

CONTACT INFORMATION

Department of Mathematics
University of British Columbia
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EDUCATION

Ph.D., Applied Mathematics, 2008; Northwestern University, Evanston, IL, USA

Dissertation advisor: Prof. Hermann Riecke

Dissertation title: “Complex Patterns in Oscillatory Systems”

M.S. Applied Mathematics, 2003; Northwestern University, Evanston, IL, USA

B.S. Honours Applied Mathematics, 2002; McGill University, Montreal, Qc, Canada

RESEARCH EXPERIENCE

Sep 2008-present **Postdoctoral Fellow**, Department of Mathematics, University of British Columbia

Supervisor: Prof. Daniel Coombs

Area of research: Mathematical epidemiology and immunology

- Created a branching process model of viral load in treated HIV+ individuals to investigate different mechanisms for viral production. Analyzed model via stochastic simulation.

Developed novel numerical method based on probability generating functions to further analyze model and compare with clinical data.

- Developed stochastic model of early HIV infection to evaluate the efficacy of post-exposure prophylaxis (PEP) to prevent infection and consider the emergence of drug resistance in the case of failed PEP.

- Worked on thermodynamic model of HIV virus/dendritic cell binding dynamics to improve understanding of HIV infection initiation at the cellular level.

Sep 2008-Jan 2010 **Postdoctoral Fellow**, Division of Mathematical Modeling (DMM), UBC Centre for Disease Control, University of British Columbia

Supervisor: Prof. Babak Pourbohloul

Area of research: Mathematical epidemiology and immunology

- Developed hybrid network/compartamental influenza transmission model for Vancouver, to investigate timing and targeting strategies for immunization in a pandemic. Model continues to be used internally by the DMM for government recommendations.

- Active in “CIHR Team study of Acute HIV Infection in Gay Men” (cross-disciplinary team with immunologists, epidemiologists, sociologists). Developed compartmental model to explore if increased infectivity during acute infection drives Vancouver’s HIV epidemic.

2003-2008 **Graduate Research Assistant**, Engineering Sciences and Applied Mathematics Department, Northwestern University

Supervisor: Prof. Hermann Riecke

Area of research: Pattern formation in oscillatory media

- Investigated complex pattern formation in systems undergoing a Hopf bifurcation through the complex Ginzburg-Landau equation for the complex amplitude of oscillations. Used weakly nonlinear analysis, Floquet theory, and entropy arguments to show the stability of superlattice patterns. Confirmed analytic results through direct numerical simulation.

Summer 2002 **Undergraduate Research Assistant**, Department of Mathematics, McGill University

Supervisor: Prof. Nilima Nigam

Area of research: Image processing

- Developed algorithm to recover depth (3d) information from 2d images.

TEACHING EXPERIENCE

Instructor

Responsibility for all instruction in class, writing and grading all exams, assigning and grading homework (with a grader), holding office hours, and attending regular meetings with other course instructors.

- Fall 2010 *Ordinary Differential Equations*, University of British Columbia
- Fall 2009 *Partial Differential Equations*, University of British Columbia
- Fall 2008 *Linear Differential Equations*, University of British Columbia
- Winter 2008 *Multiple Integration and Vector Calculus*, Northwestern University

Supervisor

- Spring 2009 Supervised undergraduate honours project on strain diversity using network modeling
Student: Mani Hamidi, University of British Columbia
Final Report: "Computational Study of Multi-Strain Pathogen Dynamics in Host Networks"

Teaching Assistant

Responsible for weekly tutorials for 25-40 students, holding office hours. At Northwestern University responsibilities also included writing and grading weekly quizzes, and grading the final exam.

- Fall 2008 *Partial Differential Equations*, University of British Columbia
- 2003-2007 *Multiple Integration and Vector Calculus, Differential Equations*, Northwestern (various quarters)

HONOURS

- Jun 2010-present *Fellowship Award in the Area of Biomedical / Clinical HIV/AIDS Research* (\$67 500 CAD)
Canadian Institutes of Health Research (CIHR), Canada
- 2010 *Postdoctoral Teaching Award*, for excellence in mathematics teaching
UBC Department of Mathematics
- 2008-2009 (declined) *Visiting Fellowships in Canadian Government Laboratories (VF)*
National Sciences and Engineering Research Council, Canada
- Mar-Jun 2008 *Smith Fellowship* (approx. \$6800 USD)
Northwestern University
- Sep 2002-Jun 2003 *Walter P. Murphy Fellowship* (approx \$50 000 USD)
Northwestern University
- Aug 1998-May 1999 *McGill University Entrance Scholarship* (\$1000 CAD)
McGill University

RESEARCH INTERESTS

Within-Host infectious disease dynamics

- Viral dynamics in HIV+ individuals on treatment (*branching processes, nonlinear ODEs, stochastic simulation*)
- Emergence of drug resistance
- Applications of methods developed to other diseases, e.g. Hepatitis C

Between-Host infectious disease dynamics

- Pandemic influenza, immunization (*network modeling, compartmental modeling, optimization*)
- Pathogen strain diversity (*network modeling*)
- Emergence and spread of drug resistant strains for acute (e.g. influenza) and chronic (e.g. HIV) infections (*multi-scale modeling, network dynamics*)

Pattern Formation in Oscillatory Media

- Pattern formation in systems that undergo a Hopf bifurcation (*nonlinear dynamics, nonlinear pdes*)
- Pattern stability via resonant forcing (*linear and weakly nonlinear analysis, Floquet theory, simulation*)
- Application to physical/chemical systems, e.g. Belousov-Zhabotinsky reaction, CO-Pt oxidation

PUBLICATIONS

- J.M. Conway et al, "Vaccination against 2009 pandemic H1N1 in a population dynamical model of Vancouver, Canada: timing is everything," *BMC Public Health*, **11**(2011):932.
- J.M. Conway and D. Coombs, "A stochastic model of latently infected cell reactivation and viral blip generation in treated HIV patients," *PLoS Computational Biology* **7**(2011):e1002033.
- J.M. Conway and H. Riecke, "Superlattice patterns in the complex Ginzburg-Landau equation with multi-resonant forcing," *SIAM Journal of Applied Dynamical Systems* **8**(2009):977.
- J.M. Conway and H. Riecke, "Quasipatterns in a model for chemical oscillations forced at multiple resonance frequencies," *Physical Review Letters* **99**(2007):218301.
- J.M. Conway and H. Riecke, "Multiresonant forcing of the complex Ginzburg-Landau equation: pattern selection," *Physical Review E* **76**(2007):057202.
Unpublished
- J.M. Conway, B.P. Konrad, and D. Coombs, "Stochastic analysis of pre- and post-exposure prophylaxis against HIV infection," submitted.

SCIENTIFIC PRESENTATIONS

- 'Stochastic modeling of early HIV infection'
- Jul 2011 (contributed) International Congress on Industrial & Applied Mathematics, Vancouver BC Canada
- 'Continuous-Time Branching Processes Model of Viral Load in Treated HIV+ Individuals'
- Jul 2011 (invited) Computational Math Day 2011, Simon Fraser University
- Jun 2011 (contributed) European Conference on Mathematical and Theoretical Biology, Krakow, Poland
- Jan 2011 (invited) Applied and Industrial Mathematics Seminar, York University
- Jul 2010 (invited) Fields Institute Summer 2010 Thematic Program on the Mathematics of Drug Resistance in Infectious Diseases, Theme Weeks on Mathematical Immunology.
- Mar 2010 (invited) Probability Seminar, University of British Columbia
- Jan 2010 (poster) International Workshop - Systems Approaches in Immunology: Advances and Challenges in Multi-Scale Modeling, Santa Fe NM USA
- Jul 2009 (contributed) Annual Meeting of the Society for Mathematical Biology, Vancouver BC Canada
- 'Timing and targeting of immunization campaigns in a pandemic'
- Jul 2011 (invited) Minisymposium on Epidemic Spread on Networks; International Congress on Industrial & Applied Mathematics, Vancouver BC Canada
- May 2011 (invited) Minisymposium on Epidemiology, Population Dynamics and Networks I; Dynamical Systems Meeting, Society for Industrial and Applied Mathematics
- Jan 2011 (invited) CIC Workshop on Mathematics in Emerging Infectious Diseases, Cuernavaca Mexico
- May 2010 (contributed) University of British Columbia, Mathematical Biology Work-in-Progress
- 'HIV in Vancouver's MSM community: early recognition, rapid response'
- Mar 2010 (invited) Grand Rounds, BC Centre for Disease Control
(with Drs. Malcolm Steinberg, Mel Krajden, and Bill Coleman)
- 'Complex pattern formation in resonantly-forced oscillatory systems'
- Oct 2009 (invited) IAM Seminar Series, University of British Columbia
- May 2009 (invited) Minisymposium on Forced Chemical Patterns; Dynamical Systems Meeting, Society for Industrial and Applied Mathematics
- Feb 2009 (invited) CSC Seminar, Dept. of Mathematics, Simon Fraser University
- Mar 2008 (invited) Mathematical Biology and related seminars, University of British Columbia
- Jul 2008 (poster) Gordon Research Conference on Oscillations and Dynamic Instabilities in Chemical Systems, Waterville ME USA
- Jan 2008 (contributed) AMS/MAA Joint Mathematics Meetings, San Diego CA USA
- Nov 2007 (invited) Dynamical Systems and Continuum Physics workshop; Centre de recherches mathématiques
- May 2007 (contributed) Dynamical Systems Meeting, Society for Industrial and Applied Mathematics

ACTIVITIES**Scientific contributions**

- Sep 2012 Disease Dynamics 2012: Immunization, a true multi-scale problem
Funding confirmed Dec 2011
Vancouver, BC Canada
Conference organizer (lead) with Daniel Coombs (University of British Columbia) and Rafael Meza (University of Michigan)
- Jul 2010 31st Annual Meeting of the Canadian Applied and Industrial Mathematics Society (CAIMS*SCMAI)
St John's NL Canada
Organizer, contributed mini-symposium on Mathematical Techniques in Disease Modeling
- Jul 2009 Annual Meeting of the Society for Mathematical Biology, Vancouver BC Canada
Scientific planning, aided in selection from contributed talks/posters for presentation at the meeting.
- 2006-2007 Prelim prep, Engineering Sciences and Applied Math Department, Northwestern University
Coordinator and Instructor, Coordinating, planning lessons, preparing problems and teaching review sessions to prepare first year graduate students for their compulsory preliminary exams.

Additional training

- Jul 2010 *Summer School in Biophysics at UT/ORNL: Computational and Experimental Challenges*
Knoxville TN USA
Presentation and discussion of a wide variety of research problems at the interface of biological and physical and computational sciences. A secondary goal of the summer school was to present open biological problems that require advanced technical approach and therefore are highly interdisciplinary.
- Jun 2010 *American Association of Immunologists 2010 Introductory Course in Immunology*
University of Pennsylvania, Philadelphia PA USA
Intensive two-part course, taught by world-renowned immunologists, that provides a comprehensive overview of the basics of immunology.
- Sep 2004 *NATO ASI Physbio 5: Self-Assembly, Pattern Formation and Growth Phenomena in Nano-Systems*
Sponsored by the EU under FP5 High Level Scientific Conferences and the NATO Advanced Study Institute, St-Étienne de Tinée, France
The school's objective is to give a comprehensive, self-contained, and methodically unified survey of nonlinear dynamics in non-equilibrium systems and to give participants analytical and computational tools required in various applications of nonlinear dynamics in physics, chemistry and biology.
- Aug 2004 *Mathematical Modeling in Industry - A Workshop for Graduate Students*
2004 IMA Summer Program, Minneapolis MN USA
Project topic: Embedded Real-Time Safety-Critical Computer and Communication Systems
Technical report: 'New Approaches to Polyhedral Containment Check within a Linear Hybrid Automata Reachability Procedure'
(available at <http://www.ima.umn.edu/modeling/mm04abstracts/final-reports/2004-team5-report.pdf>)
Mentor: Steve Vestal of Honeywell Laboratories
Learned about the modeling process, analysis and computational work associated with a real-world industrial problem by working on a project provided by a mentor from industry.

LANGUAGES

English (fluent), French (fluent)

Computer Languages and Software: Fortran, Matlab, Maple, Mathematica

SOCIETY MEMBERSHIP

Society for Industrial and Applied Mathematics (SIAM)

Society for Mathematical Biology (SMB)

Canadian Applied and Industrial Mathematics Society (CAIMS)

Canadian Consortium for Pandemic Preparedness Modeling (CanPan)