Eric Libby

Santa Fe Institute
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EDUCATION/ EMPLOYMENT

Santa Fe Institute — 2013-present
Santa Fe, United States
Omidyar Fellow

New Zealand Institute for Advanced Study, Massey University — 2009-2013
Auckland, New Zealand
Postdoctoral Fellow
Supervisor: Prof. Paul Rainey

AAAS Mass Media Fellowship — 2008
Washington DC, United States
Science journalist at Voice of America
Wrote and recorded 21 radio pieces with web content

McGill University — 2002-2007
Montreal, Canada
PhD in Quantitative Physiology
Dissertation: Investigations into the design and dissection of genetic networks
Supervisor: Prof. Leon Glass

Rice University — 1998-2002
Houston, United States
Bachelor of Arts in Computational and Applied Mathematics, *summa cum laude*
Supervisor: Prof. Steve Cox

GRANTS/ SUBMITTED

NASA Exobiology (Under Review, thus far labelled Selectable and Competitive) 2015
CoPI with Matthew Herron and William Ratcliff
"Origin and evolutionary consequences of multicellular life cycles", $870,210 USD

NSF IOS preproposal (submitted) 2015
CoPI with William Ratcliff
"Origin of multicellular complexity in experimentally-evolved *Saccharomyces cerevisiae*"

NSF DEB preproposal (submitted) 2015
CoPI with Ben Kerr and William Ratcliff
"Origin and consequences of fitness decoupling during the evolutionary transition to multicellularity"

GRANTS/ AWARDED

John Templeton Foundation: Foundational Questions in Evolutionary Biology 2012
CoPI with Paul Rainey and Ben Kerr
"Theoretical and empirical analyses of the evolution of emergence during the transition in individuality from single-celled to multicellular organisms", $400,000 USD

Royal Society of New Zealand: Marsden Fund for fundamental research 2010
CoPI with Prof. Paul Rainey
"Principles of genetic evolution", $870,000 NZD

MENTORING

Co-supervisor PhD student Yuriy Pichugin	2011-present
Supervisor INSPIRE (high school researcher) Isabelle Kuziel	2014-present
Supervisor INSPIRE (high school researcher) Grecia Morales	2014-present
Supervisor REU (undergraduate researcher) Emma Wolinsky	2014
Co-supervisor graduate student Sumona Mitra	2012-2013
Co-supervisor summer graduate student Sathej Gopalakrishnan	2009

PUBLICATIONS

Gallie, J., **Libby, E.**, Jendresen, CB., Bertels, F., Ferguson, G.C., Beaumont, H.J.E., Kilstrup, M., & Rainey, P.B. (2015) Natural selection exploits molecular noise to generate a bistable phenotypic switch (accepted at *PLoS Biology*)

Libby, E., & Ratcliff W.C. (2014) Ratcheting the evolution of multicellularity. *Science*, 346(6208):426-7.

Ratcliff, W.C., Hawthorne, P., & **Libby, E.** (2014) Courting disaster: how diversification rate affects fitness under risk. *Evolution*, 69(1):126-35.

Libby, E., Kerr, B., Ratcliff, W.C., & Travisano, M. (2014) Geometry shapes evolution of early multicellularity. *PLoS Comp Biol*,10(9):e1003803.

Libby, E. (2014) "Self-Organization and Emergence" chapter in *Discoveries in Modern Science: Exploration, Invention, Technology.* editors: James Trefil, Patricia Daniels, Donna McPhie, & Craig Schiffries.

Machovsky Capuska, G.E., Hauber, M., **Libby, E.**, Amiot, C., & Raubenheimer, D. (2014) The contribution of private and public information in foraging by Australasian gannets. *Animal Cognition*, 17(4), 849-858.

Libby, E., & Rainey, P.B. (2013) Eco-evolutionary feedback and the tuning of protodevelopmental life cycles. *PLoS One*, 8(12): e82274.

Libby, E., & Rainey, P. B. (2013). A conceptual framework for the evolutionary origins of multicellularity. *Physical Biology*, 10, 035001.

Libby, E. (2013) "A Microcosm of Evolution" chapter in *Notas de Modelación y Métodos Numéricos. Mathematical Modeling of Biological Systems: From Molecules to Populations.* editors: Miguel Angel Moreles Vázquez & Salvador Botello Rionda.

Machovsky-Capuska, G.E., Hauber, M.E., Dassis, M., **Libby, E.**, Wikelski, M.C., Schuckard, R., Melville, D.S., Cook, W., Houston, M., Raubenheimer, D. (2013) Foraging behaviour and habitat use of chick-rearing Australasian Gannets in New Zealand. *Journal of Ornithology.* doi:10.1007/s10336-013-1018-4.

Libby, E., & Rainey, P. B. (2011). Exclusion rules, bottlenecks and the evolution of stochastic phenotype switching. *Proceedings of the Royal Society B: Biological sciences.* doi:10.1098/rspb.2011.0146.

Rainey, P. B., Beaumont, H. J. E., Ferguson, G. C., Gallie, J., Kost, C., **Libby, E.**, & Zhang, X.-X. (2011). The evolutionary emergence of stochastic phenotype switching

in bacteria. *Microbial Cell Factories*, 10 Suppl 1, S14.

Ritchie, S. R., Fraser, J. D., **Libby, E.**, Morris, A. J., Rainey, P. B., & Thomas, M. G. (2011). Demographic variation in community-based MRSA skin and soft tissue infection in Auckland, New Zealand. *The New Zealand Medical Journal*, 124(1332), 21-30.

Libby, E., & Glass, L. (2010). The calculus of committee composition. *PLoS One*, 5(9), e12642.

Cardin, S., Pelletier, P., **Libby, E.**, Le Bouter, S., Xiao, L., Kääb, S., Demolombe, S., Glass, L., & Nattel, S. (2008). Marked differences between atrial and ventricular gene-expression remodeling in dogs with experimental heart failure. *Journal of Molecular and Cellular Cardiology*, 45(6), 821-831.

Burstein, B., **Libby, E.**, Calderone, A., & Nattel, S. (2008). Differential behaviors of atrial versus ventricular fibroblasts: a potential role for platelet-derived growth factor in atrial-ventricular remodeling differences. *Circulation*, 117(13), 1630-1641.

Libby, E., Perkins, T. J., & Swain, P. S. (2007). Noisy information processing through transcriptional regulation. *Proceedings of the National Academy of Sciences of the United States of America*, 104(17), 7151-7156.

Cardin, S., **Libby, E.**, Pelletier, P., Le Bouter, S., Shiroshita-Takeshita, A., Le Meur, N., Léger, J., Demolombe, S., Ponton, A., Glass, L., & Nattel, S. (2007). Contrasting gene expression profiles in two canine models of atrial fibrillation. *Circulation Research*, 100(3), 425-433.

Wang, T.-T., Tavera-Mendoza, L. E., Laperriere, D., **Libby, E.**, MacLeod, N. B., Nagai, Y., Bourdeau, V., Konstorum, A., Lallemant, B., Zhang, R., Mader, S., & White, J.H. (2005). Large-scale in silico and microarray-based identification of direct 1,25-dihydroxyvitamin D3 target genes. *Molecular Endocrinology*, 19(11), 2685-2695.

MANUSCRIPTS

Wolpert, D.H., Grochow, J.A., **Libby, E.**, DeDeo, S. (2014) A framework for optimal high-level descriptions in science and engineering—preliminary report. (http://arxiv.org/abs/1409.7403)

Ratcliff, W.C., **Libby, E.**, & Driscoll, W.W. (2015) Bet hedging selects for microbial programmed cell death.

Wolinsky, E., & **Libby, E.** (2015) The Evolution of a Developmental Program from a Stochastic Response.

Libby, E., & Ratcliff, W.C. (2015) Success and Extinction: Stochastic Switching in Temporally Correlated Fluctuating Environments.

Libby, E., & Herron, M. (2015) Life Cycle Evolution in a Coupled Moran Process.

TALKS & SEMINARS

SFI Meeting: Major Transitions in Natural, Synthetic, and Artificial Evolution 2014
"Early Steps in the Transition to Multicellularity"

SFI Meeting: Information Theory, Ecosystems, and Schrodinger's Paradox 2014
"A framework for optimal high-level descriptions in science and engineering"

Station biologique de Roscoff, France 2014
"The Evolution of Biological Complexity"

SFI Complex Systems in Political and Social Sciences Workshop 2014
"The Evolution of Biological Complexity"

ASM Conference on Experimental Evolution 2014
"Geometry Shapes Early Evolution of a Multicellular Organism"

University of Montana Division of Biological Sciences 2014
"Shaping the evolution of early multicellularity"

Princeton University Evolutionary Biology Department 2014
"Geometry shapes evolution of early multicellularity"

Project GUTS / Code.org Curriculum Workshop 2014
"Mathematics and Modeling in Experimental Evolution"

Northern New Mexico College 2014
"The Evolutionary Origins of Multicellularity: Theoretical and Experimental Approaches"

Los Alamos National Laboratory 2013
"Theoretical Approaches to the Evolutionary Origins of Multicellularity"

University of Massachusetts Dartmouth Department of Biology 2013
"Evolutionary Origins of Multicellularity"

Santa Fe Institute 2013
"Evolutionary Origins of Multicellularity"

Allan Wilson Centre for Molecular Ecology and Evolution Annual Meeting 2012
"Modeling the Emergence of Primitive Complexity"

Cystic Fibrosis: Ecology, Evolution, and Eradication Workshop Telluride 2011
"Modeling Approaches of Microbial Communities in the CF Lung"

Centre for Applied Mathematics in Bioscience and Medicine invited speaker 2010
"Evolutionary Origins of Stochastic Switching"

University of Washington Department of Biology 2009
"Experimental Evolution of a Stochastic Switcher"

Auckland Bioinformatics Department invited speaker 2009
"The Number of Judges: Balancing Cost and Accuracy from Figure Skating to Grant Reviews"

McGill Physiology Department invited speaker 2007
"A Poor Mans Juicing Of Microarray Data"

McGill Graduate Research Day 2006
"Probe by Probe: Detecting Differential Expression on Affymetrix Microarrays"

POSTERS Gordon Conference on Microbial Stress Responses 2014

"Deterministic and Stochastic Stress Responses"

Gordon Conference on Microbial Population Biology 2011
"Stochastic switchers as an evolutionary route to multicellularity"

Gordon Research Conference: Stochastic Physics in Biology 2011
"Stochastic switchers as an evolutionary route to multicellularity"

15th Annual International Conference on Intelligent Systems for Molecular Biology (ISMB) & 6th European Conference on Computational Biology (ECCB). Vienna, Austria. 2007
"Probing the Probeset"

MITACS (The Mathematics of Information Technology and Complex Systems) and CAIMS (Canadian Applied and Industrial Mathematics Society) joint Meeting. 2006
"Probing the Probeset"

TEACHING

Complex Systems Summer School 2014
Lecture on the Evolution of Biological Complexity

REU Tutorial Series 2014
Introduction to programming in MATLAB

Course: Lecturer in Genetics and Evolution, 3rd year course 2009-2012
Covers evolutionary algorithms, game theory, lac operon models, genetic networks, systems biology, the evolution of cooperation

Mathematical Modeling of Biological Systems: From Molecules to Populations 2012
Workshop in CIMAT, Guanajuato, Mexico
Invited speaker: Mathematics in Evolution

Course: Teaching assistant for Mathematical Models in Biology 2003-2006
Covers finite difference equations, boolean network dynamics, fractals, continuous differential equations, and chaos

Lab: Cardiovascular lab with electrocardiographs 2003, 2007

Lab: Compound action potentials with frog sciatic nerves 2005, 2006

Lab: Fourier analysis of sleeping cycles and blood pressure 2004-2006

Lab: Modeling circadian rhythm genetic networks 2005

Lab: Vestibular ocular reflex 2004

Lab: Signal acquisition and processing with Fourier transforms 2003

Lab: Modeling chemical reactions with differential equations 2003

Teaching assistant in matrix analysis, physics, and calculus 1999-2002

PUBLIC SERVICE

Science on Screen "*Alien* and the Evolution of Complex Parasite Life Cycles" 2014

Science Radio Cafe interview about research 2014

Science Club "Routes to Multicellularity" 2014

Santa Fe Watershed Association annual river clean up 2014

Wrote "Pond scum offers clues to life's puzzles" in *Santa Fe New Mexican* 2014

Santa Fe Watershed Association outdoors science field trip 2014

Slice of Science "The Biological Individual" 2014

Radio NZ: Our Changing World interview about research 2011

Radio and online science journalist VOA, author of 21 pieces 2008

ACADEMIC SERVICE

Reviewer for journals *PLoS Comp Bio* (3), *Genetics* (2), *Science* (1), *Proc B* (1), *J. R. Soc. Interface* (1), *Phys Biol* (1) 2009-present

Georgia Southern University, Complex Adaptive Systems curriculum reviewer 2015

Code.org Workshop on curriculum development 2014

Reviewer for *Science* Books and Film 2008-2013

Organizer of Massey University Institute of Natural Sciences and New Zealand Institute for Advanced Study seminar series 2011-2012

F1000 reviewer 2010-2013

Physiology Graduate Society president 2003-2007

REFERENCES

Prof. Paul Rainey

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Web:	`http://evolution.massey.ac.nz/rainey/paul.shtml`
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