December, 2013

Eric A. Gaucher
CURRICULUM VITAE

Gaucher, Eric
Associate Professor
School of Biology
Georgia Institute of Technology

Educational Background:

B.A.	Biology	1994	University of Missouri
Ph.D.	Molecular Biology	2001	University of Florida

Employment History:

Postdoctoral Fellow, NASA Astrobiology Institute	2001-2003
President & Researcher, Foundation for Applied Molecular Evolution	2003-2008
Associate Professor, School of Biology, Georgia Tech	2008-present
Courtesy Appointment, School of Chemistry, Georgia Tech	2009-present

Current Fields of Interest:

Bioinformatics, biomedicine, comparative genomics, computational biology, evolutionary synthetic biology, molecular biology, molecular evolution and origins of life

Refereed Publications:

Kratzer, J. T., Lanaspa, M. A., Murphy, M., Cicerchi, C., Graves, C. L., Tipton, P. A., Ortlund, E. A., Johnson, R. J., Gaucher, E. A. (2014) Evolution history and metabolic insights of ancient mammalian uricases. ***PNAS***, Epub Feb 18
(PNAS accompanying commentary, by Belinda Chang)
(Press coverage by National Geographic)

Kacar, B., Gaucher, E. A. (2013) Experimental evolution of protein-protein interaction networks. ***Biochemistry Journal,*** 453(3):311-319.

Petrov, A. S., Bernier, C. R., Hershkovits, E., Xue, Y., Waterbury, C. C., Hsiao, C., Stepanov, V. G., Gaucher, E. A., Grover, M. A., Harvey, S. C., Hud, N. V., Wartell, R. M., Fox, G. E., Williams, L. D. (2013) Secondary structure and domain architecture of the 23S and 5S rRNAs. ***Nucleic Acids Research,*** 41(15):7522-7535.

Laos, R., Shaw, R., Leal, N. A., Gaucher, E., Benner, S. (2013). Directed evolution of polymerases to accept nucleotides with nonstandard hydrogen bond patters. ***Biochemistry,*** 52:5288-5294.

Ingles-Prieto, A., Ibarra-Molero, B., Delgado-Delgado, A., Perez-Jimenez, R., Fernandez, J. M., Gaucher, E. A., Sanchez-Ruiz, J. M., Gavira, J. A. (2013) Conservation of protein structure over four billion years. ***Structure,*** 21:1690-1697.
(Selected by multiple 'Faculty of 1000', press coverage by BBC and others)

Cole, M. F., Cox, V. E., Gratton, K. L., Gaucher, E. A. (2013) Reconstructing evolutionary adaptive paths for protein engineering. ***Methods in Molecular Biology,*** 978:115-25.

Risso, V. A., Gavira, J. A., Mejia-Carmona, D. F., Gaucher, E. A., Sanchez-Ruiz J. M. (2013) Hyperstability and Substrate Promiscuity in Laboratory Resurrections of Precambrian β-Lactamases. ***Journal of the America Chemical Society,*** 135(8):2899-2902.
(2 Selections by 'Faculty of 1000', spotlighted by ACS Chemical Biology)

Cacan, E., Kratzer, J. T., Cole, M. F., Gaucher, E. A. (2013) Interchanging Functionality Among Homologous Elongation Factors Using Signatures of Heterotachy. ***Journal of Molecular Evolution,*** 76(1-2):4-12.

Gromiha, M. M., Pathak, M. C., Saraboji, K., Ortlund, E. A., Gaucher, E. A. (2013) Hydrophobic environment is a key factor for the stability of thermophilic proteins. ***Proteins***, 81(4):715-721.

Kacar, B. & Gaucher, E. A. (2012) Towards the recapitulation of ancient history in the laboratory: Combining synthetic biology with experimental evolution. **Artificial Life XIII Proceedings of the Thirteenth International Conference on the Simulation and Synthesis of Living Systems**, C. Adami, D. M. Bryson, C. Ofria and R. T. Pennock, eds., pp. 11-18. MIT Press. *arXiv ID:1209.5032*

Zhou, Y., Asahara, H., Gaucher, E. A., Chong, S. *In vitro* reconstitution of protein translation from *Thermophilus thermophilus* reveals a minimal set of components sufficient for protein synthesis at high temperatures and a remarkable evolutionary conservation among both ancient and modern translation components. ***Nucleic Acid Research,*** *40(16)*:7932-7945.

Johnson, R. J., Lanaspa, M. A., Gaucher, E. A. (2011) Uric Acid: a danger signal from the RNA world that may have a role in the epidemic of obesity, metabolic syndrome, and cardiorenal disease: evolutionary considerations. ***Semin Nephrol***., 5:394-399.

Cole, M. F. & Gaucher, E. A. (2011) Utilizing natural diversity to evolve protein function: applications towards thermostability. ***Current Opinions in Chemical Biology***, 15(3):399-406.

Zhao, Z. M., Reynolds, A. B. & Gaucher, E. A. (2011) The evolutionary history of the catenin gene family during metazoan evolution, ***BMC Evolutionary Biology,*** 11:198.
(Designated 'Highly Accessed')

Perez-Jimenez, R., Inglés-Prieto, A., Zhao, Z., Sanchez-Romero, I., Alegre-Cebollada, J., Kosuri, P., Garcia-Manyes, S., Holmgren, A. , Sanchez-Ruiz, J. M., Gaucher, E. A. & J. M. Fernandez, J.M. (2011) Paleoenzymology at the single-molecule level: probing the chemistry of resurrected enzymes, ***Nature Structural and Molecular Biology****,* 18(5):592-596.

Cole, M.F. & Gaucher, E. A. (2011) Exploiting models of molecular evolution to efficiently direct protein engineering, ***Journal of Molecular Evolution****,* 72:193-203.

Carnahan, R. H., Rokas, A., Gaucher, E. A., Reynolds, A. B. (2010) The molecular evolution of the p120-catenin subfamily and its functional associations. ***PLoS One***, 5(12):e15747.

Gaucher, E. A., Kratzer, J. T., and R. N. Randall (2010) Deep Phylogeny – How a tree can help characterize early life on Earth. ***Cold Spring Harb. Perspect. Biol.*** 2(1):a002238.

Chen, F.*, Gaucher, E. A.*, Leal, N. A., Hutter, D., Havemann, S. A., Govindarajan, S., Ortlund, E. A., Benner, S. A. (2010) Reconstructed evolutionary adaptive paths give polymerases accepting reversible terminators for sequencing and SNP detection, *these authors contributed equally, ***PNAS,*** 107:1948-53.

Perez-Jimenez, R. and 18 others (2009). Diversity of chemical mechanisms in Thioredoxin catalysis. ***Nature Struct. & Mol. Biol.***, 16: 890-896.

Johnson, R. J., Gaucher, E. A., Sautin, Y. Y., Henderson, G. N., Angerhofer, A. J., and S. A. Benner (2008). The planetary biology of ascorbate and uric acid and their relationship with the epidemic of obesity and cardiovascular disease. ***Med Hypotheses***. 71:22-31.

Gaucher, E. A., Ganesh, O. & S. Govindarajan (2008). Paleotemperature trend for Precambrian life inferred from resurrected proteins. ***Nature***, 451: 704-707.
(News & Views in same *Nature* issue by Gouy & Chaussidon)
(2 Selections by 'Faculty of 1000')
(*Cell*, editor summary, v. 133)

Benner, S. A., Sassi, S., and E. A. Gaucher (2007*). Molecular Paleoscience. Systems Biology from the Past*. ***Adv. Enzymol. Relat. Areas Mol. Biol.*** 75:1-132.

Gaucher, E. A., De Kee, D. W., and S. A. Benner (2006) Application of DETECTER, an evolutionary genomic tool to analyze genetic variation, to the cystic fibrosis gene family. ***BMC Genomics*** 7:44.

Li, T., Chamberlin, S. G., Caraco M. D., Gaucher, E. A., Liberles, D. A., and S. A. Benner (2006). Transition redundant approach-to-equilibrium analysis of gene sequences: Tools to date events in the genomic record. ***BMC Evol. Biol.*** 6:25.

Phillips, S. E., Vincent, P., Rizzieri, K. E., Schaaf, G., Bankaitis, V. A., and E. A. Gaucher (2006). The diverse biological functions of phosphatidylinositol transfer proteins in eukaryotes. ***Crit. Rev. Biochem. Mol. Biol.*** 41:21-49.

Gaucher, E. A. and M. Miyamoto (2005). A call for likelihood phylogenetics even when evolution is heterogeneous. ***Molecular Phylogenetics & Evolution*** 37:928-931.

Thomson, J. M., Gaucher, E. A., Burgan, M. F., Li, T., Aris, J. P. and S. A. Benner (2005). Resurrecting ancient alcohol dehydrogenases from Yeast. ***Nature Genetics*** 37:630-635.
(Selected by 'Faculty of 1000')

Gaucher, E. A., Graddy, L. G., Simmen, R. C. M., Simmen, F. A., Kowalski, A. A., Schreiber, D. R., Liberles, D. A., Zhao, G., Janis, C. M. and S. A. Benner (2004). The planetary biology of aromatases in pigs. ***BMC Biology.*** 2(1):19.
(Selected as Editor's Choice; 'Faculty of 1000')

West, C. M., Van Der Wel, H., Sassi, S. and E. A. Gaucher (2004). Cytoplasmic glycosylation of protein-hydroxyproline and its relationship to other glycosylation pathways. ***Biochim. Biophys. Acta.*** 1673:29-44.
(Selected by 'Faculty of 1000')

Gaucher, E. A., Burgan, M. F., Thomson, J. M. and S. A. Benner (2003). Inferring the paleoenvironment of ancient bacteria based on resurrected ancestral proteins. ***Nature*** 425:285-288.
(2 Selections by 'Faculty of 1000')

Gaucher, E. A., Miyamoto, M. M. and S. A. Benner (2003). Evolutionary, structural and biochemical evidence for a new interaction site of the leptin obesity protein. ***Genetics*** 163:1549-1553.

Gaucher, E. A, Gu, X., Miyamoto, M. M. and S. A. Benner (2002). Predicting functional divergence in protein evolution by site-specific rate shifts. ***Trends Biochem. Sci.*** 27:315-321.

Benner, S. A., Caraco, M. D., Thomson, J. M. and E. A. Gaucher (2002). Planetary biology - paleontological, geological, and molecular histories of life. ***Science*** 296:864-868.

West, C. M., van der Wel, H. and E.A. Gaucher (2002). Complex glycosylation of Skp1 in Dictyostelium: implications for the modification of other eukaryotic cytoplasmic and nuclear proteins. ***Glycobiology*** 12:17R-27R.

Gaucher, E. A., Das, U. K., Miyamoto, M. M. and S. A. Benner (2002). The Crystal Structure of eEF1A Supports the Functional Predictions of an Evolutionary Analysis of Rate Changes among Elongation Factors. ***Mol. Biol. Evol.*** 19:569-573.

Benner, S. A. and E. A. Gaucher (2001). Evolution, language and analogy in functional genomics. ***Trends Genet.*** 17:414-418.

Gaucher, E. A., Miyamoto, M. M. and S. A. Benner (2001). Function-structure analysis of proteins using covarion-based evolutionary approaches: Elongation factors. ***Proc. Nat. Acad. Sci.*** 98:548-552.

Laten, H. M., Majumdar, A. and E. A. Gaucher (1998). SIRE-1, a copia/Ty1-like retroelement from soybean, encodes a retroviral envelope-like protein. ***Proc. Nat. Acad. Sci.*** 95:6897-6902.

Chapters in Books (all invited):
Cox, V, Cole, M. F., Gaucher, E. A. (2012) *Bridging protein evolution and engineering*. in Methods in Molecular Biology (Enzyme Engineering Edition) (Editor James Samuelson, Springer Press).

Kratzer, J. K., Cole, M. F., Gaucher, E. A. (2012) *Protein engineering guided by natural diversity*. in Protein Engineering Handbook 3rd Edition (Eds Lutz and Bornscheuer, Wiley Press).

Cole, M. F. & Gaucher, E. A. (2011) *Proteins*. in Encyclopedia of Astrobiology (Eds Gargaud, Amils, Cleaves, Irvine, Pinti and Viso, Springer Press).

Gaucher, E. A. (2007). *Ancestral sequence reconstruction as a tool to understand natural history and guide synthetic biology: Realizing (and extending) the vision of Zukerkandl and Pauling.* in Ancestral Sequence Reconstruction pp. 20-33 (Editor: David Liberles, Oxford University Press).

Gaucher, E. A. (2007). *Experimental resurrection of ancient biomolecules: gene synthesis, heterologous protein expression, and functional assays.* in Ancestral Sequence Reconstruction pp.153-163 (Editor: David Liberles, Oxford University Press).

Danchin, E. G. J., Gaucher, E. A., P. Pontarotti (2007). *Computational reconstruction of ancestral genomic regions from evolutionarily conserved gene clusters*. in Ancestral Sequence Reconstruction pp. 139-152 (Editor: David Liberles, Oxford University Press).

Brooks, D. J. and Gaucher, E. A. (2007). *Inferred thermophily of the last universal ancestor based on estimated amino acid composition.* in Ancestral Sequence Reconstruction pp. 200-207 (Editor: David Liberles, Oxford University Press).

Research Grants and Contracts: Title, Agency, Dates, and Amounts
Funded:
2013 'Young Professor Award', DuPont, $75,000
2013 'Early Career Fellowship', NASA, PI, 1 year, $100,000
2012-2015 'Experimental phylogenies to benchmark ancestral sequence reconstruction', NSF, PI, 3 years, $227,000/year in total costs
2013-2016 'Experimental evolution and resurrected ancestral genes to study historical contingency and determinism', NASA, PI, 3 years, $170,000/year in total costs
2011 VentureLab Phase IA funding for my start-up company General Genomics, LLC, Georgia Research Alliance, 6 months, $25,000 (direct costs only allowed)
2009-2014 'The Georgia Tech center for ribosome adaptation and evolution', NASA, Co-I, 5 years, $131,275/year in total costs to my laboratory
2008-2012 'Exploiting paleogenetics and experimental-evolution to reconstruct and recapitulate adaptive evolution', NASA, PI, 4 years, $110,000/year in total costs

2011 VentureLab Phase IB funding for my start-up company General Genomics, LLC, Georgia Research Alliance, 6 months, $20,000 (direct costs only allowed)

Patents:

2010 'Variants of Ancestral Uricases and Use Thereof', U.S. Patent and Trademark Office & PTC, *pending*
2010 'Variants of Ancestral Thioredoxins and Use Thereof', U.S. Patent and Trademark Office, *pending*
2008 'Taq polymerase sequences useful for incorporating analogs of nucleoside triphosphates', U.S. Patent and Trademark Office, *pending*

Field-work Associated with the Gaucher Laboratory

Stromatolite sample collection (fossil and living samples), Shark Bay, Western Australia, 2011, for Astrobiolo Summer Camp for High School Students (Summers 2009-2013)

Committees - Georgia Tech:

2013-2014 School of Biology, Systems/Synthetic Biology Faculty Search
2012-present School of Biology, Graduate Student Committee
2009-present Co-director, summer research experience 'Astrobiology: Life on the Edge' for high school teachers and students
2009-2010 School of Biology, Microbial Systems Faculty Search, Chair
2010-2011 School of Chemistry, Chemical Biology Faculty Search
2009-present School of Biology, Cherry Emerson Space Committee
2012 School of Biology Annual Retreat

Professional Service:

2014 NSF, Panel Reviewer for Molecular and Cellular Biosciences
2013 NASA, Ad hoc grant proposal reviewer
2012 Department of Energy, Microbial Biosystems Panel
2012 Department of Energy, Ad hoc grant proposal reviewer
2012 Spelman College, Ad hoc grant proposal reviewer
2011 NSF, Panel Reviewer for Molecular and Cellular Biosciences
2010-present Associate Editor BMC Evolutionary Biology
2009-present NASA, EPSCoR grant proposal reviewer
2009-present Canada Research Chairs, proposal reviewer
2008-present Associate Editor Journal of Molecular Evolution
2008-present NSF, Ad hoc grant proposal reviewer
2008-present Referee for *Bioinformatics, Biological Procedures, Biological Reviews, BMC journals, Gene, International Journal of COPD, Journal of Cystic Fibrosis, Journal of Molecular Biology, Journal of Molecular Evolution*, *Molecular Biology and Evolution, Nucleosides, Nucleotides and Nucleic Acids, New Phytologist, Pharmacogenetics and Genomics, PLoS Computational Biology, PLoS Genetics, PLoS ONE,* and *Proceedings of the National Academy of Sciences.*

Education and Public Outreach:

2009-present Host two high school students and their teacher (GIFT program) from Dunwoody High School to conduct research in my laboratory every summer. National Siemens Competition in Math, Science and Technology (Semi-Finalists, 2011), State of Georgia Finalists (2013)
2010-present Co-Founder and Advisor GT's undergraduate International Genetic Engineering Machine (iGEM) competition, winners of bronze and silver medals over the years
2009-present Advisor for two GT Summer Undergraduate Research Experience (SURE) students
2009-present Co-developer and Instructor Georgia Tech's summer camp for high school students Astrobiology: Life on the Edge
2009, 2011 Atlanta Science Tavern outreach to general public, discussion on Astrobiology and Origins of Life

Honors, Awards, and Recognitions:

2013 DuPont Young Professor Award
2012 Georgia Tech Class of 1934 Course Survey Teaching Effectiveness Award
2010 Formed Start-Up Company General Genomics, LLC. Company located in ATDC VentureLab space and has received GRA seed funding and Peter Thiel Foundation funding
2010 International iGEM competition, Co-Founder and Faculty leader for GT team
2009 Invitation to attend Keck Futures Initiative (NAKFI), *Synthetic Biology: Building on Nature's Inspiration*
2008 Carl Sagan Fellowship for Early Career Researchers, NASA
2000 Walter M. Fitch award for outstanding graduate research from the Society of Molecular Biology and Evolution (SMBE)

Graduate and Undergraduate Students Supervised:

Ziming Zhao, Ph.D., arrived Fall 2008 (currently a postdoc at Yale University)
Ercan Cacan, M.S., arrived Fall 2008
James Kratzer, Ph.D. - Chemistry, arrived Spring 2009 (recipient GT TI:GER graduate student Fellowship, 2009-2011, GAANN graduate student Fellowship, 2011-2012)
Amreen Fazal, undergraduate, arrived Spring 2009
Joshua Stern, M.S., arrived Fall 2009 (recipient NASA graduate student Fellowship, 2010-2013)
Co-Founder and Advisor for Georgia Tech's undergraduate iGEM team (www.igem.org)
Christina Graves, undergraduate, arrived summer 2010 (currently a Ph.D. student University of Florida)
Racchit Thapliyal, M.S., arrived Fall 2010
Vanessa Cox, Ph.D. - Chemistry, arrived Spring 2012
Brian Kwan, undergraduate, arrived Spring 2012
Kelsey Gratton, undergradute, Petit Scholar, started Spring 2012

Postdoctoral Fellows/Vistors Supervised:

Dr. Betul Kacar Arslan (Emory, Ph.D.), arrived Fall 2009 (recipient of NASA Astrobiology Postdoctoral Fellowship, 2012-2014)
Dr. Megan Cole (MIT, Ph.D.), arrived Fall 2009 (recipient NRSA NIH Postdoctoral Kirschstein Fellowship, 2010-2013)(currently a faculty member at Emory University)
Prof. Michael Gromiha (Visiting from AIST, JAPAN), visited during Fall 2009