GAVIN MURRAY DOUGLAS

Email: gavinmdouglas@gmail.com
Website: www.gavindouglas.ca

EDUCATION AND TRAINING

Postdoctoral Researcher (May 2021 – *Ongoing*)

McGill University, Montréal, QC, Canada | **Supervisor**: Dr. Jesse Shapiro

PhD Microbiology and Immunology (Jan. 2017 – May 2021)

Dalhousie University, Halifax, NS, Canada **| Supervisor**: Dr. Morgan Langille

Thesis: Integrating Functional and Taxonomic Data Types for Microbiome Data Analysis

MSc Ecology and Evolutionary Biology (Sept. 2013 – Nov. 2015)

University of Toronto, Toronto, ON, Canada | **Supervisor**: Dr. Alan Moses

Thesis: Investigating the Evolutionary Forces Acting on Mammalian Transcription Factor Binding

BSc Specialist in Evolutionary Biology (Sept. 2009 – June 2013)

University of Toronto, Toronto, ON, Canada

ACADEMIC AWARDS

NSERC Postdoctoral Fellowship 2021-*Ongoing*
Government of Canada ($90,000 / 2 years)

Globalink Research Award 2019
Mitacs Canada ($6,000)

NSERC Michael Smith Foreign Study Supplement 2019
Government of Canada ($6,000)

NSERC Alexander Graham Bell CGS D 2017-2020
Government of Canada ($105,000 / 3 years)

Honorary Izaak Walton Killam Predoctoral Scholarship (Level 2) 2017-2019
The Killam Trusts (Honorary)

President's Award 2017-2019
Dalhousie University (Tuition / 3 years)

Kathryn A. Weldon Travel Award 2018
Dalhousie Medical Research Foundation ($2,000)

Early Career Scientist Bursary 2018
International Human Microbiome Consortium (€500)

NSERC Canada Graduate Scholarships Master's Program 2013-2014
Government of Canada ($17,500)

NSERC Undergraduate Student Research Award 2012
Government of Canada ($5,625)

Chancellor's Scholarship 2011
Trinity College, University of Toronto ($200)

PEER-REVIEWED PUBLICATIONS

Douglas GM and Langille MGI. 2021. A primer and discussion on DNA-based microbiome data and related bioinformatics analyses. *Peer Community Journal* 1:e5.

Douglas GM and Shapiro BJ. 2021. Genic Selection Within Prokaryotic Pangenomes. *Genome Biology and Evolution*. Advance Access.

Wright AH, Shawkat A, Migicovsky Z, **Douglas GM**, Yurgel S, Bunbury-Blanchette A, Franklin J, Adamas SJ, Walker AK. *Early Access*. A Characterization of a Cool Climate Organic Vineyard's Microbiome. *Phytobiomes.* Advance Access.

Cook J, **Douglas GM**, Zhang J, Glick BR, Langille MGI, Liu K-H, Cheng Z. 2021. Transcriptomic profiling of *Brassica napus* responses to *Pseudomonas aeruginosa*. *Innate Immunity* 27:143-157.

Douglas GM, Bielawski JP, Langille MGI. 2020. Re-evaluating the relationship between missing heritability and the microbiome. *Microbiome* 8:87. (Interview on the *Finding Genius Podcast*: Link)

Douglas GM, Maffei VJ, Zaneveld J, Yurgel SN, Brown JR, Taylor CM, Huttenhower C, Langille MGI. 2020. PICRUSt2 for prediction of metagenome functions. *Nature Biotechnology* 38:685-688.

Nejman D*, Livyatan I*, Fuks G*, *et al.* 2020. The human tumor microbiome is composed of tumor type-specific intracellular bacteria. *Science* 368:973-980 (**joint first authors*).

Palau M, Piqué N, Comeau AM, **Douglas GM**, Ramírez-Lázaro MJ, Lario S, Calvet X, Langille MGI, Miñana-Galbis D. 2020. Detection of *Helicobacter pylori* Microevolution and Multiple Infection from Gastric Biopsies by Housekeeping Gene Amplicon Sequencing. *Pathogens* 9:97.

Douglas GM and Langille MGI. 2019. Current and Promising Approaches to Identify Horizontal Gene Transfer Events in Metagenomes. *Genome Biology and Evolution* 11:2750-2766.

Bolyen E*, Rideout JR*, Dillon MR*, Bokulich NA*, *et al*. 2019. Reproducible, interactive, scalable and extensible microbiome data science using QIIME 2. *Nature Biotechnology* 37:852-857 (**joint first authors*).

Yurgel SN, Nearing JT, **Douglas GM**, Langille MGI. 2019. Metagenomic Functional Shifts to Plant Induced Environmental Changes. *Frontiers in Microbiology* 10:1682.

Singh R, Chandrashekharappa S, Bodduluri SR, Baby BV, Hegde B, Kotla NG, Hiwale AA, Saiyed T, Patel P, Vijay-Kumar M, Langille MGI, **Douglas GM**, Cheng X, Rouchka EC, Waigel SJ, Dryden GW, Alatassi H, Zhang H, Haribabu B, Vemula PK, Jala VR. 2019. Enhancement of the gut barrier integrity by a microbial metabolite through the Nrf2 pathway. *Nature Communications* 10:89.

Nearing JT, **Douglas GM**, Comeau AM, Langille MGI. 2018. Denoising the Denoisers: An independent evaluation of microbiome sequence error-correction approaches. *PeerJ* 6:e5364.

Yurgel SN, **Douglas GM**, Dussault A, Percival D, Langille MGI. 2018. Dissecting community structure in wild blueberry root and soil microbiome. *Frontiers in Microbiology* 9:1187.

McElroy MS, Navarro AJR, Mustiga G, Stack C, Gezan S, Peña G, Sarabia W, Saquicela D, Sotomayor I, **Douglas GM**, Migicovsky Z, Amores F, Tarqui O, Myles S, Motamayor JC. 2018. Prediction of Cacao (*Theobroma cacao*) Resistance to *Moniliophthora spp.* Diseases via Genome-Wide Association Analysis and Genomic Selection. *Frontiers in Plant Science* 9:343.

Douglas GM*, Hansen R*, Jones C, Dunn K, Comeau AM, Bielawski JP, Tayler R, El-Omar EM, Russell RK, Hold GL, Langille MGI, Van Limbergen J. 2018. Multi-omics Differentially Classify Disease State and Treatment Outcome in Pediatric Crohn's Disease. *Microbiome* 6:13 (* *joint first authors*).

McClure KA, Gardner KM, **Douglas GM**, Toivonen PMA, Hampson CR, Song J, Forney CF, DeLong J, Rajcan I, Myles S. 2018. A Genome-Wide Association Study of Fruit Quality and Historical Scab Resistance in an Apple Collection. *The Plant Genome* 11:170075.

Inkpen A, **Douglas GM**, Brunet T, Leuschen K, Doolittle F, Langille MGI. 2017. The coupling of taxonomy and function in microbiomes. *Biology and Philosophy* 32:1225-43.

Yurgel SN, **Douglas GM**, Comeau AM, Mammoliti M, Dussault A, Percival D, Langille MGI. 2017. Variation in Bacterial and Eukaryotic Communities Associated with Natural and Managed Wild Blueberry Habitats. *Phytobiomes* 1:102-113.

Comeau AM, **Douglas GM**, Langille MGI. 2017. Microbiome Helper: A Custom and Streamlined Workflow for Microbiome Research. *mSystems* 2:e00127-16.

Douglas GM, Wilson MD, Moses AM. 2016. Decreased Transcription Factor Binding Levels Nearby Primate Pseudogenes Suggests Regulatory Degeneration. *Molecular Biology and Evolution* 33:1478-85.

Douglas GM*, Gos G*, Steige KA*, Salcedo A, Holm K, Ågren JA, Hazzouri KM, Wang W, Platts AE, Josephs EB, Williamson RJ, Neuffer B, Lascoux M, Slotte T, Wright SI. 2015. Hybrid origins and the earliest stages of diploidization in the highly successful recent polyploid *Capsella bursa-pastoris*. *PNAS USA* 112:2806-11 (**joint first authors*).

Khan T, **Douglas GM**, Patel P, Nguyen Ba AN, Moses AM. 2015. Polymorphism Analysis Reveals Reduced Negative Selection and Elevated Rate of Insertions and Deletions in Intrinsically Disordered Protein Regions. *Genome Biology and Evolution* 7:1815-26.

PRE-PRINTS

Nearing JT*, **Douglas GM***, Hayes M, MacDonald J, Desai D, Allward N, Jones CMA, Wright R, Dhanani A, Comeau AM, Langille MGI. 2021. Microbiome differential abundance methods produce disturbingly different results across 38 datasets. *bioRxiv.* DOI: 10.1101/2021.05.10.443486 (**joint first authors*).

BOOK CHAPTERS

Douglas GM, Comeau AM, Langille MGI. 2018. Processing a 16S rRNA Sequencing Dataset with the Microbiome Helper Workflow. Microbiome Analysis – Methods and Protocols (Springer; Editors: Beiko RG, Hsiao RG, Parkinson J):131-141.

Douglas GM, Beiko RG, Langille MGI. 2018. Predicting the Functional Potential of the Microbiome from Marker Genes Using PICRUSt. Microbiome Analysis – Methods and Protocols (Springer; Editors: Beiko RG, Hsiao RG, Parkinson J):169-177.

ORAL PRESENTATIONS

Douglas GM. July 2019. The Need-To-Know Facts of Microbiome Research. As part of the Continuing Medical Education session: "Gut Flora and the Answers Your Patients are Looking For" (Dartmouth General Hospital, Dartmouth, Canada).

Douglas GM. March 2019. Prediction of microbial genomes from 16S rRNA gene sequences and application for disease state classification. Crossroads Interdisciplinary Health Research Conference (Halifax, Canada).

Douglas GM. March 2019. Predicting Microbial Functions for Application in Clinical Classification Models. Three Minute Thesis Competition - Participant (Dalhousie University).

Douglas GM. May 2018. Differences in host gene expression linked to predicted shifts in microbial pathways in an inflammatory bowel disease cohort. Professional & Research Education Program Graduate Student Research Day (Dalhousie University).

Douglas GM. May 2017. Multi-omics Differentially Classify Disease State and Treatment Outcome in Pediatric Crohn's Disease. Professional & Research Education Program Graduate Student Research Day (Dalhousie University).

POSTERS (*Presenter in bold*)

Nearing JT, Douglas GM, Hayes M, MacDonald J, Desai D, Allward N, Jones CMA, Wright R, Dhanani A, Comeau AM, Langille MGI. June 2020. Microbiome differential abundance methods produce strikingly different results across 38 datasets. Symposium: "Having IMPACTT: Advancing Microbiome Research" (Held virtually, but organized at the University of Calgary, Canada).

Douglas GM, Langille MGI, Borenstein E. October 2020. Identifying Robust Functional Biomarkers in Microbiome Sequencing Data with POMS. Cold Spring Harbor Laboratory Conference - Microbiome (Held virtually, but organized in Cold Spring Harbor, USA).

Douglas GM, Langille MGI, Borenstein E. September 2020. Identifying Robust Functional Biomarkers in Microbiome Sequencing Data with POMS. Wellcome Genome Informatics Conference (Held virtually, but organized in Hinxton, UK).

Douglas GM, Langille MGI. December 2019. Making sense of functional microbiome associations with POMS. Genomics in Medicine Conference (Dalhousie University).

Douglas GM, Zaneveld J, Maffei VJ, Xu ZZ, Leuschen K, Brown JR, Huttenhower C, Langille MGI. June 2018. PICRUSt 2.0: Novel Features for Predicting Functional Potential. 7th International Human Microbiome Conference (Killarney, Ireland).

Douglas GM, Zaneveld J, Maffei VJ, Xu ZZ, Leuschen K, Huttenhower C, Brown JR, Langille MGI. March 2018. PICRUSt 2.0: Novel Features for Predicting Functional Potential. Keystone Symposia: Microbiome, Host Resistance and Disease (Banff, Canada).

Leuschen K, Douglas GM, Langille MGI. May 2017. Assessing functional stability in the human microbiome. Professional & Research Education Program Graduate Student Research Day (Halifax, Canada).

Stadnyk AW, Douglas GM, Comeau AM, Jain U, Schaeble W, Stover C, Beiko R, Langille MGI. March 2017. Properdin deficiency does not impact the mouse response to DSS-induced colitis despite differences in colonic microbiome. Canadian Digestive Diseases Week (Banff, Canada).

Jones C, Douglas GM, Comeau AM, Hansen R, Russell R, Hold G, Van Limbergen J, **Langille MGI**. November 2016. Assessing the relative contribution of genetics and micro-omics for predicting pediatric Crohn's Disease. International Human Microbiome Consortium (Houston, USA).

Jones C, Douglas GM, Comeau AM, Hansen R, Russell R, Hold G, Langille MGI, Van Limbergen J. October 2016. An integrated microbiome and genetic analysis of pediatric Crohn's disease. World Congress of Pediatric Gastroenterology, Hepatology and Nutrition (Montréal, Canada).

Jones C, **Douglas GM**, Comeau AM, Hansen R, Russell R, Hold G, Langille MGI, Van Limbergen J. August 2016. Assessing the relative contribution of genetics and the microbiome for predicting pediatric Crohn's disease. International Society for Microbial Ecology (Montréal, Canada).

Comeau AC, Douglas GM, **Langille MGI**. June 2016. Integrated Microbiome Resource: Developing an open and streamlined experimental and analysis pipeline for microbiomics research. American Society for Microbiology (Boston, USA).

Douglas GM, Wilson MD, Moses AM. January 2015. Detecting selection on mammalian transcription factor binding sites. Stochastic Physics in Biology - Gordon Research Conference (Ventura, USA).

Douglas GM, Wilson MD, Moses AM. June 2014. Degeneration of mammalian cis-regulatory modules. Society for Molecular Biology and Evolution Conference (San Juan, Puerto Rico).

Khan T, **Douglas GM**, Nguyen Ba AN, Moses AM. June 2014. Analysis of polymorphisms reveal constraints on amino acids and increased rates of insertions and deletions in intrinsically disordered regions. Society for Molecular Biology and Evolution Conference (San Juan, Puerto Rico).

Douglas GM, Lascoux M, Holm K, Steige KA, Slotte T, Gos G, Hollister J, Wright SI. July 2013. Rapid Relaxation of Purifying Selection in the Young Allopolyploid *Capsella bursa-pastoris*. Society for Molecular Biology and Evolution Conference (Chicago, USA).

ADDITIONAL WORK EXPERIENCE

Independent Contractor (Sept. 2015 – Aug. 2020)

I contributed to several bioinformatics projects on an independent basis. I have also contributed to a consulting report on the genetic basis of carotenoid content in spinach for recommendations for a future breeding program.

Bioinformatician (Sept 2015 – Dec. 2016)

Integrated Microbiome Resource, Dalhousie University
Supervisors: Dr. Morgan Langille and Dr. Sean Myles
I was responsible for building tools and pipelines to use for analyzing a variety of different datasets. My main focuses were on analyzing microbiome data and associating mutations with phenotypes of interest.

VOLUNTEER AND SERVICE EXPERIENCE

Peer Community in Genomics (PCI Genomics) Recommender (Apr. 2021 - *Ongoing*)

PCI Genomics is a platform for reviewing and recommending preprints. The recommender's role is similar to that of a traditional editor except that they write a short article recommending the preprint after it passes the review process.

Member of Graduate Studies Committee (Sept. 2019 – Aug. 2020)

Department of Microbiology and Immunology, Dalhousie University
Responsibilities: Representing graduate students' perspectives in discussions related to graduate student mental health, program requirements, and funding.

iGEM Mentor (May 2018 – Oct. 2018)

Responsibilities: Supervising the bioinformatics work of the Dalhousie University undergraduate team for the 2018 International Genetically Engineered Machine (iGEM) competition.

Scientific Peer-Reviewing

Annals of the New York Academy of Sciences – one review
Bioinformatics – one review
BMC Supplements – one review
Computational and Structural Biotechnology Journal – one review
Environmental Science and Pollution Research – one review
Frontiers in Genetics – one review
The Journal of Open Source Software – two reviews
mSystems – six reviews
PCI Genomics – one review
PLOS Computational Biology – two reviews
Scientific Reports – four reviews

Volunteer Research Assistant (Jan. 2012 - May 2013)

Department of Ecology and Evolutionary Biology, University of Toronto
Supervisor: Dr. Aneil Agrawal
Responsibilities: Sorting and scoring fruit flies.

Genetic Counseling Clinic Volunteer (Jan. - April 2012)

Mount Sinai Hospital, Toronto, Ontario
Supervisor: Seema Panchal
Responsibilities: Contributed to building family pedigrees of disease risk.

TEACHING EXPERIENCE

Guest Lecturer (Oct. 26, 2020, Dalhousie University)

I presented a guest lecture introducing the human microbiome to students in the fourth-year undergraduate course Host-Pathogens Interactions (MICI4119).

Teaching Assistant (Jan. – April 2020, Dalhousie University)

I helped lead lab sessions and marked students' reports for MICI2400 (Laboratory Methods in Microbiology & Immunology), which is an entirely lab-based course.

Microbiome Analysis Workshop Instructor (May 16, 2019, Sheba Medical Center, Tel Aviv, Israel)

I presented a lecture on how to use PICRUSt2, which is a software that I developed. I also wrote a tutorial on running PICRUSt2, which students worked through during the workshop.

R Programming for Biologists Workshop Instructor (August 2018, Dalhousie University)

I presented a series of four workshops to biology graduate students. I began each workshop with a lecture and then lead the students through in-class assignments to solidify the lecture content.

Canadian Bioinformatics Workshop Instructor and Teaching Assistant (June 5-7, 2018, Ontario Institute for Cancer Research, Toronto, Canada)

I presented a lecture on the major classes of bioinformatics tools used for taxonomic and functional profiling of shotgun metagenomics data and developed a tutorial to complement this lecture. I was also a teaching assistant for all tutorials presented over three days.

Bioinformatic Tutorial Developer (Sept. 2015 – Oct. 2017, Dalhousie University)

While working as a bioinformatician in the Langille lab at Dalhousie University I developed several online tutorials to teach researchers how to analyze microbiome data. These tutorials were presented at several international conferences and have been used to train hundreds of trainees.

Module Instructor (Nov. – Dec. 2016, Dalhousie University)

I lectured and developed a four-week graduate-level module entitled "Introduction to Python Programming for Biologists". I was responsible for the structure and the content of this short course. I lectured two classes each week and created all the quizzes and assignments for the students (3 quizzes and 4 assignments). This module was one of several modules offered as part of BIOL5705 (Graduate Modules class) in the Biology department.

Teaching Assistant (Sept. – Dec. 2013 and Sept. – Dec. 2014, University of Toronto)

I supervised laboratory classes for BIO120 (Adaptation and Biodiversity), which complemented key lecture topics.

SUPERVISORY EXPERIENCE

Arvin Mahmoodi: NSERC undergraduate student research award recipient
May - August 2020, Dalhousie University

Jocelyn MacDonald: undergraduate experiential learning student
January - April 2019, Dalhousie University