CURRICULUM VITAE

Daniel A. Charlebois, Ph.D., P.Phys.

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Education

University of Ottawa 2010-2013
Ph.D. Physics (Biological Physics, Supervisor: Prof. Mads Kærn)

- Thesis: Computational Investigations of Noise-Mediated Cell Population Dynamics (nominated for a thesis prize)

University of Ottawa 2008-2010
M.Sc. Physics (Biological Physics, Supervisor: Prof. Mads Kærn)

- Thesis: An Algorithm for the Stochastic Simulation of Gene Expression and Cell Population Dynamics

University of Calgary 2002-2008
B.Sc. Physics with Applied Mathematics Minor and
B.Sc. Biological Sciences

- Supervisor for honors stream projects: Dr. Stuart A. Kauffman

Publications

Forthcoming/Preprint

1. "Backward evolution from gene network dynamics", *Merzu Belete, ***Daniel A. Charlebois**, Gábor Balázsi, *bioRxiv*, doi: 10.1101/369371.

Published

1. "Engineered gene networks enable non-genetic drug resistance and enhanced cellular robustness", Brendan Camellato, Ian J. Roney, Afnan Aziz, **Daniel A. Charlebois**, Mads Kærn, (2019) *Engineering Biology*, doi: 10.1049/enb.2019.0009.

2. "Role of network-mediated stochasticity in mammalian drug resistance", Kevin Farquhar, **Daniel A. Charlebois**, Mariola Szenk, Joseph Cohen, Dmitry Nevozhay, Gábor Balázsi, (2019) *Nature Communications*, 10: 2766.

3. "Modeling Cell Population Dynamics", **Daniel A. Charlebois**, Gábor Balázsi. (2019) *In Silico Biology*, 13: 21.

4. "Multiscale effects of heating and cooling on genes and gene networks", **Daniel A. Charlebois**, Kevin Hauser, Sylvia Marshall, Gábor Balázsi, (2018) *Proceeding of the National Academy of Sciences of the United States of*

America, doi: 10.1073/pnas.1810858115.

5. “Negative Regulation Gene Circuits with Efflux Pump Control”, *__Daniel A. Charlebois__, *Junchen Diao, Dmitry Nevozhay, Gábor Balázsi. (2018) *Methods in Molecular Biology*, 1772: 25.

6. “Frequency-dependent selection: a diversifying force in microbial populations”, **Daniel A. Charlebois**, Gábor Balázsi. (2016) *Molecular Systems Biology*, 12: 880.

7. “Efflux pump control alters synthetic gene circuit function”, Junchen Diao, **Daniel A. Charlebois**, Dmitry Nevozhay, Zoltán Bódy, Csaba Pál, Gábor Balázsi. (2016) *ACS Synthetic Biology*, doi: 10.1021/acssynbio.5b00154.

8. “Effect and evolution of gene expression noise on the fitness landscape”, **Daniel A. Charlebois**. (2015) *Physical Review E*, 92: 022713.

9. “Coherent Feedforward Transcriptional Regulatory Motifs Enhance Drug Resistance”, **Daniel A. Charlebois**, Gábor Balázsi, Mads Kærn. (2014) *Physical Review E*, 89: 052708.

10. “An Accelerated Method for Simulating Population Dynamics”, **Daniel A. Charlebois**, Mads Kærn. (2013) *Communications in Computational Physics*, 14: 461.

11. “What all the Noise is About: The Physical Basis of Cellular Individuality”. **Daniel A. Charlebois**, Mads Kærn. (2012) *Canadian Journal of Physics*, 90: 919.

12. “Gene Expression Noise Facilitates Adaptation and Drug Resistance Independently of Mutation”. **Daniel A. Charlebois**, Nezar Abdennur, Mads Kærn. (2011) *Physical Review Letters*, 117: 218101.

13. “An Algorithm for the Stochastic Simulation of Gene Expression and Heterogeneous Population Dynamics”. **Daniel A. Charlebois**, Dawn Fraser, Jukka Intosalmi, Mads Kærn. (2011) *Communications in Computational Physics*, 9: 89.

14. “Stochastic Gene Expression and the Processing and Propagation of Noisy Signals in Genetic Networks”. **Daniel A. Charlebois**, Theodore J. Perkins, Mads Kærn. (2011) *Information Processing and Biological Systems*. A.S. Ribeiro and S. Niiranen (Eds). Springer-Verlag, pg. 89-112, ISBN: 978-3-642-19620-1.

15. "A biophysicist ponders the application of hidden metric spaces to genetic networks". **Daniel Charlebois**. (2009) *Nature*, 458: 811.

16. “*CellLine*, a stochastic cell lineage simulator”. Andre S. Ribeiro, **Daniel A. Charlebois**, Jason Lloyd-Price. (2007) *Bioinformatics*, 23: 3409.

17. “Effects of microarray noise on inference efficiency of a stochastic model of gene networks". **Daniel A. Charlebois**, Andre S. Ribeiro, Antti Lehmussola, Jason Lloyd-Price, Olli Yli-Harja, Stuart A. Kauffman. (2007) *WSEAS Transactions on Biology and Biomedicine*, Vol. 4: 15.

*Equal contribution. Underline denotes trainee.

Research Experience

Assistant Professor of Biophysics

Department of Physics, University of Alberta 2019-Present

Natural Sciences and Engineering Research Council (NSERC) Postdoctoral Fellow/Postdoctoral Associate

Laufer Center for Physical and Quantitative Biology, Stony Brook University 2014-2019

- Supervisor: Prof. Gábor Balázsi

Research Assistant

Ottawa Institute of Systems Biology, University of Ottawa 2008-2014

Institute for Biocomplexity and Informatics, University of Calgary 2005-2007

Canadian Blood Services, National Epidemiology and Surveillance Division 2005

Teaching Experience

Teaching

Instructor, University of Alberta Winter 2020
Course: PHYS495/595 – Intro to Biophysics

Guest Lecturer, Stony Brook University Winter 2018
Course: Genetic Engineering

Guest Lecturer, Stony Brook University Winter 2018
Women in Science and Engineering (WISE) Course:
Opportunities in STEM and Beyond

Co-Instructor, Stony Brook University Winter 2017 & Fall 2018
WISE Course: Women in the Laboratory:
Introduction to Science, Engineering, and Mathematics Research

Laboratory Guest Instructor, Stony Brook University Fall 2016
Physical and Quantitative Biology

Guest Lecturer, Stony Brook University Summer 2016
Course: Introduction to Biomedical Engineering

Teaching Assistant, Department of Physics, University of Ottawa 2008-2012
Courses: Statistical Thermodynamics, Mechanics, Theoretical Physics,
Fundamentals of Physics I, II & III

Supervision

Graduate Thesis Supervisor 2020-Present
Akila Bandara, MSc Student, Department of Physics, University of Alberta

Research Supervisor 2019-Present
Rebekah Hall, Undergraduate Student, Department of Mathematical and Statistical Sciences, University of Alberta

Undergraduate Thesis Co-Supervisor (with Prof. Gábor Balázsi) 2015-2016
Sylvia Marshall, BSc Chemistry (Hons.) 2016, Laufer Center for Physical and Quantitative Biology, Stony Brook University

Mentoring

Mentor 2019-Present
University of Alberta-Women in Science and Engineering (UA-WISE)/ Women in Scholarship, Engineering, Science, and Technology (WiSEST) Mentorship Program

Advisor 2016-2018
Stony Brook University
Senior Design Project in Biomedical Engineering

International Genetically Engineered Machine (iGEM) Competition Advisor 2014
Stony Brook University
Model of a Synthetic *E. Coli* System for Programmed Melittin Formation
(bronze medal awarded at championship)

iGEM Advisor 2013
University of Ottawa
Modeling a synthetic fold-change molecule detector network in budding yeast
(gold medal awarded at championship)

Assisted Prof. Kærn and Prof. Balázsi with training and supervising undergraduate and graduate students 2010-2019
(both theoretical and experimental projects)

Fellowships & Grants

Submitted/Under Review

New Frontiers of Research Fund 2020
(Social Sciences and Humanities Research Council,
$250,000 requested over 2 years)

Discovery Grant 2020
(NSERC, $338,750 requested over 5 years)

Awarded

Start-Up Funds 2019-2022
(Faculty of Science, University of Alberta, $250,000)

NVIDIA Graphical Processing Unit (GPU) Grant Program 2018
2 Titan X Pascal GPUs (NVIDIA Corporation, $3,000)

Natural Sciences and Engineering Research Council of Canada 2014-2016
Postdoctoral Fellowship (Government of Canada, $90,000)

NVIDIA GPU Grant Program 2014
2 Tesla K40 GPU Accelerators (NVIDIA Corporation, $15,000)

Awards & Scholarships

Submitted/Under Review

Canada's Top 40 Under 40, Caldwell 2020
(Nominated by the Department of Physics, University of Alberta)

Awarded/Nominated

Sloan Research Fellowship, Alfred P. Sloan Foundation 2020
(Nominated by the Department of Physics/Faculty of Science, University of Alberta)

Blavatnik Awards for Young Scientists, New York Academy of Sciences 2017 & 2019
(Nominated by Stony Brook University)

Faculty of Graduate and Postdoctoral Studies Dean's Scholarship 2014
(University of Ottawa, for doctorate, $3,000)

Queen Elizabeth II Scholarship in Science and Technology 2012-2014
(Government of Ontario, $30,000)

Excellence Scholarship 2012-2014
(University of Ottawa, $16,000)

Faculty of Graduate and Postdoctoral Studies Dean's Scholarship 2010
(University of Ottawa, for master's with a thesis, $1,500)

Jason Lang Scholarship 2008
(Government of Alberta, $1,000)

Laurence Decore Award for Student Leadership 2006
(Government of Alberta, $500)

Computer Science Undergraduate Society 2005
Schlumberger Calgary Technology Centre Award
(CSUS and Schlumberger Information Systems, $1,000)

ExxonMobil Higher Education Award 2002-2005
(ExxonMobil, $15,000)

Scientific Talks

"The Role of Gene-Network Mediated Stochasticity in Mammalian Drug Resistance", LBD 2019 Webinar on Biosystems/Laboratory of Biosystem Dynamics, Tampere University, Online/Virtual Conference (invited), December 10, 2019.

"Non-genetic to Genetic Antimicrobial Resistance: Mechanisms from Mathematical and Fungal Model Systems", Biochemistry Department, University of Alberta, Edmonton, Canada (invited), November 6, 2019.

"Gene Networks and Drug Resistance: Breakthroughs Using Novel Model Systems", Biological & Biomedical Engineering Research Symposium, McGill University, Montreal, Canada (invited keynote), March 22, 2019.

"Multiscale Effects of Temperature on Synthetic Gene Circuits", American Physical Society March Meeting, Boston, USA, March 4, 2019.

"Heterogeneity in Mammalian Drug Resistance", Gordon Research Conference on Drug Resistance, Bryant University, Smithfield, USA, July 25, 2018.

"Stochasticity in Mammalian Drug Resistance", American Physical Society March Meeting, Los Angeles, USA, March 7, 2018.

"Functional Effects of Heating and Cooling Gene Networks", LBD 2017 Webinar on Biosystems, hosted at the Tampere University of Technology, Tampere, Finland (invited), December 11, 2017.

"Effect of Temperature on Synthetic Positive and Negative Feedback Gene Circuits", American Physical Society March Meeting, New Orleans, USA, March 16, 2017.

"Evolving Drug Resistance: Quantitative Models and Synthetic Gene Networks", Mini-Workshop: Cellular Heterogeneity and Evolution, Stony Brook University, Stony Brook, USA (invited), August 25, 2016.

"Gene Expression Noise, Fitness Landscapes, and Evolution", APS March Meeting, Baltimore, USA, March 16, 2016.

"Theoretical Investigations on the Development of Drug Resistance", Laufer Center Retreat, Old Field Club, Stony Brook, USA, April 20, 2015.

"From Mathematical Models to the Laboratory: Shedding New Light on Drug Resistance", SBU Postdoc Spotlight, Stony Brook University, Stony Brook, USA, September 18, 2014.

"Modelling & Simulation of Cellular Population Dynamics: The Case for Noise-Mediated Drug Resistance", Mathematical Tools for Evolutionary Systems Biology, BIRS, Banff, Canada, May 29, 2013 (invited).

"Gene Expression Noise Facilitates Adaptation and Drug Resistance Independently of Mutation", Ottawa-Carleton Institute for Physics, University of Carleton, Ottawa, Canada, April 30, 2013.

"Simulating Heterogeneous Cell Populations and the Development of Noise Induced Drug Resistance", University of Texas MD Anderson Cancer Center, Houston, USA, August 20, 2012.

"Modelling Drug Resistance in Cell Populations", 2011 OISB Symposium, Montebello, Canada, June 8, 2011.

"Stochastic Simulation of Gene Expression and Heterogeneous Population Dynamics", Ottawa-Carleton Institute for Physics, University of Carleton, Ottawa, Canada, December 15, 2009.

"*P53Sim*, Multiple Cells and Cell Lineage P53-Mdm2 Feedback Loop Delayed Stochastic Simulator", Department of Physics and Astronomy, University of Calgary, Calgary, Canada, April 25, 2007.

"Inference Algorithms, Threshold Test for Gene Regulatory Networks", Department of Biological Sciences, University of Calgary, Calgary, Canada, April 6, 2006.

Service & Public Outreach

Member, Undergraduate Biophysics Degree Program Development Committee, Department of Physics, University of Alberta (2019-Present)

Member, Graduate Admissions Committee, Department of Physics, University of Alberta (2019-Present)

Member, Thesis Committee (Aaron Lyons and Furkan Altincicek), Department of Physics, University of Alberta (2019-Present)

S^4 Humans of Physics Talk, "Daniel Charlebois = Human Biophysicist", Department of Physics, University of Alberta (2019)

APS March Meeting Focus Session Co-Organizer and Chair, Single-Cell Variability and Dynamics, and Evolutionary Systems Biology I & II, Los Angeles (2018)

Moderator, SBU Postdoc Spotlight, Stony Brook University (2017)

Judge, Three Minute Thesis Competition, Stony Brook University (2017)

Editorial Board Member, *In Silico Biology* (2016-Present)

TEDx Talk, "Drug Resistance: A New Paradigm", Stony Brook University (2016)

Member, Postdoc Advisory Committee, Stony Brook University (2016-2019)

Panel Participant, NSF Graduate Research Fellowship Program information session, Stony Brook University (2016)

Grant Review Panelist, National Science Foundation (2016)

SBU Postdoc Spotlight Presentation, "From Mathematical Models to the Laboratory: Shedding New Light on Drug Resistance", Stony Brook University (2014)

Journal Reviewer: *Advances in Difference Equations*, *DNA Research*, *Earth Systems and Environment Science*, *FEBS Letters*, *In Silico Biology*, *Molecular Biosystems*, *Physical Review E*, *PLOS Biology*, *PLOS Computational Biology, PLOS ONE* (2014-Present)

Languages & Computational/Experimental Skills

Languages: Fluent in English and French;

Operating Systems: Windows, Mac, Linux

Software: MATLAB, Mathematica, XPPAUT, MatCont, LaTeX, OpenMP, FCS Express

Programming Languages: Fortran, Python, C++, Pascal

Experimental Microbiology: Cell culture, flow cytometry, microscopy and microfluidics, cell counter, plate reader, gel electrophoresis, yeast transformation

Professional Memberships

American Association for the Advancement of Science (member since 2017)

Biophysical Society of Canada (member since 2019)

Canadian Association of Physicists (member since 2008, Professional Physicist (P.Phys.) since 2011)

National Postdoctoral Association (affiliate member 2014-2019)

New York Academy of Sciences (member since 2015)

Sigma Xi (elected, full member since 2010)