**Jarrett D. Phillips, Ph.D.**
**Adjunct Professor**
**School of Computer Science**
**Department of Integrative Biology**
**University of Guelph**
jphill01@uoguelph.ca
jphill01

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## EXECUTIVE SUMMARY

My academic work and research interests can best be described as *computational molecular biodiversity science*. Biodiversity is under threat in a rapidly changing world, where mitigation requires innovative and collaborative solutions from multiple disciplines. DNA-based specimen identification and species discovery through techniques like DNA barcoding and environmental DNA (eDNA) offer promising ways forward, yet produce overwhelming amounts of data. I leverage AI/ML/Data Science/Big Data methods to help researchers find meaningful signal in a vast sea of noise.

## ACADEMIC APPOINTMENTS

**Adjunct Professor**, School of Computer Science 2023–Present
University of Guelph

## EDUCATION

**Ph.D.** in Computational Sciences**,** University of Guelph 2016–2022
**Co-Advisors**: Dr. Daniel Gillis and Dr. Robert Hanner
**Advisory Committee Members**: Dr. Deborah Stacey and Dr. Graham Taylor
**Thesis**: A Novel Statistical Framework for Assessment of Intraspecific Haplotype Sampling Completeness: Implications for DNA Barcode Gap Estimation

**Master of Bioinformatics (MBinf.)**, University of Guelph 2013–2014
**Co-Advisors**: Dr. Robert Hanner and Dr. Daniel Ashlock
**Thesis**: Assessing DNA Barcode Haplotype Sampling Diversity in the Ray-finned Fishes (Chordata: Actinopterygii)

**BSc. (Hons.)** in Biological Science, University of Guelph 2009–2013
Coursework in bioinformatics, ecology, evolutionary biology, comparative physiology, genetics, mathematics, and statistics

## RESEARCH EXPERIENCE

**Postdoctoral Fellow** 2023–Present
University of Guelph
GBADs Informatics Team
Stacey Lab, School of Computer Science
Supervisor: Dr. Deborah Stacey

- Currently developing an R package to run a compartmentalized equation-based Dynamic Population Model (DPM) for the Global Burden of Animal Diseases (GBADs) initiative to calculate the Animal Health Loss Envelope (AHLE) in livestock species as part of a larger team of computer scientists, software engineers, data scientists, epidemiologists, and veterinarians
- Co-developed and ran a week-long data workshop at the University of Liverpool alongside other members of the GBADs Informatics Working Group and international colleagues

**Postdoctoral Fellow** 2023–Present
University of Guelph
Gillis Lab, School of Computer Science
Hanner Lab, Department of Integrative Biology
Supervisors: Drs. Daniel Gillis and Robert Hanner

- Mentored and supervised CIS*4900/4910, STAT*4600, IBIO*6070, and URA students in projects on seafood fraud and environmental DNA sampling using computational methods
- Participated in conceptualization and drafting of various manuscripts for both academic and non-academic audiences, where I was lead author on most

**Postdoctoral Fellow** 2022
University of Guelph
Hanner Lab, Department of Integrative Biology
Supervisor: Dr. Robert Hanner

- Mentored and supervised a Master of Bioinformatics (MBINF.) BINF*6999 student on research project examining DNA barcoding in Canadian pests and disease vectors
- Participated in conceptualization and drafting of various manuscripts and invited book chapters, many as primary author

**Summer Research Assistant** 2016
Algoma University
Plant and Soil Ecology Lab, Department of Biology
Invasive Species Research Institute (ISRI)
Supervisor: Dr. Pedro Antunes

- Offered bioinformatics and statistical analysis support in R
- Assisted Principal Investigator and undergraduate thesis student with initial drafting of a manuscript on invasive plant root lesion staining quantification

**Lab Assistant Volunteer** 2014–2016
Algoma University
Plant and Soil Ecology Lab, Department of Biology
Invasive Species Research Institute (ISRI)
Supervisor: Dr. Pedro Antunes

- Offered bioinformatics and statistical analysis support in R
- Assisted with collaborative and outreach initiatives for the Terrestrial Invasive Plant Species (TIPS) Network Project through drafting communication letters to public and private conservation agencies across Canada and the USA seeking volunteers to collect invasive plant species for root lesion quantification

**Undergraduate Research Assistant** 2013
University of Guelph
Vaccine Discovery Research Group
Supervisor: Dr. Mario Monteiro

- Performed various experimental techniques (gas chromatography-mass spectrometry (GC-MS) and Nuclear Magnetic Resonance (NMR)) on bacterial polysaccharide samples for vaccine synthesis and development under the supervision of qualified graduate students

## TEACHING EXPERIENCE

**Graduate Teaching Assistant (GTA)** 2016–2020
University of Guelph
**CIS*3130 – System Modelling and Simulation** 2020
~ 30 students · Python
- Statistical and Monte Carlo methods

**CIS*1910 – Discrete Structures in Computing I** 2017
~ 300 students
- Deductive logic, set theory, and mathematical proof techniques

**CIS*2460 – Modelling of Computer Systems** 2016–2019
~ 60 students · R, Excel, Java
- Statistical and Monte Carlo methods

## STUDENT SUPERVISION AND MENTORSHIP

***** Indicates students under my direct mentorship or supervision
****** Indicates students under my indirect mentorship or supervision

***Nikolett Toth** 2024
CIS*4900/4910 · Mining association rules for eDNA spatiotemporal sampling
***Nikolett Toth** (with Dan Gillis) 2024
Summer Undergraduate Research Assistant (URA) · Mining association rules for eDNA spatiotemporal sampling

***Nathan Zeinstra** (with Dirk Steinke) 2024
IBIO*6070 · Bayesian habitat occupancy modelling of sea lamprey using eDNA
***Fynn De Vuono-Fraser** (with Dan Gillis) 2024
CIS*4900/4910 · Bayesian modelling of seafood fraud in the Canadian supply chain
***Zaid Al-Gayyali** (with Dan Gillis) 2023
Summer Undergraduate Research Assistant (URA) · Seafood Fraud Visualization Tool Shiny app
***Fynn De Vuono-Fraser** (with Dan Gillis) 2023
STAT*4600 · Bayesian modelling of seafood fraud in the Canadian supply chain
***Amina Asif** (with Bob Hanner) 2022
BINF*6999 · DNA barcode gap analysis of Canadian disease vectors and agricultural pests
***Navdeep Singh** (with Dan Gillis) 2021
CIS*4900 · HACSim RShiny web application
***Scarlett Bootsma** (with Dan Gillis) 2020–2021
CIS*4900/4910 · HACSim simulation study
***Maya Persram** (with Bob Hanner) 2020
Hanner Lab volunteer · R reporting ecological meta-analysis
****Ashley Chen** (with Bob Hanner) 2020
Hanner Lab volunteer · R reporting ecological meta-analysis
****Olivia Friesen Kroeker** (with Bob Hanner) 2020
Hanner Lab volunteer · R reporting ecological meta-analysis
****Christina Fragel** (with Bob Hanner) 2018–2019
BINF*6999 · DNA barcode sequence classification with machine learning
****Jiaojia (Paula) Yu** (with Bob Hanner) 2018–2019
BINF*6999 · MDMAPR R Shiny app
****Danielle St. Jean** (with Dan Gillis) 2018–2019
MSc. thesis · DNA barcode sequence classification with machine learning
***Steven French** (with Dan Gillis) 2018
CIS*4900/4910 · HACSim R package
****Julia Harvie** (with Bob Hanner) 2018–2019
MCB*4500/4510 · Data mining GenBank and BOLD
****Ankita Bhanderi** (with Bob Hanner) 2018
BINF*6999 · Data mining GenBank and BOLD

## ASSISTANTSHIPS, AWARDS, SCHOLARSHIPS AND GRANTS

**Food from Thought Advancing Research Impact (ARIF) Fund – Knowledge Mobilization Grant** 2024
University of Guelph $30000 CAD (not funded)

- 1-year postdoctoral funding to develop association rule classifiers for targeted aquatic eDNA species detection

**Food from Thought Advancing Research Impact (ARIF) Fund – Livestock Innovation Grant** 2024
University of Guelph $40000.00 CAD

- 1-year postdoctoral funding to develop and refine the Dynamic Population Model (DPM) to assess global disease burden in livestock

**Food from Thought Advancing Research Impact (ARIF) Fund** 2022
University of Guelph $30000.00 CAD

- 1-year postdoctoral funding to develop a Bayesian hierarchical binary logistic time-series regression model of seafood fraud in the Canadian supply chain

**NSERC Postdoctoral Fellowship** 2021
University of Waterloo $90000.00 CAD (not funded)

- 2-year postdoctoral funding to develop an ensemble machine learning model for taxonomic classification of regulated species in Canada

**Guelph Institute for Environmental Research Small Grants Program (GIER SGP)** 2020
University of Guelph $15000.00 CAD (not funded)

- 1-year postdoctoral funding to develop a Bayesian hierarchical binary logistic time-series regression model of seafood fraud in the Canadian supply chain

**SoCS Travel Grant** 2019
University of Guelph $1000.00 CAD

- Supported travel to the 8th International Barcode of Life Conference in Trondheim, Norway to present doctoral research

**Arthur D. Latornell Graduate Travel Grant** 2019
University of Guelph $500.00 CAD

- Awarded for first-class academic standing in Ph.D. coursework
- Supported travel to the 8th International Barcode of Life Conference in Trondheim, Norway to present work related to resource management and conservation

**Graduate Teaching Assistantships** 2017–2020
University of Guelph $34,506.00-35,148.00 CAD

**Graduate Research Assistantships** 2017–2019
University of Guelph $11,000.00 CAD

**CPES Graduate Dean's Scholarship** 2017
University of Guelph $3500.00 CAD

- Awarded in recognition of achieving over 85% in Master's coursework

**CPES Graduate Excellence Entrance (GEE) Scholarship** 2016
University of Guelph $30000.00 CAD

- Awarded in recognition of achieving over 85% in Master's coursework

## ACADEMIC SERVICE

**Pathways to Increase Standards and Competency in eDNA Surveys (PISCeS) Conference** 2023
University of Guelph

- Organized and participated in international eDNA conference hosted by the Hanner Lab
- Duties included registration, upload, and audiovisual support

**School of Computer Science (SoCS) Search Committee** 2018
University of Guelph

- Associate Professor position in cybersecurity
- Responsibilities included reviewing and ranking received applications, shortlisting strong candidates to be invited for formal interviews, participating in interview questioning, and attending organized events with candidates and other SoCS faculty

**School of Computer Science (SoCS) Search Committee** 2017–2018
University of Guelph

- Two-year contractually-limited Assistant Professor position in cybersecurity
- Tasks included reviewing and ranking received applications, shortlisting strong candidates to be invited for formal interviews, participating in interview questioning, and attending organized events with candidates and other SoCS faculty

## ACADEMIC PEER REVIEW SERVICE

*Ecology and Evolution*, *F1000 Research*, *Frontiers in Ecology and Evolution*, *Lifestyle Genomics*, *Mitochondrial DNA Part A*, *Molecular Ecology Resources*, *Molecular Biology Reports*, *Methods in Ecology and Evolution*

## PROCEEDINGS

**CEPS Undergraduate Student Poster Day** (student poster presentation) 2024
Nikolett Toth · Association Rule Mining of eDNA Datasets
University of Guelph, Canada

**CBS Undergraduate Poster Session** (student poster presentation) 2024
Nikolett Toth · Association Rule Mining of eDNA Datasets
University of Guelph, Canada

**9th International Barcode of Life Conference** (poster presentation) 2024
Estação das Docas, Brazil · A Measure of the DNA Barcode Gap for Applied and Basic Research
(not attended)

**GBADs Technical Workshop** (oral presentation) 2023
University of Liverpool, England

**CEPS Student Research Day** (student poster presentation) 2023
Fynn De Vuono-Fraser · Estimating Seafood Mislabelling Rates in Canada Using Bayesian Modelling
University of Guelph, Canada

**Pathway to Increase Standards and Competency of eDNA Surveys (PICSeS) International Conference** (poster presentation) 2023
University of Guelph, Canada

**8th International Barcode of Life Conference** (oral presentation) 2019
NTNU University Museum and Norwegian Biodiversity Information Centre, Norway

**Guelph BioMathematics and Statistics (BioM&S) Symposium**
**Artificial Intelligence and Machine Learning in Biology** (attended) 2019
University of Guelph, Canada

**CEPS Undergraduate Student Poster Day** (student poster presentation) 2018
Steven French · Estimating Sampling Size Using Haplotype Accumulation Curves and Semiparametric Models
University of Guelph, Canada

**7th International Barcode of Life Conference** (oral presentation) 2017
University of Johannesburg, South Africa

**6th International Barcode of Life Conference** (poster presentation) 2015
University of Guelph, Canada

## SOFTWARE DEVELOPMENT

RulesTools · R package

- Streamlined tools to facilitate association rule mining and visualization using various discretization and imputation methods, along with heatmaps and Euler diagrams
- R package available for download through the Comprehensive R Archive Network (CRAN) package repository

GBADsDPM (**G**lobal **B**urden of **A**nimal **D**iseases **D**ynamic **P**opulation **M**odel) · R package

- A novel stochastic age- and sex-structured compartmentalized equation-based model to assess the burden of animal diseases in livestock such as cattle, small ruminants, and poultry within developing countries like Ethiopia

HACSim (**H**aplotype **A**ccumulation **C**urve **Sim**ulator) · R package · R Shiny web app

- A novel nonparametric stochastic (Monte Carlo) local search optimization method of iteratively generating species' haplotype accumulation curves through extrapolation to assess within-species sampling completeness
- R package and Shiny app respectively available for download through CRAN or at shinyappps.io
- Publication *in PeerJ Computer Science* was one of the top five most viewed papers in the category *Optimization Theory and Computation*
- Has been downloaded over 32000 times since being published in May 2019

VLF (**V**ery **L**ow **F**requency) · R package

- A novel tool to assess PCR errors, sequencing errors, *etc.* in the form of very low frequency variants, within DNA sequences using a sliding window approach
- R package available for download through CRAN
- Manuscript published in the *Biodiversity Data Journal*
- Has been downloaded over 37000 times since publication

## REFEREED WORK

**Journal Articles**
Citations: 233 · H-index: 6 (According to Google Scholar, as of January 23, 2024)

***** Indicates students under my direct mentorship or supervision
****** Indicates students under my indirect mentorship or supervision

*Published or Accepted*

8. Raymond, K., Sobkowich, K.E., **Phillips, J.D.**, Nguyen, L., McKechnie, I., Mohideen, R.N., Fitzjohn, W., Szurkowski, M., Davidson, J., Rushton, J., Stacey, D.A. and Bernardo T.M. (2024). GBADs informatics strategy: User-centric tools, data quality, and model interoperability. *WOAH Scientific and Technical Review*, **43**: 96-107. DOI: 10.20506/rst.43.3522.
7. **Phillips, J.D.** and *****De Vuono-Fraser, F.A. (2024). Statistical modelling of seafood fraud in the Canadian supply chain. bioRxiv. DOI: 10.1101/2024.02.05.578947.

6. **Phillips, J.D.**, Athey, T.B.T., Hanner, R.H. and McNicholas, P.D. VLF: An R package for the analysis of very low frequency variants in DNA sequences. *Biodiversity Data Journal,* e96480*.* DOI: 10.3897/BDJ.11.e98480. Number of article citations: 1.
5. **Phillips, J.D.**, Gillis, D.J. and Hanner, R.H. (2022). Lack of statistical rigor in DNA barcoding likely invalidates the presence of a true species' barcode gap. *Frontiers in Ecology and Evolution*, 10: 859099. DOI: 10.3389/fevo.2022.859099. Number of article citations: 30.
4. D'Ercole, J., Dincă, V., Opler, P.A., Kondla, N.G., Schmidt, C.B., **Phillips, J.D.**, Robbins, R., Burns, J.M., Miller, S.E., Grishin, N., Zakharov, E.V., deWaard, J.R., Ratnasingham, S. and Hebert, P.D.N. (2021). A DNA barcode library for the butterflies of North America. *PeerJ*, 9: e11157. DOI: 10.7717/peerj.11157. Number of article citations: 23.
3. **Phillips, J.D.**, *****French, S.H., Hanner, R.H. and Gillis, D.J. (2020). HACSim: An R package to estimate intraspecific sample sizes for genetic diversity assessment using haplotype accumulation curves. *PeerJ Computer Science*, 6(192): 1-37. DOI: 10.7717/peerj-cs.243. Number of article citations: 22.
2. **Phillips, J.D.**, Gillis, D.J. and Hanner, R.H. (2019). Incomplete estimates of genetic diversity within species: Implications for DNA barcoding. *Ecology and Evolution,* 9(5): 2996-3010. DOI: 10.1002/ece3.4757. Number of article citations: 115.
1. **Phillips, J.D.**, Gwiazdowski, R.A., Ashlock, D. and Hanner, R. (2015). An exploration of sufficient sampling effort to describe intraspecific DNA barcode haplotype diversity: examples from the ray-finned fishes (Chordata: Actinopterygii). *DNA Barcodes*, 3: 66-73. DOI: 10.1515/dna-2015-0008. Number of article citations: 31.

*Submitted or Under Revision*

2. **Phillips, J.D.** and *****De Vuono-Fraser, F.A. Statistical modelling of seafood fraud in the Canadian supply chain. Submitted to *Journal of the Royal Statistical Society Series A: Statistics in Society*.
1. **Phillips, J.D.** A Bayesian coalescent model of the DNA barcode gap. Submitted to *Systematic Biology*.

*In Preparation or To Be Submitted*

8. *Toth, N., **Phillips, J.D.**, Hanner, R.H., and Gillis, D.J. Mining association rules for targeted spatiotemporal aquatic environmental DNA (eDNA) sampling. Targeted to *Environmental DNA*.
7. **Phillips, J.D.** and *****De Vuono-Fraser, F.A. Swimming in uncertainty: How proper statistical modelling can help expose seafood product mislabelling. Targeted to *CHANCE*.
6. **Phillips, J.D., ***Al-Gayyali, Z.B.**,** *De Vuono-Fraser, F.A., Hanner, R.H. and Gillis, D.J. The Seafood Fraud Visualization Tool: An R Shiny web app to summarize, model, and visualize seafood mislabelling trends in the supply chain.
5. Morey, K.C., **Phillips, J.D.**, Loeza-Quintana, T. and Hanner, R.H. Haplotype diversity reveals challenges and opportunities for developing targeted detection assays for COI in Canadian freshwater fish. Targeted to *Environmental DNA.*
4. Young, R.G., ******Persram, M., ******Friesen, O., ******Chen, A., ******Yu, J., **Phillips, J.D.** and Hanner, R.H. Incomplete and irregular reporting of the R statistical and computing environment highlights the need for citation guidelines to support scientific reproducibility.
3. **Phillips, J.D.**, *****Singh, N., Hanner, R.H. and Gillis, D.J. The HACSim R Shiny app: A web interface to estimate specimen sampling sufficiency for species genetic diversity assessment with DNA sequence data.
2. D'Ercole, J., Dapporto, L., **Phillips, J.D.**, Dincă, V.E., Vila, R., Talavera, G. and Hebert, P.D.N. Macrogenetics of North American butterflies—The impact of Quaternary climatic fluctuations. Targeted to *PNAS.*

1. **Phillips, J.D.**, *Bootsma, S.E., Hanner, R.H. and Gillis, D.J. Solving the genetic specimen sample size problem with a local search optimization algorithm. Targeted to *Methods in Ecology and Evolution.*

**Book Chapters**

*Published or Accepted*

2. **Phillips, J.D**., Griswold, C.K., Young, R.G., Hubert, N. and Hanner, R.H. (2024). A measure of the DNA barcode gap for applied and basic research. DNA Barcoding Methods and Protocols. Methods in Molecular Biology. Springer Nature. URL: https://link.springer.com/protocol/10.1007/978-1-0716-3581-0_24 Number of times cited: 1.

1. Hubert, N., **Phillips, J.D**. and Hanner, R.H. (2024). Delimiting species with single-locus DNA sequences. DNA Barcoding Methods and Protocols. Methods in Molecular Biology. Springer Nature. URL: https://link.springer.com/protocol/10.1007/978-1-0716-3581-0_3

**Conference Proceedings**

4. Morey, K., Loeza-Quintana, T., **Phillips, J.** and Hanner R. (2023). Haplotype diversity reveals challenges and opportunities for developing targeted detection assays for *COI* in Canadian freshwater fish. Pathways to Increase Standards and Competency in eDNA Surveys (PISCeS) Conference. Poster.

3. **Phillips, J.D.**, Gillis, D. and Hanner, R. (2019). HACSim: Iterative extrapolation of haplotype accumulation curves for assessment of intraspecific COI DNA barcode sampling completeness Scientific abstracts from the 8th International Barcode of Life Conference, Trondheim, Norway (ed. Torbjørn Ekrem), *Genome*, 62(6): 349-453. Oral presentation.

2. **Phillips, J.D.**, Gillis, D. and Hanner, R. (2017). Intraspecific sample size estimation for DNA barcoding: Are current sampling levels enough? Scientific abstracts from the 7th International Barcode of Life Conference, Johannesburg, South Africa (ed. M. van der Bank), *Genome*, 60(11): 881-1019. Oral presentation.

1. **Phillips, J.D.**, Gwiazdowski, R.A., Ashlock, D. and Hanner, R. (2015). An exploration of sufficient sampling effort to describe intraspecific haplotype diversity in the ray-finned fishes (Chordata: Actinopterygii). Scientific abstracts from the 6th International Barcode of Life Conference, Guelph, ON., Canada (ed. S.J. Adamowicz), *Genome*, 58(5): 163-303. Poster.

**NON-REFEREED WORK**

***** Indicates students under my direct mentorship or supervision

9. *****Toth, N. (2024). eDNA Collection Gets a Tech Update. Student contributed CEPS Research Highlights article. URL: https://www.uoguelph.ca/ceps/news/2024/07/edna-collection-gets-tech-upgrade

8**. Phillips, J.D.** (2022). A Novel Statistical Framework for Assessment of Intraspecific Haplotype Sampling Completeness: Implications for DNA Barcode Gap Estimation. Ph.D. Thesis. URL: https://atrium.lib.uoguelph.ca/items/8addfcc5-f21c-4691-89b7-c4db051892eb

7. **Phillips, J.D.** (2022) Mind the Gap — The DNA Barcode Gap, That Is. Contributed CEPS Research Highlights article. URL: https://www.uoguelph.ca/ceps/news/2022/08/mind-gap-–-dna-barcode-gap

6. **Phillips, J.D.** (2020). Barcode Cracking. Contributed CEPS Research Highlights article. URL: https://www.uoguelph.ca/ceps/news/2020/02/barcode-cracking

5. **Phillips, J.D.** (2020). Protecting Biodiversity Through the Lens of Genetic Diversity. Contributed guest post to the Science Borealis-syndicated blog of Dr. Daniel Gillis. URL:

https://danielgillis.wordpress.com/2020/01/30/protecting-biodiversity-through-the-lens-of-genetic-diversity/
4. **Phillips, J.D.** (2019). IBOL8 and the Midnight Sun. Contributed guest post to the Science Borealis-syndicated blog of Dr. Daniel Gillis. URL: https://danielgillis.wordpress.com/2019/07/02/reflections-ibol8-and-the-midnight-sun/
3. **Phillips, J.D.** (2017). The Big Five and IBOL7. Contributed guest post to the Science Borealis-syndicated blog of Dr. Daniel Gillis. URL: https://danielgillis.wordpress.com/2017/12/06/reflections-the-big-five-and-ibol7/
2. **Phillips, J.D.** (2016). Sample size estimation for DNA barcoding: Are current sampling levels enough? Contributed guest post to the DNA Barcoding Blog of Dr. Dirk Steinke. URL: http://dna-barcoding.blogspot.com/2016/01/guest-post-sample-size-estimation-for.html
1. **Phillips, J.D.** (2016). Sample size estimation for DNA barcoding of ray-finned fishes: Are current sampling levels enough? Contributed newsletter article to the Barcode Bulletin, 7(1).

## VOLUNTEER EXPERIENCE

1. **Wireframing session** 2021-2024
University of Guelph
- Participated in student-led use case mobile app prototype demonstrations for CIS*3750 – System Analysis and Design in Applications
- Graded students based on several factors via Qualtrics surveys

## REFERENCES


Dr. Daniel Gillis
Full Professor & Statistician
School of Computer Science
University of Guelph
50 Stone Road East
Guelph, ON.
N1G 2W1
dgillis@uoguelph.ca

Dr. Robert Hanner
Full Professor
Department of Integrative Biology
Biodiversity Institute for Conservation Synthesis
University of Guelph
Guelph, ON.
50 Stone Road East
N1G 2W1
(519) 824-4120 ext. 53479
rhanner@uoguelph.ca

Dr. Deborah Stacey
Associate Professor Emerita
School of Computer Science
University of Guelph
50 Stone Road East
Guelph, ON.
N1G 2W1
dastacey@uoguelph.ca

Dr. Graham Taylor
Full Professor
School of Engineering
University of Guelph
50 Stone Road East
Guelph, ON.
N1G 2W1
(519) 824-4120 ext. 53644
gwtaylor@uoguelph.ca

Dr. Dirk Steinke
Associate Director – Analytics
Adjunct Professor
Centre for Biodiversity Genomics
Department of Integrative Biology
University of Guelph
50 Stone Road East
N1G 2W1
Guelph, ON.
(519) 824-4120 ext. 53759
dsteinke@uoguelph.ca

Dr. Sarah Adamowicz
Associate Professor
Department of Integrative Biology
University of Guelph
50 Stone Road East
N1G 2W1
Guelph, ON.
(519) 824-4120 ext. 53055
sadamowi@uoguelph.ca