

## Education

- 2006 **PhD in Applied Mathematics**, *Cambridge University*.
  - Thesis title: "Shear-flow instabilities in viscoelastic fluids" ([pdf 16mb](#)).
  - Used numerical and analytical methods to study viscoelastic instabilities.
  - Awarded 2006 *Vernon Harrison Prize* from the British Society of Rheology for "the most original and significant contribution to any branch of rheological research leading to the award of a PhD degree [in the UK]".
- 2001 **MMath (Part III)**, *Cambridge University*.  
Attended using a Churchill Fellowship.
- 2000 **Bachelor of Science in Mathematics**, *Harvey Mudd College*.
  - With High Distinction and Honors
  - Awarded 2000 Stavros Busenburg Prize for top Applied Mathematician.

## Awards

- 2000 **Hertz graduate fellowship**, (*most prestigious US graduate fellowship in physical sciences/engineering*), [http://en.wikipedia.org/wiki/Hertz\\_Foundation](http://en.wikipedia.org/wiki/Hertz_Foundation).
- 2014 **Monash Larkins Fellowship**, (*2 years' salary + 250,000 AUD research funds*) "designed to help attract internationally competitive early to mid-career researchers who will become the next generation researching in alignment with Monash's strategic priorities".
- 2008 **NIH Research and Policy for Infectious Disease Dynamics (RAPIDD)**, *post-doctoral fellowship 90,000 USD/yr (stipend + travel)*.
- 2008 **National Science Foundation postdoctoral fellowship**, *From Division of Mathematical Sciences: 108,000 USD*.
- 2006 **Vernon Harrison Award**, *for best 2005 UK doctoral thesis in rheology (a field in fluid dynamics)*.
- 2000 **NDSEG, NSF, and Churchill graduate fellowships**.
- 2003,2004 **Most Valuable Player**, *Otter Water Polo (UK National League)*.

## Research Experience

I am an applied mathematician with a primary focus on infectious disease dynamics I have worked on problems including infectious diseases (in particular HIV, Cholera, and Influenza), dynamic processes on networks, algorithms for studying networks, viscoelastic fluid flow, and carbon sequestration. I currently work at the Institute for Disease Modeling, a Bill Gates-funded research institute focused on disease eradication.

## Research Positions

- 2016–Present **Senior Research Scientist**, *Institute for Disease Modeling*.
- Primary responsibility is developing mathematical models of infectious disease in networks.
  - Help in design of efficient algorithms for epidemic simulation.
  - Organize (and bake for) monthly internal seminar series *Caketalks*.
- 2014–2016 **Senior Lecturer**, *Monash University*.
- Awarded a Larkins Fellowship.
  - Joint appointment in mathematics and biology, studying:
    - The impact of concurrent relationships on HIV transmission.
    - How clustering influences the spread of “complex” contagions (such as behaviors).
    - The interactions of multiple diseases in a contact network.
    - Algorithms for generating various classes of “random” networks.
    - The role of dose-dependent infection on cholera epidemics.
- 2012–2013 **Assistant Professor**, *Penn State University*.  
Tenure track (left to solve  $2 + \epsilon$  body problem after daughter born to wife living in Boston)
- Joint appointment in mathematics and biology.
  - Member of the Center for Infectious Disease Dynamics.
  - Focused on disease spread in contact networks.
- 2012–2015 **Visiting Scientist**, *Harvard School of Public Health*.
- 2012–2015 **Consultant**, *NIH Research and Policy for Infectious Disease Dynamics (RAPIDD) Program*.
- 2008–2011 **NIH Postdoctoral Fellow**, *Harvard School of Public Health & Fogarty Institute*.
- One of four postdocs selected for the prestigious **RAPIDD** program in 2008.
  - Gave talks to project sponsors at Dept of Homeland Security and the Foreign Animal Disease Threat subcommittee of US Office of Science.
  - Developed novel mathematical models of infection spread in populations with non-negligible partnership duration. In many cases this allows analytic approaches to replace stochastic simulation. See publications for more detail.
  - Helped gather data about the 2009 pandemic influenza and helped predict the relative impact of various interventions.
- 2007–2008 **Postdoctoral Fellow**, *University of British Columbia Centre for Disease Control*.
- Developed and analyzed epidemic models of generic respiratory disease in heterogeneous populations.
  - Provided mathematical support for measurements of HIV incidence in British Columbia
- 2005–2007 **Postdoctoral Fellow**, *Los Alamos National Laboratory*.
- Investigated the role small-scale clustered social groups play in epidemic dynamics.
  - Organized *epitalks*, a weekly seminar series bringing together members of disparate infectious disease modeling groups within Los Alamos National Laboratory.

## Service

### Editorial Positions.

- **2016–present** Bulletin of Mathematical Biology
- **2016–present** Infectious Disease Modelling

### Workshop/Minisymposium Organization.

- **2019 Melbourne, Victoria, Australia** Organizing a session on parameter estimation as part of a MATRIX workshop.
- **2018 Bellevue, Washington.** Organized a session on pandemics and influenza at the 2018 Institute for Disease Modeling Symposium.
- **2011 Vancouver, British Columbia.** Organized minisymposium on epidemics on networks at the biannual International Conference on Industrial and Applied Mathematics.
- **2009 Boston, MA.** Co-organized RAPIDD Infectious Disease Dynamics Across Scales workshop at Harvard School of Public Health.
- **2006 Tucson, AZ.** Co-organized Los Alamos/Arizona Days conference, a joint applied mathematics conference involving Los Alamos, Arizona State University and University of Arizona.

### Peer reviewer.

- See my publons page: <https://publons.com/author/287636/joel-c-miller>
- PNAS, Royal Society Interface, PLoS Computational Biology, Nature Communications, Journal of Mathematical Biology, Mathematical Biosciences, Journal of Biological Dynamics, PLoS One, Journal of Theoretical Biology, Oikos, Theoretical Population Biology, Complexity Journal, Physical Review Letters, Physical Review E, Physica A, Physics Letters A, Journal of Non-Newtonian Fluid Mechanics, IEEE Transactions on Network Science and Engineering, Journal of Geographical Systems, Science Asia, International Journal of Biomathematics, Journal of Engineering Mathematics, Random Conference, and World Wide Web Conference

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## Teaching Experience

I have had good success in my teaching: Typically the majority rate my teaching as “excellent”. I have received emails years later from students asking for guidance with math problems they have encountered.

2011–Present **Instructor: Summer Institute in Statistics and Modeling of Infectious Diseases, University of Washington.**

- Co-teach “Networks and Infectious Diseases”. My half consists of five 90 minute lectures to classes of 20-40 students (ranging from PhD student to faculty member) on the use of dynamic models to study the spread of infectious diseases on static and dynamic networks.
- [Lecture notes](#)
- Teaching evaluation from majority of students has been ‘excellent’.

2014–2016 **Senior Lecturer, Monash University.**

- Taught several units, including Mathematical Biology and Mathematical Modelling.
- Supervised (or cosupervised) 3 honours theses and 6 summer research students, with one project leading to a publication (Lang et al 2018).

2012–2013 **Assistant Professor, Penn State University.**

- Full responsibility for honors section of “Matrices” (~30 students/semester). Designed course and wrote [text](#) (~165pgs).
- Teaching evaluation from majority of students was “good” or “excellent”.

2011 **Undergraduate research supervisor, Harvard School of Public Health.**

- 2011: supervised an undergraduate student’s research into infectious disease spread on networks, incorporating “age-of-infection” effects.
- 2010: supervised 3 undergraduate summer students from underrepresented backgrounds who were researching optimal distribution of pandemic influenza vaccine between children and adults.

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📄 [scholar.harvard.edu/joelmiller](http://scholar.harvard.edu/joelmiller)

- 2008 **Instructor**, *University of British Columbia Mathematics Department*.
  - Full responsibility for “Linear Differential Equations” (40 students).
  - Teaching evaluation from majority of students was ‘excellent’.
- 2008 **Outreach**, *University of British Columbia Mathematics Department*.
  - Helped with mathematics outreach program for grade 7-8 students.
- 2006–2007 **Summer Student Supervisor**, *Los Alamos National Laboratory*.
  - Supervised 2 graduate students investigating control measures for respiratory diseases. One project led to a publication (Kenah and Miller, 2011).

## Research Outputs

### ○ Summary Statistics

- Over 40 peer-reviewed publications, most of which are first or last author. *H-index*=26. Over 2000 citations. More details at Google Scholar: <http://bit.ly/MillerGoogleScholar>.
- Most papers available at <http://scholar.harvard.edu/joelmiller/publications>.

### ○ Books

- *Mathematics of epidemics on networks: from exact to approximate models*. I. Z. Kiss, J. C. Miller, and P. Simon. Springer. 2017 (413pp)
  - A monograph describing mathematical methods applied to the study of epidemics on networks.
  - <http://www.springer.com/la/book/9783319508047>.

### ○ Open source software

- *Epidemics on Networks (EoN)*: <http://epidemicsonnetworks.readthedocs.io/en/latest/>
  - A Python module I wrote for efficient simulation of epidemics on networks and efficient numerical solution of related ODE models. Consists of about 90 user-functions.
- *Invasion\_PGF*: [https://github.com/joelmiller/Invasion\\_PGF](https://github.com/joelmiller/Invasion_PGF)
  - A Python module I wrote for applying Probability Generating Functions to biological problems in invasive processes (in particular disease spread).
  - Provided along with a 60 page tutorial I have under review on the topic.
- *Networkx* [[networkx.github.io](http://networkx.github.io)]
  - Contributed algorithm for [generating Chung-Lu networks in  \$\mathcal{O}\(N\)\$  time](#) based on my 2011 *Workshop on Algorithms and Models for the Web Graph* paper with Aric Hagberg. The previous best-available algorithm is  $\mathcal{O}(N^2)$ .
  - Contributed algorithm for [generating random clustered networks](#) based on my 2009 *Physical Review E* paper.

### ○ Refereed Publications

#### - Under review

- ([pdf](#)) J. C. Miller. *A Primer on the use of Probability Generating Functions in Infectious Disease Modeling*.
- R. C. Barnard, I. Z. Kiss, L. Berthouze, J. C. Miller. *Edge-based compartmental modelling of an SIR epidemic on a dual-layer static-dynamic multiplex network with tunable clustering*.
- Z. Vizi, I. Z. Kiss, J. C. Miller, G. Röst. *Smaller variance in the infectious periods leads to larger reproduction number and more severe outbreak for network epidemics*.
- A. Bershteyn et al. *Implementation and applications of the EMOD individual-based disease modeling platform: software design and development processes to enable multi-scale modeling*.

- **2018**
  - o (pdf) J. C. Lang, J. L. Kaiser, H. De Sterck, J. C. Miller. *Analytic Models for SIR Disease Spread on Random Spatial Networks*. Journal of Complex Networks.
- **2017**
  - o (pdf) I. Z. Kiss, L. Berthouze, J. C. Miller, and P. Simon. *Chapter: Mapping out emerging network structures in dynamic network models coupled with epidemics*. In *Temporal Network Epidemiology*. Springer
  - o (pdf) J. C. Miller. *Mathematical models of SIR disease spread with combined non-sexual and sexual transmission routes*. Infectious Disease Modeling.
  - o (pdf) N Sherborne, J. C. Miller, K. B. Blyuss, and I. Z. Kiss. *Mean-field models for non-Markovian epidemics on networks: from edge-based compartmental to pairwise models*. Journal of Mathematical Biology.
  - o (pdf) J. C. Miller and A. C. Slim. *Saturation effects and the concurrency hypothesis: Insights from an analytic model*. PLoS One.
  - o (pdf) S. Fox J. C. Miller, and L. A. Meyers. *Seasonality in risk of pandemic influenza emergence*. PLoS Computational Biology.  
See NY Times article: <https://www.nytimes.com/2017/12/08/health/next-flu-pandemic.html>
- **2016**
  - o (pdf) J. C. Miller. *Equivalence of several generalized percolation models on networks*. Physical Review E.
- **2015**
  - o (pdf) C. Zhang, S. Zhou, J. C. Miller, I. J. Cox, and B. M. Chain. *Optimizing Hybrid Spreading in Metapopulations*. Scientific Reports.
  - o (pdf) J. C. Miller *Complex Contagions and hybrid phase transitions in unclustered and clustered random networks*. Journal of Complex Networks
- **2014**
  - o (pdf) J. C. Miller and I. Z. Kiss. *Epidemic spread in networks: Existing methods and current challenges*. Mathematical Modeling of Natural Phenomena
  - o (pdf) P. Rattana, J. C. Miller, and I. Z. Kiss. *Pairwise and edge-based models of epidemic dynamics on correlated weighted networks*. Mathematical Modeling of Natural Phenomena.
  - o (pdf) J. C. Miller *Epidemics on networks with large initial conditions or changing structure*. PLOS ONE
  - o (pdf) G. Abramson, M. N. Kuperman, J. M. Morales, and J. C. Miller. *Space use by foragers consuming renewable resources*. European Physical Journal B.
- **2013**
  - o (pdf) J. C. Miller and E. M. Volz. *Model hierarchies in edge-based compartmental modeling for infectious disease spread*. Journal of Mathematical Biology.
  - o (pdf) J. C. Miller and E. M. Volz. *Incorporating Disease and Population Structure into Models of SIR Disease in Contact Networks*. PLoS ONE.
  - o (pdf) J. C. Miller. *Cocirculation of infectious diseases in networks*. Phys Rev E.
  - o (pdf) A. C. Slim, M. M. Bandi, J. C. Miller, and L. Mahadevan. *Dissolution-driven convection in a Hele–Shaw cell*. Physics of Fluids.
- **2012**
  - o (pdf) J. C. Miller. *A note on the derivation of epidemic final sizes*. Bulletin of Mathematical Biology.
  - o (pdf) B. Davoudi, J. C. Miller, R. Meza, L. A. Meyers, D. J. D. Earn, and B. Pourbohloul.

*Early Real-time Estimation of the Basic Reproduction Number of Emerging Infectious Diseases.* Physical Review X.

- (pdf) [J.C. Miller](#), and M. Lipsitch. *Cholera modeling: challenges to quantitative analysis and predicting the impact of interventions.* Y. Grad, Epidemiology.
- (pdf) [J.C. Miller](#), A.C. Slim, and E.M. Volz. *Edge-based compartmental modelling for infectious disease spread.* Royal Society Interface.

- **2011**

- (pdf) E. Goldstein, S. Takahashi, S. Cobey, [J.C. Miller](#), and M. Lipsitch. *Predicting the epidemic sizes of influenza A/H1N1, A/H3N2 and B.* PLoS Medicine.
- (pdf) E.M. Volz, [J.C. Miller](#), A. Galvani, and L.A. Meyers. *Effects of heterogeneous and clustered contact patterns on infectious disease dynamics.* PLoS Computational Biology. e1002042.
- (pdf) [J.C. Miller](#) and A. Hagberg. *A note on a paper by Erik Volz: SIR dynamics in random networks.* Journal of Mathematical Biology.
- (pdf) [J.C. Miller](#) and A. Hagberg. *Efficient generation of networks with given expected degrees.* Proceedings of 8th Workshop on Algorithms and Models for the Web Graph. 115–126.
- (pdf) E. Kenah and [J.C. Miller](#). *Epidemic Percolation Networks, epidemic outcomes, and interventions.* Interdisciplinary Perspectives on Infectious Diseases. 543520.

- **2010**

- (pdf) M. Lajous, L. Danon, R. López-Ridaura, C.M. Astley, [J.C. Miller](#), S.F. Dowell, J.J. O'Hagan, E. Goldstein, and M. Lipsitch. *Mobile Messaging as Surveillance Tool during Pandemic (H1N1) 2009, Mexico.* Emerging Infectious Diseases.
- (pdf) E. Goldstein, B. Cowling, J.J. O'Hagan, L. Danon, V. Fang, A. Hagy, [J.C. Miller](#), D. Reshef, J. Robins, P. Biedrzycki, and M. Lipsitch. *Oseltamivir for treatment and prevention of pandemic influenza A/H1N1 virus infection in households, Milwaukee, 2009.* BMC Infectious Diseases.
- (pdf) E. Goldstein, A. Apolloni, B. Lewis, [J.C. Miller](#), M. Macauley, S. Eubank, M. Lipsitch, and J. Wallinga. *Distribution of vaccine/antivirals and the 'Least Spread Line' in a stratified population.* Journal of the Royal Society Interface.
- (pdf) [J.C. Miller](#), L. Danon, E. Goldstein, M. Lajous, J.J. O'Hagan, and M. Lipsitch. *Student behavior during a school closure caused by Pandemic Influenza A/H1N1.* PLoS One.
- (pdf) E. Goldstein, [J.C. Miller](#), J.J. O'Hagan, and M. Lipsitch. *Predispensing of antivirals to high-risk individuals in an influenza pandemic.* Influenza and Other Respiratory Viruses.
- (pdf) [J.C. Miller](#), B. Davoudi, R. Meza, A.C. Slim, and B. Pourbohloul. *Epidemics with general generation interval distributions.* Journal of Theoretical Biology.

- **2009**

- (pdf) [J.C. Miller](#) *Spread of infectious diseases through clustered populations.* Journal of the Royal Society Interface.
- (pdf) M. Lipsitch, M. Lajous, [J.C. Miller](#), E. Goldstein, T. Cohen, L. Danon, J.J. O'Hagan, J. Wallinga, S. Riley, S. Dowell, C. Reed, and M. McCarron. *Use of cumulative incidence of Novel Influenza A/H1N1 in foreign travelers to estimate lower bounds on cumulative incidence in Mexico.* PLoS One.
- (pdf) [J.C. Miller](#). *Percolation and epidemics in random clustered networks.* Phys Rev E.
- (pdf) A.C. Slim, N.J. Balmforth, R.V. Craster, and [J.C. Miller](#). *Surface wrinkling of a*

*channelized flow*. Proceedings of the Royal Society A.

- **2008**

- o (pdf) [J.C. Miller](#). *Bounding the size and probability of epidemics on networks*. Journal of Applied Probability.

- **2007**

- o (pdf) [J.C. Miller](#) and J.M. Hyman. *Effective vaccination strategies for realistic social networks*. Physica A.
- o (pdf) G. Chowell, P. Diaz-Dueñas, [J.C. Miller](#), P.W. Fenimore, J.M. Hyman, and C. Castillo-Chavez. *Estimation of the reproduction number of Dengue fever from spatial epidemic data*. Mathematical Biosciences.
- o (pdf) [J.C. Miller](#). *Epidemic size and probability in populations with heterogeneous infectivity and susceptibility*. Phys Rev E.
- o (pdf) [J.C. Miller](#) and J.M. Rallison. *Interfacial instability between sheared elastic liquids in a channel*. Journal of Non-Newtonian Fluid Mechanics.
- o (pdf) [J.C. Miller](#) and J.M. Rallison. *Instability of coextruded elastic liquids at high Weissenberg number*. Journal of Non-Newtonian Fluid Mechanics.

- **2006 and earlier**

- o 2006 (pdf) A. Farahat, T. LoFaro, [J.C. Miller](#), G. Rae, and L.A. Ward. *Authority rankings from HITS, PageRank, and SALSA: Existence, uniqueness, and effect of initialization*. SIAM Journal on Scientific Computing.
- o 2004 (pdf) D. Baldwin, U. Goktas, W. Hereman, L. Hong, R.S. Martino, and [J.C. Miller](#). *Symbolic computation of exact solutions expressible in hyperbolic and elliptic functions*. Journal of Symbolic Computation.
- o 2003 (pdf) [J.C. Miller](#) and A. Bernoff. *Rates of convergence to self-similar solutions of Burgers' equation*. Studies in Applied Mathematics.
- o 2001 (pdf) [J.C. Miller](#), G. Rae, F. Schaefer, T. LoFaro, L.A. Ward, and A. Farahat. *Modifications of Kleinberg's HITS Algorithm using matrix exponentiation and web log records*. Proceedings of the SIGIR2001 Conference.

## Selected Presentations

o **Disease spread in random spatial networks**

- NetSci: Paris, France (invited) Jun 2018
- Oxford Networks Group: Oxford, UK Jul 2017
- Mathematical Models in Ecology and Evolution: London, UK (invited) Jul 2017
- CAIMS: Edmonton, Canada (invited) Jun 2016

o **Epidemic spread in networks with birth/death**

- Stochastic models of the spread of disease and information on networks: Edinburgh, UK (invited) Jul 2016
- Netsci-X2015: Rio de Janeiro, Brazil (refereed) Jan 2015

o **Dynamic models for infection spread on networks**

- University of Melbourne: Melbourne (invited) Mar 2018
- Bill Gates: Bellevue, Washington Aug 2017
- NTU-Warwick Complexity Science Winter School: Singapore Feb 2015
- Institute for Disease Modeling: Seattle WA Sep 2014
- Utrecht University: Utrecht, Netherlands Nov 2012
- (video) Epidemics on Networks workshop: Girona, Spain (invited) Sept 2012

- Los Alamos National Laboratory: Los Alamos, NM Aug 2011
- SAMSI Dynamics ON Networks workshop: Durham, NC (invited) Mar 2011
- Fogarty International Center: Washington DC Jan 2010
- RIVM (Dutch Ministry of Health): Utrecht, Netherlands Sep 2010
- **Critical community size and vaccination**
- Mathematical Biosciences Institute: Columbus Ohio (invited) Mar 2018
- **Model hierarchies in infectious disease spread**
- Department of Homeland Security, Agriculture: Washington DC Nov 2009
- Foreign Animal Disease Subcommittee, White House Office of Science: Washington DC Sep 2009
- **Epidemic dynamics with arbitrary generation interval distribution**
- Fogarty Center: Bethesda, MD Oct 2009
- **Epidemics on networks**
- China-Canada Colloquium on Modelling Infectious Diseases: Xi'an, China (plenary) Sept 2009
- University of Alberta PIMS Mathematical Biology: Edmonton, Canada (invited) Dec 2007
- Pacific Institute of Mathematical Sciences: Vancouver, Canada (invited) Dec 2007
- **Epidemics in clustered populations**
- Modelling & Data Analysis for Inf. Disease Control Workshop: Murraramang, Australia Mar 2009
- Los Alamos National Laboratory: Los Alamos, NM Feb 2009
- **Epidemic spread in heterogeneous populations**
- Los Alamos National Laboratory: Los Alamos, NM Oct 2007
- Harvard School of Public Health: Boston, MA Mar 2007
- University of Texas: Austin, TX Sep 2006
- **Targeted vaccination**
- Pan-American Advanced Studies Institute: Mar del Plata, Argentina Dec 2006
- SIAM Annual meeting: Boston, MA Jul 2006
- **Interfacial Instabilities of inertialess elastic fluids**
- British Society of Rheology: Lake Vyrnwy, Wales (invited) Apr 2007

## Other

- **Water Polo:**
  - [Full Blue](#), Cambridge University (during my PhD).
  - Captain, Cambridge University Water Polo Club.
  - Twice Most Valuable Player, London Otter Water Polo Club (competed in UK National League two years while a PhD student).
  - Coached Los Alamos High School team.
- **Kayaking:**
  - Longest trip: 10 days. Farthest North: 72.5°. Strongest headwinds: 35 knot gusts. Strangest animal: *Clione limacina*.