

MARISA EISENBERG

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Research interests include mathematical epidemiology, parameter identifiability and estimation, infectious diseases, cancer, networks.

Education & Experience

ASSISTANT PROFESSOR – Departments of Epidemiology and Mathematics, University of Michigan, Ann Arbor, 2012 - present. Part of the UM Interdisciplinary Cluster Hiring Program in *The Diversity and Complexity of Biological Networks*.

POSTDOCTORAL FELLOW – Mathematical Biosciences Institute, Ohio State University, 2009 - 2012.

PHD, MS BIOMEDICAL ENGINEERING – University of California, Los Angeles, 2009. *Dissertation Title*: Development and Clinical Applications of a Feedback Control System Model of the Hypothalamic-Pituitary-Thyroid Axis.

BS CYBERNETICS – University of California, Los Angeles, 2003.

Grants, Awards, & Fellowships

- 2014 - 2019 PRINCIPAL INVESTIGATOR, NIH GRANT U01 CA182915-01A1, “From Mechanism to Population: Modeling HPV-related Oropharyngeal Carcinogenesis.”
- 2014 - 2019 CO-INVESTIGATOR, NIH MIDAS GRANT U01 GM110712-01, “Modeling the Effects of the Environment on Enteric Pathogen Dynamics.”
- 2014 - 2019 CO-INVESTIGATOR, NIH MIDAS GRANT U54 GM111274-01, “Center for Statistics and Quantitative Infectious Diseases.”
- 2015 - 2016 CO-INVESTIGATOR, NIH GRANT R56 AG048937, “Dynamic Social Network Structures in Aging: A Complex Systems Approach.”
- 2011 - 2016 CO-PRINCIPAL INVESTIGATOR, SUBAWARD PI, NSF/NIH ECOLOGY OF INFECTIOUS DISEASES GRANT 1115881, “Modeling the effects of heterogeneity in water quality on cholera disease dynamics.”
- 2014 - 2016 CO-INVESTIGATOR, WHO GRANT 485861-01, “Strategies to Guide the Polio Eradication Endgame.”
- 2014 - 2015 CO-INVESTIGATOR, PROCTER AND GAMBLE AWARD, “Exploring Dental Biofilm Community Architecture and Structure.”
- 2014 - 2015 PRINCIPAL INVESTIGATOR, UNIVERSITY OF MICHIGAN THAI STUDIES INSTITUTE GRANT, “Understanding Climate and Vector Drivers of Dengue in Thailand.”
- 2013 - 2015 PRINCIPAL INVESTIGATOR, UNIVERSITY OF MICHIGAN M-CUBED AWARD, “Oral High-Risk HPV and the Risk of Oral and Pharyngeal Cancer.”
- 2013 - 2014 PRINCIPAL INVESTIGATOR, UNIVERSITY OF MICHIGAN GLOBAL PUBLIC HEALTH INSTITUTE GRANT, “Modeling Cholera Transmission and Vaccination in a Refugee Camp: Water, the Environment, and Social Structure.”
- 2013 - 2014 CO-INVESTIGATOR, CDC GRANT U01CK000185, “A Randomized Study of Exclusion Criteria in a University Population.”
- 2006 - 2009 FELLOW, NIH NRSA SYSTEMS AND INTEGRATIVE BIOLOGY TRAINING GRANT T32-GM008185
- 2006 - 2007 UCLA GRADUATE RESEARCH MENTORSHIP FELLOWSHIP

Publications

(Student/advisee/mentee marked in *italics*)

- (1) *Brouwer AF*, Meza R, **Eisenberg MC**. Transmission Heterogeneity and Autoinoculation in a Multisite Infection Model of HPV. *Mathematical Biosciences*, in press.
- (2) *Krishna N*, *Pennington H*, Coppola C, **Eisenberg MC**, Schugart R. 2015. Connecting Local and Global Sensitivities for a Mathematical Model in Wound Healing. *Bulletin of Mathematical Biology*, in press.
- (3) *Blanco-Herrera N*, **Eisenberg MC** (co-corresponding), Stillwell T, Foxman B. Vaccination, Contact Precautions and Antivirals: What best controls influenza spread in a hospital? *American Journal of Epidemiology*, in press.
- (4) Meshkat N, Sullivant S, and **Eisenberg MC**, Identifiability results for several classes of linear compartment models. *Journal of Mathematical Biology*, in press.
- (5) *Hayashi MAL* and **Eisenberg MC**. Effects of Adaptive Protective Behavior on the Dynamics of Sexually Transmitted Infections. *J. Theoretical Biology*, in press.
- (6) Fan K, **Eisenberg MC**, *Walsh A*, Aiello A, Heller K. Hierarchical Graph-Coupled HMMs on Heterogeneity and Personalized Health. 2015. *KDD '15 Proceedings of the 21th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, 239-248.
- (7) Greene C, Vadlamudi G, **Eisenberg MC**, Foxman B, Koopman J, and Xi C. Fomite-Fingerpad Transfer Efficiency (pick-up and deposit) of *Acinetobacter baumannii* With and Without a Latex Glove. *American Journal of Infection Control*, 43(9):928–934.
- (8) Alexander KA, Sanderson CE, Marathe M, Lewis BL, Rivers CM, Shaman J, Drake JM, Lofgren E, Dato VM, **Eisenberg MC**, Eubank S. 2015. What factors might have led to the emergence of Ebola in West Africa? *PLOS Neglected Tropical Diseases*, in press.
- (9) Tien JH, Shuai Z, **Eisenberg MC**, van den Driessche P. 2015. Disease invasion on community networks with environmental pathogen movement. *Journal of Mathematical Biology* 70(5): 1065-1092.
- (10) Lofgren L, Halloran ME, Rivers CM, Drake JM, Porco TC, Lewis B, Yang W, Vespignani A, Shaman J, Eisenberg JNS, **Eisenberg MC**, Marathe M, Scarpino SV, Alexander KA, Meza R, Ferrari MJ, Hyman JM, Meyers LA, Eubank S. 2014. Opinion: Mathematical models: A key tool for outbreak response. *PNAS* 111(51): 18095-18096.
- (11) Halloran EM, Vespignani A, Bharti N, Feldstein LR, Alexander K, Ferrari M, Shaman J, Drake JM, Porco T, Eisenberg J, DeValle S, Lofgren E, Scarpino SV, **Eisenberg MC**, Gao D, Hyman JM, Eubank S, Longini IM. 2014. Ebola: Mobility Data. *Science* 346 (6208): 433.
- (12) **Eisenberg MC**, *Hayashi MAL*. 2014. Determining Structurally Identifiable Parameter Combinations Using Subset Profiling. *Mathematical Biosciences* 256: 116–126.
- (13) **Eisenberg MC**, Kujbida G, Tuite AR, Fisman DN, Tien JH. 2013. Examining rainfall and cholera dynamics in Haiti using statistical and dynamic modeling approaches. *Epidemics* 5(4): 197–207.
- (14) Robertson SL, **Eisenberg MC**, Tien JH. 2013. Heterogeneity in multiple transmission pathways: modeling the spread of waterborne disease in networks with a common water source. *J. Biological Dynamics* 7(1): 254-275.
- (15) **Eisenberg MC**, Shuai Z, Tien JH, van den Driessche P. 2013. A Cholera Model in a Patchy Environment with Water and Human Movement. *Math Biosciences* 246(1): 105-112.
- (16) **Eisenberg MC**, Robertson S, Tien J. 2013. Identifiability and estimation of multiple transmission pathways in cholera and waterborne disease. *J. Theor Biol* 324: 84-102.

- (17) *Ben-Shachar R, Eisenberg MC* (corresponding), Huang SA, DiStefano JJ. 2012. Simulation of post thyroidectomy treatment alternatives for T₃ or T₄ replacement in pediatric thyroid cancer patients. *Thyroid* 22(6):1-9.
- (18) **Eisenberg MC**, Kim Y, Li R, Ackerman WE, Kniss DA, Friedman A. 2011. Mechanistic modeling of the effects of myoferlin on tumor cell invasion. *Proceedings of the National Academy of Sciences (PNAS)* 108(50): 20078-20083.
- (19) **Eisenberg MC**, Ash JN, Siegal-Gaskins D. 2011. *In silico* synchronization of cellular populations through expression data deconvolution. *Proceedings of the ACM/IEEE Design Automation Conference (DAC) 2011*. (Reprint available at <http://arxiv.org/abs/1105.0955>)
- (20) Tuite RA, Tien J, **Eisenberg MC**, Earn JDJ, Ma J, Fisman DN. 2011. Cholera Epidemic in Haiti, 2010 – Using a Transmission Model to Explain Spatial Spread of Disease and Identify Optimal Control Interventions. *Annals of Int Med* 154(9): 593-601.
- (21) **Eisenberg MC**, Santini F, Marsili A, Pinchera A, DiStefano JJ. 2010. TSH Regulation Dynamics In Central & Extreme Primary Hypothyroidism. *Thyroid* 22(11): 1215-1228.
- (22) Meshkat NC, **Eisenberg MC**, DiStefano JJ. 2009. Algorithm for finding globally identifiable parameter combinations and reparameterizations of nonlinear ODE models using Gröbner Bases. *Math Biosciences*, 222:61-72.
- (23) **Eisenberg MC**, DiStefano JJ. 2009. TSH-based protocol, tablet instability, and absorption effects on L-T₄ bioequivalence. *Thyroid* 19(2): 103-110.
- (24) **Eisenberg MC**, Samuels MH, DiStefano JJ. 2008. Extensions, Validation & Clinical Applications of a Feedback Control System Simulator of the Hypothalamic-Pituitary-Thyroid Axis. *Thyroid* 18(10): 1071-1085.
- (25) **Eisenberg MC**, Samuels MH, DiStefano JJ. 2006. L-T₄ Bioequivalence and Hormone Replacement Studies Via Feedback Control Simulations. *Thyroid* 16(12): 1279-1292.

Submitted and In Revision:

- (26) **Eisenberg MC**, Eisenberg JNS, *D'Silva JP*, Wells EV, *Cherng S*, Kao Y, Meza R. Forecasting and Uncertainty in Modelling the 2014-2015 Ebola Epidemic in West Africa. *Submitted*.
- (27) *D'Silva J* and **Eisenberg MC**. Development of a Spatial Model of Interventions for Ebola in West Africa. *Submitted*.
- (28) *Kelly MR*, Tien J, **Eisenberg MC**, Lenhart S. The impact of spatial arrangements on epidemic disease dynamics and intervention strategies. *Submitted*.
- (29) *Brouwer AF*, **Eisenberg MC**, Carey TE, Meza RM. Trends in HPV cervical and seroprevalence and analysis of multisite (oral, genital, sero) concurrence and type-concordance in NHANES 2003–2010. *Submitted*.
- (30) *Brouwer AF*, **Eisenberg MC**, Meza R. Age effects and temporal trends in HPV-related and HPV-unrelated oral cancer in the United States: A multistage carcinogenesis modeling analysis. *Submitted*.
- (31) *Han SX*, **Eisenberg MC**, DiStefano JJ. THYROSIM: A Web Application for Human Thyroid Hormone Regulation Dynamics Education and Research. *In revision*.
- (32) Aiello AE, Simanek AM, **Eisenberg MC**, *Walsh AR*, Davis B, Volz E, Cheng C, Rainey JJ, Uzicanin A, Gao H, Osgood N, Knowles D, Stanley K, Tarter K, Monto AS. Design and Methods of a Social Network Isolation Study for Reducing Respiratory Infection Transmission: The eX-FLU Cluster Randomized Trial. *In revision*.

Teaching Experience

INTRO TO MATHEMATICAL MODELING IN EPIDEMIOLOGY & PUBLIC HEALTH (EPID 633), UNIVERSITY OF MICHIGAN, ANN ARBOR (2013-2015) – basic introduction to math modeling in epidemiology, with examples drawn broadly from infectious disease, chronic disease, and social epidemiology.

SCIENTIFIC WRITING FOR EPIDEMIOLOGISTS (EPID 530), UNIVERSITY OF MICHIGAN, ANN ARBOR (2014-2015) – introduction to scientific writing and communication.

SYSTEMS MODELING OF SOCIAL PROCESSES, BEHAVIOR, AND CHRONIC DISEASE (EPID 618), UNIVERSITY OF MICHIGAN, ANN ARBOR (Fall 2013) – complex system modeling of chronic diseases and social behavior processes, using agent-based, network models, and dynamic system models.

NC STATE TUTORIAL WORKSHOP: PARAMETER ESTIMATION FOR DYNAMIC BIOLOGICAL MODELS (Summer 2014). Lecturer for a tutorial workshop on parameter estimation at NC State.

NIMBios TUTORIAL WORKSHOP: PARAMETER ESTIMATION FOR DYNAMIC BIOLOGICAL MODELS (Summer 2014). A three-day tutorial based at the National Institute for Mathematical and Biological Synthesis, University of Tennessee.

NIMBios-MBI-CAMBAM SUMMER GRADUATE PROGRAM: CONNECTING MODELS WITH DATA IN MATHEMATICAL BIOLOGY (Summer 2013). A two-week summer graduate program based at the National Institute for Mathematical and Biological Synthesis, University of Tennessee.

MICHIGAN MATH & SCIENCE SCHOLARS PROGRAM – guest lecturer for advanced high school program for students in mathematical biology. (Summer 2013)

FOUNDATIONS OF HIGHER MATHEMATICS (MATH 345), THE OHIO STATE UNIVERSITY (Fall 2010) – this course introduces students (primarily math majors) to basic proof techniques, logic, and set theory.

MATHEMATICAL ECOLOGY & EVOLUTION, MBI SUMMER GRADUATE WORKSHOP (Summer 2011) – mentored graduate students on projects in mathematical epidemiology and patch models in waterborne disease for the MBI-NIMBios-CAMBAM Graduate Summer School (together with Joe Tien).

MBI BOOTCAMP ON CANCER MODELING (Fall 2010) – developed and lead labs on VEGF receptor binding and apoptosis for the signaling pathways tutorial (together with Harsh Jain).

NONLINEAR DYNAMICS IN BIOLOGICAL NETWORKS, MCGILL UNIVERSITY (Summer 2010) – developed and taught a series of labs and research projects on symmetry and networks for the joint CAMBAM/MBI Graduate Summer School (together with Marty Golubitsky and Yunjiao Wang).

PROJECT LEADER, CALCULUS FOR LIFE SCIENCES (MATH 150), THE OHIO STATE UNIVERSITY (Fall 2009, Fall 2010) – mentored a small group of students in a calculus project on enzyme-substrate dynamics.

LEAD INSTRUCTOR, UCLA JUNIOR MATH CIRCLE (2008-2009) – lead instructor for the new UCLA Junior Math Circle (grades K-3); also instructor and mentor for advanced high school, junior high, and elementary school students at the weekly UCLA Math Circle.

TEACHING ASSISTANT/FELLOW AND GUEST LECTURER AT UCLA (2004-2009)

Physical Biochemistry (Chemistry 156)	3 quarters
Intro. to Computational & Systems Biology (Computer Science (CS) 186A)	1 quarter
Modeling and Simulation of Biological Systems (CS 186B)	4 quarters
Comp. & Systems Biology Research Lab (CS 186L) – TA & project mentor	4 quarters
Advanced Modeling Methodology (CS 296A)	1 quarter

JULIA ROBINSON MATHEMATICS FESTIVAL, UCLA (2009) – activity leader for chessboard tilings table. The festival is a one-day annual mathematical event for students grades 6-12.

Recent Invited and Conference Talks 2014-2015

Tools and Technology Seminar, Department of Computational Medicine and Bioinformatics, University of Michigan, 2015 - Identifiability and Uncertainty in Modeling Disease Dynamics (**Invited talk**)

International Congress on Industrial and Applied Mathematics, 2015 - Examining Forecasting and Uncertainty in Modeling Ebola Transmission Dynamics (**Invited talk**)

International Congress on Industrial and Applied Mathematics, 2015 - Interacting Scales in Modeling HPV and Oropharyngeal Cancer (**Invited talk**)

Viral Dynamics and Cancer: Modeling Oncogenic and Oncolytic Viruses, Casa Mathematica Oaxaca/Banff International Research Station Workshop, 2015 - Interacting scales in modeling HPV & oropharyngeal cancer dynamics (**Invited talk**)

Israel Ministry of Health, Public Health Services Unit, 2015 - Spatiotemporal Trends of Polio Silent Transmission: Israel 2013-14

Big Data Summer Institute Journey Lecture, University of Michigan, Ann Arbor, 2015 - Math in the Time of Cholera: mathematical modeling in Public Health (**Invited talk**)

Society for Industrial & Applied Mathematics (SIAM) Conference on Dynamical Systems, 2015 - Interacting Scales in Modeling HPV and Oropharyngeal Cancer

Society for Industrial & Applied Mathematics (SIAM) Conference on Dynamical Systems, 2015 - Examining Forecasting and Uncertainty in Modeling Ebola Transmission Dynamics (**Invited talk**)

Integrative Cancer Biology Program Meeting, NIH, 2015 - From Mechanism to Population: Modeling HPV-related Oropharyngeal Carcinogenesis

NIH Models of Infectious Disease Agent Study (MIDAS) Network Meeting, 2015 - Spatiotemporal Trends of Polio Silent Transmission: Israel 2013-14

University of Nevada, Reno, Mathematics Department Colloquium, 2015 - Identifiability and Interacting Scales in Modeling Disease Dynamics (**Invited talk**)

Center for the Study of Complex Systems, University of Michigan, 2015 - Identifiability and Interacting Scales in Modeling Disease Dynamics (**Invited talk**)

Epidemiology Department Seminar, University of Michigan, 2015 - Identifiability and Interacting Scales in Modeling Disease Dynamics

Kalamazoo College, Ebola in Perspective: Our Roles as Global Citizens, 2014 – Epidemiological Considerations in Modeling Ebola (**Invited talk**)

University of Michigan, Ann Arbor, Fear, Panic, and Isolation: Ebola and Public Health, 2014 – Invited Panelist

Center for Systems Biology, University of Michigan, 2014 - Multi-scale dynamic modeling of disease transmission (**Invited talk**)

Society for Industrial & Applied Mathematics (SIAM) Conference on the Life Sciences, 2014 - Identifiability and Parameter Estimation in Modeling Disease Dynamics (**Invited talk**)

The 10th AIMS Conference on Dynamical Systems, Differential Equations and Applications, 2014 - Interacting scales in modeling HPV & oropharyngeal cancer dynamics (**Invited talk**)

Prince of Songkla University, Hat Yai, Thailand, 2014 - Multi-scale dynamic modeling of disease transmission (**Invited talk**)

US Centers for Disease Control & Thailand Ministry of Public Health, Bangkok, Thailand, 2014 - Multi-scale dynamic modeling of disease transmission (**Invited talk**)

Western Kentucky University, Mathematics Department Colloquium, 2014 - Exploring cholera dynamics and transmission pathways using identifiability and parameter estimation (**Invited talk**)

Ohio State University, Mathematical Biosciences Institute, Workshop: From Within-Host Dynamics to the Epidemiology of Infectious Diseases, 2014 - Identifiability and interacting scales in modeling disease dynamics (**Invited talk**)

University of Michigan, Ann Arbor, Symposium on Signaling Across Scales: Life Sciences to Social Systems, 2014 - Modeling Dynamic Interactions between Behavior, Networks and Disease Transmission (**Invited talk**)

University of Michigan, Applied and Interdisciplinary Mathematics Seminar, 2014 - Exploring cholera dynamics & transmission pathways using identifiability & parameter estimation

University of California, Los Angeles, Research Symposium entitled Metamorphosis: From Cybernetics to Computational Systems Biology, 2014 - Math in the time of cholera: Using Cybernetics in Public Health (**Invited talk**)

Professional Activities and Memberships

MEMBER, Center for the Study of Complex Systems, University of Michigan (CSCS) (2013-present)

MEMBER, Center for Systems Biology, University of Michigan (CSB) (2013-present)

MEMBER, Michigan Center for Diabetes Translational Research (MCDTR) (2012-present)

ADVISORY GROUP MEMBER for the Malaria Host-Pathogen Interaction Center (Malaria Host Pathogen Working Group), based at Emory University, Georgia Tech, and University of Georgia (2013-present)

DISCUSSION LEADER for Mathematical Biosciences Institute Workshop on Sustainable Management of Living Natural Resources, Ohio State University 2013.

ORGANIZER & LECTURER for the 2013 NIMBioS-MBI-CAMBAM Summer Graduate Program: Connecting Models with Data in Mathematical Biology.

ORGANIZER for the 2011 Workshop for Young Researchers in Mathematical Biology, held at the Mathematical Biosciences Institute

ORGANIZER for minisymposium entitled, "*Bridging the Divide: Cancer Models in Clinical Practice*," for the 8th European Conference on Mathematical and Theoretical Biology (2011)

Mathematical Biosciences Institute Colloquium Committee (2009-2010)

REVIEWER, *Proc. Royal Society Series B*, *Journal of Mathematical Biosciences*, *Mathematical Medicine & Biology*, *American Naturalist*, *Health Education & Behavior*, *Frontiers in Molecular & Cellular Oncology*, *Thyroid*, *Journal of Pharmacy & Pharmacology*, *PLOS One*; Assisted in proposal reviews for: the US-Israel Science Foundation, University of Missouri Internal Grants

Participated in several programs with the UM Center for Research on Learning and Teaching (CRLT), including the HEALTH SCIENCES TEACHING ACADEMY, FACULTY INSTRUCTIONAL TECHNOLOGY SPECIAL INTEREST GROUP (IT-SIG), MID-TERM-STUDENT FEEDBACK PROGRAM, and the PROVOST'S SEMINAR ON TEACHING IN THE CLOUD: USING GOOGLE APPS & OTHER ONLINE COLLABORATION TOOLS FOR STUDENT ENGAGEMENT.

PROFESSIONAL SOCIETIES: American Thyroid Association, Biomedical Engineering Society, Society for Industrial and Applied Mathematics, Society for Mathematical Biology, Association for Women in Mathematics