

Eric A. Gaucher
CURRICULUM VITAE

Eric Gaucher
Professor, Department of Biology
Georgia State University
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I. Earned Degrees:

B.A.	Biology	1994	University of Missouri
M.S.	Genetics	1997	Loyola University
Ph.D.	Molecular Biology	2001	University of Florida

II. Employment History (chronological):

Postdoctoral Fellow, NASA Astrobiology Institute	2001-2003
President & Researcher, Foundation for Applied Molecular Evolution	2003-2008
Associate Professor, School of Biology, Georgia Tech	2008-2017
Courtesy Appointment, School of Chemistry and Biochemistry, Georgia Tech	2009-present
Associate Chair, School of Biological Sciences, Georgia Tech	2014-2017
Professor [Adjunct], School of Biological Sciences, Georgia Tech	2017-present
Professor & former Chair, Department of Biology, Georgia State University	2017-present

Current Fields of Interest:

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

III. Honors, Awards, and Recognitions (reverse chronological):

2020	Elected to Sigma Xi (scientific research honor society)
2018	Georgia State University, Executive Leadership Series
2016	Nelson and Bennie Abell Professorship, Georgia Tech
2014	Georgia Tech Paul A. Duke GIFT Mentor Award
2014	Georgia Tech CETL Award for Education Partnership (w/ Mrs. Greenwood, Dunwoody High)
2013	DuPont Young Professor Award
2013	The Laura Sheard Graduate Lecture, University of Washington
2012	Georgia Tech Class of 1934 Course Survey Teaching Effectiveness Award
2010	International iGEM competition, Co-Founder and Faculty leader for GT team
2009	Invitation to attend Keck Futures Initiative (NAKFI), <i>Synthetic Biology: Building on Nature's Inspiration</i>
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)

IV. Research, Scholarship and Creative Activities**A. Publications****Books, Chapters & Volumes:**

Cox, V. & Gaucher, E. A. (2015) *Proteins*. in Encyclopedia of Astrobiology (Eds Gargaud, Irvine, Amils, Cleaves, Pinti, Cernicharo Quintanilla, Rouan, Spoh, Tirard, and Viso, Springer Press).

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).

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

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).

B. Refereed Publications and Submitted Articles

Currently in peer-review (submitted)

Hoshino, Y., Nettersheim, B. J., Hallmann, C., Vinnichenko, G., van Maldegem, L. M., Brock, J. J., and Gaucher, E. A. (2021) 2-Methylhopanes as cyanobacterial specific biomarkers before 1.2 billion years ago. (in revision).

B1. Published/Accepted Journal Articles:

Johnson, R. J., Sanchez-Lozada, L. G., Nakagawa, T., Rodriguez-Iturbe, B., Tolan, D., Gaucher, E. A., Andrews, P., and Lanaspa, M. A. (2022) Do thrifty genes exist? Revisiting uricase. *Obesity*, 30(10): 1917-1926 doi: 10.1002/oby.23540

Li, Z., Hoshino, Y., Tran, L., and Gaucher, E. A. (2022) Phylogenetic articulation of uric acid evolution in mammals and how it informs a therapeutic uricase. *Molecular Biology & Evolution*, 39(1): doi: 10.1093/molbev/msab312

Gamiz-Arco, G., Risso, V. A., Gaucher, E. A., Gavira, J. A., Naganathan, A. N., Ibarra-Molero, B, and Sanchez-Ruiz, J. M. (2021) Combining ancestral reconstruction with folding-landscape simulations to engineer heterologous protein expression. *Journal of Molecular Biology*, 433(24): 167321 doi: 10.1016/j.jmb.2021.167321

de Lima Balico, L. & Gaucher, E. A. (2021) CRISPR/Cas9-mediated Reactivation of the Uricase Pseudogene in Human Cells Prevents Acute Hyperuricemia. *Molecular Therapy: Nucleic Acid*, 25: 578-584 doi: 10.1016/j.omtn.2021.08.002

- Fini, M. A., Lanaspá, M. A., Gaucher, E. A., Boutwell, B., Nakagawa, T., Wright, R. M., Sanchez-Lozada, L. G., Andrews, P., Stenmark, K., and Johnson, R. J. (2021) The Uricase Mutation in Humans Increases our Risk for Cancer Growth. **Cancer & Metabolism**, 9(1):32 doi: 10.1186/s40170-021-00268-3
- Knight, K. A., Coyle, C. W., Radford, C. E., Parker, E. T., Fedanov, A., Shields, J. M., Szlam, F., Purchel, A., Chen, M., Denning, G., Sniecinski, R. M., Lollar, P., Spencer, H. T., Gaucher, E. A. and Doering, C. B. (2021) Identification of coagulation factor IX variants with enhanced activity through ancestral sequence reconstruction. **Blood Advances**, 5(17): 3333-3343 doi: 10.1182/bloodadvances.2021004742
- Hoshino, Y. & Gaucher, E. A. (2021) Evolution of bacterial steroid biosynthesis and its impact on eukaryogenesis. **Proc. Natl. Acad. Sci.**, 118(25): 1-9. doi: 10.1073/pnas.2101276118
- Selberg, A. G. A., Gaucher, E. A., Liberles, D. A. (2021) Ancestral Sequence Reconstruction, From Chemical Paleogenetics to Maximum Likelihood Algorithms and Beyond. **Journal of Molecular Evolution**, 89(3): 157-164. doi: 10.1007/s00239-021-09993-1
- Zakas, P. M., Coyle, C. W., Brehm, A., Bayer, M., Solecka-Witulska, B., Radford, C. E., Brown, C. Nesbitt, K., Dwyer, C., Kannicht, C., Gaucher, E. A., Doering, C. B., Lillicrap, D. (2021) Molecular co-evolution of coagulation factor VIII and von Willebrand factor. **Blood Advances**, 5(3): 812-822. doi: 10.1182/bloodadvances.2020002971
- Gamiz-Arco, G., Gutierrez-Rus, L. I., Risso, V. A., Ibarra-Molero, B., Hoshino, Y., Petrović, D., Justicia, J., Cuerva, J. M., Romero-Rivera, A., Seelig, B., Gavira, J. A., Kamerlin, S. C. L., Gaucher, E. A., Sanchez-Ruiz, J. M. (2021) Heme-binding enables allosteric modulation in an ancient TIM-barrel glycosidase. **Nature Communications**, 12(1):380 [1-16] doi: 10.1038/s41467-020-20630-1
- Das, S., Crooke, S. N., Tran, L., Bhattacharya, S., Gaucher, E. A., Finn, M. G. (2020) Stabilization of Near-Infrared Fluorescent Proteins by Packaging in Virus-like Particles. **Biomacromolecules**, 21(6): 2432-2439. doi: 10.1021/acs.biomac.0c00362
- Johnson, R. J., Stenvinkel, P., Andrews, P., Sánchez-Lozada, L. G., Nakagawa, T., Gaucher, E. A., Andres-Hernando, A., Rodriguez-Iturbe, B., Jimenez, C. R., Garcia, G., Kang, D. H., Tolan, D. R., Lanaspá, M. A. (2020) Fructose metabolism as a common evolutionary pathway of survival associated with climate change, food shortage and droughts. **Journal of Internal Medicine**, 287(3): 252-262. doi: 10.1111/joim.12993
- Gamiz-Arco, G., Rissom, V. A, Candel, A. M., Inglés-Prieto, A., Romero-Romero, M. L., Gaucher, E. A., Gavira, J. A., Ibarra-Molero, B., Sanchez-Ruiz, J. M. (2019) Non-conservation of folding rates in the thioredoxin family reveals degradation of ancestral unassisted-folding. **Biochemical Journal**, 476(23): 3631-3647. doi: 10.1042/BCJ20190739
- DeLey Cox, V. E., Cole, M. F., Gaucher, E. A. (2019) Incorporation of modified amino acids by engineered Elongation Factors with expanded substrate capabilities. **ACS Synthetic Biology**, 8(2): 287-296. doi: 10.1021/acssynbio.8b00305
- Hoshino, Y., Gaucher, E. A. (2018) On the origin of isoprenoid biosynthesis. **Molecular Biology and Evolution**, 35(9): 2185-2197. doi: 10.1093/molbev/msy120
- Okafor, C. D., Pathak, M. C., Fagan, C. E., Bauer, N. C., Cole, M. F., Gaucher, E. A., Ortlund, E. A. (2018) Structural and dynamics comparison of thermostability in ancient, modern, and consensus Elongation Factor Tus, **Structure**, 26(1):118-129. doi: 10.1016/j.str.2017.11.018
- Risso, V. A., Martinez-Rodriguez, S., Candel, A. M., Krüger, D. M., Pantoja-Uceda, D., Ortega-Muñoz, M., Santoyo-Gonzalez, F., Gaucher, E. A., Kamerlin, S. C. L., Bruix, M., Gavira, J. A., Sanchez-Ruiz, J. M. (2017) De novo active sites for resurrected Precambrian enzymes, **Nature Communications**, 8: 16113. doi: 10.1038/ncomms16113
- Kacar, B., Ge, X., Sanyal, S., Gaucher, E. A. (2017) Experimental evolution of *E. coli* harboring an ancient translation protein, **Journal of Molecular Evolution**, 84(2-3): 69-84. doi: 10.1007/s00239-017-9781-0

Zakas, P. M., Brown, H. C., Knight, K., Spencer, H. T., Gaucher, E. A., Doering, C. B. (2017) Bioengineering coagulation Factor VIII through ancestral sequence reconstruction, *Nature Biotechnology*, 35(1): 35-37. doi: 10.1038/nbt.3677

(News & Views, Nat. Biotech.)

Randall, R. N., Radford, C. E., Roof, K. A., Natarajan, D. K., Gaucher, E. A. (2016) An experimental phylogeny to benchmark ancestral sequence reconstruction, *Nature Communications*, 7:12847.

(selected by two F1000, tweeted by Nature Editor)

Tan, P. K., Farrar, J. E., Gaucher, E. A., Miner, J. N. (2016) Coevolution of the URAT1 transporter and uricase: implications for serum uric acid homeostasis and gout during primate evolution, *Molecular Biology & Evolution*, 33(9):2193-2200.

(Selected for Fast-track)

Romero-Romero, M. L., Risso, V. A., Martinez-Rodriguez, S., Gaucher, E. A., Ibarra-Molero, B., Sanchez-Ruiz, J. M. (2016) Selection for protein kinetic stability connects denaturation temperatures to organismal temperatures and provides clues to Archaean life, *PLoS One*, 11(6):e0156657.

Cox, V. E., Gaucher, E. A. (2015) Molecular evolution directs protein translation using unnatural amino acids. *Current Protocols in Chemical Biology*, 7(4):223-228.

Risso, V. A., Manssour, F., Delgado-Delgado, A., Arco, R., Barroso-delJesus, A., Ingles-Prieto, A., Godoy-Ruiz, R., Gavira, J. A., Gaucher, E. A., Ibarra-Molero, B., Sanchez-Ruiz, J. M. (2015) Mutational analyses on resurrected ancestral proteins reveal conservation of site-specific amino acid preferences over billions of years. *Molecular Biology and Evolution*, 32(2):440-455.

Cox, V. E., Gaucher, E. A. (2014) Engineering proteins by reconstructing evolutionary adaptive paths. *Methods in Molecular Biology*, 1179:353-563.

Cicerchi, C., Li, N., Kratzer, J. T., Garcia, G., Roncal-Jimenez, C. A., Tanabe, K., Hunter, B., Rivard, C. J., Sautin, Y. Y., Gaucher, E. A., Johnson, R. J., Lanaspá, M. A. (2014) Uric acid-dependent inhibition of AMP kinase induces hepatic glucose production in diabetes and starvation: evolutionary implications of the uricase loss in hominds. *FASEB J.*, 28(8):3339-3350.

Risso, V. A., Gavira, J. A., Gaucher, E. A., Sanchez-Ruiz, J. M. (2014) Phenotypic comparisons of consensus variants versus laboratory resurrections of Precambrian proteins. *Proteins*, 82(6):887-96.

Veleva-Rotse, B. O., Smart, J. L., Baas, A. F., Edmonds, B., Zhao, Z. M., Brown, A., Klug, L. R., Hansen, K., Reilly, G., Gardner, A. P., Subbiah, K., Gaucher, E. A., Clevers, H., Barnes, A. P. (2014) STRAD pseudokinases regulate exogenesis and LKB1 stability. *Neural Dev.*, 9:5.

Kratzer, J. T., Lanaspá, 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*, 111(10):3763-3768.

(PNAS accompanying commentary, by Belinda Chang)

(Press coverage by National Geographic and many others)

Kaçar, 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 patterns. **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.

Zhou, Y., Asahara, H., Gaucher, E. A., Chong, S. (2012) *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., Lanaspá, 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.

#co-first authors

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.

C. Patents:

- 2022 Gaucher, E. A., Tran, L., Finn, M. G., Das, S. Delivery of therapeutic recombinant uricase using nanoparticles. Disclosure vetted by internal and external counsel, currently being prepared for International Patent Application.
- 2019 Zakas, P, Lillicrap, D., Doering, C., Spencer, T., Radford, C., Gaucher, E. Von Willebrand Factor Proteins for Treating Bleeding Disorders. U.S. Patent Application Serial No. 62/580,133 International Patent Application No. PCT/CA2018/051389
- 2019 Doering, C., Spencer, H., Radford, C., Gaucher, E. Ancestral and Bioengineered Coagulation Factor IX Variants. U.S. PCT Application No. PCT/US2018/031881
- 2015 'Variants of Ancestral Coagulation Factor VIII and Their Uses', U.S. Patent and Trademark Office & PTC, with Emory University, *pending*
- 2010 'Variants of Ancestral Uricases and Use Thereof', U.S. Patent and Trademark Office & PTC, **issued**
- 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, **issued**

E. Grants and Contracts: Date, Title, Agency, Amounts and Duration if >1 year

E1. As Principal Investigator:

- 2022 'Evolution of Urate Metabolism', NIH R01, PI, \$3,700,000, 5 years (renewal pending)
- 2021 'NSF-BSF: Unraveling the molecular determinants of protein evolution', NSF, PI, \$1,200,000, 4 years
- 2017 'Evolution of Urate Metabolism', NIH R01, PI, \$1,700,000 total costs, 5 years
- 2016 Abell Professorship, GT School of Biology, PI, \$40,000
- 2015 'GAANN Traineeship: GT School of Biology', PI, Department of Education, \$442,917, three years
- 2015 'Recombinant uricases to develop gout therapeutics', PI, GRA, \$110,000
- 2015 'Engineering protein-based biinks for 2D printing', PI, GT/IEN Seed Grant, \$6,000
- 2013 'Young Professor Award', DuPont, \$75,000
- 2013 'Early Career Fellowship', NASA, PI, \$100,000

- 2013- 'Experimental evolution and resurrected ancestral genes to study historical contingency and
2016 determinism', NASA, PI, 3 years, \$170,000/year in total costs
- 2012 'Computational-based Optimization of Recombinant Therapeutic Uricase Production', TRIBES-GTRI
Seed Grant, \$37,000
- 2012- 'Experimental phylogenies to benchmark ancestral sequence reconstruction', NSF, PI, 3
2015 years, \$227,000/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)
- 2008- 'Exploiting paleogenetics and experimental-evolution to reconstruct and recapitulate
2012 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)

E2. As Co-Principal Investigator:

- 2021 'Ancestral Sequence Reconstruction Engineering of Coagulation Factors', NIH, Co-I, our portion
\$210,000, 4 years (w/Emory University)
- 2018 'De novo enzyme evolution using ancestral proteins as scaffolds', Human Frontier Science Program,
Co-I, our portion \$300,000 total costs, 5 years (w/University of Granada, U of Minnesota)
- 2016 'Engineering the Translation Apparatus for the Synthesis of Electronically
Active Sequence-defined Polymers', Department of Defense, co-I, subaward, our portion \$1,142,625
total costs, 7 years (w/Northwestern, UT – Austin, UIUC)
- 2015 'Recombinant FVIII to develop novel therapeutics for hemophilia', Co-I, GT/CHOA Pediatric Center for
Innovation, \$50,000 (w/Emory University)
- 2015 'Recombinant FVIII to develop novel therapeutics for hemophilia', Co-I, Bayer, \$50,000 (w/Emory)
- 2009- 'The Georgia Tech center for ribosome adaptation and evolution', NASA, Co-I, 5 years,
2014 \$650,000 in total costs to my laboratory

F. Other Scholarly and Creative Accomplishments

- 2010 Formed Start-Up Company General Genomics, LLC. This company exploits protein engineering
principles from the Gaucher Group and applies them to commercial and biotherapeutic proteins.

IV. Teaching/Advising

A. Courses taught (reverse chronological order):

			Students
Spring, 2009	4802/8802-D	Special Topics: Evol. & Syn. Biol.	6
Fall, 2010	4802-F	Special Topics: Astrobiology	11
Spring, 2010	4450-C	Senior Seminar	12
Spring, 2011	4450-D	Senior Seminar	15
Spring, 2011	4590-B	Research Project Lab	16
Fall, 2011	3600-A	Introduction to Evolution	48
Fall, 2011	4803-D	Astrobiology	27
Fall, 2011	8803-C	Astrobiology	8
Spring, 2013	1510	Principles of Biology	190
Spring, 2013	3600	Introduction to Evolution	70
Fall, 2013	3600	Introduction to Evolution	56
Fall, 2014	4450-C	Senior Seminar	12
Spring, 2015	1510	Principles of Biology	190
Fall, 2015	3600	Introduction to Evolution	33
Fall, 2015	8803	Special Topics: Frontiers in Molecular Biology	7
Fall, 2016	8803	Special Topics: Frontiers in Molecular Biology	9
Fall, 2016	4460-C	Communicating Biology Research	12
Spring, 2017	1510	Principles of Biology	130
Fall, 2019	2108	Principles of Biology II	97
Fall, 2020	8700	Biology Seminar	47

Fall, 2021	2108	Principles of Biology II	99
Fall, 2022	6640	Bioinformatics	26

A. Ph.D. students:

Ziming Zhao, Ph.D., arrived Fall 2008 (graduated currently a postdoc at Yale University)
 James Kratzer, Ph.D. - Chemistry, arrived Spring 2009 (recipient GT TI:GER graduate student Fellowship),
 graduated (currently working for pharmaceutical company)
 Vanessa Cox, Ph.D. - Chemistry, arrived Spring 2012 (passed qualification exams)
 Jennifer Farrah, Ph.D., arrived Fall 2015 (GT Presidential Fellow)
 Nolan English, Ph.D., arrived Fall 2016 (GT Presidential Fellow)
 Lake Li, Ph.D., arrived 2018
 Lanqiao Xiong, Ph.D., arrived 2018
 Nurul 'Ballanah' Torbett, arrived 2021

B. M.S. students (all with thesis option):

Ercan Cacan, M.S., graduated 2011
 Racchit Thapliyal, M.S., graduated 2011
 Joshua Stern, M.S., (recipient NASA graduate student Fellowship, 2010-2013), graduated 2013
 Deepak Unni, M.S. bioinformatics, graduated Fall 2014
 Krutika Gaonkar, M.S. bioinformatics, graduated Fall 2014
 Will Butler, M.S. biology, graduated Fall 2014
 Petar Penev, M.S., bioinformatics, graduating Fall 2016
 Hameed Sanusi, M.S., bioinformatics, arrived Fall 2022

C. Undergraduate students:

Amreen Fazal, undergraduate, graduated 2010
 Christina Graves, undergraduate, graduated 2011 (received Ph.D. from University of Florida, postdoc at
 Rockefeller University, currently Assistant Professor UNC – Chapel Hill)
 Brian Kwan, undergraduate, graduated Spring 2013
 Kelsey Gratton, undergraduate, Petit Scholar, graduated Spring 2013
 Peter Schnaak, undergraduate, Petit Scholar, graduated Spring 2015 (M.D. student Vanderbilt)
 Divya Natarajan, undergraduate, graduated Spring 2015 (Master's program Cambridge)
 Kelsey Roof, undergraduate, arrived summer 2015
 Caelan Radford, undergraduate, arrived summer 2015 (current Ph.D. student in Jesse Bloom's group, UW)
 Divya Shah, undergraduate, arrived 2018
 Muhammad Numan, undergraduate, arrived 2018
 Shyanna Lowers, SLOAN undergraduate fellow, arrived 2018
 Theresa Parker, undergraduate, arrived 2019
 Steve Herrera, undergraduate, arrived 2019
 Mehjabin Khan, undergraduate, arrived 2019
 Sara Desta, undergraduate, arrived 2020
 Natalie Santana, undergraduate, arrived 2020
 Amelia Floryance, undergraduate, arrived 2021
 Caleb Smith, undergraduate, arrived 2022
 Calvin Kottke, undergraduate, arrived 2022

D. Service on thesis or dissertations committees

Tracey Hazen, M.S. committee, defended 2009
 Andrey Kislyuk, Ph.D. committee, defended 2010.
 Anna Duraj-Thatte, Ph.D. committee, defended 2012
 Elsa Zhao, Ph.D. committee, defended 2013 (currently postdoc at Rockefeller University)
 Chad Bernier, Ph.D. committee, defended 2014
 Lively Lie, Ph.D. committee, defended 2015

Eric Parker, Ph.D. committee, defended 2016
 Mary Beth Wilhelm, Ph.D. committee, entered School of Earth and Atmospheric Sciences 2012
 Nick Kovacs, Ph.D. committee, entered School of Chemistry 2013
 Emily Yasi, Ph.D. committee, entered School of Chemistry 2014
 Rena Ingram, Ph.D. committee, entered School of Chemistry 2014
 Allison Geoghan, Ph.D. committee, entered School of Chemistry 2014
 Martin Solano, Ph.D. committee, entered School of Chemistry 2014
 Timothy Fisher, Chair Ph.D. candidacy exam, Department of Biology 2021
 Oluwatomi Amuda, Member Ph.D. candidacy exam, Department of Biology 2021
 Shannon Stone, Chair Ph.D. candidacy exam, Department of Biology 2021 (extended to 2022)
 Corbett Ouellette, Chair Ph.D. candidacy exam, Department of Biology, Fall 2022

E. Mentorship of postdoctoral fellow or visiting scholars

Dr. Betül Kaçar (Emory, Ph.D.), arrived Fall 2009 (recipient of NASA Astrobiology Postdoctoral Fellowship, 2012-2014) (currently Faculty, University of Arizona)
 Dr. Megan Cole (MIT, Ph.D.), arrived Fall 2009 (recipient NRSA NIH Postdoctoral Kirschstein Fellowship, 2010-2013) (currently Faculty, Emory University)
 Dr. Michael Gromiha (AIST, JAPAN), visited during Fall 2009 (currently Faculty, Indian Institute of Technology)
 Dr. Raul Perez Jimenez (Visiting Columbia University), visited Summer 2011
 Dr. Diego Fernando Mejia Carmona (Visiting from Granada University), visited Summer 2011
 Adam Thomas (Visiting Ph.D. from University of Exeter), visited Spring 2016
 Dr. Yosuke Hoshino (Macquarie University, Ph.D.), arrived Fall 2016 (recipient of Agouron Postdoctoral Fellowship, \$130,000)
 Dr. Mariko Matsuura (University of Florida, Ph.D.), arrived Spring 2017
 Dr. Liliam Martinez-Bello (University of Valencia, Ph.D.), arrived Fall 2018
 Dr. Lais Balico (University of Sao Paulo, Ph.D.), arrived Fall 2018

V. Service

A. Professional Contributions:

2023 Human Frontier Science Program (HFSP), *ad hoc* grant reviewer
 2021-2022 U.S.-Israel Binational Science Foundation (BSF), Panel Reviewer
 2020 Cottrell Scholars, Research Corporation for Science Advancement, *ad hoc* grant review
 2020 Alfred P. Sloan Foundation, *ad hoc* grant reviewer
 2020 NASA Astrobiology/Exobiology, *ad hoc* grant reviewer
 2020 Austrian Science Fund (FWF), *ad hoc* grant reviewer
 2020 National Science Centre (Poland), *ad hoc* grant reviewer
 2020 Panel Reviewer for Fellowship: Genes, Genomes, and Genetics, NIH (March & June)
 2020 Canada Research Chairs, *ad hoc* reviewer
 2019 State of Nevada, *ad hoc* Regents' Researcher Award Reviewer
 2017 Department of Energy, Microbial Biosystems Panel Reviewer
 2017 Panel Reviewer for Genetic Variation & Evolution, NIH
 2016 Panel Reviewer for Genetic Variation & Evolution, NIH
 2016 Royal Society, *ad hoc* reviewer
 2016 Canada Research Chairs, *ad hoc* reviewer
 2015 NSF, Panel Reviewer for Molecular and Cellular Biosciences
 2014 NSF, Panel Reviewer for Molecular and Cellular Biosciences
 2013 NASA, *ad hoc* 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
 2010-2014 Associate Editor BMC Evolutionary Biology
 2009-present NASA, EPSCoR grant proposal reviewer

2009-present Canada Research Chairs, *ad hoc*
 2008-2014 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*, *Genome Biology and Evolution*, *International Journal of COPD*, *Journal of Cystic Fibrosis*, *Journal of Molecular Biology*, *Journal of Molecular Evolution*, *Molecular Biology and Evolution*, *Nature*, *Nature Communications*, *Nature Ecology 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*.

B. Public and Community Service

2020-present Science Fair Judge, Clayton County Middle and High School Fairs
 2019-present Collaborative outreach with Clayton County Superintendent to enhance STEM outcomes for teachers and students.
 2010-present President, General Genomics, LLC
 2009-present Board of Directors, Foundation for Applied Molecular Evolution, Gainesville, FL
 2009-present Host 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
 2012 Georgia Public Broadcasting, radio interview on resurrecting ancient proteins
 2011 Atlanta Botanical Gardens, Science Café, presentation to the public on resurrecting ancient proteins

C. Institute Committees - Georgia Tech (prior to 2017) / Georgia State University (2017-present):

2022 Faculty Search Committee, Member
 2022-present Faculty Senate, Planning and Development Committee
 2022-present Faculty Senate, Research Committee
 2022 Chair, Triennial Review Committee
 2021-2022 Promotion and Tenure Review Committee, Chair
 2021-2022 Faculty Search Committee, Chair
 2019-present Executive Committee, Department of Biology
 2019-present Undergraduate Committee, Department of Biology
 2019-present Curriculum Assessment & Review Committee, Department of Biology
 2017-2019 Director, School of Biology
 2015-2017 School of Biology, Endowed Faculty Search, Chair
 2014-2017 Associate Chair of Research, School of Biology
 2014-2017 GT Research Advisory Committee
 2014-2017 GT Conflict of Interest Committee
 2014-2017 GT Library Faculty Advisory Board
 2014-2017 GT Postdoctoral Advisory Council
 2014-2015 School of Biology, Synthetic Biology/Neuroscience Faculty Search
 2013-2014 School of Biology, Systems/Synthetic Biology Faculty Search
 2012-2014 School of Biology, Graduate Student Committee
 2009-2012 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
2009-2017 School of Biology, Cherry Emerson Space Committee