

## CURRICULUM VITAE

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## Education

University of Ottawa 2010-2014

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: Prof. Stuart A. Kauffman, M.D.

## Publications

### *Preprints*

1. “Backward Evolution from Gene Network Dynamics”, \*Merzu Belete, \***Daniel A. Charlebois**, Gábor Balázsi, *bioRxiv*, doi: 10.1101/369371.

### *Published*

22. “Advancing Antimicrobial Resistance Through Quantitative Modeling and Synthetic Biology”. Kevin S. Farquhar, Harold Flohr, **Daniel A. Charlebois**, (2020) *Frontiers in Bioengineering and Biotechnology*, 8: 583415.
21. Rebekah Hall, **Daniel A. Charlebois**, Book review on “A World Beyond Physics: The Emergence and Evolution of Life” by Stuart A. Kauffman. (2020) *The Quarterly Review of Biology*, 95: 133.
20. “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.
19. “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.
18. “Modeling Cell Population Dynamics”, **Daniel A. Charlebois**, Gábor Balázsi. (2019) *In Silico Biology*, 13: 21. (Among “Most read ISB articles in 2019”).

17. "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.
16. "Negative Regulation Gene Circuits with Efflux Pump Control", \***Daniel A. Charlebois**, \*Junchen Diao, Dmitry Nevozhay, Gábor Balázsi. (2018) *Methods in Molecular Biology*, 1772: 25.
15. "Frequency-Dependent Selection: A Diversifying Force in Microbial Populations", **Daniel A. Charlebois**, Gábor Balázsi. (2016) *Molecular Systems Biology*, 12: 880.
14. "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.
13. "Effect and Evolution of Gene Expression Noise on the Fitness Landscape", **Daniel A. Charlebois**. (2015) *Physical Review E*, 92: 022713.
12. "Coherent Feedforward Transcriptional Regulatory Motifs Enhance Drug Resistance", **Daniel A. Charlebois**, Gábor Balázsi, Mads Kærn. (2014) *Physical Review E*, 89: 052708.
11. "An Accelerated Method for Simulating Population Dynamics", **Daniel A. Charlebois**, Mads Kærn. (2013) *Communications in Computational Physics*, 14: 461.
10. **Daniel A. Charlebois**. Book review on "Number-Crunching" by Paul J. Nahin. (2013) *Physics in Canada*, 69: 72.
9. "What all the Noise is About: The Physical Basis of Cellular Individuality". **Daniel A. Charlebois**, Mads Kærn. (2012) *Canadian Journal of Physics*, 90: 919.
8. "Gene Expression Noise Facilitates Adaptation and Drug Resistance Independently of Mutation". **Daniel A. Charlebois**, Nezar Abdennur, Mads Kærn. (2011) *Physical Review Letters*, 117: 218101.
7. "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.
6. "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.

5. "Dynamics of Stochastic Gene Rings". **Daniel A. Charlebois**. (2010) *Canadian Undergraduate Physics Journal*, 8: 13.
4. "A Biophysicist Ponders the Application of Hidden Metric Spaces to Genetic Networks". **Daniel Charlebois**. (2009) *Nature*, 458: 811.
3. **Daniel Charlebois**, Book review on "The Human Side of Einstein" by Walter Isaacson. (2008) *Canadian Undergraduate Physics Journal*, 8: 37.
2. "*CellLine*, a Stochastic Cell Lineage Simulator". Andre S. Ribeiro, **Daniel A. Charlebois**, Jason Lloyd-Price. (2007) *Bioinformatics*, 23: 3409.
1. "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

### ***Adjunct Professor***

Department of Biological Sciences, University of Alberta 2021-Present

### ***Affiliate Faculty Member***

Collaborative Mathematical Biology Group, University of Alberta 2020-Present

### ***Natural Sciences and Engineering Research Council Postdoctoral Fellow/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 Course: BIOPH401/501 – Advanced Biophysics	Winter 2021
Instructor/Supervisor, University of Alberta Course: PHYS499 – Undergraduate Research Project Students: Joshua Guthrie and Samiha Ali	Fall 2020
Instructor, University of Alberta Course: PHYS495/595 – Intro to Biophysics	Winter 2020
Guest Lecturer, Stony Brook University Course: Genetic Engineering	Winter 2018
Guest Lecturer, Stony Brook University Women in Science and Engineering Course: Opportunities in STEM and Beyond	Winter 2018
Co-Instructor, Stony Brook University WISE Course: Women in the Laboratory: Introduction to Science, Engineering, and Mathematics Research	Winter 2017 & Fall 2018
Laboratory Guest Instructor, Stony Brook University Physical and Quantitative Biology	Fall 2016
Guest Lecturer, Stony Brook University Course: Introduction to Biomedical Engineering	Summer 2016
Teaching Assistant, Department of Physics, University of Ottawa Courses: Statistical Thermodynamics, Mechanics, Theoretical Physics, Fundamentals of Physics I, II & III	2008-2012

### *Supervision*

Graduate Thesis Supervisor Akila Bandara, PhD Student, Department of Physics, University of Alberta	2020-Present
Graduate Thesis Supervisor Harold Flohr, MSc Student, Department of Physics, University of Alberta	2020-Present
Research Supervisor Samira Rasouli Koochi, MSc Student, Department of Physics, University of Alberta	2020-Present

Undergraduate Research Supervisor and/or PHYS499 Supervisor 2019-Present

- Samiha Ali, Undergraduate Student, Department of Mathematical and Statistical Sciences & Department of Physics, University of Alberta
- Joshua Guthrie, Undergraduate Student, Department of Physics, University of Alberta
- 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 2010-2019  
 undergraduate and graduate students  
 (theoretical and experimental projects)

### **Fellowships & Grants**

#### ***Submitted/Under Review***

\*John R. Evans Leaders Fund (Principal Applicant) 2020

- Canada Foundation for Innovation and the Alberta Ministry of Economic Development and Trade and Tourism, \$247,424
- “Mitigation of Drug Resistance in Bacteria and Pathogenic Yeasts”

\*CFI component awarded – matching EDTT component under review

## ***Awarded***

Discovery Grant (Primary Investigator)	2020-2025
<ul style="list-style-type: none"><li>• Natural Sciences and Engineering Research Council of Canada, \$145,000</li><li>• “Biophysical models of the effect of the physico-chemical environment on genetic networks”</li></ul>	
Discovery Launch Supplement (Primary Investigator)	2020-2021
<ul style="list-style-type: none"><li>• Natural Sciences and Engineering Research Council of Canada, \$12,500</li><li>• “Biophysical models of the effect of the physico-chemical environment on genetic networks”</li></ul>	
New Frontiers in Research Fund – Exploration (Primary Investigator)	2020-2022
<ul style="list-style-type: none"><li>• Government of Canada, \$250,000</li><li>• “Understanding and mitigating drug resistance: Quantitative models and synthetic gene networks”</li></ul>	
Start-Up Funds	2019-2022
<ul style="list-style-type: none"><li>• Faculty of Science, University of Alberta</li></ul>	
GPU Grant (Primary Investigator)	2018
<ul style="list-style-type: none"><li>• NVIDIA Corporation, 2 Titan X Pascal GPUs valued at \$3,000</li></ul>	
Postdoctoral Fellowship	2014-2016
<ul style="list-style-type: none"><li>• Natural Sciences and Engineering Research Council of Canada, \$90,000</li></ul>	
GPU Grant (Primary Investigator)	2014
<ul style="list-style-type: none"><li>• NVIDIA Corporation, 2 Tesla K40 GPU Accelerators valued at \$15,000</li></ul>	

## **Awards & Scholarships**

### ***Awarded***

Randy & Audrey Lomnes Early Career Endowment Award in Physics (Department of Physics, University of Alberta and Randy & Audrey Lomnes, \$90,000)	2020-2022
Faculty of Graduate and Postdoctoral Studies Dean’s Scholarship (University of Ottawa, for doctorate, \$3,000)	2014
Queen Elizabeth II Scholarship in Science and Technology (Government of Ontario, \$30,000)	2012-2014
Excellence Scholarship (University of Ottawa, \$16,000)	2012-2014



Faculty of Graduate and Postdoctoral Studies Dean's Scholarship (University of Ottawa, for master's with a thesis, \$1,500)	2010
Jason Lang Scholarship (Government of Alberta, \$1,000)	2008
Laurence Decore Award for Student Leadership (Government of Alberta, \$500)	2006
Computer Science Undergraduate Society Schlumberger Calgary Technology Centre Award (CSUS and Schlumberger Information Systems, \$1,000)	2005
ExxonMobil Higher Education Award (ExxonMobil, \$15,000)	2002-2005

### Scientific Talks

24. "Effects of Temperature and Drugs on the Function, Dynamics, and Evolution of Gene Regulatory Networks and Antimicrobial Resistance" online seminar hosted by the Department of Biological Sciences, University of Alberta, Canada, November 19, 2020 (Invited).
22. "Drug Resistance: Noise, Networks, and Evolution" online seminar hosted by the Department of Physics, University of Calgary, Canada, October 29, 2020. (Invited)
21. "Investigations on Drug Resistance: Mathematical and Engineered Model Systems", Mathematical Biology Seminar Series, online seminar hosted by the Collaborative Mathematical Biology Group & Department of Mathematics and Statistics, University of Alberta, Canada, April 6, 2020. (Invited)
20. "Gene Network-Mediated Heterogeneity in Mammalian Drug Resistance", Advances in Theoretical and Experimental Methods for Analyzing Complex Regulatory Networks, BIRS, Banff, Canada, February 20, 2020. (Invited)
19. "The Role of Gene Network-Mediated Stochasticity in Mammalian Drug Resistance", LBD 2019 Webinar on Biosystems/Laboratory of Biosystem Dynamics, hosted by Tampere University, Finland, December 10, 2019. (Invited)
18. "Non-genetic to Genetic Antimicrobial Resistance: Mechanisms from Mathematical and Fungal Model Systems", Biochemistry 623 Molecular and Cellular Biology Seminar Series, Biochemistry Department, University of Alberta, Edmonton, Canada, November 5, 2019. (Invited)

17. "Gene Networks and Drug Resistance: Breakthroughs Using Novel Model Systems", Biological & Biomedical Engineering Research Symposium, McGill University, Montreal, Canada, March 22, 2019. (Invited keynote)
16. "Multiscale Effects of Temperature on Synthetic Gene Circuits", American Physical Society March Meeting, Boston, USA, March 4, 2019.
15. "Heterogeneity in Mammalian Drug Resistance", Gordon Research Conference on Drug Resistance, Bryant University, Smithfield, USA, July 25, 2018.
14. "Stochasticity in Mammalian Drug Resistance", American Physical Society March Meeting, Los Angeles, USA, March 7, 2018.
13. "Functional Effects of Heating and Cooling Gene Networks", LBD 2017 Webinar on Biosystems, online conference hosted by the Tampere University of Technology, Finland, December 11, 2017. (Invited)
12. "Effect of Temperature on Synthetic Positive and Negative Feedback Gene Circuits", APS March Meeting, New Orleans, USA, March 16, 2017.
11. "Evolving Drug Resistance: Quantitative Models and Synthetic Gene Networks", Mini-Workshop: Cellular Heterogeneity and Evolution, Stony Brook University, Stony Brook, USA, August 25, 2016. (Invited)
10. "Gene Expression Noise, Fitness Landscapes, and Evolution", APS March Meeting, Baltimore, USA, March 16, 2016.
9. "Theoretical Investigations on the Development of Drug Resistance", Laufer Center Retreat, Old Field Club, Stony Brook, USA, April 20, 2015.
8. "From Mathematical Models to the Laboratory: Shedding New Light on Drug Resistance", SBU Postdoc Spotlight, Stony Brook University, Stony Brook, USA, September 18, 2014.
7. "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)
6. "Gene Expression Noise Facilitates Adaptation and Drug Resistance Independently of Mutation", Ottawa-Carleton Institute for Physics, University of Carleton, Ottawa, Canada, April 30, 2013.
5. "Simulating Heterogeneous Cell Populations and the Development of Noise Induced Drug Resistance", University of Texas MD Anderson Cancer Center, Houston, USA, August 20, 2012.

4. "Modelling Drug Resistance in Cell Populations", 2011 OISB Symposium, Montebello, Canada, June 8, 2011.
3. "Stochastic Simulation of Gene Expression and Heterogeneous Population Dynamics", Ottawa-Carleton Institute for Physics, University of Carleton, Ottawa, Canada, December 15, 2009.
2. "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.
1. "Inference Algorithms, Threshold Test for Gene Regulatory Networks", Department of Biological Sciences, University of Calgary, Calgary, Canada, April 6, 2006.

### **Service & Public Outreach**

External Grant Reviewer, New Frontiers in Research Fund – Exploration (2020)

Judge, Best Student Oral Presentation, Division of Physics in Medicine and Biology, 2020 Canadian Association of Physicists Virtual Congress (2020)

Pint of Science Festival Talk, "Physics + Biology = Weapons Against Drug Resistance", Pint of Science Canada, online (2020)

Judge, Nat Rutter "Outstanding Technician of the Year" Award, Sigma Xi, University of Alberta Chapter (2020)

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<sup>4</sup> 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*, *BioEssays*, *DNA Research*, *Earth Systems and Environment Science*, *FEBS Letters*, *In Silico Biology*, *Molecular Biosystems*, *Physical Review E*, *Physical Review Letters*, *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: bacterial, fungal, and mammalian cell culture, flow cytometry, microscopy and microfluidics, cell counter, plate reader, gel electrophoresis, yeast transformation, drug resistance/evolution experiments

### **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)

Engineers Without Borders (member since 2004)

National Postdoctoral Association (affiliate member 2014-2019)

New York Academy of Sciences (member since 2015)

Sigma Xi (elected, full member since 2010)