

# DEXTER BARROWS

## CURRICULUM VITAE

🔗 [dexter.barrows.io](https://dexter.barrows.io)

✉ [dexter@barrows.io](mailto:dexter@barrows.io)

### *Professional Experience*

#### *Software Developer II*

SEASPIN

2021–PRESENT

Design and implement system software for image-guided surgical navigation.

- Create software features for flagship surgical navigation application
- Develop new applications for navigation of specialized surgical procedures
- Serve as a technical resource for team members, especially on software architecture and design, UI/UX, and code quality
- Onboard and train junior software team members

LANGUAGES C#, C++

FRAMEWORKS CUDA, OpenMP, WPF

#### *Software Developer*

7D SURGICAL

2017–2019

Developed software for image-guided surgical navigation of the spine and cranium.

- Worked closely with clinical team members to greatly streamline UX of all clinical applications, leading to improved utility and experience for surgeons
- Designed and implemented cranial biopsy procedure guidance software
- Redesigned application data structuring and handling to enable multiple concurrent workflows in cranial navigation software
- Refined UI of clinical applications in concert with sales and marketing teams
- Improved automated test coverage used in CI/CD system
- Sped up critical image processing pipeline by 50%
- Actively participated in all phases of the software lifecycle in compliance with ISO 13485
- Gave presentations on software profiling and data processing, WPF layouts, and Git LFS

LANGUAGES C#, C++

FRAMEWORKS CUDA, OpenMP, WPF

#### *Research Assistant*

BIOPHOTONICS AND BIOENGINEERING LABORATORY (BBL)

2015–2017

Architected modular software solution for real-time, GPU-accelerated medical image processing for use in a variety of research projects.

- Designed medical image processing pipeline for semi-automated anatomical segmentation
- Developed 3D image-processing tools to aid data processing for major clinical study
- Served as a technical resource on software development methods and practices, and gave presentations on core topics such as codebase analysis and Git

LANGUAGES C++, MATLAB

FRAMEWORKS CUDA, OpenGL

#### *Data Analyst*

CANADIAN SOCIETY OF ASSOCIATION EXECUTIVES (CSAE)

2013

Performed data sourcing, verification, and analysis.

## Education

### *Doctor of Philosophy – Mathematics*

TORONTO METROPOLITAN UNIVERSITY

2023

Developing new optimisations for techniques designed for the simulation of biochemical reaction-diffusion systems. Focus is on the utilisation of inference schemes to determine optimal parameters for accurate and efficient simulations, and the development of R/C++ software packages to make these enhancements available to practitioners.

THESIS *Efficient stochastic simulation of reaction-diffusion networks*  
 SUPERVISORS Dr. Silvana Ilie & Dr. Katrin Rohlf

### *Master of Science – Applied Mathematics*

MCMASTER UNIVERSITY

2016

Examined techniques for parameter inference and forecasting of time series, within the context of epidemic forecasting. Developed and utilised massively parallel implementations of iterated particles filters in R/C++/CUDA.

THESIS *A Comparative Study of Techniques for Estimation and Inference of Nonlinear Stochastic Time Series*  
 SUPERVISOR Dr. Ben Bolker  
 ☞ <https://github.com/dbarrows/epidemic-forecasting>

### *Bachelor of Science, with Distinction – Mathematics and Computer Science*

TORONTO METROPOLITAN UNIVERSITY

2014

Created software framework for the simulation of biochemical kinetics, including a novel application of the Multi-level Monte-Carlo method to this domain, in MATLAB/CUDA.

THESIS *Software for Multi-level Monte-Carlo Simulation of Stochastic Biochemical Kinetics*  
 SUPERVISOR Dr. Silvana Ilie  
 ☞ <https://github.com/dbarrows/biochemical-kinetics>

## Teaching Experience

### *Graduate Assistant*

TORONTO METROPOLITAN UNIVERSITY

2019–PRESENT

Run tutorials and labs, and invigilate and grade quizzes/tests/exams.

COURSES Numerical Analysis, Linear Algebra  
 LANGUAGES MATLAB

### *Teaching Assistant*

MCMASTER UNIVERSITY

2014–2016

Ran tutorials and labs, and invigilated and graded tests/exams.

COURSES Introduction to Scientific Computing, Calculus for Life Sciences  
 LANGUAGES Python

### *Math and Science Tutor*

THE MATH GURU

2010–2014

Taught mathematics, physics, and computer science up to university level.

LANGUAGES Python

## Awards

### *Postgraduate Scholarship – Doctoral (PGS D)*

THE NATIONAL SCIENCE AND ENGINEERING RESEARCH COUNCIL OF CANADA (NSERC)

2020–2023

National scholarship supporting high-calibre scholars who are engaged in doctoral programs in the natural sciences or engineering.

### *Queen Elizabeth II – Science and Technology (QEII-GSST)*

TORONTO METROPOLITAN UNIVERSITY / THE PROVINCE OF ONTARIO

2019–2020

Provincial merit-based scholarship for students in a graduate research-based programs in a science and technology discipline.

## Journal Publications

### *Optical coherence tomography for dynamic axial correction of an optical end-effector for robot-guided surgical laser ablation*

OPTICAL ENGINEERING

2019

AUTHORS J Jivraj, C Chen, D Barrows, VXD Yang

✉ <https://doi.org/10.1117/1.OE.58.5.054106>

### *Optimization of laser osteotomy at 1064 nm using a graphite topical absorber and a nitrogen assist gas jet*

BIOMEDICAL OPTICS EXPRESS

2019

AUTHORS J Jivraj, D Barrows, X Gu, VXD Yang

✉ <https://doi.org/10.1364/BOE.10.003114>

## Conference Presentations

### *Efficient techniques for inferring stochastic biochemical system reaction rates*

CANADIAN APPLIED AND INDUSTRIAL MATHEMATICS SOCIETY (CAIMS) ANNUAL MEETING

2021

AUTHORS D Barrows, S Ilie

### *Optimal bath particle density selection for Reactive Multiparticle Collision dynamics*

CANADIAN APPLIED AND INDUSTRIAL MATHEMATICS SOCIETY (CAIMS) ANNUAL MEETING

2021

AUTHORS D Barrows, K Rohlf

### *Inference of Stochastic Biochemical System Reaction Rates*

INTELLIGENT SYSTEMS FOR MOLECULAR BIOLOGY (ISMB)

2020

AUTHORS D Barrows, S Ilie

### *A Software Ecosystem for Stochastic Biochemical Network Simulation in R*

SIAM/CANADIAN APPLIED AND INDUSTRIAL MATHEMATICS SOCIETY (CAIMS) ANNUAL MEETING

2020

AUTHORS D Barrows, K Rohlf, S Ilie

### *Graphics processor unit acceleration enables realtime endovascular Doppler optical coherence tomography imaging*

SPIE PHOTONICS WEST

2017

AUTHORS D Barrows, B Vuong, K Lee, J Jivraj, VXD Yang

✉ <https://doi.org/10.1117/12.2254930>

*Graphics processor unit acceleration enables realtime endovascular Doppler optical coherence tomography imaging: development and validation*

SPIE PHOTONICS WEST

2017

AUTHORS D Barrows, JM Ramjist, B Vuong, K Lee, J Jivraj, VXD Yang

🔗 <https://doi.org/10.1117/12.2256623>

*Assessment of haemodynamics of intracranial aneurysms using Doppler optical coherence tomography in patient specific phantoms: preliminary results*

SPIE PHOTONICS WEST

2017

AUTHORS JM Ramjist, J Jivraj, D Barrows, B Vuong, R Wong, VXD Yang

🔗 <https://doi.org/10.1117/12.2256532>

## *Invited Presentations & Trainings*

*The Stochastic Simulation Algorithm*

TORONTO METROPOLITAN UNIVERSITY, DEPARTMENT OF MATHEMATICS

2021

*Inhomogeneous biochemical systems: modelling and stochastic simulation*

TORONTO METROPOLITAN UNIVERSITY, DEPARTMENT OF MATHEMATICS

2020

*Biochemical systems: modelling and stochastic simulation*

TORONTO METROPOLITAN UNIVERSITY, DEPARTMENT OF MATHEMATICS

2019

*Spatiotemporal models*

MCMASTER UNIVERSITY, DEPARTMENT OF MATHEMATICS & STATISTICS

2015

*Julia sets*

MCMASTER UNIVERSITY, DEPARTMENT OF MATHEMATICS & STATISTICS

2015

*Epidemic forecasting: review of the state of the art*

MCMASTER UNIVERSITY, DEPARTMENT OF MATHEMATICS & STATISTICS

2015

*Fringe: software for OCT data acquisition and imaging*

BIOPHOTONICS AND BIOENGINEERING LABORATORY

2016

*Git & Github*

BIOPHOTONICS AND BIOENGINEERING LABORATORY

2016

*Models for systems of biochemical reactions: simulation and software implementation*

TORONTO METROPOLITAN UNIVERSITY, DEPARTMENT OF MATHEMATICS

2014

## Software

### rendr

R PACKAGE

2020

An R package for simulating reaction and reaction-diffusion systems.

LANGUAGES R, C++

FRAMEWORKS OpenMP

🔗 <https://dexter.barrows.io/rendr>

### mountie

R PACKAGE

2020

An R package providing an efficient C++ implementation of the Reactive Multi-Particle Collisions (RMPC) algorithm.

LANGUAGES R, C++

FRAMEWORKS OpenMP

🔗 <https://dexter.barrows.io/mountie>

### bondr

R PACKAGE

2020

Provides utilities and classes for working with reaction networks in R.

LANGUAGES R, C++

🔗 <https://dexter.barrows.io/bondr>

### wplot

R PACKAGE

2020

A clean theme for ggplot2 with matching geom defaults.

LANGUAGES R

🔗 <https://dexter.barrows.io/wplot>

### Fringe

WINDOWS APPLICATION

2016

Program for Optical Coherence Tomography (OCT) data acquisition and imaging.

LANGUAGES C++

FRAMEWORKS CUDA, OpenGL

### MARS

MATLAB TOOLKIT

2014

Toolkit for simulating well-stirred biochemical systems.

LANGUAGES MATLAB

FRAMEWORKS CUDA

🔗 <https://github.com/dbarrows/biochemical-kinetics/tree/master/code>

## Certifications

### *LBR iiwa – Commissioning and Programming*

KUKA COLLEGE

2017

Operation and programming of the KUKA LBR iiwa personal robotic assistant, including safe interaction, manual operation, basic maintenance, authoring robotic applications, and debugging.

LANGUAGES Java

*Leadership**President, Mathematics Course Union (MCU)*

TORONTO METROPOLITAN UNIVERSITY

2013–2014

Acted as a liaison between students, the Department of Mathematics, and the Faculty of Science.

COMMITTEES Curriculum Advising Committee, By-law Revising Subcommittee, Ryerson Science Society  
(RSS) Steering Committee

*Vice President – Financial, Ryerson Science Society (RSS)*

TORONTO METROPOLITAN UNIVERSITY

2012-2013

Ensured transparent flow of financial resources for student events