

## Todd L. Parsons

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Date/Place of Birth: January 3, 1975, Etobicoke (Toronto), Ontario, Canada

### Education

**2012** Ph.D. Mathematics, University of Toronto  
Dissertation: Asymptotic analysis of some stochastic models from population dynamics and population genetics.  
Co-advisors: Peter A. Abrams (Ecology & Evolutionary Biology), Joseph Repka (Mathematics)  
**1997** M.Sc. Mathematics, University of Toronto.  
Project: Modular forms and L-functions. Advisor: James G. Arthur  
**1996** B.Math. Pure Mathematics, University of Waterloo *With Distinction - Dean's Honours List.*

### Academic Positions

**2013 - present** Chargé de recherche (CRCN), Centre National de la Recherche Scientifique (CNRS)  
**2012 - 2013** Postdoctoral fellow, Laboratoire de Probabilités et Modèles Aléatoires, Université Pierre et Marie Curie (Paris 6).  
**2007-2011** Research associate, Biology, University of Pennsylvania.  
**2005-2007** Research associate, Ecology & Evolutionary Biology, University of Toronto.  
**2003-2005** Sessional instructor, Mathematics, University of Toronto.  
**1994-1996** Research assistant, Symbolic Computation Group, Department of Computer Science, University of Waterloo (partially supported by NSERC USRA).

### Awards and Honours

**2012** Fondation Sciences Mathématiques de Paris Postdoctoral Fellowship  
**2011** NSERC Post Doctoral Fellowship (PDF) (*declined*)  
**1996-1999** NSERC Post Graduate Scholarship (PGS-A, PGS-B).  
**1996** Graduate Entrance Award, University of Toronto.  
**1996** Pure Mathematics Book Prize, University of Waterloo.  
**1994, 1995, 1996** NSERC Undergraduate Student Research Award (USRA).  
**1993** Hewlett Packard Award, University of Waterloo.  
**1993-1996** Senate Scholarship Mathematics Award, University of Waterloo.  
**1992** Descartes Entrance Scholarship, University of Waterloo.  
**1992-1996** Canada Scholarship.

### Selected Teaching Experience

**2005** Instructor, Calculus I (MAT 135Y) University of Toronto.  
**2005** Principal Instructor, Calculus of Several Variables (MAT 232H) University of Toronto.  
**2004** Principal Instructor, Multivariable Calculus (MAT 237Y) University of Toronto.  
**2003** Instructor, Calculus II (MAT 235Y) University of Toronto.

### Students Supervised

**2014** Kouadio Jean Claude Kouaho, (stagiaire M2).

## Publications

- Parsons, T. L.**, Lambert, A., Day, T., and Gandon, S. (2018) Pathogen evolution in finite populations: slow and steady spreads the best. *J. Royal Soc. Interface.* 15 (147): 20180135.
- Parsons, T. L.** (2018) Invasion probabilities, hitting times, and some fluctuation theory for the stochastic logistic process. *J. Math. Biol.* 77 (4): 1193–1231.
- Parsons, T. L.**, Rogers, T. (2017) Dimension reduction for stochastic dynamical systems forced onto a manifold by large drift: a constructive approach with examples from theoretical biology. *J. Phys. A: Math. Theor.* 50 (41): 415601
- Harris, K., **Parsons, T. L.**, Ijaz, U. Z., Lahti L., Holmes, I., and Quince, C. (2017) Linking statistical and ecological theory: Hubbell’s unified neutral theory of biodiversity as a hierarchical Dirichlet process. *Proc. IEEE* 105 (3): 516–529.
- Stewart, A. J., **Parsons, T. L.**, and Plotkin, J. B. (2016) Evolutionary consequences of behavioral diversity. *Proc. Natl. Acad. Sci. U. S. A.* 113 (45): E7003–E7009.
- Stewart A. J., **Parsons, T. L.**, and Plotkin J. B. (2012) Environmental robustness and the evolvability of populations. *Evolution* 66 (5): 1598–1612.
- Morlon, H., **Parsons, T. L.**, and Plotkin J. B. (2011) Reconciling molecular phylogenies with the fossil record. *Proc. Natl. Acad. Sci. U. S. A.* 108 (39): 16327–16332 .
- Draghi J. A., **Parsons, T. L.** and Plotkin, J. B. (2011) Epistasis increases the rate of conditionally neutral substitution in an adapting population. *Genetics* 187 (4): 1139–1152.
- Parsons, T. L.**, Quince, C., and Plotkin, J. B. (2010) Some Consequences of demographic stochasticity in population genetics. *Genetics.* 185 (4): 1345–1354.
- Draghi J. A., **Parsons, T. L.**, Wagner, G. P., and Plotkin, J. B. (2010) Mutational robustness can facilitate adaptation. *Nature.* 463 (7279): 353–355.
- Parsons, T. L.**, Quince, C., and Plotkin, J. B. (2008) Expected times to absorption and fixation for neutral and quasi-neutral haploid populations with density dependence. *Theor. Pop. Biol.*: 74 (4), 302–310.
- Parsons, T. L.** and Quince, C. (2007b) Fixation in haploid populations exhibiting density dependence II: The quasi-neutral case. *Theor. Pop. Biol.* 72 (4): 468–479.
- Parsons, T. L.** and Quince, C. (2007a) Fixation in haploid populations exhibiting density dependence I: The non-neutral case. *Theor. Pop. Biol.* 72 (1): 121–135.

## Accepted, Pending Revision

Billaud, O., Moen, D., **Parsons, T. L.**, and Morlon, H. Estimating Diversity Through Time using Molecular Phylogenies: Old and Species-Poor Frog Families are the Remnants of a Diverse Past. Major revisions at *Syst. Biol.*

## Revise and Resubmit

Bowen, E. J., **Parsons, T. L.**, Curtis, T. P., Plotkin, J. B., and Quince, C. Breakdown of population synchronicity in a complex microbial community – an interplay of stochastic and deterministic dynamics.

## In Preparation

Lambert, A., **Parsons, T. L.**, Achaz, G., and Lartillot, N. A non-exchangeable coalescent arising in phylogenetics.

**Parsons, T. L.**, Lambert, A., Day, T., and Gandon, S. Pathogen evolution in stochastic epidemics after vaccination

**Parsons, T. L.**, Plotkin, J. B. and Stewart, A. J. Clonal interference and entrenched social norms.

**Parsons, T. L.**, Invasion and persistence in density-dependent population processes.

## Popularization

**Parsons, T. L.** (2016) Genes, Chinese Restaurants & Textual Analysis. *Eureka* 64.

## Academic Visits

- 2018** Thematic Program on Emerging Challenges in Mathematical Biology. Fields Institute, Toronto.
- 2014** Understanding Microbial Communities; Function, Structure and Dynamics. Isaac Newton Institute for Mathematical Sciences, Cambridge.
- 2000-2001** Automorphic Forms and Representation Theory. Institute for Advanced Study, Princeton.
- 1997-1998** Special year on Automorphic Forms and Number Theory. Centre de Recherches Mathématiques, Montréal.

## Conference Presentations

- 2017** The Population Genetics of Pathogen Virulence. Annual Meeting of The Society of Mathematical Biology (University of Utah)
- 2016** Invasion in Density Dependent Population Processes. World Congress in Probability and Statistics (Fields Institute, Toronto)
- 2009** Stochastic Competition in Ecology, Epidemiology and Population Genetics. International Conference on Mathematical Biology and Annual Meeting of The Society of Mathematical Biology (University of British Columbia)

## Invited Presentations

- 2018** The Population Genetics of Pathogen Virulence. Applied Mathematics Seminar, University of Waterloo.
- 2018** Endowed with an Extra Sense: Mathematics and Evolution. Electrical and Computer Engineering Seminar, University of Toronto.
- 2018** The Population Genetics of Pathogen Virulence. Workshop on Multiscale Dynamics of Infections, Mathematical Biosciences Institute, Ohio.
- 2018** The Population Genetics of Pathogen Virulence. Mathematical Biology Seminar, Fields Institute, Toronto.
- 2017** The Population Genetics of Pathogen Virulence. Workshop on Ecology and Evolutionary Biology, Deterministic and Stochastic Models, Institut de Mathématiques de Toulouse.
- 2017** The Stochastic Evolution of Pathogen Virulence. Mathematics and Statistics Colloquium, Queen's University.
- 2016** The Stochastic Evolution of Pathogen Virulence. Mathematical Biology Seminar, McMaster University.
- 2016** The Stochastic Evolution of Pathogen Virulence. CRM-ISM Probability Seminar, McGill University.
- 2016** Scaling From the Microscopic to the Macroscopic in Complex Eco-evolutionary Models: a Host-Pathogen Example. Quantitative Laws II: From Interaction Structures to Collective Behavior, Lake Como School of Advanced Studies Summer School.
- 2015** Escaping from the Boundary in Density Dependent Population Processes. Conference on Probability and Biological Evolution, Centre International de Rencontres Mathématiques.
- 2015** The Conventional Wisdom Redux? Stochastic Evolution in Multistrain Epidemics. Centre for Mathematical Biology Seminar, University of Bath.
- 2014** Endowed with an Extra Sense: Mathematics and Evolution. Cambridge University Mathematics Society Seminar.
- 2014** A Non-exchangeable Coalescent Process Arising In Phylogenetics. Understanding Microbial Communities; Function, Structure and Dynamics, the Newton Institute.
- 2014** The Conventional Wisdom Redux? Stochastic Evolution in Multistrain Epidemics. Séminaire Mathématiques, Evolution, Génome, Aix-Marseille Université.
- 2014** Limit Theorems for the Unified Neutral Theory of Biodiversity and Their Application to the Human Gut Microbiome. Rencontre de la chaire Modélisation Mathématique et Biodiversité, Ecole Polytechnique.

- 2013** Estimating Long Term Diversity Dynamics Using Molecular Phylogenies and Limited Fossil Record, Workshop on Integrating Molecular Phylogenies and the Fossil Record, University of California, Berkeley.
- 2013** An Invariance Principle for the Neutral Theory of Biodiversity and its Applications to the Human Gut Microbiome, Workshop on Mathematics for an Evolving Biodiversity, Centre de Recherches Mathématiques, Montréal.
- 2013** The ‘Conventional Wisdom’ Redux? Stochastic Evolution in Multi-strain Epidemics, Séminaire d’Écologie et d’Évolution, Institut des Sciences de l’Évolution, Université Montpellier 2.
- 2013** The Conventional Wisdom Redux? Stochastic Evolution in Multi-strain Epidemics, Mathematical Genetics Seminar, Oxford University.
- 2012** From Population Genetics to Population Genomics: the Evolutionary Consequences of Neutrality and Epistasis, Cross Disciplinary Genomics, 2<sup>nd</sup> Symposium Paris - From Genome to Ecosystem, Université Pierre et Marie Curie.
- 2012** The Conventional Wisdom Redux: Stochastic Evolution in Multi-strain Epidemics, CMALS/Mathematical Biology Seminar, University of Glasgow.
- 2011** Inferring Diversity Dynamics, Mathematical Biology Research Seminar, McMaster University.
- 2011** A Mathematical Framework for Density Dependent Population Genetics, Applied Mathematics and Statistics Seminar, University of California, Santa Cruz.
- 2010** Limit Theorems for Density-Dependent Population Genetics, Probability Seminar, University of California, Berkeley.
- 2010** Neutrality, Epistasis & Evolvability: Can the Topology of Genome Space Affect Evolution?, Applied Math Seminar, University of Waterloo.
- 2010** Limit Theorems for Density-Dependent Population Genetics, Mathematical Biology Seminar, University of Glasgow.
- 2010** Neutral networks, robustness and evolvability: a mathematical perspective, Mathematical Genetics Group, Dept. of Statistics, Oxford University.
- 2009** Neutral networks, robustness and evolvability: a mathematical perspective. Université Pierre et Marie Curie.
- 2009** Limit Theorems for Density-Dependent Population Genetics, Séminaire de Probabilités et Statistiques, Université Lille 1.
- 2009** Some Results for Density Dependent Population Genetics, Math Biology Seminar, Arizona State University.
- 2009** Neutral networks, robustness and evolvability: a mathematical perspective, Mathematics Colloquium, Georgetown University.
- 2008** Exploring the limits of mathematical population genetics, Ecology and Evolutionary Biology Seminar, McMaster University.
- 2008** Some results on haploid populations exhibiting density dependence. Workshop on Theoretical Landscape Microbial Ecology, University of Glasgow.
- 2007** Asymptotics for the fixation of alleles in density dependent populations, Applied Mathematics Colloquium, University of Western Ontario.
- 2007** Asymptotics for the fixation of alleles in density dependent populations, Applied Mathematics Seminar, University of Ottawa.

**Conferences  
Co-Organized**

- 2015** Mathematical Models in Ecology and Evolution, Collège de France.
- 2008** Workshop on Stochasticity in Population and Disease Dynamics, DIMACS, Rutgers University.
- 1996** President, 3<sup>rd</sup> Canadian Undergraduate Mathematics Conference, Faculty of Mathematics, University of Waterloo.

**Professional  
Service**

Manuscript reviews for *American Naturalist*, *Annals of Applied Probability*, *Bulletin of Mathematical Biology*, *Discrete and Continuous Dynamical Systems – Series B*, *Ecology Letters*, *Electronic Journal of Probability*, *Evolution*, *Genetics*, *IEEE Transactions on Network Science and Engineering*, *Journal of Dynamics and Differential Equations*, *Journal of Dynamics and Games*, *Journal of Mathematical Biology*, *Journal of Statistical Mechanics: Theory and Experiment*, *Journal of the Royal Society Interface*, *Journal of Theoretical Biology*, *Mathematical Population Studies*, *Physical Review E*, *PLOSOne*, *Proceedings of the Royal Society Series B*, *Stochastic Models*, *Theoretical Ecology*, and *Theoretical Population Biology*.

Grant reviews for *the Netherlands Organisation for Scientific Research (NWO)* and *Deutsche Forschungsgemeinschaft (DFG)*

**Non-academic  
Employment  
and Service**

**2005** Participant, Maytree Foundation's Leaders for Change

**2003-5** Independent consultant: research, project development, and grant writing, for Pro Bono Law Ontario and North Toronto Green Community

**1998-2000** Founder, steering committee chair, and grant writer, BikeShare, Toronto.

**1998-2000** Advisory board member (fundraising portfolio), Community Bicycle Network.

**1998-2000** Campaigner (part-time), Earthroots.