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Education

- 1996 Ph.D., Chemical Engineering, University of Texas at Austin
Advisor: George Georgiou
1990 B.S., Chemical Engineering, University of Wisconsin-Madison

Positions and Employment

- 2011- Professor of Chemical and Biomolecular Engineering, Johns Hopkins University
2007- Faculty Member, Chemistry-Biology Interface Program, Johns Hopkins University.
2000- Faculty Member, Program in Molecular Biophysics, Johns Hopkins University.
2011-2013 Vice Chair, Chemical and Biomolecular Engineering, Johns Hopkins University
2008-2011 Director of the Graduate Program, Chemical and Biomolecular Engineering, Johns Hopkins University.
2007-2011 Associate Professor of Chemical and Biomolecular Engineering, Johns Hopkins University.
2005-2008 Director of the Undergraduate Program, Chemical and Biomolecular Engineering, Johns Hopkins University.
2000-2007 Assistant Professor of Chemical and Biomolecular Engineering, Johns Hopkins University.
1996-2000 Postdoctoral Fellow, Chemistry Department, Pennsylvania State University.
Advisor: Stephen J. Benkovic

Honors and Awards

- 2014- Fellow of the American Institute for Medical and Biological Engineering
2003-2008 NSF CAREER Award
1996-1999 NIH Postdoctoral Fellowship

Publications

78. T. Xiong, G. E. Meister, R. E. Workman, N. C. Kato, M. J. Spellberg, T. Fulya, W. Timp, M. Ostermeier, C. D. Novina (2017) "Targeted DNA methylation in human cells using engineered dCas9-methyltransferases" *Sci. Rep.*, **7**: 6732.
77. L. F. Ribeiro, T. D. Warren, M. Ostermeier (2017) "Construction of protein switches by domain insertion and directed evolution" *Methods Mol. Biol.*, **1596**, 43-55.
76. N. Y. Shelat, S. Parhi, M. Ostermeier (2017) "Development of a cancer-marker activated enzymatic switch from the herpes simplex virus thymidine kinase" *Protein Eng. Des. Sel.* **30**, 95-103.
75. P. Hauk, K. Stephens, R. McKay, C. Virgile, H. Ueda, M. Ostermeier, K.-S. Ryu, H. Sintim, W. Bentley (2016) "Directed evolution of *Escherichia coli* quorum sensing promoter region of the *IsrACDBFG* operon: a tool for synthetic biology systems and protein expression" *Nucleic Acids Res.*, **44**, 10515-10525.
74. N. Y. Shelat, S. Parhi, M. Ostermeier (2016) "A positive selection for nucleoside kinases in *E. coli*" *PLoS One*, **11(9)**:e0162921.
73. J. H. Choi, T. Xiong, M. Ostermeier (2016) "The interplay between effector binding and allostery in an engineered protein switch" *Protein Sci.* **25**, 1605–1616.

72. L. F. Ribeiro, J. Tullman, N. Nicholes, S. R. B. Silva, D. S. Vieira, M. Ostermeier, R. J. Ward (2016) "A xylose-stimulated xylanase-xylose binding protein chimera created by random nonhomologous recombination" *Biotechnol. Biofuels*, **9**:119.
71. B. Steinberg, M. Ostermeier (2016) "Shifting fitness and epistatic landscapes reflect tradeoffs along an evolutionary pathway" *J. Mol. Biol.* **428**, 2730–2743.
70. B. Steinberg, M. Ostermeier (2016) "Environmental changes bridge evolutionary valleys" *Sci. Adv.*, **2**(1):e1500921.
69. N. Nicholes, A. Date, P. Beaujean, P. Hauk, M. Kanwar, M. Ostermeier (2016) "Modular protein switches derived from antibody mimetic proteins" *Protein Eng. Des. Sel.*, **29**, 77-85.
68. J. Tullman, N. Nicholes, M. R. Dumont, L. F. Ribeiro, M. Ostermeier (2016) "Enzymatic protein switches built from paralogous input domains" *Biotechnol. Bioeng.*, **113**, 852-858.
67. J. H. Choi, M. Zayats, P. C. Searson, M. Ostermeier (2016) "Electrochemical activation of engineered protein switches" *Biotechnol. Bioeng.*, **113**, 453-456.
66. J. P. Fuenzalida, P. K. Nareddy, I. Moreno-Villoslada, B. M. Moerschbacher, M. J. Swamy, S. Pan, M. Ostermeier, F. M. Goycoolea (2016) "On the role of alginate structure in complexing with lysozyme and application for enzyme delivery". *Food Hydrocolloids*, **53**, 239-248.
65. J. H. Choi, A. H. Laurent, V. J. Hilser, M. Ostermeier (2015) "Design of protein switches based on an ensemble model of allostery" *Nat. Commun.*, **6**:6968.
64. J. H. Choi, M. Ostermeier (2015) "Rational design of a fusion protein to exhibit disulfide-mediated logic gate behavior" *ACS Synth. Biol.*, **4**, 400-406.
63. L. F. Ribeiro, N. Nicholes, J. Tullman, L. F. C. Ribeiro, C. A. Fuzo, D. S. Vieira, G. P. Furtado, M. Ostermeier, and R. J. Ward (2015) "Insertion of a xylanase in xylose binding protein results in a xylose-stimulated xylanase" *Biotechnol. Biofuels*, **8**:118.
62. L. S.-L. Cheung, D. J. Shea, N. Nicholes, A. Date, M. Ostermeier, and K. Konstantopoulos (2015) "Characterization of monobody scaffold interactions with ligand via force spectroscopy and steered molecular dynamics" *Sci. Rep.*, **5**: 8247.
61. Russell, J. H. and M. Ostermeier (2014) "The thymidylate kinase genes from *Mycobacterium tuberculosis* and methicillin resistant *Staphylococcus aureus* confer 3'-azido-3'-deoxythymidine resistance to *Escherichia coli*" *FEMS Microbiol. Lett.*, **361**, 158-165.
60. R. C. Wright, A. Khakhar, J. R. Eshleman, M. Ostermeier (2014) "Advancements in the development of HIF-1 α -activated protein switches for use in enzyme prodrug therapy" *PLoS One*, **9**(11): e114032
59. Chaikind, B. and M. Ostermeier. (2014) "Directed evolution of improved zinc finger methyltransferases." *PLoS One* **9**(5): e96931.
58. Firnberg, E., J. W. Labonte, J. J. Gray, and M. Ostermeier. (2014) "A comprehensive, high-resolution map of a gene's fitness landscape." *Mol. Bio. Evol.* **31**, 1581-1592.
57. Valdes, G., R. W. Schulte, M. Ostermeier, and K. S. Iwamoto. (2014) "The high-affinity maltose switch MBP317-347 has low affinity for glucose: implications for targeting tumors with metabolically-directed enzyme prodrug therapy." *Chem. Biol. Drug Des.* **83**, 266-271.
56. Firnberg, E. and M. Ostermeier. (2013) "The genetic code constrains yet facilitates Darwinian evolution." *Nucleic Acids Res.* **41**, 7420-7428.
55. Choi, J. H., A. San, and M. Ostermeier. (2013) "Non-allosteric enzyme switches possess larger effector-induced changes in thermodynamic stability than their non-switch analogs." *Protein Sci.* **22**, 475-485.
54. Kanwar, M., R. C. Wright, A. Date, J. Tullman, and M. Ostermeier. (2013) "Protein switch engineering by domain insertion." *Methods in Enzymology*, **523**, 369-388.
53. Firnberg, E. and M. Ostermeier. (2012) "PFunkel: efficient, expansive, user-defined mutagenesis." *PLoS One* **7**(12): e52031.
52. Chaikind, B., K. P. Kilambi, J. J. Gray, and M. Ostermeier. (2012) "Targeted DNA methylation using an artificially bisected M.HhaI fused to zinc fingers." *PLoS One* **7**(9): e44852.

51. Ke, W., A. H. Laurent, M. D. Armstrong, Y. Chen, W. E. Smith, J. Liang, C. M. Wright, M. Ostermeier, and F. van den Akker. (2012) "Structure of an engineered β -lactamase maltose binding protein fusion protein: insights into heterotropic allosteric regulation" *PLoS One*, **7(6)**: e39168.
50. Guntas, G., M. Kanwar, and M. Ostermeier. (2012) "Circular permutation in the Ω -loop of TEM1 β -lactamase results in improved activity and altered substrate specificity." *PLoS One* **7(4)**: e35998.
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48. Heins, R. A., J. H. Choi, T. Sohka, and M. Ostermeier. (2011) "In vitro recombination of non-homologous genes can result in gene fusions that confer a switching phenotype to cells." *PLoS One* **6(11)**: e27302.
47. Wright, C. M., R. C. Wright, J. R. Eshleman, and M. Ostermeier. (2011) "A protein therapeutic modality founded on molecular regulation." *Proc. Nat. Acad. Sci. USA*, **108**, 16206-16211.
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45. Tullman, J., G. Guntas, M. Dumont, and M. Ostermeier. (2011) "Protein switches identified from diverse insertion libraries created using S1 nuclease digestion of supercoiled-form plasmid DNA." *Biotechnol. Bioeng.*, **108**, 2535-2543.
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42. Meister, G. E., S. Chandrasegaran, and M. Ostermeier. (2010) Heterodimeric DNA methyltransferases as a platform for creating designer zinc finger methyltransferases for targeted DNA methylation in cells. *Nucleic Acids Res.* **38**, 1749–1759.
41. Wright, C. M., A. Majumdar, J. R. Tolman, and M. Ostermeier. (2010) NMR characterization of an engineered domain fusion between maltose binding protein and TEM1 β -lactamase provides insight into its structure and allosteric mechanism. *Proteins.* **78**, 1423–1430.
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36. Phelan, R. M., M. Ostermeier, and C. A. Townsend. (2009) Design and synthesis of a β -lactamase activated 5-fluorouracil prodrug. *Bioorg. Med. Chem. Lett.* **19**, 1261-1263.
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34. Meister, G. E., S. Chandrasegaran, and M. Ostermeier. (2008) An engineered split M.HhaI-zinc finger fusion lacks the intended methyltransferase specificity. *Biochem. Biophys. Res. Commun.* **377**, 226-230.
33. Berrondo, M., M. Ostermeier, and J.J. Gray (2008) Structure prediction of domain insertion proteins from structures of the individual domains. *Structure* **16**, 513-527.
32. Hida, K., J. Hanes, M. Ostermeier (2007) Directed evolution for drug and nucleic acid delivery. *Adv. Drug Deliv. Rev.* **59**, 1562-1578.
31. Wright, C. M., R. A. Heins, and M. Ostermeier. (2007) As easy as flipping a switch? *Curr. Opin. Chem. Biol.* **11**, 342-346.

30. Liang, J., J. R. Kim, J. T. Boock, T. J. Mansell and M. Ostermeier. (2007) Ligand binding and allostery can emerge simultaneously. *Protein Sci.* **16**, 929-937.
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25. Ostermeier, M. (2005) Engineering allosteric protein switches by domain insertion. *Protein Eng. Des. Sel.* **18**, 359-364.
24. Guntas, G., Mansell, T. J., Kim, J. R., and Ostermeier, M. (2005) Directed evolution of protein switches and their application to the creation of ligand-binding proteins. *Proc. Nat. Acad. Sci. USA* **102**, 11224-11229.
23. Choe, W., S. Chandrasegaran, and M. Ostermeier, (2005) Protein fragment complementation in M.HhaI DNA methyltransferase. *Biochem. Biophys. Res. Commun.* **334**, 1233-1240.
22. Bosley, A. D. and Ostermeier, M. (2005) Mathematical expressions useful in the construction, description and evaluation of protein libraries. *Biomolecular Engineering* **22**, 57-61.
21. Guntas, G., Mitchell, S.F. and Ostermeier, M. (2004) A molecular switch created by *in vitro* recombination of non-homologous genes. *Chem. Biol.* **11**, 1483-1487.
20. Paschon, D.E. and Ostermeier, M. (2004) Construction of protein fragment complementation libraries using incremental truncation. *Methods Enzymol.* **388**, 103-116.
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17. Ostermeier, M. (2003) Theoretical distribution of truncation lengths in incremental truncation libraries. *Biotechnol. Bioeng.* **82**, 564-577.
16. Ostermeier, M. and Lutz, S. (2003) The creation of ITCHY hybrid protein libraries. *Methods Mol. Biol.* **231**, 129-142.
15. Lutz, S. and Ostermeier, M. (2003) Preparation of SCRATCHY hybrid protein libraries: size- and in-frame selection of nucleic acid sequences. *Methods Mol. Biol.* **231**, 143-152.
14. Ostermeier, M., Lutz, S. and Benkovic, S.J. (2002) Generation of protein fragment libraries by incremental truncation. In: Golemis, E.A. (ed) Protein-Protein Interactions: A Molecular Cloning Manual, Cold Spring Harbor Laboratory Press (Cold Spring Harbor, NY).
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12. Lutz, S., Ostermeier, M. and Benkovic, S. J. (2001) Rapid generation of incremental truncation libraries for protein engineering using α -phosphothioate nucleotides. *Nucleic Acids Res.* **29**, e16.
11. Ostermeier, M. and Benkovic, S. J. (2001) Construction of hybrid gene libraries involving the circular permutation of DNA. *Biotechnology Letters* **23**, 303-310.
10. Ostermeier, M. and Benkovic, S. J. (2000) Evolution of protein function by domain swapping. *Advances in Protein Chemistry* **55**, 29-77.
9. Ostermeier, M. and Benkovic, S. J. (2000) A two-phagemid system for the creation of non-phage displayed antibody libraries approaching one trillion members. *J. Immunol. Methods* **237**, 175-186.

8. Ostermeier, M., Shim, J. H. and Benkovic, S. J. (1999) A combinatorial approach to hybrid enzymes independent of DNA homology. *Nature Biotechnol.* **17**, 1205-1209.
7. Ostermeier, M., Nixon, A. E. and Benkovic, S. J. (1999) Incremental truncation as a strategy in the engineering of novel catalysts. *Bioorg. Med. Chem.* **7**, 2139-2144.
6. Ostermeier, M. and Benkovic, S. J. (1999) Finding Cinderella's slipper—proteins that fit. *Nature Biotechnol.* **17**, 639-640.
5. Ostermeier, M., Nixon, A. E., Shim, J. H. and Benkovic, S. J. (1999) Combinatorial protein engineering by incremental truncation. *Proc. Nat. Acad. Sci. USA* **96**, 3562-3567.
4. Nixon, A. E., Ostermeier, M. and Benkovic, S. J. (1998) Hybrid enzymes: manipulating enzyme design. *Trends Biotechnol.* **16**, 258-264.
3. Ostermeier, M., De Sutter, K. and Georgiou, G. (1996) Eukaryotic protein disulfide isomerase complements *Escherichia coli dsbA* mutants and increases the yield of a heterologously secreted protein with disulfide bonds. *J. Biol. Chem.* **271**, 10616-10622.
2. Georgiou, G., Valax, P., Ostermeier, M. and Horowitz, P. M. (1994) Folding and aggregation of TEM β -lactamase: analogies with the formation of inclusion bodies in *Escherichia coli*. *Prot. Sci.* **3**, 1953-1960.
1. Ostermeier, M. and Georgiou, G. (1994) The folding of bovine pancreatic trypsin inhibitor in the *Escherichia coli* periplasm. *J. Biol. Chem.* **269**, 21072-21077.

Patents

7. M. Ostermeier and E. Firnberg "Methods for efficient, expansive user-defined DNA mutagenesis", U.S. patent 9,347,057 and 9,458,453.
6. M. Ostermeier and C. M. Wright "Prodrug activation in cancer cells using molecular switches" U.S. patent 8,771,679 and 9,469,841.
5. J. R. Kim; B. Pierre, M. Ostermeier, and C.-S. Kim "Protein stabilization by domain insertion into a thermophilic protein" U.S. patent 8,592,192.
4. M. Ostermeier, "Molecular switches and methods for making and using the same." U.S. patents 8,492,122 and 9,273,319.
3. M. Ostermeier and G. Guntas, "Methods for making and using molecular switches involving circular permutation" U.S. patents 8,338,138; 8,679,753 and 9,290,544.
2. S. J. Benkovic, M. Ostermeier, A. E. Nixon, and S. Lutz, "Incrementally truncated nucleic acids and methods of making same" U.S. patents 7,332,308 and 7,820,413.
1. G. Georgiou and M. Ostermeier, "Methods for producing soluble, biologically-active disulfide-bond containing eukaryotic proteins in bacterial cells" U.S. patent 6,027,888.