

Timothy C. Reluga

Contact Information

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Professional History and Awards

Recipient of 14th Bellman prize for best biannual paper in Mathematical Biosciences for *A general approach to population games with application to vaccination* (September, 2013).

Associate Professor of Mathematics and Biology at Pennsylvania State University, member of the Center for Infectious Disease Dynamics (July, 2013 - present)

Assistant Professor of Mathematics and Biology at Pennsylvania State University (July, 2007 - June, 2013)

Postdoctoral Researcher at Los Alamos National Lab (September, 2006 - June, 2007)

Research Fellow in Epidemiology and Public Health at Yale (October, 2004 - May, 2006)

Ph.D. in Applied Mathematics, supervised by Prof. Mark Kot,
University of Washington, Seattle, WA (June, 2004),
“Results on Temporal and Spatial Heterogeneity in Theoretical Ecology”

Boeing Award for Excellence
Department of Applied Mathematics, University of Washington, 2004

VIGRE Graduate Fellow, University of Washington
(September, 2001 - June, 2003)

Graduate Student, Teaching Assistant, and Lecturer at the University of Washington
(September, 1998 - June, 2004)

B.S. with majors in Biology and Mathematics,
Tufts University, Medford, MA (June, 1998)

Publications

Jing Li, Darla V. Lindberg, Rachel A. Smith, and Timothy C. Reluga. *The systems theory of community health and infectious disease*, submitted, 2013.

Timothy C. Reluga and Allison Shaw. *Optimal migratory behavior in spatially-explicit seasonal environments* Submitted July, 2013.

Assieh Saadatpour, Reka Albert, and Timothy Reluga. *A reduction method for Boolean networks proven to conserve attractors*. accepted to SIAM Journal on Applied Dynamical Systems, August, 2013.

Timothy C. Reluga. *Solutions of an epidemic game with linear social distancing cost*, Bulletin of Mathematical Biology, 2013. doi:10.1007/s11538-013-9879-5

Timothy C. Reluga and Jing Li. *Games of Age-Dependent Prevention of Chronic Infections by Social Distancing*. Journal of Mathematical Biology, May, 2012. doi:10.1007/s00285-012-0543-8

T. Reluga and A. Galvani. *A general approach to population games with application to vaccination*. Mathematical Biosciences, 2011, volume 230(2), 67-78. doi:10.1016/j.mbs.2011.01.003

- D. M. Cornforth, T. C. Reluga, E. Shim, C. T. Bauch, A. P. Galvani, and L. A. Meyers. *Erratic flu vaccination emerges from short-sighted behaviour in contact networks* PLOS Computational Biology, 2011, volume 7(1): e1001062. doi:10.1371/journal.pcbi.1001062
- T. Reluga. *Game theory of social distancing in response to an epidemic*. PLOS Computational Biology, 2010, volume 6 (5): e1000793. doi:10.1371/journal.pcbi.1000793
- T. Reluga. *Branching processes and non-commuting random variables in population biology*. Canadian Applied Math Quarterly Quarterly, 2009, volume 17 (2), 387. [Link](#)
- T. Reluga. *An SIS epidemiology game with two subpopulations*. Journal of Biological Dynamics, 2009, volume 3, 515-531. doi:10.1080/17513750802638399
- T. Reluga, J. Medlock, and A. Galvani. *The discounted reproductive number for epidemiology*. Mathematical Biosciences and Engineering, 2009, volume 6, 377-393. doi:10.3934/mbe.2009.6.377
- T. Reluga, H. Dahari, and A. S. Perelson. *Analysis of hepatitis C virus infection models with hepatocyte homeostasis*. SIAM Journal of Applied Mathematics, 2009, volume 69, 999-1023. doi:10.1137/080714579
- T. Reluga, J. Medlock, and A. S. Perelson. *Backward bifurcations and multiple equilibria in epidemic models with structured immunity*. Journal of Theoretical Biology. May 2008, volume 252, 155-165. doi:10.1016/j.jtbi.2008.01.014
- T. Reluga, D. B. Walton, R. Meza, and A. Galvani. *Reservoir interactions and emerging infectious diseases*. Theoretical Population Biology, November 2007, volume 72, 400-408. doi:10.1016/j.tpb.2007.07.001
- T. Reluga, J. Medlock, E. Poolman, and A. Galvani. *Optimal timing of disease transmission in an age-structured population*. Bulletin of Mathematical Biology, November 2007, volume 69, 2711-2722. doi:10.1007/s11538-007-9238-5
- T. Reluga and J. Medlock. *Resistance mechanisms matter in SIRS models*. Mathematical Biosciences and Engineering, July 2007, volume 4, 553-563. [Link](#)
- A. Galvani, T. Reluga, and G. Chapman. *Long-standing influenza vaccination policy is in accord with individual self-interest but not with the utilitarian optimum*. Proceedings of the National Academy of Sciences of the United States, March 27, 2007, volume 104, 5692-5697. doi:10.1073/pnas.0606774104
- T. Reluga, C. Bauch, and A. Galvani. *Evolving public perceptions and stability in vaccine uptake*. Mathematical Biosciences, November 2006, volume 204, 185-198. doi:10.1016/j.mbs.2006.08.015
- T. Reluga, J. Medlock, and A. Galvani. *A model of spatial epidemic spread when individuals move within overlapping home ranges*. Bulletin of Mathematical Biology, February, 2006, volume 68, 401-416. doi:10.1007/s11538-005-9027-y
- T. Reluga. *On antibiotic cycling and optimal heterogeneity*. Mathematical Medicine and Biology, March 18, 2005, volume 22, 187-208. doi:10.1093/imammb/dqi002
- T. Reluga and S. Viscido. *A model for the evolution of selfish herd behavior*. Journal of Theoretical Biology, January 2005, volume 234, 213-225. doi:10.1016/j.jtbi.2004.11.035
- H. Qian and T. Reluga. *Nonequilibrium thermodynamics of a nonlinear biochemical switch in a cellular signaling process*. Physical Review Letters, January 21, 2005, article 028101. doi:10.1103/PhysRevLett.94.028101
- M. Kot, J. Medlock, T. Reluga, and D. B. Walton. *Stochasticity, invasions, and branching random walks*. Theoretical Population Biology, November 2004, volume 66, 175-184. doi:10.1016/j.tpb.2004.05.005
- T. Reluga. *Analysis of periodic growth-disturbance models*. Theoretical Population Biology, September 2004, volume 66, 151-161. doi:10.1016/j.tpb.2004.05.003

T. Reluga. *A two-phase epidemic driven by diffusion*. Journal of Theoretical Biology, July 2004, volume 229, 249-261. doi:[10.1016/j.jtbi.2004.03.018](https://doi.org/10.1016/j.jtbi.2004.03.018)

Selected Talks

Dynamical systems insights into migration. Everybody Disperses to Miami, in honor of Chris Cosner's 60th birthday, University of Miami, (December 14, 2012).

The mathematics of epidemiology and infectious disease policy. Department of Mathematics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia (October 26, 2012).

Modelling epidemiology and the microeconomics of infectious disease policy. School of Public Health, University of Pittsburgh, Pittsburgh, Pennsylvania (May 3, 2012).

Bard Citizen Science lectures, Bard College, Annandale-on-Hudson, New York (January 18, 2012).

Modelling epidemiology and the microeconomics of infectious disease policy. Department of Ecology and Evolutionary Biology, Princeton University, Princeton, New Jersey (November 21, 2011).

Accounting for self-interest in the public-health management of infectious diseases. Department of Mathematics, University of Wisconsin, Madison, Wisconsin (March 25, 2011).

Accounting for self-interest in the public-health management of infectious diseases. Department of Mathematics, Queens University, Queens, Ontario (March 11, 2011).

Resistance, immunity, and bifurcations in epidemiology. Veterinary Medicine, University of Vermont, Burlington, Vermont (February 14, 2011).

Linear models of antibiotic cycling. (Fields Institute, July 6, 2010)

Mathematical Biology and It's Relationship to Social Planning and Public Policy. (Clemson University, April 9, 2010)

Accounting for self-interest in the public-health management of infectious diseases. (University of West Virginia Department of Biology, September 21, 2009)

Discounted Reproduction Numbers. (University of Utah Department of Mathematics, November 21, 2008)

The Effects of Life History on Risky Behavior Choice and Disease Transmission (SMB Annual Meeting, Toronto, August 1, 2008)

A Homeostasis Hypothesis for Hepatitis C (Fred Hutchinson Cancer Research Center, April 9, 2008)

Resistance, Immunity, and Bifurcations in Epidemiology (PIMS Disease Dynamics 2008 meeting, April 4, 2008)

The Theory of Population Games and Their Applications to Public Health (Yale School of Public Health, January 24, 2008)

Population Games for Vaccination and Epidemiology (DIMACS Workshop on Game Theoretic Approaches to Epidemiology and Ecology, October 15, 2007)

Modeling Influenza Vaccine Choice (Canadian Mathematical Society-MITACS Joint Conference, June 1, 2007)

Modeling Ecological Invasions (Yale Institute for Biospheric Studies, October 14, 2005)

Perspectives on Optimizing Vaccination Policies (DIMACS Workshop on Evolutionary Considerations in Vaccine Use, June 28, 2005)

Current Funding

Agency:	National Science Foundation
Principal Investigator:	Dr. Timothy Reluga
Co-Investigators:	
Project Title:	ICES:Large:Collaborative Research: The Role of Space, Time, and Information in Controlling Epidemics
Award Dates:	7/1/2012 - 6/30/2015
Current Awarded Total Costs:	\$130,000 (Average annual support \$43,333)

Completed Funding

Agency:	National Science Foundation
Principal Investigator:	Dr. Timothy Reluga
Co-Investigators:	
Project Title:	ARRA - Spatial Population Games in Epidemiology and Ecology
Award Dates:	9/15/2009 - 8/31/2012
Current Awarded Total Costs:	\$180,000 (Average annual support \$45,473)
No-Cost Extension Granted:	Yes , to 8/31/13

Agency:	John E. Fogarty International Center
Principal Investigator:	Dr. Darla Lindberg
Co-Investigators:	Dr. Rachel A. Smith, Dr. Timothy Reluga, Dr. Mary Poss, Dr. Jill L. Findeis
Project Title:	Examining Policy Resistance and Infectious Disease with Dynamic Network Conditions at the U. S./Mexico Border
Award Dates:	9/1/2009 - 6/30/2011
Current Awarded Total Costs:	\$396,857 (Average annual support \$99,214)
No-Cost Extension Granted:	Yes , to 6/30/13

Agency:	Yale University
Principal Investigator:	Dr. Timothy Reluga
Co-Investigators:	
Project Title:	Impacts of Individual and Social Behavior on Influenza Dynamics and Control
Award Dates:	6/1/2009 - 4/30/2010
Total Costs:	\$29,159

Agency:	Yale University
Principal Investigator:	Dr. Timothy Reluga
Co-Investigators:	
Project Title:	Optimal Influenza Vaccination and Population Adherence
Award Dates:	9/1/2007 - 8/31/2008
Total Costs:	\$13,409

Courses Taught

Undergraduate ordinary and partial differential equations
 Introduction to matrices and linear algebra
 Introduction to discrete mathematics and proofs
 Introduction to numerical methods
 Mathematical modeling
 Modelling for medicine and biology

Graduate ordinary differential equations

Mentoring activities

Jing Li (August 2010 - June 2012). Jing Li was a postdoctoral researcher on an NIH grant. She has a tenure-track position in the Mathematics Department at California State University Northridge campus.

PhD students in progress: Guoliang Fang and Dongmei Zhang.

Service on 11 other doctoral committees.

Other Activities

Member of the National Academy of Science Expert Review Committee on the Evaluation of the Updated Site-Specific Risk Assessment for the National Bio- and Agro-Defense Facility in Manhattan, Kansas, and co-author of the report *Evaluation of the updated site-specific risk assessment for the national bio- and agro-defense facility in Manhattan, Kansas*. (August 2011 - August 2012).

National Academy of Science Expert Review Committee on Evaluation of a Site Specific Risk Assessment for the Department of Homeland Security's Planned National Bio- and Agro-Defense Facility in Manhattan, Kansas. (2010) [Link](#)

National Academy of Science Expert Review Committee for Evaluation of the Health and Safety Risks of the New USAMRIID High Containment Facilities at Fort Detrick, Maryland (2009-2010) [Link](#)

Articles reviewed for journals including *American Journal of Preventive Medicine*, *American Naturalist*, *Advances in Complex Systems*, *Applied Mathematical Modeling*, *Bulletin of Mathematical Biology*, *Canadian Applied Mathematics Quarterly*, *Journal of Applied Ecology*, *Journal of Biology*, *Journal of Biological Dynamics*, *Journal of Difference Equations and Applications*, *Journal of Health Economics*, *Journal of the Indian Mathematical Society*, *Journal of the Royal Society Interface*, *Journal of Theoretical Biology*, *Lancet*, *Mathematical Biosciences*, *Mathematical Biosciences and Engineering*, *Mathematics and Computers in Simulation*, *Mathematical Medicine and Biology*, *Mathematical and Computer Modeling*, *Natural Resource Modelling*, *Population Ecology*, *PLoS Computational Biology*, *PLoS One*, *Proceedings of the National Academy of Sciences*, *Proceedings of the Royal Society B*, *SIAM Journal on Applied Mathematics*, *Theoretical Population Biology*, *Vaccine*, and conference proceedings.

National and international grant review panels

Ongoing code contributor to open source [SymPy](#) symbolic algebra package (2012 - present)

Organizer of the Penn State [Mathematical Biology and Physiology](#) seminar series at Penn State (2010 - present)

Co-organized a two-part minisymposium titled "Economic, Social-Science, and Decision-Making Issues in Infectious-Disease Modeling" at the 7th International Conference for Industrial and Applied Mathematics, Vancouver, British Columbia, Canada http://meetings.siam.org/sess/dsp_programsess.cfm?SESSIONCODE=12195 (July 18-22, 2011).

Teaching in the Program for Research on Immune Modeling and Experimentation at Yale University. (June 12 - 16, 2011).

Co-organized a minisymposium proposal titled "Behavior and Infectious Diseases" with Jan Medlock for the 2011 International Conference on Industrial and Applied Mathematics in Vancouver (October 2010).

Session Chair at the Society of Mathematical Biologist Annual Meeting in Vancouver, British Columbia, Canada (July 2009).

Organized a minisymposium titled “Modelling the within-host dynamics of viral infections” at the Society for Industrial and Applied Mathematics Annual Life Sciences meeting, Montreal, Quebec, Canada (August 2008).

Organized a minisymposium titled “Game-Theory Approaches in Epidemiology” at the annual Society of Mathematical Biology meeting at the University of Toronto, Toronto, Ontario, Canada (July - August 2008).

Co-Organized an international 3-day Center for Infectious Disease Dynamics Workshop on “Control and management of infectious diseases” with Petra Klepac, Penn State University, University Park, Pennsylvania (June 2008).

Co-organizer for Center for Discrete Mathematics and Theoretical Computer Science Game Theoretic Approaches to Epidemiology and Ecology Workshop (October 2007).

Co-Organizer of the UW Mathematical Ecology Journal Club (October, 2002 - June, 2004)

Co-Founder and Treasurer of the SIAMUW (August, 2003 - July, 2004)

UW Graduate and Professional Student Senator (Fall, 2002 - Spring, 2004)

Professional Society Memberships

Society for Mathematical Biology (SMB, since 2001)

Society for Industrial and Applied Mathematics (SIAM, since 2001)

Mathematical Association of America (MAA, since 2001)

American Mathematical Society (AMS, since 2001)

American Economics Association (AEA, since 2005)

References

Associate Professor Mark Kot (Doctoral Adviser)
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Assistant Professor Alison Galvani (Postdoctoral supervisor)
 Department of Epidemiology and Public Health
 Yale University Medical School
 P.O. Box 208034
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Senior Fellow Alan Perelson (Postdoctoral supervisor)
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 Los Alamos National Laboratory
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