Middlebury College, Biology, minor in Religion, summa cum laude, 2000

FELLOWSHIPS AND HONORS

Class of 1969 Teaching Fellow, Georgia Tech, 2011
Harvard NSF IGERT Fellowship - Biomechanics, 2007
NIH Genetics Training Grant, 2003-2005
Phi Kappa Phi induction, 2002
NASA Spacegrant Fellowship, 2001-2002
Governor Kenny Guinn Environmental Research Fellowship, 2001-2002
Outstanding Student Poster Award - 2001 ASLO Aquatic Sciences Meeting, 2001
Sierra Pacific Fellowship, 2000-2001
Phi Beta Kappa induction, 2000
Barry Goldwater Scholarship, 1999-2000
HHMI Undergraduate Research Fellowship, 1998
Paul W. Ward Memorial Writing Award, Honorable Mention, Middlebury College, 1997

RESEARCH INTERESTS

Genome evolution and ecology of microbial symbioses
Functional diversity and gene expression in natural microbial communities
Metagenomics and transcriptomics
Molecular evolution through genomics
Marine microbiology and deep-sea biology

RESEARCH EXPERIENCE

- Postdoctoral Associate, Civil and Environmental Engineering Department, MIT (advisor: Ed DeLong), 1) Meta-transcriptomics of bacterioplankton from an Oxygen Minimum Zone in the eastern South Pacific, 2) Sample-specific methods for rRNA subtraction in environmental metatranscriptomics
- Ph.D Student, Organismic and Evolutionary Biology Department, Harvard University (advisor: Colleen Cavanaugh), Thesis: "Evolution of chemosynthetic endosymbionts of deep-sea clams," 2003-2008
- Lab Technician, Microbial Systems Laboratory, Desert Research Institute, PI: Christian H. Fritsen and Alison E. Murray, Project: DGGE/clone library analysis of sea ice prokaryotic diversity, Jan-Aug 2003
- M.S. Student, Microbial Systems Laboratory, Desert Research Institute (advisor: C.H. Fritsen), Project: "Winter Distribution and Activities of Sea Ice Microbial Communities in the Western Antarctic Peninsula Region," Southern Ocean Global Ocean Ecosystems Dynamics (SO GLOBEC) program, 2000-2002
- Research Assistant, Crary Science Laboratory, McMurdo Station, Antarctica, PI: C.H. Fritsen, Project: "Microbial Life within the Extreme Environment Posed by Permanent Antarctic Lake Ice," Life in Extreme Environments (LExEn) Project - NSF, Dec 1999-Feb 2000
- REU Intern, Microbial Systems Laboratory, Desert Research Institute, PI: C.H. Fritsen, Project: enumeration and microscopy of sea ice bacteria, summer 1999
- HHMI Intern, Biology Department, Middlebury College, PI: Matthew Dick, Primary project: scanning electron microscopy of Bering Sea bryozoans, summer 2008

TEACHING EXPERIENCE

- Microbial Symbiosis as Biological Innovation, BIOL 4083, Georgia Tech, beginning Spring 2012
- Introductory Microbiology, BIOL 3083, Georgia Tech, 2011
- Biology of Symbiosis, OEB 123, Harvard University, Teaching Fellow, 2007
- Topics in Organismic and Evolutionary Biology, OEB 399, Harvard University, Teaching Fellow, 2006
- Genetics and Genomics, BS 50, Harvard University, Teaching Fellow, 2005
- Harvard Microbial Sciences Initiative - Summer Teachers Workshop, Lab Instructor, 2007, 2008
- Aquatic Ecology, University of Nevada-Reno, Lab Instructor, 2002
- Genetics, Genomics, and Evolution, Life Sciences 1b, Harvard University, Grader, 2007, 2008

OCEANOGRAPHIC CRUISES

- R/V Vidal Gormaz*, Agouon-OMZ project, eastern South Pacific, Chilean coast, 2010
- R/V Vidal Gormaz*, Agouon-OMZ project, eastern South Pacific, Chilean coast, 2009
- R/V Atlantis*, "Extreme 2004" cruise, East Pacific Rise, 2004
- R/V Atlantis*, "Extreme 2003" cruise, East Pacific Rise, 2003
- R/V Nathaniel B. Palmer*, SO GLOBEC program, Western Antarctic Peninsula, 2002
- R/V Nathaniel B. Palmer*, SO GLOBEC program, Western Antarctic Peninsula, 2001
- R/V Laurence M. Gould*, SO GLOBEC program, Western Antarctic Peninsula, 2001
- F/V Arcturas*, NMFS bottom-fish/invertebrate trawl survey, Bering sea, 1998

FIELD EXPERIENCE

- Benthic invertebrate sampling, *Solemya* sp., US Atlantic coast, summer 2005, 2006
- Monthly periphyton sampling, Truckee River Biomass Monitoring (TRBM) project, 2000-2001
- Terrestrial lake ice sampling, LExEN project, McMurdo Dry Valleys, Antarctica, 1999-2000

PUBLICATIONS

- Bryant JA, **Stewart FJ**, Eppley JM, and DeLong EF. 2012. Microbial community phylogenetic and trait diversity decline steeply with depth in a marine oxygen minimum zone. *Ecology*. In press.
- Stewart FJ**, Ulloa O, DeLong EF. 2012. Microbial metatranscriptomics in a permanent marine oxygen minimum zone. *Environ. Microbiol.* DOI: 10.1111/j.1462-2920.2010.02400.x
- Stewart FJ**. 2011. Dissimilatory sulfur cycling in oxygen minimum zones: an emerging metagenomics perspective. *Biochemical Society Transactions*. 39: 1859-63.
- Stewart FJ**, Dmytrenko O, DeLong EF, Cavanaugh CM. 2011. Metatranscriptomic analysis of sulfur oxidation genes in the endosymbiont of *Solemya velum*. *Front. Microbiol.* 2:134. doi:10.3389/fmicb.2011.00134
- Stewart FJ**, Cavanaugh CM. Pyrosequencing analysis of endosymbiont diversity. 2011. In: de Bruijn FJ (ed.). *Handbook of Molecular Microbial Ecology II: Metagenomics in Different Habitats*. Wiley-Blackwell. In press.
- Stewart FJ**, Sharma AK, Bryant JA, Eppley JM, DeLong EF. 2011. Community transcriptomics reveals universal patterns of protein sequence conservation in microbial communities. *Genome Biology*. 12:R26.
- Canfield DE, **Stewart FJ**, Thamdrup B, De Brabandere L, Dalsgaard T, DeLong EF, Revsbech NP, Ulloa O. 2010. A cryptic sulfur cycle in oxygen-minimum zone waters off the Chilean Coast. *Science*. 330: 1375-1378.
- Stewart FJ**, Ottesen EA, DeLong EF. 2010. Development and quantitative analyses of a universal rRNA-subtraction protocol for microbial metatranscriptomics. *ISME J.* 4: 896-907.
- Roeselers G, Newton ILG, Woyke T, Auchtung TA, Dilly GF, Dutton RJ, Fisher MC, Fontanez KM, Lau E, **Stewart FJ**, Richardson P, Barry K, Saunders E, Detter JC, Wu D, Eisen JA, Cavanaugh CM. Complete genome sequence of *Candidatus Ruthia magnifica*. *Stan. Genomic. Sci.* 3:163-173.
- Stewart FJ**, Baik AHY, Cavanaugh CM. 2009. Genetic subdivision of chemosynthetic endosymbionts of *Solemya velum* along the southern New England coast. *Appl. Environ. Microbiol.* 75:6005-6007.
- Stewart FJ**, Cavanaugh CM. 2009. Pyrosequencing analysis of endosymbiont population structure: co-occurrence of divergent symbiont lineages in a single vesicomyid host clam. *Environ. Microbiol.* 11:2136-2147.
- Stewart FJ**, Young CR, Cavanaugh CM. 2009. Evidence for homologous recombination in intracellular chemosynthetic clam symbionts. *Mol. Biol. Evol.* 26:1391-1404.
- Fritsen CH, Memmott JC, **Stewart FJ**. 2008. Inter-annual sea ice dynamics and micro-algal biomass in winter pack ice: Marguerite Bay, Antarctica. *Deep-Sea Res. Pt II.* 55:2059-2067.
- Stewart FJ**, Young CR, Cavanaugh CM. 2008. Lateral symbiont acquisition in a maternally transmitted chemosynthetic clam endosymbiosis. *Mol. Biol. Evol.* 25:673-687.
- Stewart FJ**, Cavanaugh CM. 2007. Intragenomic variation and evolution of the internal transcribed spacer of the rRNA operon in Bacteria. *J. Mol. Evol.* 65:44-67.
- Newton ILG, Woyke T, Auchtung TA, Dilly GF, Dutton RJ, Fisher MC, Fontanez KM, Lau E, **Stewart FJ**, Richardson PM, Barry KW, Detter JC, Wu D, Eisen JA, Cavanaugh CM. 2007. The *Calyptogena magnifica* chemoautotrophic symbiont genome. *Science*. 315:998-1000.
- Stewart FJ**, Cavanaugh CM. 2006. Bacterial endosymbioses in *Solemya* (Mollusca, Bivalvia): model systems for studies of symbiont-host adaptation. *Anton. Leeuw. Int. J. G.* 90:343-360.
- Cavanaugh CM, McKiness ZP, Newton ILG, **Stewart FJ**. 2006. Marine chemosynthetic symbioses. In: Dworkin M, Falkow S, Rosenberg E, Schleifer KH, Stackebrandt E (eds.). *The Prokaryotes. Third Edition. A Handbook on the Biology of Bacteria: Symbiotic Associations, Biotechnology, Applied Microbiology*. Springer, New York.
- Mix LJ, Armstrong JC, Mandell AM, Mosier AC, Raymond J, Raymond SN, **Stewart FJ**, von Braun K, Zhaxybayeva O (eds.). 2006. The Astrobiology Primer: An outline of general knowledge. *Astrobiology*. 6(5):735-813.
- Stewart FJ**, Cavanaugh CM. 2005. Symbiosis of thioautotrophic bacteria with *Riftia pachyptila*. In: Overmann, J. (ed.). *Molecular Basis of Symbiosis*. Springer-Verlag, Berlin. p.197-225.

Stewart FJ, Newton ILG, Cavanaugh CM. 2005. Chemosynthetic endosymbioses: adaptations to oxic-anoxic interfaces. *Trends Microbiol.* 13(9): 439-448.

Stewart FJ, Fritsen CH, Garrison DL. 2005. Bacteria-algae associations in the sea ice and upper water column of the Ross Sea in late austral summer. *Antarct. J. US.* 33: 38-41.

Stewart FJ, Fritsen CH. 2004. Bacteria-algae relationships in Antarctica sea ice. *Antarct. Sci.* 16(2): 143-156.

Stewart FJ. 2000. Bacteria and bacteria-phototroph associations in ice habitats of the Ross Sea and the McMurdo Dry Valleys, Antarctica. undergraduate thesis. Middlebury College.

MANUSCRIPTS IN REVIEW / REVISION

Ulloa O, **Stewart FJ**, Canfield DE. 2011. A new look at the microbial oceanography of oxygen minimum zones. In review at Science.

MANUSCRIPTS IN PREPARATION

Stewart FJ, Dalsgaard T, Thamdrup B, Revsbech NP, Ulloa O, Canfield DE, and DeLong EF. Experimental perturbation and oxygen addition elicit profound changes in community transcription in OMZ bacterioplankton.

Bristow LA, Stewart FJ, Ulloa O, DeLong EF, Altabet MA. Nitrogen isotopes support a role for nitrite oxidation throughout the intense oxygen minimum zone off northern Chile

POSTERS, PRESENTATIONS, CONFERENCE PROCEEDINGS

Biddle J, Guigo R, Peplies J, Stewart F. 2011. Training Marine Microbiologists Today: Culturing Versus Unix. In: US-EU Task Force on Biotechnology Research, EC-US Workshop on Marine Genomics, Oct 2011.

Kerwin A, Rotjan R, Dimond J, Thornhill D, Stewart F, Distel D, Sharp K. 2011. Variation in bacterial assemblages associated with different symbiotic states of the facultatively symbiotic coral, *Astrangia poculata*. Boston Bacterial Meeting.

Mondav R, Tyson G, Stewart F, Schmidt S. 2010. Metatranscriptomic comparison of an agricultural and a forest soil. Poster. Soil Metagenomics 2010

Bristow LA, Altabet MA, Stewart FJ, DeLong EF, Ulloa O. 2010. Enriched nitrate and depleted nitrite isotopic signatures in the OMZ off Northern Chile. Poster. 2010 AGU Fall Meeting.

Stewart FJ, Young CR, Cavanaugh CM. 2008. Pyrosequencing analysis of endosymbiont population structure: co-occurrence of divergent bacterial symbiont lineages in a single host clam. Poster. ASM Annual Meeting, and Boston Bacterial Meeting.

Newton ILG, Stewart FJ, Woyke T, Richardson PM, Barry KW, Detter JC, Bruce DC, Eisen JA, Cavanaugh CM. 2006. The *Calyptogenia magnifica* symbiont draft genome: an obligate, maternally transmitted endosymbiont with extensive metabolic capabilities. Poster. ASM Annual Meeting.

Fritsen CH, Stewart FJ, Stammerjohn S, Smith R. 2004. Winter sea ice biota and environmental change along the Western Antarctic Peninsula. Poster. Eos. Trans. AGU. 84(52). Ocean Sci. Meet. Suppl., Abstract O532B-21.

Stewart FJ, Fritsen CH, Murray AE, Carter BJ. 2003. Prokaryotes in Antarctic sea ice: richness and assemblage composition. Presentation. Life in Ice session. ASLO Aquatic Sciences Meeting.

Fritsen CH, Stewart FJ, Marschall SM, Memmott JC, Hartsough PC, Cunningham LM, Boc J, Blees MK, Adkins P. 2003. Interannual variation in winter sea ice biota: response to interannual variability in sea ice formation along the Western Antarctic Peninsula. Presentation. ASLO Aquatic Sciences Meeting.

Stewart FJ, Fritsen CH, Marschall SM, Memmott JM. 2002. Sea ice and water column microbial biomass and activity during the fall-winter transition west of the Antarctic Peninsula. Poster. ASLO Ocean Sciences Meeting.

Stewart FJ, Fritsen CH, Garrison DL, Gibson AH. 2001. Bacteria-algae associations in the sea ice and upper water column of the Ross Sea in the late austral summer. Poster. ASLO 2001 Aquatic Sciences Meeting.

PROPOSALS FUNDED

Getting the 411 on 454: Evaluating the efficacy of DNA pyrosequencing in microbial diversity studies. Harvard

University Center for the Environment (HUCE) Seed Grant. co-written with Colleen Cavanaugh, 2008
Virulence and cell division genes in mutualistic bacterial endosymbionts: Insights into animal cell invasion and intracellular growth via comparative genomics. Merck. co-written with Colleen Cavanaugh, 2005
Nomination of the Proteobacterial symbiont of the hydrothermal vent clam *Calymene magnifica* for genome sequencing by the Department of Energy. DOE Microbial Genomes. co-written with Colleen Cavanaugh, 2004

PROPOSALS IN REVIEW

Transmission Mode, Gene Expression, and Genetic Diversity of Host-Associated and Free-Living Chemosynthetic Endosymbionts. NSF – Physiological and Structural Systems.
Resilience of metal-respiring microbial communities to global climate change. NSF – Dimensions of Biodiversity. Co-PI with Thomas DiChristina and Martial Tallefert (Georgia Tech)
CAREER: A phylogenetic and functional understanding of microbial sulfur cycling in oxygen minimum zones. NSF – CAREER, Biological Oceanography.
PIRE – Microfluidic Microbial Fuel Cells: Innovative Pathways to Sustainable Clean Energy, Co-PI with Thomas DiChristina and Martial Tallefert (Georgia Tech), Howard Stone (Princeton)

INVITED TALKS

New Mexico State University, HHMI Invited Speaker, Nov. 2011
University of Indiana, Microbiology Seminar Series, Sept. 2011
European N-Cycle meeting, Plenary address, Nijmegen, The Netherlands, July 2011
Georgia Tech, REU Aquatic Chemical Ecology summer program, June 2011
Georgia Tech, Integrative BioSystems Institute (IBSI) chalk talk, May 2011
J. Craig Venter Institute, San Diego, Symposium: “Paleobiology During the Genomics Era”, May 2011
University of Michigan, MACEPID Symposium – “Water, Microbes, and the Environment”, School of Public Health, April 2011
US-EC Workshop on Marine Genomics, Washington DC, Oct. 2010
Georgia Tech, School of Biology Seminar Series, Feb. 2010
Northwestern University, CEE Dept. Seminar Series, Feb. 2010

PROFESSIONAL ACTIVITIES AND ASSOCIATIONS

Review Editor, Frontiers in Evolutionary and Genomic Microbiology
Panel reviewer: Ridge 2000 Program, NSF
Member: American Society of Microbiology
Member: American Association for the Advancement of Science
Coordinator: School of Biology Seminar Series

ADVISEES

Georgia Tech: Natalie Chilcutt (U), Sangita Ganesh (G), Josh Parris (tech), Raghav Sharma (G), Arpita Yadav (U), Sarah York (U); **MIT:** Jessica A. Bryant (tech); **Harvard:** Alan Baik (U), Oleg Dmytrenko (G), Jessica Thompson (U)