Sean P. Stromberg

CONTACT INFORMATION

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RESEARCH INTERESTS

The goal of any complex system analysis is to identify the key degrees of freedom, out of many, that capture the behavior of interest. My emphasis has been multifaceted, looking at immunology, epidemiology, human social dynamics, and human decision making. I am drawn to problems where heterogeneity, stochasticity or non-linear dynamics plays a critical role, and where a multi-scale approach can resolve uncertainties. I frequently explain the properties of complex systems in terms of tradeoffs.

EDUCATION

University of California, Santa Barbara
Ph.D. Physics, December 2009; **Area of Specialization:** Systems Biology
Dissertation: *Dynamics of Immune System Vulnerabilities*
Committee: Jean M. Carlson (advisor), Everett Lipman, Boris Shraiman

University of California, Santa Cruz
B.S. Physics, *with highest honors*
Thesis: *The bending of light from General Relativity and Spherically Symmetric Indices of Refraction*

RESEARCH EXPERIENCE

University of California, Santa Barbara, Department of Physics and Institute for Collaborative Biotechnologies (ICB)

2012-present *Postdoctoral Researcher*
Collaborators: Jean Carlson (advisor), Danielle Bassett, David Alderson, Kimberly Schlesinger
Projects: Epidemiology and tradeoffs associated with transmissible vaccinations where the basic reproductive ratio is low (theory). Pathogen population-genetics and speciation during infection (theory). Dynamics of human decision making and social networks during a disaster response (experiment). The utility of accurate information to act as a vaccine during an epidemic of fear (theory and experiment). The cost and robustness tradeoffs in group decision making (theory and experiment).

Emory University, Department of Biology, Atlanta, Georgia

2010-2012 *Postdoctoral Researcher*
Collaborators: Rustom Antia (advisor), Ilya Nemenman, Philip L.F. Johnson, Benjamin Youngblood
Projects: Theory of novel vaccine technique by delayed treatment of infections. Theory of chronic infections with T cell exhaustion and thymic influx. Population epigenetics of rapid single locus demethylation. Development of "population expression models" which integrate the dynamics of gene product expression and population dynamics.

RESEARCH EXPERIENCE (cont.)

University of California, Santa Barbara, Department of Physics and Institute for Collaborative Biotechnologies (ICB)

2004-2009	*Graduate Student Researcher*
Collaborators:	Jean M. Carlson (advisor), John C. Doyle, Frank Doyle
Projects:	Multi-scale modeling and systems biology of anomalous immune responses. Examples being: aged immune systems, autoimmune disease, and dengue hemorrhagic fever.
2003-2004	*Graduate Student Researcher*
Collaborators:	Joseph Incandela, Einar Nygard (Interon Corporation)
Projects:	Work on CDF at Fermilab and Development of front-end amplifier for next generation CAT scan sensor. Circuit design and layout of low-noise, low-power, application specific integrated circuit.

Lawrence Berkeley National Lab, Semiconductor Based Radiation Detector Group, Berkeley, California

2001-2002	*Materials Scientist/Engineer*
Supervisors:	Mark Amman, Craig Tindall, Paul Luke
Projects:	Processing semiconductor radiation detectors including mechanical preparation of planar detectors, surface treatment via chemical etchants, thermal depositions, and sputtering, and bulk doping via lithium drifting. Testing prepared detectors with laboratory radiation sources. Mechanical design and construction of testing apparatus for segmented planar detectors. Design construction and implementation of automated control system for lithium drifting silicon wafers.

Xenogen Corp. (Now Caliper), Alameda, California

2000-2001	*Quality Assurance/Service Engineer*
Supervisors:	Bo Nelson, Brad Rice
Projects:	Qualifying, calibrating, troubleshooting, installing and servicing cryogenic cameras for in-vivo bio-photonic imaging systems. Astrophysical quality cameras used in imaging bio-luminescent transgenic cells in living mammal tissue. Technology used for scientific research and drug development.

Santa Cruz Institute for Particle Physics (SCIPP)
University of California, Santa Cruz

1998-1999	*Undergraduate Research Assistant*
Supervisors:	Hartmut Sadrozinski, Robert Johnson
Projects:	Dose rate dependance of radiation damage to bipolar transistors for ATLAS experiment. Development of quality control system for testing detectors and hybrid electronics for Fermi Gamma Ray Space Telescope.

Publications

Sean P Stromberg, Ilya Nemenman, Rustom Antia, "Population-expression models of immune response," *Physical Biology* **10(3)**, 035010, (2013).

Sean P Stromberg and Jean M Carlson, "Diversity of T-cell responses," *Physical Biology* **10(2)**, 025002, (2013).

Sean P Stromberg and Rustom Antia, "On the roll of CD8 T cells in the control of chronic infections," *Biophysical Journal* **103(8)**, 18021810, (2012).

Sean P Stromberg and Rustom Antia, "Vaccination by Delayed Treatment of Infection," *Vaccine* **29(52)**, doi:10.1016/j.vaccine.2011.10.047, (2011).

Sean P Stromberg and Jean M Carlson, "Suppression of Immune System Disorders by Passive Attrition," *PLoS One* **5(3)**, e9648, (2010).

Sean P Stromberg, "Dynamics of Immune System Vulnerabilities (Dissertation)," *Dissertation Abstracts International* **71(02), Section: B**, p1083, (2009).

Sean P Stromberg and Jean M Carlson, "Robustness and Fragility in Immunosenescence," *PLoS Computational Biology* **2(11)**, p1475-1481, (2006).

Atwood E, Atwood W, et al., "The silicon tracker of the beam test engineering model of the GLAST large-area telescope," *Nucl. Instrum. Meth. A* **457(1-2)**, p126-136, (2001).

Allport P, Atwood E, Atwood W, et al., "The assembly of the silicon tracker for the GLAST beamtest engineering model," *Nucl. Instrum. Meth. A* **466(2)**, p376-382, (2001).

Dorfan D, Dubbs T, Grillo AA, et al., "Measurement of dose rate dependance of radiation induced damage to the current gain in bipolar transistors," *IEEE Trans. Nucl. Sci.* **46(6)**, p1884-1890, (1999).

Under Review

Jean Carlson, David Alderson, Sean Stromberg, Danielle Bassett, Emily Craparo, Francisco Gutierrez-Villarreal, Thomas Otani, "Measuring and Modeling Behavioral Decision Dynamics in Collective Evacuation," *http://arxiv.org/abs/1304.4704*, (2013).

In Preparation

Sean P Stromberg, "Population Epigenetics of Multisite Passive Demethylation," *http://arxiv.org/abs/1210.1237*, (2012).

Kimberly Schlesinger, Sean P Stromberg, Jean Carlson, "Host Pathogen Coevolution During Chronic Infection," , (2013).

Sean P Stromberg, Jean Carlson, David Alderson, "Information as a vaccine in an epidemic of fear," , (2013).

Honors and Awards

2007	Recognition of Gradlife Service, UCSB Physics Department.
2007	Boulder School for Condensed Matter Physics, University of Colorado.
2005	Science Fair Judge, Santa Barbara Middle School.
2003	United States Particle Accelerator School, Fermilab.
1999	Summer Research Fellow, National Science Foundation.
1998-1999	University Scholarship, University of California, Santa Cruz.
1998	Summer Research Fellow, National Science Foundation.

Teaching

2012 *Guest Lecture*
Spectral methods and properties of operators.

2009 *Science Fair Mentor*
Mentored high-school student Carolyn Mathieu who won the gold medal in her county science fair in the mathematics division for her project on the immune response to salmonella infection.

2002-2004 *Teaching Assistant*
University of California, Santa Barbara, Department of Physics
Physics 6C introductory physics for non-physics majors, lab and discussion section for primarily life science students studying electricity and magnetism. Included grading and grade assignment.

Physics 128A and 128B advanced lab course for physics majors, assisted students in upper division experiment course graded lab notebooks, taught error propagation methods.

Physics 129L computer interfacing, taught C programing, computer interfacing and temperature control to upper division physics majors using QNX real-time operating system, graded lab exercises.

2000 Math and Science Tutor
Tutored Math, Physics, Chemistry, Engineering, and Waste-water treatment subjects at community college drop-in tutoring center.

Service

Present Referee: *Vaccine, Journal of Theoretical Biology, PLoS Computational Biology, PLoS One, Theoretical Biology and Medical Modelling, BMC Systems Biology.*

2010 Coordinator, Disease Dynamics Theory Journal Club.

2010 Coordinator, Theoretical Population Biology Journal Club.

2007-2009 Physics Gradlife Committee Co-chair, UC Santa Barbara

2007-2009 Founder and Coordinator, Physics Graduate Student Colloquium

2005 Coordinator, University sponsored panel discussion on scientific ingegrity.

Invited Presentations

2012 Frontiers in Systems Biology, University of California, San Francisco (March)
Dynamics of Gene and Protein Expression when Coupled with Population Dynamics

2009 Omidyar Fellowship Candidate Seminar, Santa Fe Institute (February)
Homeostasis and Autoimmune Suppression

2008 Multi-scale Modeling of Immune Responses Workshop, Center for Infectious Disease Dynamics, PennState University (June)
Immune System Repertoire Dynamics

2007 Workshop on Complexities of Aging in Biological Systems, Santa Fe Institute (March)
Robustness and Fragility in Immunosenescence

Contributed Presentations

2013 Data Mining and Bioinformatics Seminar, UC Santa Barbara (June)
Behavioral Decision Dynamics in Collective Evacuation

2013 Cognitive Neurosciences Seminar, UC Santa Barbara (May)
Behavioral Decision Dynamics in Collective Evacuation

2012 Systems Biology & Theoretical Ecology Seminar, UC Santa Barbara (November)
Population Expression Models

2012 Quantitative Immunology: Experiments meet Modeling, Kavli Institute for Theoretical Physics (December)
Integrating Within-cell Systems Biology and Multicellular Population Dynamics: Pedagogical Talk on Why and How

2012 Theoretical Immunology Seminar, Emory University (March)
Population Expression Models

2011 Candidate Seminar, Prognosys Biosciences (March)
The Suppression of Immune System Disorders by Infectious Diseases

2010 Theoretical Disease Dynamics Seminar, Emory University (October)
Probabilistic Models of within Host Drug Resistance

2009 Theoretical Immunology Seminar, Emory University (February)
Passive Attrition and the Hygiene Hypothesis

2008 Theoretical Immunology Group Seminar, Los Alamos National Lab (July)
Autoimmune Disease vs. Immunological Memory Loss

2008 Theoretical Immunology Group Seminar, Los Alamos National Lab (July)
Immune System Repertoire Dynamics

2008 Theoretical Ecology Seminar, University of California, Santa Barbara (January)
Immune System Dynamics

2007 Theoretical Ecology Seminar, University of California, Santa Barbara (May)
Robustness and Fragility in Immunosenescence

2007 Arkin Lab Group Seminar, Lawrence Berkeley National Lab (May)
Immune System Resource Tradeoffs

2007 Theoretical Immunology Group Seminar, Los Alamos National Lab (March)
Highly Optimized Tolerance in Immunosenescence

2007 Physics Department Graduate Student Colloquium, University of California, Santa Barbara (March)
Introduction to Immunology for Physicists

2005 Institute for Collaborative Biotechnologies Systems Biology Seminar, University of California, Santa Barbara (March)
Evolutionary PLR Dynamics

Posters Presented

2012 Q-bio, Santa Fe NM (August)
Population Expression Models

2012 Systems Approaches in Immunology, Santa Fe NM (January)
T-cell exhaustion and thymic influx in chronic infections

2011 PRiME Symposium on Systems Biology of Influenza, Yale University (July)
Treatment as a Vaccine

2011 Immunologic Memory and Host Defense, Keystone CO (February)
When can Treatment be Used as a Vaccine

Posters Presented (cont.)

2009 Institute for Collaborative Biotechnologies Army-Industry Collaboration Conference, Santa Barbara CA (March)
Mathematical Model of Immunological Memory Loss and the Hygiene Hypothesis

2009 Immunologic Memory and Host Defense, Keystone CO (February)
Mathematical Model of Immunological Memory Loss and the Hygiene Hypothesis

2009 Dynamics Days 2009, San Diego CA (January)
Dynamics of the Hygiene Hypothesis Based on Competition for Growth Factor

2008 Frontiers in Immunological Memory Conference, Irvine CA (October)
Mathematical Model of Immunological Memory Loss and the Hygiene Hypothesis

2008 Physics Department Research Symposium, UC Santa Barbara (March)
Mechanism for Dengue Hemorrhagic Fever

2008 ICB Army-Industry Collaboration Conference, UC Santa Barbara (February)
Exploitation of Immune System Tolerance Mechanisms by the Dengue Virus

2007 Boulder School for Condensed Matter and Materials Physics, Boulder CO (July)
Robustness and Fragility in Immunosenescence

2007 Physics Department Research Symposium, UC Santa Barbara (March)
Immune System Dynamics

2007 Dynamics Days 2007, Boston MA (January)
Highly Optimized Tolerance in Immunosenescence

2007 Dynamics Days 2007, Boston MA (January)
Highly Optimized Tolerance in Immunosenescence

2006 ICB Army-Industry Collaboration Conference, UC Santa Barbara (May)
Robustness and Fragility in Immunosenescence

2005 ICB Army-Industry Collaboration Conference, UC Santa Barbara (April)
Evolutionary H.O.T. Models

References

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Associate Professor
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