

**BRIAN PALENIK**

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**PROFESSIONAL PREPARATION**

Princeton University, Princeton NJ, Civil Engineering B.S.E. (honors), 6/81

MIT and MIT-Woods Hole Oceanographic Institution Joint Program in Oceanography, Boston and Woods Hole, MA PhD, 9/82-6/89

University of Chicago, Dept. of Molecular Genetics and Cell Biology, Chicago IL 9/89 -9/92  
(post-doc with H. Swift, R. Haselkorn),

**APPOINTMENTS**

Chair, SIO Graduate Department	7/2015-7/2017
Vice Chair, SIO Graduate Department	9/2014-6/2015
Education Program Director, Ocean Biosciences Program	7/2011-6/2015
Associate Director, Marine Biology Research Division	3/2001-6/2015
Full Professor	7/04 -present
Associate Professor	7/98-6/04
Assistant Professor	9/92-6/98

Scripps Institution of Oceanography, Univ. of California, San Diego  
La Jolla, CA

**AWARDS**

Darbaker Prize, Botanical Society of America 2010

**CURRENT TEACHING**

SIO282 Phytoplankton Diversity (graduate)  
SIO126 Marine Microbiology (undergraduate)  
SIO139 Current Research in Marine Biology Colloquium (undergraduate)

**SOCIETY MEMBERSHIPS/EDITORIAL BOARDS**

American Society for Microbiology (ASM), Editorial Board, Applied Environmental Microbiology (1996-2001) and reviewer.  
Association for the Sciences of Limnology and Oceanography (ASLO), reviewer for L&O.  
Phycological Society of America (PSA). Associate Editor (2017-current) for J. Phycology.

**OTHER**

Co-curator for Birch Aquarium, "Sea of Genes", an exhibit on marine genomics funded by NSF.  
In place 1.5 years.

Collaborator with Ocean Discovery Institute for development of middle school science lab materials on non-point source pollution, funded by NSF.

Undergraduate mentor for undergraduates with diverse backgrounds through school year projects and summer NSF REUs such as the SIO SURF program.

Grant panel participant and reviewer for NSF.

## **PUBLICATIONS**

1. Jones, G.J., B.P. Palenik, F.M.M. Morel, 1987. Trace-Metal Reduction by Phytoplankton - the Role of Plasmalemma Redox Enzymes. *Journal of Phycology*. 23:237-244
2. Palenik, B., O.C. Zafiriou, F.M.M. Morel, 1987. Hydrogen-peroxide production by a marine phytoplankton. *Limnology and Oceanography*. 32:1365-1369.
3. Palenik, B, Morel FMM. 1988. Dark production of hydrogen peroxide in the Sargasso Sea. *Limnology and Oceanography*. 33:1606-1611
4. Palenik, B. and F.M.M. Morel, 1988. The aquatic chemistry of biofilms. Structure and Function of Biofilms. 50( Characklis WG, Wilderer PA, Eds.):351-366., Chichester: John Wiley & Sons, Ltd.
5. Palenik, B., J.C. Block, R.G. Burns, W.G. Characklis, B.E Christensen, W.C. Ghiorse, A.G. Gristina, F.M.M. Morel, W.W. Nichols, O.H. Tuovinen, G.J. Tuschewitzki, H.A. Videla, 1989. Biofilms: Properties and processes. Structure and Function of Biofilms. 50( Characklis WG, Wilderer PA, Eds.):351-366., Chichester: John Wiley & Sons, Ltd.
6. Palenik, B., D.J. Kieber, F.M.M. Morel, 1989. Dissolved organic nitrogen use by phytoplankton: The role of cell-surface enzymes. *Biological Oceanography*. 6:347-354.
7. Price, N.M., G.I. Harrison, J.G. Hering, R.J. Hudson, P.M.V Nirel, B. Palenik, F.M.M. Morel, 1989. Preparation and chemistry of the artificial algal culture medium Aquil. *Biological Oceanography*. 6:443-461.
8. Palenik, B. and F.M.M. Morel, 1990. Comparison of cell-surface L-amino-acid oxidases from several marine-phytoplankton. *Marine Ecology-Progress Series*. 59:195-201.
9. Palenik, B. and F.M.M. Morel, 1990. Amino acid utilization by a marine phytoplankton: A novel mechanism. *Limnology and Oceanography*. 35:260-269.
10. Roulier, M.A., B. Palenik, F.M.M. Morel, 1990. A method for the measurement of choline and hydrogen-peroxide in seawater. *Marine Chemistry*. 30:409-421.
11. Palenik, B., N.M. Price, F.M.M. Morel, 1991. Potential effects of UV-B on the chemical environment of marine organisms . *Environmental Pollution*. 70:117-130.

12. Palenik, B. and F.M.M. Morel, 1991. Amine Oxidases of Marine-Phytoplankton. *Applied and Environmental Microbiology*. 57:2440-2443.
13. Chisholm, S.W., S.L. Frankel, R. Goericke, R.J. Olson, B. Palenik, J.B. Waterbury, L. Westjohnsrud, E.R. Zettler, 1992. *Prochlorococcus marinus* nov. gen. nov. sp.: An oxyphototrophic marine prokaryote containing divinyl chlorophyll a and b. *Archives of Microbiology*. 157:297-300.
14. Palenik, B and R. Haselkorn, 1992. Multiple evolutionary origins of prochlorophytes, the chlorophyll b-containing prokaryotes. *Nature*. 355:265-267.
15. Palenik, B., 1992. Polymerase evolution and organism evolution. *Current Opinion in Genetics and Development* 6: 931-936.
16. Swift, H. and B. Palenik, 1993. Prochlorophyte evolution and the origin of chloroplasts: Morphological and molecular evidence, in *Origins of Plastids* (R.A. Lewin, ed.), Chapman & Hall, New York, pp. 123-139.
17. Pantoja, S., C. Lee, J. F. Marecek and B. Palenik, 1993. Synthesis and use of fluorescent molecular probes for measuring cell-surface enzymatic oxidation of amino acids and amines in seawater. *Analytical Biochem.* 211: 210-218.
18. Palenik, B., 1994. Cyanobacterial community structure as seen from RNA polymerase gene sequence analysis. *Appl. Environ. Micro.* 60: 3212-3219.
19. Palenik, B. and J. A. Koke, 1995. Characterization of a nitrogen-regulated protein identified by cell surface biotinylation of a marine phytoplankton. *Appl. Environ. Micro.* 61: 3322-3315.
20. Palenik, B. and H. Swift, 1996. Cyanobacterial evolution and prochlorophyte diversity as seen in DNA-dependent RNA polymerase gene sequences. *J. Phycol.* 32: 638-646.
21. Dyhrman, S. T. and B. P. Palenik, 1997. The identification and purification of a cell-surface alkaline phosphatase from the dinoflagellate *Prorocentrum minimum* (Dinophyceae). *J. Phycol.* 33: 602-612.
22. Palenik, B. and A. M. Wood, 1998. Molecular markers of phytoplankton physiological status and their application at the level of individual cells, in *Molecular Approaches to the Study of the Ocean* (K. Cooksey, ed.), Chapman & Hall, New York, pp. 187-205. Book Chapter
23. Palenik, B. and S. E. Henson, 1997. The use of amides and other organic nitrogen sources by the phytoplankton *Emiliana huxleyi*. *Limnology and Oceanography* 42: 1544-1551.
24. Toledo, G. and B. Palenik, 1997. *Synechococcus* diversity in the California Current as seen by RNA polymerase (rpoC1) gene sequences of isolated strains. *Applied and Environmental Microbiology* 63: 4298-4303.

25. Ferris, M. J. and B. Palenik, 1998. Niche adaptation in ocean cyanobacteria. *Nature* 396: 226-228.
26. Palenik, B. and S. T. Dyhrman, 1998. Recent progress in understanding the regulation of Roles in Molecular, Cellular, Organismic, and Ecosystem Processes (J.P. Lynch and J. Deikman, eds.), *American Soc. of Plant Physiologists*, pp. 26-38. Review Article
27. Dyhrman, S. T. and B. Palenik, 1999. Phosphate stress in cultures and field populations of the dinoflagellate *Prorocentrum minimum* detected by a single-cell alkaline phosphatase assay. *Appl. Environ. Microbiol.* 65: 3205-3212.
28. Collier, J. L., B. Brahamsha and B. Palenik, 1999. The marine cyanobacterium *Synechococcus* sp. WH7805 requires urease (urea amidohydrolase, EC 3.5.1.5) to utilize urea as a nitrogen source: molecular-genetic and biochemical analysis of the enzyme. *Microbiology U.K.* 145: 447-459.
29. Palenik, B., G. Toledo and M. J. Ferris, 1999. Cyanobacterial diversity in marine ecosystems as seen by RNA polymerase (*rpoC1*) gene sequences, in *Marine Cyanobacteria* (L. Charpy and A.W.D. Larkum, eds.), *Bull. l'Inst. Oceanographique, Monaco, Spec. Issue No. 19*, pg. 101-105. Review
30. Palenik, B., 2000. Why do isolates of eubacterial species have different growth rates under the same conditions, in *Microbial Biosystems: New Frontiers* (C.R. Bell, M. Brylinsky and P. Johnson-Green, eds.), *Proceedings of the 8th International symposium on Microbial Ecology. Atlantic Canada Soc. For Microbial Ecology, Halifax, Canada*, pp. 611-616. Reviewed Article
31. Toledo, G., B. Palenik, and B. Brahamsha, 1999. Swimming marine *Synechococcus* strains with widely different photosynthetic pigment ratios form a monophyletic group. *Applied and Environmental Microbiology* 65: 5247-5251.
32. Palenik, B., 2001. Chromatic adaptation in marine *Synechococcus* strains. *Applied and Environmental Microbiology* 67: 991-994.
33. Dyhrman, S. T. and B. Palenik, 2001. A single-cell immunoassay for phosphate stress in the dinoflagellate *Prorocentrum minimum* (Dinophyceae). *J. Phycology* 37: 400-410.
34. Toledo, G. and B. Palenik. 2003. A *Synechococcus* serotype is found preferentially in surface marine waters. *Limnol. Oceanogr.* 48: 1744-1755.
35. B. Palenik, B. Brahamsha, F.W. Larimer, M. Land, L. Hauser, P. Chain, J. Lamerdin, W. Regala, E. A. Allen, J. McCarren, I. Paulsen, A. Dufresne, F. Partensky, E. A. Webb, J. Waterbury. 2003. The genome of a motile marine *Synechococcus*. *Nature* 424:1037-42.
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38. A. Z. Worden, J.K. Nolan and B. Palenik. 2004. Assessing the dynamics and ecology of marine picophytoplankton: The importance of the eukaryotic component. *Limnol. Oceanogr.* 49:168-179.
39. E.V. Armbrust, J.A. Berges, C. Bowler et al (Palenik). 2004. The genome of the diatom *Thalassiosira pseudonana*: Ecology, evolution, and metabolism. *Science* 306: 79-86.
40. X. Chen, Z. Su, P. Dam, B. Palenik, Y. Xu, and T. Jiang. 2004. Operon prediction by comparative genomics: an application to the *Synechococcus* sp. WH8102 genome. *Nucleic Acids Research.* 32: 2147-2157.
41. A.K. Davis, M. Hildebrand, B. Palenik. 2005. A stress-induced protein associated with the girdle band region of the diatom *Thalassiosira pseudonana*. *J. Phycol.* 41:577-589.
42. Z.C. Su, M. Fenglou, P. Dam, H.W. Wu, V. Olman, I.T. Paulsen, B. Palenik, Y. Xu. 2006. Computational inference and experimental validation of the nitrogen assimilation regulatory network in cyanobacterium *Synechococcus* sp. WH8102. *Nucleic Acids Research.* 34:1050-1065.
43. A.K. Davis, M. Hildebrand, B. Palenik. 2006. Gene expression induced by copper stress in the diatom *Thalassiosira pseudonana*. *Eukaryotic Cell.* 5:1156-1168.
44. D Landry, T. Gaasterland, B. Palenik. 2006. A Cell Surface Protein Induced by Phosphate Limitation in *E. huxleyi*. *J. Phycol.* 42:814-821.
45. Brian Palenik, Qinghu Ren, Chris L. Dupont, Garry S. Myers, John F. Heidelberg, Jonathan H. Badger, Ramana Madupu, William C. Nelson, Lauren M. Brinkac, Robert J. Dodson, A. Scott Durkin, Sean C. Daugherty, Stephen A. Sullivan, Hoda Khouri, Yasmin Mohamoud, Rebecca Halpin, and Ian T. Paulsen. 2006. The genome of *Synechococcus* CC9311: Insights into adaptation to a coastal environment. *Proc. National Academy of Sciences.* 103:13555-13559.
46. Chris L. Dupont, Song Yang, B. Palenik, P. Bourne. 2006. Modern Proteomes Contain Putative Imprints of Ancient Shifts in Trace Metal Geochemistry *Proc. National Academy of Sciences.* 103 (47): 17822-17827.
47. Denis de la Broise, B. Palenik 2007.. Immersed in situ microcosms: a tool for the assessment of pollution impact on phytoplankton. *JEMBE.* 341:274-281.
48. Brian Palenik, Jane Grimwood, Andrea Aerts, Pierre Rouz , Asaf Salamov, Nicholas Putnam, Chris Dupont, Richard Jorgensen, Evelyne Derelle, Stephane Rombauts, Kemin Zhou, Robert Otillar, Sabeeha S. Merchant, Sheila Podell, Terry Gaasterland, Carolyn Napoli, Karla Gendler, Andrea Manuell, Vera Tai, Olivier Vallon, Gwenael Piganeau, S verine Jancek, Marc

Heijde, Kamel Jabbari, Chris Bowler, Martin Lohr, Steven Robbens, Gregory Werner, Inna Dubchak, Gregory J. Pazour, Qinghu Ren, Ian Paulsen, Chuck Delwiche, Jeremy Schmutz, Daniel Rokhsar, Yves Van de Peer, Hervé Moreau, and Igor V. Grigoriev. 2007. The tiny eukaryote *Ostreococcus* provides genomic insights into the paradox of plankton speciation. *Proc. National Academy of Sciences*. 104: 7705-7710.

49. C. L. Dupont, K. Barbeau, B. Palenik. 2008. Ni uptake and limitation in marine *Synechococcus* strains. *Appl. Environ. Micro.* 74:23-31.

50. A. K. Davis and B. Palenik. 2008. Characterization of a modular, cell-surface protein and identification of a new gene family in the diatom *Thalassiosira pseudonana*. *Protist*. 159: 195-207.

51. C.L. Dupont, K. Neupane, J. Shearer, B. Palenik. 2008. Diversity, function and evolution of genes coding for putative Ni-containing superoxide dismutases. *Environ. Microbiol.*10: 1831-1843.

52. A. Dufresne, M. Ostrowski, D.J. Scanlan, L. Garczarek, S. Mazard, B.P. Palenik, I.T. Paulsen, N.T. de Marsac, P. Wincker, C. Dossat, S. Ferriera, J. Johnson, A.F. Post, W.R. Hess, F. Partensky. 2008. Unraveling the genomic mosaic of a ubiquitous genus of marine cyanobacteria. *Genome Biology*, 9(5):R90.

53. B. Palenik, Q. Ren, V. Tai, I. T. Paulsen. 2009  
Coastal *Synechococcus* metagenome reveals major roles for horizontal gene transfer and plasmids in population diversity *Environmental Microbiology* 11:349-359.

54. D. M. Landry, S. Kristiansen, B. Palenik. 2009. Molecular Characterization and antibody detection of a nitrogen-regulated cell-surface protein of the coccolithophore, *Emiliana Huxleyi* (Prymnesiophyceae). *Journal of Phycology* Volume: 45 Issue: 3 Pages: 650-659 .

55. V. Tai and B. Palenik. 2009. Temporal variation of *Synechococcus* clades at a coastal Pacific Ocean monitoring site. *The ISME Journal*. 3:903-915.

56. S. G. Tetu, B. Brahamsha, D. A. Johnson, V. Tai, K. Phillippy, B. Palenik, and I.T. Paulsen. Microarray analysis of phosphate regulation in the marine cyanobacterium *Synechococcus* sp. WH8102. *The ISME Journal*. 3:835-849.

57. E.V. Thomas, K.H. Phillippy, B. Brahamsha, D.M. Haaland, J.A. Timlin L.D.H. Elbourne, B. Palenik, I.T. Paulsen. 2009. Statistical Analysis of Microarray Data with Replicated Spots: A Case Study with *Synechococcus* WH8102. *Comparative And Functional Genomics*. Article Number: 950171 .

58. V. Tai, I. T. Paulsen, K. Phillippy, D. A. Johnson, B. Palenik. 2009. Whole genome microarray analyses of *Synechococcus*-*Vibrio* interactions. *Environmental Microbiology*. 11: 349-359.

59. Rhona K. Stuart, Chris L. Dupont, D. Aaron Johnson, Ian T. Paulsen, Brian Palenik. 2009. Coastal strains of marine *Synechococcus* exhibit increased tolerance to copper shock and a distinctive transcriptional response relative to open ocean strains. *Appl. Environmental Microbiol.* 75:5047-5057.
60. D. Scott Snyder, Bianca Brahamsha, Parastoo Azadi, and B. Palenik. 2009. Structure of Compositionally Simple Lipopolysaccharide from Marine *Synechococcus* J. Bacteriol. 191: 5499-5509.
61. C.L. Dupont, K.N. Buck, Brian Palenik, K. Barbeau. 2010. Nickel utilization in phytoplankton assemblages from contrasting oceanic regimes. *Deep-Sea Research Part I-Oceanographic Research Papers* 57:553-566.
62. X. Mayali, B. Palenik, R.S. Burton. 2010. Dynamics of marine bacterial and phytoplankton populations using multiplex liquid bead array technology. *Environmental Micro.* 12 (4):975-989.
63. X.Z. Mao, V. Olman, R. Stuart, I.T. Paulsen, B. Palenik, Y. Xu. 2010. Computational prediction of the osmoregulation network in *Synechococcus* sp. WH8102. *BMC Genomics* 11 Art No. 291.
64. M. Ostrowski, S. Mazard, S.G. Tetu, K. Phillippy, A. Johnson, B. Palenik, I.T. Paulsen, D.J. Scanlan. 2010. PtrA is required for coordinate regulation of gene expression during phosphate stress in a marine *Synechococcus*. *ISME J.* 4 (7):908-921.
65. V. Tai, R.S. Burton, Brian Palenik. 2011. Temporal and spatial distributions of marine *Synechococcus* in the Southern California Bight assessed by hybridization to bead-arrays Source: *Marine Ecology-Progress Series* 426: 133-U164 DOI: 10.3354/meps09030 .
66. Andrew J. Lucas, Christopher L Dupont, V. Tai, John L. Largier, Brian Palenik, and Peter J. S. Franks. 2011. The green ribbon: Multiscale physical control of phytoplankton productivity and community structure over a narrow continental shelf. *Limnology and Oceanography* 56: 611-626. DOI: 10.4319/lo.2011.56.2.0611 .
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68. Todd L. Johnson, Brian Palenik, Bianca Brahamsha. 2011. Characterization of a functional vanadium-dependent bromoperoxidase in the marine cyanobacterium *Synechococcus* sp. CC9311. *Journal of Phycology* Volume: 47 Issue: 4 Pages: 792-801 DOI: 10.1111/j.1529-8817.2011.01007.x .
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71. Meagan J. K. Moore, Hiroshi Furutani, Gregory C. Roberts, Ryan C. Moffet, Mary K. Gilles, Brian Palenik, Kimberly A. Prather 2011. Effect of organic compounds on cloud condensation nuclei (CCN) activity of sea spray aerosol produced by bubble bursting. *Atmospheric Environment* 45: 7462-7469 DOI: 10.1016/j.atmosenv.2011.04.034 .
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74. Rhona K Stuart, Bianca Brahamsha, Kayla Busby, Brian Palenik. 2013. Genomic island genes in a coastal marine *Synechococcus* strain confer enhanced tolerance to copper and oxidative stress. *The ISME Journal.* 7:1139-1149. DOI: 10.1038/ismej.2012.175
75. Kim Prather et al 2013. Bringing the ocean into the laboratory to probe the chemical complexity of sea spray aerosol. *PNAS.* 110: 7550-7555. DOI: 10.1073/pnas.1300262110.
76. Sasha G Tetu, Daniel A Johnson, Deepa Varkey, Katherine Phillipy, Rhona K Stuart, Chris L Dupont, Karl A Hassan, Brian Palenik, Ian T Paulsen. 2013. Impact of DNA damaging agents on genome-wide transcriptional profiles in two marine *Synechococcus* species. *Frontiers in Microbiology* 4: 232. DOI: 10.3389/fmicb.2013.00232
77. Javier Paz-Yepes, Bianca Brahamsha, and Brian Palenik. 2013. Role of a Microcin-C-like biosynthetic gene cluster in allelopathic interactions in marine *Synechococcus* *PNAS* 110:12030-12035. DOI: 10.1073/pnas.1306260110
78. Hamilton, TJ, Paz-Yepes J, Morrison RA, Palenik B, Tresguerres M. 2014. Exposure to bloom-like concentrations of two marine *Synechococcus* cyanobacteria (strains CC9311 and CC9902) differentially alters fish behaviour. *Conservation Physiology.* 2 10.1093/conphys/cou020
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80. Gutiérrez-Rodríguez, Andrés, Gillian Slack, Emy F. Daniels, Karen E. Selph, Brian Palenik, and Michael R. Landry. 2014. Fine spatial structure of genetically distinct picocyanobacterial populations across environmental gradients in the Costa Rica Dome.



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81. Keeling, Patrick J.; Burki, Fabien; Wilcox, Heather M.; et al. 2014. The Marine Microbial Eukaryote Transcriptome Sequencing Project (MMETSP): Illuminating the Functional Diversity of Eukaryotic Life in the Oceans through Transcriptome Sequencing  
PLOS Biology Volume: 12 Issue: 6 Article Number: e1001889

82. Taton, Arnaud; Unglaub, Federico; Wright, Nicole E.; et al. 2014.  
Broad-host-range vector system for synthetic biology and biotechnology in cyanobacteria  
Nucleic Acids Research 42: Article Number: e136

83. Ma, Yingfei; Allen, Lisa Zeigler; Palenik, Brian. 2014.  
Diversity and genome dynamics of marine cyanophages using metagenomic analyses  
Environmental Microbiology Reports 6 (6): 583-594.

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A Deg-protease family protein in marine *Synechococcus* is involved in outer membrane protein organization. *Frontiers of Marine Science*. doi: 10.3389/fmars.2014.00016

85. Foflonker, Fatima, Dana C. Price, Huan Qiu, Brian Palenik, Shuyi Wang and Debashish Bhattacharya. 2015. Genome of the halotolerant green alga *Picochlorum* reveals strategies for thriving under fluctuating environmental conditions. *Environmental Microbiology*. 17 (2) : 412-426. DOI: 10.1111/1462-2920.12541

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DOI: 10.1002/lno.10009

87. Dupont , Chris L et al. Genomes and gene expression across light and productivity gradients in eastern subtropical Pacific microbial communities. *The ISME Journal* 9: 1076–1092.  
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92. Foflonker, F, Ananyev G, Qiu H, Morrison A, Palenik B, Dismukes GC, Bhattacharya D. 2016. The unexpected extremophile: Tolerance to fluctuating salinity in the green alga *Picochlorum*. *Algal Research-Biomass Biofuels and Bioproducts*. 16:465-472.
93. Paerl, RW, Bouget F-Y, Lozano J-C, Verge V, Schatt P, Allen EE, Palenik B, Azam F. 2017. Use of plankton-derived vitamin B1 precursors, especially thiazole-related precursor, by key marine picoeukaryotic phytoplankton. *ISME J*. 11:753-765.
94. Stuart, RK, Bundy R, Buck K, Ghassemian M, Barbeau K, Palenik B. 2017. Copper toxicity response influences mesotrophic *Synechococcus* community structure. *Environmental Microbiology*. 19:756-769.

## **BOOK CHAPTERS AND OTHER WORK**

1. Palenik, B. and J. Beyea, 1982. Some consequences of catastrophic accidents at Indian Point and their implications for emergency planning. Direct testimony before the Atomic Safety and Licensing Board, N.R.C. Docket Nos. 50-247 SP, 50-286 SP. Testimony.
2. Brian Palenik. 2002. The genomics of symbiosis: Hosts keep the baby and the bath water. *Proc. Natl. Acad. Sci*. 99: 11996-11997. Invited commentary.
3. Heffelfinger, Grant et al. (Brian Palenik). 2002. Carbon Sequestration in *Synechococcus* sp.: From molecular machines to hierarchical modeling. *OMICS, A Journal of Integrative Biology* 6: 305-330. Invited report from journal.
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7. Palenik, Brian. 2015. Molecular Mechanisms by Which Marine Phytoplankton Respond to Their Dynamic Chemical Environment. Edited by: Carlson, CA; Giovannoni, SJ *Ann. Review of Mar. Sci*. 7: 325-340. (Invited Review)

