



**ANNUAL REPORT**

**JULY 1, 2016 – JUNE 30, 2017**

## SECTION 1 – OVERVIEW

### 1.1 MISSION STATEMENT

In June 2008, the Centre for Comparative Genomics & Evolutionary Bioinformatics (CGEB) was officially approved by the Dalhousie Senate, with the mission to foster collaborations amongst comparative genomics/bioinformatics and microbial evolution researchers and trainees at Dalhousie. The main focus of the Centre's research is to discover how microbial genomes evolve and diversify, and our research programs collectively span computational biology, biological oceanography, computer science, statistical modeling and comparative genomics, with a strong focus on method and theory. However, through collaborations with new CGEB associates, our focus has expanded to include environmental microbiology and human disease microbiomics.

The CGEB Centre's primary goals are to: 1) recruit top-notch postdoctoral fellows and Ph.D. trainees to CGEB labs; 2) maintain a CGEB Seminar Series to attract world-class speakers to interact with CGEB principal investigators and trainees; 3) fund CGEB trainees to attend and present their work at national and international scientific meetings; and 4) provide an intellectual forum that promotes collaborations between CGEB members and associates and facilitates applications for external research funding. For each of the last nine years, we have met or exceeded all of these goals.

### 1.2 NEW AND ONGOING ACTIVITIES OF THE CENTRE

#### A. **CGEB - Integrated Microbiome Resource (CGEB-IMR)** <http://cgeb-imr.ca>

The IMR has been in operation since 2014 and continues to grow. The IMR provides sequencing and bioinformatics support for microbiome projects both locally and abroad. This facility is now operating efficiently and productively, encouraging many new internal and external collaborations and contributing support to the writing of many grant applications, many already funded. The IMR is hosted within Dr. Morgan Langille's research lab, and is managed by a full-time project resource manager Dr. André Comeau. Gavin Douglas, MSc ended his Bioinformaticist position to begin a PhD in Dr. Langille's lab in January 2017. The IMR hired Emily Lamoureux, MSc as his replacement in September 2017. The facility has processed over 20,000 samples, covering over 230 different projects, from more than 65 different principal investigators. What started as a means to consolidate microbiome research internally at Dalhousie has now blossomed into an in-demand resource also being utilized by outside researchers in Canada, the US and multiple other countries on a total of four different continents (see <http://cgeb-imr.ca/achieve.html> for a breakdown of client locations). Samples range from community diversity studies of the North Atlantic and the Bedford Basin, Crohn's disease, cancer, algal bioreactors, fish guts, exercising mice, commercial blueberries, bumblebees, fermented products, and domestic pets. Funding from the Strategic Research Initiatives Fund (SRIF) from Dalhousie Research Services ended in Oct. 2016 and since then the IMR has been operating through cost recovery fees. Cost recovery of services is achieved through fees at different rates for internal Dalhousie users, academics outside of Dalhousie, and commercial companies.

**B. Dalhousie Microbiome User Group (DalMUG)** <http://dalmug.org/>

Dr. Morgan Langille (CGEB faculty member) continues to lead the Dalhousie Microbiome User Group (DalMUG) that was founded in January 2014 and is sponsored by CGEB. This group is made up of researchers and clinicians that are primarily affiliated with Dalhousie University and who are interested in various aspects of microbiome research. DalMUG aims to foster collaborations, share resources, and build an interdisciplinary community. In the past year, the group has expanded from 58 to 69 members from various academic disciplines. DalMUG also hosts a journal club every second week during the school year that is primarily focused on training students at the undergraduate and graduate level. Attendance at the DalMUG journal club ranges from 10-15 individuals.

**C. CGEB - Herzberg Fellowships/Scholarships**

Dr. W. Ford Doolittle was previously awarded the 2013 NSERC Gerhard Herzberg Gold Medal, Canada's top award for scientific achievement, for his work in the field of microbial evolution and the tree of Life (funding award period 2014-2019). Dr. Doolittle pledged roughly half of his Herzberg award (a total of ~\$500,000 over 5 years) to support CGEB – Herzberg Fellowships/Scholarships to trainees. During this reporting period, two postdoctoral fellows and three graduate students were supported, as well as \$34,000/year for CGEB administration.

**D. CGEB Microbiome Initiatives**

Concomitant with the establishment of the CGEB-Integrated Microbiome Resource (CGEB-IMR), a number of microbiomic projects have been initiated in the last four years through CGEB collaborations. These include:

Pan-African Study of Neonatal Sepsis: Advancing Science and Gathering Evidence (PASSAGE): This is an international collaboration investigating the efficacy and mechanism by which probiotic treatment can lower neonatal sepsis in Africa. Discussions with the Bill and Melinda Gates Foundation are ongoing, and proposal writing will be starting soon. The CGEB Microbiome group (Rob Beiko, Morgan Langille, Joe Bielawski, Andrew Roger, Johan van Limbergen) are leading the computational analysis for this project).

MAREEN (Metagenomic approach to Remission in Crohn's disease using enteral nutrition): A 16S-rDNA, 18S-rDNA and whole-metagenome study of mucosa-associated microbiota in treatment-naive pediatric Crohn's disease and investigation of changes in microbiome community structure during induction and maintenance of remission in pediatric Crohn's disease using exclusive enteral nutrition (funded by NASPGHAN/CCFA awarded to CGEB Associate Johan van Limbergen in collaboration with CGEB members Morgan Langille, Joe Bielawski and Andrew Roger).

Microbiomic studies of children affected by IBD and their healthy siblings: 16S-rDNA based and whole-metagenome at diagnosis and after induction of remission in pediatric

- IBD (in collaboration with Nikhil Thomas, Tony Otley, CGEB member Joe Bielawski).
- Microbiomic metagenome changes associated with exclusive and partial enteral nutrition in a randomized clinical trial in pediatric Crohn's disease (in collaboration with Arie Levine (Israel), Tony Otley and CGEB member Joe Bielawski).
- Role of microbiome in response to methotrexate (MTX) in children with chronic inflammatory disease (led by CGEB member Morgan Langille in collaboration with Johan van Limbergen (Pediatric Gastroenterology) and Adam Huber (pediatric Rheumatology)).
- The role of the complement system in post-colitis colonization and recovery from injury (Andy Stadnyk (lead), CGEB member Rob Beiko). This involves conducting 16S rDNA profiling of the gut microbiome in a mouse model that has gene knockouts in the immune complement system.
- Microbiome of the aging mouse: (CGEB member Rob Beiko and Morgan Langille as collaborator, together with Ken Rockwood and Sue Howlett). They will be using established mouse models of frailty and to investigate changes in the microbiome associated with aging.
- A pilot project to assess the gut microbes of patients in an assisted living facility: (CGEB members Beiko, Bielawski, Doolittle and Roger in collaboration with Ken Rockwood and Sue Howlett). Fecal samples from 48 patients in an assisted care facility have been collected, and the composition of the fecal microbiota is currently being evaluated using 16S and 18S rRNA marker gene data, metagenome data, and metametabolome data, along with a comprehensive frailty assessment, to identify if linkages between frailty and the microbiome exist.

#### **E. CGEB Seminar Series**

The seminar series successfully hosted 8 well-attended seminars from July 1, 2016 to June 30, 2017, all sponsored or co-sponsored by previous funding from the Tula Foundation.

- Dr. Maureen O'Malley, University of Bordeaux, July 7, 2016. "*Bottom-up microbiome research, and its implications for holobionts*"
- Ms. Jen Wood, La Trobe University, August 29, 2016. "*Putting the ecology into microbial ecology*"
- Dr. Alberto Kornblihtt, University of Buenos Aires, September 28, 2016. "*Chromatin and transcriptional elongation regulate alternative splicing*"
- Dr. David Moreira, Universite Paris-Sud, November 21, 2016. "*The origin of plastids*"
- Dr. Purificacion Lopez-Garcia, Universite Paris-Sud, November 22, 2016. "*New constraints and old questions on the origin of eukaryotes*"
- Dr. Cory Bishop, St. Francis Xavier University, December 8, 2016. "*Greening the embryo: an enigmatic algal-salamander symbiosis and how genomics can help*"

- Dr. Alyson Santoro, University of California, Santa Barbara, May 10, 2017. "*Microbial adaptation to the open ocean: Insights from the Thaumarchaeota*"
- Dr. James Brown, GlaxoSmithKline, USA, June 5, 2017. "*Human-microbe interactions in drug discovery*"

#### **F. Meeting / Symposia Sponsorship**

CGEB provided funding support for two events this past year through its Seminar Series Fund and/or CGEB New Opportunities Fund.

- co-sponsored the **Dalhousie Picchione Visiting Scholar - Public Lecture** at Dalhousie by Dr. Alberto Kornblihtt from University of Buenos Aires, September 28, 2016
- co-sponsored (with Genome Atlantic) the **Dalhousie Microbiome Research Symposium**, August 30, 2016. Morgan Langille was the Lead Organizer.

#### **G. CGEB Journal Clubs**

CGEB hosts two journal clubs, held every second week, that trainees are encouraged to participate in:

- 1) the general **CGEB Journal Club** (since 2007) that discusses advances in comparative genomics and evolutionary biology;
- 2) a more specialized **Dalhousie Microbiome User Group (DalMUG) Journal Club** (since 2013) that focuses more specifically on methods of metagenomic and bioinformatic analysis as they apply to human (microbiomic) and environmental microbial communities.

#### **H. CGEB Weekly and Monthly Joint Lab Meetings**

All trainees attend and present their research at weekly CGEB 'protistology group' lab meetings together with the Archibald, Roger, Slamovits, Doolittle, Gray and Simpson labs.

Trainees also attend, and present at, monthly joint lab meetings that include our 12 P.I.s, Associate Members, and approx. 60 trainees of the CGEB Centre. These meetings provide trainees with a rich community with whom they can discuss their research, learn, and collaborate.

#### **I. Publications and Presentations**

During the reporting period, CGEB faculty and trainees have published **51** refereed journal papers, **11** invited book chapters and book editorships, and **7** review papers and commentaries (*see Section 2.2.I.*), including contributions in high impact journals such as *Nature Ecology and Evolution*, *Current Biology* and the *Proceedings of the National Academy of Sciences USA*. The international profile of CGEB researchers is further demonstrated by the **44** invited presentations by CGEB faculty given at international conferences and invited seminars (*see*

*Section 2.3*). In addition, CGEB trainees collectively contributed **26** presentations at local and international events (*see Section 2.4*).

#### **J. CGEB Developed Software**

A large portion of CGEB research efforts is directed at development of computer software tools for evolutionary modeling analyses and bioinformatics. Since 2007, CGEB has produced 43 bioinformatics software tools (*see Section 2.7 for an update on software development*). These are ‘open-source’ software tools (or suites of tools) for analysis of genomic data that have been created, published and made available (or soon will be) to the international scientific community through free web access.

#### **K. External Funding**

CGEB researchers have been extremely successful in attracting external funding, collectively garnering a total of approximately \$3,495,000 of external grant support and research awards over 2016-2017 from NSERC, CIHR, CFI, Canada Research Chairs, Canadian Institute for Advanced Research, Genome Canada, NSHRF, OFI, and the Gordon and Betty Moore Foundation (*see Section 3.2.1*).

### **1.3 COMING YEAR’S ACTIVITIES**

The main core activities that have really sustained the productivity of the CGEB Centre to date (*see above descriptions*) will continue in the next year. These include:

- CGEB Seminar Series (invited speakers)
- weekly lab meetings and monthly joint lab meetings of CGEB faculty, associates and trainees
- bi-weekly general CGEB Journal Club and DalMUG Journal Club
- continued sponsorship of student presentations at domestic and international events
- meetings of CGEB PIs to discuss Centre business (annual meeting, plus occasional *ad hoc* meetings), as well as *ad hoc* meetings with the Steering Committee, as required
- annual meeting of the Deans Committee Meeting (includes CGEB Director, Deans of Medicine, Science & Computer Science, and Assoc. VP (Research) designate.

## SECTION 2 – DETAILED DESCRIPTION OF ACTIVITIES

### 2.1 CORE GROUP OF PERSONNEL (July 1, 2016 – June 30, 2017)

<b>Position</b>	<b>#</b>
CGEB Faculty Members	12
CGEB Associate Members	8
Research Associates	5
Administrative & Technical Staff	6
Postdoctoral Fellows	18
Doctoral Students	11
Master's Students	17
Undergraduate Students (incl. Honours, co-op & summer students)	12
<b>Total:</b>	<b>89</b>

#### 2.1.1 CGEB Faculty Members

1. Dr. Andrew Roger, Professor and Tier 1 Canada Research Chair, Biochemistry and Molecular Biology
2. Dr. W. Ford Doolittle, Professor Emeritus, Biochemistry and Molecular Biology
3. Dr. John Archibald, Distinguished University Research Professor, Biochemistry and Molecular Biology
4. Dr. Claudio Slamovits, Associate Professor, Biochemistry and Molecular Biology
5. Dr. Michael Gray, Professor Emeritus, Biochemistry and Molecular Biology
6. Dr. Joseph Bielawski, Professor, Biology, and Mathematics and Statistics
7. Dr. Alastair Simpson, Professor, Biology
8. Dr. Erin Bertrand, Assistant Professor and Tier 2 Canada Research Chair, Biology
9. Dr. Robert Beiko, Professor and Tier 2 Canada Research Chair, Computer Science
10. Dr. Christian Blouin, Professor, Computer Science, and Biochemistry and Molecular Biology
11. Dr. Edward Susko, Professor, Mathematics and Statistics
12. Dr. Morgan Langille, Assistant Professor and Tier 2 Canada Research Chair, Pharmacology; cross-appointment with Dept. of Microbiology and Immunology

#### 2.1.2 CGEB Associate Members

1. Dr. Norbert Zeh, Professor, Computer Science
2. Dr. Julie LaRoche, Professor of Biology (Marine Geochemistry), and Tier I Canada Research Chair
3. Dr. Sean Myles, Assistant Professor, and Tier I Canada Research Chair, Faculty of Agriculture
4. Dr. Hong Gu, Professor, Mathematics and Statistics
5. Dr. Johan Van Limbergen, Clinician Scientist and Associate Professor, Pediatrics, IWK Health Centre

6. Dr. John Rohde, Associate Professor, Microbiology and Immunology
7. Dr. Christopher Field, Professor Emeritus, Mathematics and Statistics
8. Dr. Robert Lee, Adjunct Professor, Biology

### **2.1.3 CGEB Research Associates**

1. Dayana Salas-Leiva, Research Associate – Roger lab
2. André Comeau, Research Associate/Lab Manager – Langille lab
3. Huaichun Wang, Research Associate – Susko lab (co-supervised by A. Roger)
4. Katherine Dunn, Research Associate – Bielawski lab
5. Akhilesh Dhanani, Research Associate – Langille lab

### **2.1.4 CGEB Administrative and Technical Staff**

1. Wanda Danilchuk, CGEB Administrator
2. Marlina Dlutek, Lab Manager/Technician – Archibald & Roger labs
3. Gavin Douglas, Bioinformatician Technician – Langille lab
4. Kira More, Research Assistant – Bertrand lab
5. Tyler Brunet, Research Assistant – Doolittle lab
6. Carolyn Kachuk, Research Assistant – Bertrand lab

### **2.1.5 CGEB Postdoctoral Fellows**

<b>Name / Status</b>	<b>Department</b>	<b>Supervisor</b>
Åsman, Anna (in progress)	Biochem. & Mol. Biol.	John Archibald
Breglia, Susana (in progress)	Biochem. & Mol. Biol.	Claudio Slamovits
Curtis, Bruce (in progress)	Biochem. & Mol. Biol.	John Archibald & Andrew Roger
de Vries, Jan (in progress)	Biochem. & Mol. Biol.	John Archibald
de Vries, Sophie (in progress)	Biochem. & Mol. Biol.	Claudio Slamovits
Dhanani, Akhilesh (completed 08/2016); now Research Associate with Langille	Computer Science	Robert Beiko
Elustondo, Pia (in progress)	Biochem. & Mol. Biol.	Claudio Slamovits
Eme, Laura (completed 12/2016)	Biochem. & Mol. Biol.	Andrew Roger
Filloramo, Gina (in progress)	Biochem. & Mol. Biol.	John Archibald
Grisdale, Cameron (completed 04/2017)	Biochem. & Mol. Biol.	John Archibald
Harding, Tommy (in progress)	Biochem. & Mol. Biol.	Andrew Roger
Hess, Sebastian (in progress)	Biology	Alastair Simpson & Andrew Roger
Inkpen, S. Andrew (in progress)	Biochem. & Mol. Biol.	Ford Doolittle
Jerlstrom-Hultqvist, Jon (in progress)	Biochem. & Mol. Biol.	Andrew Roger
Leger, Michelle (completed 09/2016)	Biochem. & Mol. Biol.	Andrew Roger
Maguire, Finlay (in progress)	Computer Science	Robert Beiko
Mitrika, Elvira (in progress)	Computer Science	Robert Beiko
Wu, Miao (in progress)	Biology	Erin Bertrand



### 2.1.6 Visiting International Students and Researchers

1. Dr. Cory Bishop: Visiting Sabbatical Professor from St. Francis Xavier University (in Archibald lab: Oct. 2016 - April 2017)
2. Anna Busch: Visiting Master's student from Univ. Bonn (in Archibald lab: Sept. 15-Dec. 15, 2016)
3. Chen Changjiang: Visiting Scholar from Fujian Agriculture & Forestry University, China (in Blouin lab: Oct. 2015 – Sept. 2016)
4. Montse de Miguel: Visiting PhD student, Univ. Barcelona (in Langille lab: Aug. 1, 2016 – July 10, 2017)
5. Leonardo Majul: Visiting ELAP student from Argentina (in Slamovits lab: Nov. 1, 2016 – April 28, 2017)

## 2.2 PUBLICATIONS BY FACULTY & TRAINEES (July 1, 2016 – June 30, 2017)

<b>Publication Type</b>	
• Peer reviewed publications	51
• Invited book chapters & book editorships	11
• Other publications (review papers, commentaries, etc.)	7
<b>Total:</b>	<b>69</b>

*Note: CGEB faculty and trainees (those present at the time the bulk of the research was conducted) are highlighted in bold.*

### I. Peer Reviewed Journal Publications

Alarcon, M.E., Jara-F, A., Briones, R.C., Dubey, A.K. and **Slamovits, C.H.** (2017) Gregarine infection accelerates larval development of the cat flea *Ctenocephalides felis* (Bouché). *Parasitology* 144: 419-425.

Baker, J.L., **Dunn, K.A., Mingrone, J.**, Wood, B.A., Karpinski, B.A., Sherwood, C.C., Wildman, D.E., Maynard, T.M. and **Bielawski, J.P.** (2016) Functional divergence of the nuclear receptor *NR2C1* as a modulator of pluripotentiality during Hominid evolution. *Genetics* 203: 905-922.

**Bielawski, J.P.**, Baker, J.L. and **Mingrone, J.** (2016) Inference of episodic changes in natural selection acting on protein coding sequences via CODEML. *Curr. Protoc. Bioinformatics* 54: 6-15.

**Booth, A., Mariscal, C. and Doolittle, W.F.** (2016) The modern synthesis in the light of microbial genomics. *Annu. Rev. Microbiol.* 70: 279-297.

Browning, T.J., Achterberg, E.P., Rapp, I., Engel, A., **Bertrand, E.M.**, Tagliabue, A. and Moore, C.M. (2017) Nutrient co-limitation at the boundary of an oceanic gyre. *Nature*, in press.

Caron, D.A., Alexander, H., Allen, A. E., **Archibald, J.M.**, Armbrust, E.V., Bachy, C., Bharti, A., Bell, C.J., Dyhrman, S.T., Guida, S., Heidelberg, K.B., Kaye, J.Z., Metzner, J., Smith, S.R. and Worden, A.Z. (2016) Probing the evolution, ecology and physiology of marine protists using transcriptomics. *Nature Rev. Microbiol.* 15: 6-20.

Chan, C.X., **Beiko, R.G.** and Ragan, M.A. (2017) Scaling up the phylogenetic detection of lateral gene transfer events. *Methods Mol. Biol.* 1525: 421-432.

**Comeau A.M., Douglas G.M., and Langille M.G.I.** (2017) Microbiome Helper: A custom and streamlined workflow for microbiome research. *mSystems* 2: e00127.

**David, V. and Archibald J.M.** (2016) Evolution: plumbing the depths of diplomonid diversity. *Curr. Biol.* R1290-1292.

**de Vries, J. and Archibald J.M.** (2017) Endosymbiosis: did plastids evolve from a freshwater cyanobacterium? *Curr. Biol.* 27: R103-105.

**de Vries, J., Archibald, J.M., and Gould, S. B.** (2017) The carboxy terminus of YCF1 contains a motif conserved throughout >500 million years of streptophyte evolution. *Genome Biol. Evol.* 9: 473-479.

**de Vries, J., de Vries, S., Slamovits, C.H., Rose, L.E. and Archibald, J.M.** (2017) How embryophytic is the biosynthesis of Phenylpropanoids and their derivatives in streptophyte algae? *Plant Cell Physiol.* 58: 934-945.

**Doolittle, W.F.** (2017) Darwinizing Gaia. *J. Theor. Biol.*, Feb. 22 [Epub ahead of print]

**Dunn, K.A., Moore-Connors, J., MacIntyre, B., Stadnyk, A.W., Thomas, N.A., Noble, A., Mahdi, G., Rashid, M., Otley, A.R., Bielawski, J.P. and Van Limbergen, J.** (2016) Early changes in microbial community structure are associated with sustained remission after nutritional treatment of pediatric Crohn's disease. *Inflamm Bowel Dis.* 22(12): 2853-2862.

**Dunn K.A., Moore-Connors J., MacIntyre B., Stadnyk A., Thomas N.A., Noble A., Mahdi G., Rashid M., Otley A.R., Bielawski J.P. and Van Limbergen J.** (2016) The gut microbiome of pediatric Crohn's disease patients differs from healthy controls in genes that can influence the balance between a healthy and dysregulated immune response. *Inflamm Bowel Dis.* 22(11): 2607-2618.

**Eme, L. and Doolittle, W.F.** (2016) Microbial evolution: Xenology (apparently) trumps paralogy. *Curr. Biol.* 26: R1181-R1183.

**Eme, L., Gentekaki, E., Curtis, B., Archibald, J. M., and Roger, A.J.** (2017) Lateral gene transfer in adaptation of the anaerobic parasite *Blastocystis* to the gut. *Curr. Biol.* 27: 807-820.

Gawryluk, R., Kamikawa, R., **Stairs, C.W.**, Brown, M.W., Silberman, J.D. and **Roger, A.J.** (2016) The earliest stages of mitochondrial adaptation to low oxygen revealed in a novel rhizarian. *Curr. Biol.* 26: 2729-2738.

**Hall, M.W.**, Singh, N., Ng, K.F., Lam, D.K., Goldberg, M.B., Tenenbaum, H.C., Neufeld, J.D., **Beiko, R.G.** and Senadheera, D.B. (2017) Inter-personal diversity and temporal dynamics of dental, tongue, and salivary microbiota in the healthy oral cavity. *Biofilms and Microbiomes* 3: epub ahead of print.

**Harding, T.**, Brown, M.W., **Simpson, A.G.B.** and **Roger, A.J.** (2016) Osmoadaptative strategy and its molecular signature in obligately halophilic heterotrophic protists. *Genome Biol. Evol.* 8: 2241-2258.

**Harding, T.**, **Roger, A.J.** and **Simpson, A.G.B.** (2017) Adaptations to high salt in a halophilic protist: differential expression and gene acquisitions through duplications and gene transfers. *Front Microbiol.* 8: 944.

**Hleap, J.S.** and **Blouin, C.** (2016) The semantics of the modular architecture of protein structures. *Curr. Protein Pept. Sci.* 17: 62-71.

**Inkpen, S.A.** and **Doolittle, W.F.** (2016) Molecular phylogenetics and the perennial problem of homology. *J. Mol. Evol.* 83: 184-192.

**Inkpen, S.A.** (2017) Demarcating nature, defining ecology: Creating a rationale for the study of nature's 'primitive conditions'. *Perspect. Sci.* 25: 355-92.

**Inkpen, S.A.** (2017) Are humans disturbing conditions in ecology? *Biol. Philos* 32: 51-71.

Jeffery, N.W., DiBacco, C., Van Wyngaarden, M., Hamilton, L.C., Stanley, R.R.E., McKenzie, C., **Ravindran, P.R.**, **Beiko, R.G.** and Bradbury, I.R. (2017) RAD-sequencing reveals genome wide divergence between independent invasions of the European green crab (*Carcinus maenas*) in the Northwest Atlantic. *Ecol. Evol.*: epub ahead of print.

**Jones, C.T.**, **Youssef, N.**, **Susko, E.** and **Bielawski, J.P.** (2017). Shifting balance on a static mutation-selection landscape: a novel scenario of positive selection. *Mol. Biol. Evol.* 34: 391-407.

**Leger, M.M.**, Eme, L., Hug, L.A. and **Roger, A.J.** (2016) Novel hydrogenosomes in the microaerophilic jakobid *Stygiella incarcerata*. *Mol. Biol. Evol.* 33: 2318-2336.

**Leger, M.M.**, Kolisko, M., Kamikawa, R., Stairs, C.W., Kume, K., Čepicka, I., Silberman, J.D., Andersson, J.O., Xu, F., Yabuki, A., Eme, L., Zhang, Q., Takishita, K., Inagaki, Y., **Simpson, A.G.B.**, Hashimoto, T. and **Roger, A.J.** (2017) Organelles that illuminate the origins of *Trichomonas* hydrogenosomes and *Giardia* mitosomes. *Nature Ecol. Evol.* 1: 0092.

MacLellan A., Moore-Connors J., Grant, S., Cahill L., **Langille M.G.I.** and Van Limbergen J. (2017) The impact of Exclusive Enteral Nutrition (EEN) on the gut microbiome in Crohn's disease: a review. *Nutrients* 9: E0447.

**Mingrone, J., Susko, E. and Bielawski, J.** (2016) Smoothed bootstrap aggregation for assessing selection pressure at amino acid sites. *Mol. Biol. Evol.* 33: 2976-2989.

**Munoz-Gomez, S.A.,** Wideman, J.G., **Roger, A.J.** and **Slamovits, C.H.** (2017) The origin of mitochondrial cristae from alphaproteobacteria. *Mol. Biol. Evol.* 34: 943-956.

**Muñoz-Gómez, S.A.,** Mejía-Franco, F. G., Durnin, K., **Colp, M., Grisdale, C.J., Archibald, J.M.** and **Slamovits, C.H.** (2017) The new red algal subphylum Proteorhodophytina comprises the largest and most divergent plastid genomes known. *Curr. Biol.* 27: 1677-1684.

Novák, L., Zubáčová, Z., Karnkowska, A., Kolisko, M., Hroudová, M., Stairs, C.W., **Simpson, A.G.,** Keeling, P.J., **Roger, A.J.,** Čepička, I. and Hampl, V. (2016) Arginine deiminase pathway enzymes: evolutionary history in metamonads and other eukaryotes. *BMC Evol. Biol* 16: 197.

Pánek, T., Žihala, D., Sokol, M., Derelle, R., Klimeš, V., Hradilová, M., Zadrožílková, E., **Susko, E., Roger, A.J.,** Čepička, I. and Eliáš, M. (2017). Nuclear genetic codes with a different meaning of the UAG and the UAA codon. *BMC Biology* 15: 8.

Park, J.S. and **Simpson, A.G.** (2016) Characterization of a deep-branching Heterolobosean, *P. turkanaensis* n. sp., isolated from a non-hypersaline habitat, and ultrastructural comparison of cysts and amoebae among Pharyngomonas strains. *J. Eukaryot. Microbiol.* 63: 100-111.

Petkau, A., Philip Mabon, Cameron Sieffert, Natalie Knox, Jennifer Cabral, Kelly Weedmark, Rahat Zaheer, Lee S. Katz, Celine Nadon, Aleisha Reimer, Eduardo Taboada, **Robert G. Beiko,** William Hsiao, Fiona Brinkman, Morag Graham, the IRIDA Consortium, and Gary Van Domselaar (2017) SNVPhyl: A Single Nucleotide Variant Phylogenomics pipeline for microbial genomic epidemiology. *Microbial Genomics* 3: 1-11.

Robicheau, B.M., **Susko, E.,** Harrigan, A.M. and Snyder, M. (2017). The surprising link between the concerted evolution of rRNA genes, non-coding 'junk' DNA and eukaryotic genome size. *Genome Biol. Evol.* 9: 380-397.

Rutherford, K., Meehan, C.J., **Langille, M.G.,** Tyack, S.G., McKay, J.C., McLean, N.L., Benkel, K., **Beiko, R.G.** and Benkel, B. (2016) Discovery of an expanded set of avian leukosis subgroup E proviruses in chickens using Vermillion, a novel sequence capture and analysis pipeline. *Poult. Sci.* 95: 2250-2258.

**Sibbald, S.J.** and **Archibald J.M.** (2017) More protist genomes needed. *Nature Ecol. Evol.* 1, DOI: 10.1038/s41559-017-0145.

**Sibbald, S.**, Cenci, U., **Colp, M.**, **Eglit, Y.**, O’Kelly, C.J. and **Archibald, J.M.** (2017) Diversity and evolution of *Paramoeba* sp. and their kinetoplastid endosymbionts. *J. Eukaryot. Microbiol.* 4: 598-607. [Journal Cover]

Spackeen, J.L., Sipler, R.E., Xu, K., Tatters A.O., Walworth, N.G., **Bertrand, E.M.**, McQuaid, J.B., Hutchins, D.A., Allen, A.A. and Bronk, D. (2017) Interactive effects of elevated temperature and CO<sub>2</sub> on nitrate, urea, and DIC uptake by a coastal California microbial community. *Marine Ecology Progress Series*, in press.

Stuart, Y.E., **Inkpen, S.A.**, Hopkins, R. and Bolnick, D.I. (2017) Character displacement is an evolutionary pattern. So what causes it? *Biol. J. Linnean Soc.* 121: 711-715.

**Sylvester, E.V.A.**, Bentzen, P., Bradbury, I.R., Clement, M., Pearce, J., Horne, J. and **Beiko, R.G.** (2017) Applications of Random Forest for SNP selection in individual assignment of Atlantic Salmon (*Salmo salar*). *Evol. Applications*, in press.

Takishita, K., Chikaraishi, Y., Tanifuji, G., Ohkouchi, N., Hashimoto, T., Fujikura, K. and **Roger, A.J.** (2017) Microbial eukaryotes that lack sterols. *J. Eukaryot. Microbiol.*, May 16 [epub ahead of print].

**Wang, H.C.**, **Susko, E.** and **Roger A.J.** (2016) Split-specific bootstrap measures for quantifying phylogenetic stability and the influence of taxon selection. *Mol. Phylogenet. Evol.* 105: 114-125.

Xu, F., **Jerlström-Hultqvist, J.**, Kolisko, M., **Simpson, A.G.**, **Roger, A.J.**, Svärd, S.G. and Andersson, J.O. (2016) On the reversibility of parasitism: adaptation to a free-living lifestyle via gene acquisitions in the diplomonad *Trepomonas* sp. PC1. *BMC Biol.* 14: 62.

**Yang, J.**, **Harding, T.**, Kamikawa, R., **Simpson, A.G.B.** and **Roger, A.J.** (2017) Mitochondrial genome evolution and a novel RNA editing system in deep-branching heteroloboseids. *Genome Biol. Evol.* 9: 1161-1174.

Zhan, L., Paterson, I.G., Fraser, B.A., Watson, B., Bradbury, I.R., **Nadukkalam, Ravindran P.**, Reznick, D., **Beiko, R.G.** and Bentzen, P. (2017) Megasat: automated inference of microsatellite genotypes from sequence data. *Mol. Ecol. Resour.* 17: 247-256.

## **II. Invited Book Chapters and Book Editorships**

**Archibald, J.M.**, **Simpson, A.G.B.** and **Slamovits, C.H.** (2017) – Editors of *Handbook of the Protists (Second Edition)*, Springer Reference.  
<https://www.amazon.ca/Handbook-Protists-John-M-Archibald/dp/331928147X>

**Cenci, U.**, **Moog, D.** and **Archibald, J.M.** (2016) Origin and spread of plastids by endosymbiosis. In M. Grube, L. Muggia & J. Seckbach (Eds.), *Algal and Cyanobacteria Symbioses*, pp. 43-81, Springer-Verlag.

DesRoches, C.T., **Inkpen, S.A.** and Green, T.L. (2017) The eroding artificial/natural distinction? Some consequences for ecology and economics. In M. Nagatsu and A. Ruzzene (eds.), *Philosophy and the Social Sciences: A Dialogue*, Bloomsbury Publishing, London, UK, *in press*.

**Grisdale, C.** and **Archibald, J.M.** (2017) Secondary and tertiary endosymbiosis. In: *Reference Module in Life Sciences*, Elsevier Publishing. ISBN: 978-0-12-809633-8. [Invited textbook chapter].

Heiss, A.A., Brown, M.W. and **Simpson, A.G.B.** (2017) Apusomonadida. In *Handbook of the Protists (Second Edition)*, Archibald, J.M., Simpson, A.G.B. & Slamovits, C. (Eds.). Springer.

Hoef-Emden, K. and **Archibald, J.M.** (2017) Cryptophyta (Cryptomonads). In *Handbook of the Protists (2<sup>nd</sup> edition)*, Archibald, J.M., Simpson, A.G.B. & Slamovits, C. (eds.). Springer.

Leander, B.S., **Lax, G.**, Karnkowska, A. and **Simpson, A.G.B.** (2017) Euglenida. In *Handbook of the Protists (2<sup>nd</sup> edition)*, Archibald, J.M., Simpson, A.G.B. & Slamovits, C. (eds.). Springer.

Panek, T., **Simpson, A.G.B.**, Brown, M.W. & Dyer, B.D. (2017) Heterolobosea. In *Handbook of the Protists (2<sup>nd</sup> edition)*, Archibald, J.M., Simpson, A.G.B. & Slamovits, C. (eds.). Springer.

**Simpson, A.G.B.** and **Eglit, Y.** (2016) Protist diversification. In R.M. Kliman (Ed.), *Encyclopedia of Evolutionary Biology*, Vol. 3, pp. 344-360, Oxford: Academic Press.

**Simpson, A.G.B.**, **Slamovits, C.H.** and **Archibald, J.M.** (2017) Protist diversity and eukaryote phylogeny. In: *Handbook of the Protists (2<sup>nd</sup> edition)*, Archibald, J.M., Simpson, A.G.B. & Slamovits, C. (eds.). Springer.

**Susko, E.** (2016) Support measures, Phylogenetic Tree. In R.M. Kliman (Ed.), *Encyclopedia of Evolutionary Biology*, Vol. 4, pp. 256-260, Oxford: Academic Press.

### **III. Other Contributions (Review Papers, Commentaries, etc.)**

Berney, C. *et al.* [25 authors incl. **Simpson, A.G.B.**] (2017) UniEuk: Time to speak a common language in protistology! *J Eukaryot Microbiol.* 64: 407-411.

Dacks, J., Field, M., Buick, R., **Eme, L.**, Gribaldo, S., **Roger, A.J.**, Brochier, C. and Devos, D.P. (2016) The changing view of eukaryogenesis - fossils, cells, lineages and how they all come together. *J. Cell Sci.* 129: 3695-3703.

**David, V.** and **Archibald, J.M.** (2016) Evolution: plumbing the depths of diplomid diversity. *Curr. Biol.* 26: R1290-1292.

**de Vries, J.** and **Archibald, J.M.** (2017) Endosymbiosis: did plastids evolve from a freshwater cyanobacterium? *Curr. Biol.* 27: R103-105.

**Gray M.W.** (2017) Lynn Margulis and the endosymbiont hypothesis: 50 years later. *Mol. Biol. Cell* 28: 1285-1287.

**Munoz-Gomez, S.A. and Roger, A.J.** (2016) Leaving negative ancestors behind. *eLIFE* 5: e20061.

**Sibbald, S.J. and Archibald, J.M.** (2017) More protist genomes needed. *Nature Ecol. Evol.* 1: 145.

## 2.3 PARTICIPATION IN EVENTS FOR RESEARCH DISSEMINATION

### Invited Presentations by CGEB Faculty: [July 1, 2016 – June 30, 2017]

John Archibald: Invited Plenary - 13<sup>th</sup> International Colloquium on Endocytobiology and Symbiosis, Kyoto, Japan, September 10-14, 2016. Title: *One plus one equals one: historical and modern perspectives on endosymbiotic theory.*

John Archibald: Acadia University, Department of Biology Seminar Series, September 29, 2016. Title: *Symbiosis: new perspectives from the eukaryotic endosymbionts of pathogenic amoebae.*

John Archibald: NSIS Public Lecture, Nova Scotian Institute of Science, Halifax, December 5, 2016. Title: *Molecular clocks: using DNA to infer evolution.*

John Archibald: Workshop in Symbiotic Interactions in the Oceans, Grand Wailea, Maui, January 23-27, 2017. Title: *Of macrobes and microbes: symbiosis, ecology and evolution.*

John Archibald: 67<sup>th</sup> Annual Conference of the Canadian Society of Microbiologists, University of Waterloo, June 20-23, 2017. Title: *One plus one equals one: historical and modern perspectives on symbiosis.*

John Archibald: Annual meeting of the Society for General Microbiology, April 1-6, 2017. Edinburgh, GB. Title: *Symbiosis: new perspectives from eukaryotic endosymbionts within pathogenic amoebae.*

John Archibald: Frontiers in Evolutionary Ecology and Genomics Workshop, Beijing Normal University, China, June 24-26, 2017. Titles: *One plus one equals one: historical and modern perspectives on endosymbiotic theory AND Endosymbiosis and genome mosaicism in microbial eukaryotes.*

Robert Beiko: Evolutionary Networks, Roscoff, France, July 3-9, 2016. Title: *Lateral gene transfer: how many stories can a network tell?*

Robert Beiko: IRIDA Annual General Meeting / Public Lecture, Vancouver, October 2016. Title: *Monitoring the microbiome in an assisted-care facility.*

Robert Beiko: Advancing Microbiome Research Symposium: Microbiome & Disease, Potomac, MD, November 2016. Title: *Common assumptions and pitfalls of microbiome analysis.*

Robert Beiko: Vancouver Bioinformatics Users' Group (VanBUG), Vancouver, December 2016. Title: *A Coevolution-Based Approach to the Identification of Genes with Similar Phylogenetic Distributions.*

Robert Beiko: Invited Webinar - Bioinformatics for Infectious Disease Control: Mini Symposium, Simon Fraser University, December 12, 2016. Title: *Monitoring the microbiome in an assisted-care facility.*

<https://www.sfu.ca/vpresearch/events/2016/bioinformatics-for-infectious-disease-control.html>

Robert Beiko: Canadian Bioinformatics Workshop in Infectious Disease Genomic Epidemiology, Vancouver, May 2017. Title: *Phylogeographic Analysis.*

Robert Beiko: Drexel University, Philadelphia, June 2017. Title: Identifying key temporal and taxonomic bacterial clusters in the aging microbiome.

Robert Beiko: 2017 International Workshop on Environmental Genomics, St. John's, June 2017. Title: Predicting functional classes of genes from metagenomic data.

Robert Beiko: McMaster University, Hamilton, March 2017. Title: The aging and frail microbiome: diversity, time, and function.

Erin Bertrand: St. Mary's University, Department of Biology, Halifax, November 2016. Title: Phytoplankton need their vitamins too: using proteomics to study micronutrient demand in marine microbial ecosystems.

Erin Bertrand: Marine Microbial Proteomics Working Group, Woods Hole, May 2017. Title: Leveraging metagenomics and metatranscriptomics for peptide biomarker design.

Erin Bertrand: Plenary - ASM Microbe Annual Meeting, New Orleans, June 2017. Title: Micronutrient utilization and microbial interdependencies in a changing ocean.

Erin Bertrand: Plenary - Canadian Society of Microbiologists, Annual Meeting, Waterloo ON, June 2017. Title: Identifying and quantifying microbial interdependencies that underpin ocean productivity.

W. Ford Doolittle: Invited roundtable participant – Advisory Panel for Canada's Science Review, Toronto, October 25, 2016.

W. Ford Doolittle: UBC Biodiversity Seminar Series, Vancouver, March 13, 2017. Title: *Darwinizing Gaia.*



W. Ford Doolittle: Invited Phyloseminar, March 28, 2017. Title: *Darwinizing Gaia*.  
<https://www.youtube.com/watch?v=sYV2UlzayAg>

W. Ford Doolittle: Species in the Age of Discordance, University of Utah, Salt Lake City, March 23, 2017. Title: *The prokaryotic species problem is even worse*.

W. Ford Doolittle: Keynote address – 10<sup>th</sup> Annual Dr. Patrick Lett Symposium, Dalhousie University, April 7, 2017. Title: *Darwinizing Gaia*.

W. Ford Doolittle: Invited external reviewer for Harvard's Origins of Life Initiative, Cambridge, MA, April 18, 2017.

W. Ford Doolittle: Opening plenary lecture, 14<sup>th</sup> Symposium on Bacterial Genetics and Ecology, Aberdeen, Scotland, June 4, 2017. Title: *Darwinizing Gaia*.

Michael W. Gray: 115<sup>th</sup> International Titisee Conference on Evolutionary Mitochondrial Biology: Molecular, Biochemical, and Metabolic Diversity, Germany, Mar. 29–Apr. 2, 2017. Title: *The mitochondrial proteome of *Andalucia godoyi*, an early-diverging eukaryote with the most gene-rich mitochondrial genome*.

Morgan Langille: Dalhousie University Microbiome Symposium, Halifax, Aug. 30, 2016. Title: *Integrated Microbiome Resource: >10,000 samples*.

Morgan Langille: International Human Microbiome Consortium Congress 2016, Houston, Texas, Nov. 10, 2016. Title: *Assessing the relative contribution of genetics and micro-omics for predicting pediatric Crohn's disease*.

Morgan Langille: Picchione Lecture Series (General Public Lecture), Halifax, Jan. 17, 2017. Title: *Using genetics to find new treatments of disease*.

Morgan Langille: Illumina, San Diego, CA, Mar. 6, 2017. Title: *Microbiome: Techniques and recent discoveries*.

Morgan Langille: Centre for Comparative Genomics & Evolutionary Bioinformatics Seminar Series, Dalhousie University, April 20, 2017. Title: *Multi-omics machine learning*.

Andrew J. Roger: Dalhousie Microbiome Research Symposium, Halifax, August 2016. Title: *Understanding the gut-infecting protozoan *Blastocystis* through comparative genomics and microbiomics*.

Andrew Roger: Department of Biological Sciences, Mississippi State University, September 2016. Title: *Genomic mechanisms of adaptation of eukaryotic microbes to anaerobic conditions and the gut environment*.

Andrew Roger: Invited Phyloseminar, October 7, 2016. Title: *Combating phylogenetic artefacts by modeling site-specific substitution processes with mixture models and approximations.* <https://www.youtube.com/watch?v=eK2lgV4JdM8>

Andrew Roger: Eukaryogenesis Workshop, Seville, Spain, November 3, 2016. Title: *The root of the tree of eukaryotes and the nature of the last eukaryotic common ancestor.*

Andrew Roger: Genome Atlantic - Human Genetics/Genomics Seminar Series, Dalhousie University, November 16, 2016. Title: *Genomic mechanisms of adaptation of eukaryotic microbes to anaerobic conditions and the gut environment.*

Andrew Roger: 12<sup>th</sup> Annual DOE Joint Genome Institute – Genomics of Energy and Environment Meeting, Walnut Creek, CA, March 22, 2017. Title: *Adaptation of eukaryotic microbes to low oxygen and the gastrointestinal tract.*

Andrew Roger: 115<sup>th</sup> International Titisee Conference, Germany, March 29, 2017. Title: *The evolutionary history of anaerobic mitochondrion-related organelles in microbial eukaryotes.*

Andrew Roger: Canadian Institute for Advanced Research, Integrated Microbial Biodiversity Program Meeting, Whistler, June 8, 2017. Title: *Eukaryogenesis and mitochondria: knowns, unknowns and crazy ideas.*

Alastair Simpson: St Francis Xavier University, Biology Seminar Series, November 2, 2016. Title: *The tree of (eukaryotic) life – a story told by free-living protozoa.*

Claudio Slamovits: Acadia University, Department of Biology Seminar Series, Wolfville, November 2016. Title: *Molecular and evolutionary aspects of dinoflagellate protists*

Ed Susko: Celebrating 50 years Statistics and Actuarial Science, Waterloo, Ontario, July 2017. Title: *Bayes factor biases for non-nested models and corrections.*

## 2.4 STUDENT RESEARCH ACTIVITIES

**The following is a list of Undergraduate and Graduate Student trainees in CGEB labs for the period July 1, 2016 – June 30, 2017:**

**Student Name / Status / Supervisor lab / Thesis Title (if applic.)**

Bashwih, Rana: Master's student (completed 08/2016) – Bielawski

Buchwald, Robyn: Master's student (completed 08/2016) – Simpson

Thesis title: *Detection and quantification of an ecologically important marine pathogen *Paramoeba invadens**

Chen, Chang: Master's student (completed 08/2016) – Beiko

Thesis title: *Statistical modeling of microbial community distributions*

Colp, Morgan: Honours student (in progress) – Archibald

David, Vojtech: Master's student (in progress) – Archibald  
Douglas, Gavin: PhD student (in progress) - Langille  
Durnin, Keira: Co-op summer student (completed 08/2016) – Slamovits  
Eglit, Yana: PhD student (in progress) – Simpson  
Glennon, Kate: Undergraduate summer student – Roger  
Hall, Michael: Master's student (completed 08/2016; now PhD student) – Beiko  
Thesis title: *Unsupervised clustering of time series from microbial marker-gene data.*  
Harding, Tommy: PhD student (completed 11/2016; now PDF here) – co-supervisors Roger & Simpson. Thesis title: *Molecular adaptations in obligate halophilic protists.*  
Hayes, Mary (Molly): Honours student with Langille & Gu (completed 05/2017; now Master's student)  
Jones, Casey: Master's student (in progress) – Langille  
Jones, Chris: PhD student (in progress); co-supervisors Susko & Bielawski  
Kitching, Tor: USRA student (in progress) – Bertrand  
Lamoureux, Emily: Master's student (completed 08/2017; now Research Ass't) – Langille  
Lax, Gordon: PhD student (in progress) – Simpson  
LeBlanc, Travis: Master's student (completed 08/2016) – Langille  
Thesis title: *Drug use and age alters the drug metabolism potential of the human gut microbiome.*  
Lindenfield, Brett: Co-op summer student (completed 08/2016) – Slamovits  
Liu, Chaoyue: Master's student (completed 04/2016); now PhD student – Beiko  
Thesis title: *Network-based approaches to identifying phylogenetically related sets of genes*  
Lu, Simiao: PhD student (in progress) – Blouin  
McCain, J. Scott: PhD student (in progress) – Bertrand  
Mingrone, Joseph: PhD student (in progress) – co-supervisors Susko & Bielawski  
More, Kira: Honours student (completed 04/2017; now Research Ass't) – Simpson  
Munoz-Gomez, Sergio: PhD student (in progress) – co-supervisors Roger & Slamovits  
Nomi, Eyre: Master's student (terminated 10/2016) – co-supervisors Beiko & Roger  
Qazi, Zaahirah: Master's student – Blouin  
Radan, Katherine: summer student (completed 08/2017) – Roger  
Ravindran, Praveen Nadukkalam: PhD student (in progress) – Beiko  
Rose, Sonja: Honours student (in progress) - Bertrand  
Shala, Donika: Master's student (completed 08/2017) – Slamovits  
Sibbald, Shannon: Master's student (completed 08/2017; now Research Ass't) – Archibald  
Streight, Steven: Honours student (left program 01/2017) – Simpson  
Sylvester, Emma: Master's student (completed 08/2017) – Beiko  
Thesis title: *Novel applications of random forest for exploring population structure of Atlantic Salmon (*Salmo salar*)*  
Tang, Chongci: Master's student (completed 08/2016) – co-supervisors Bielawski & Susko  
Williams, Shelby: Undergraduate summer student – Roger  
Wong, Dennis: PhD student (in progress) – Beiko  
Yang, Jiwon: Master's student (completed 07/2016) – Roger & Simpson  
Thesis title: *Mitochondrial genome evolution in the deep-branching heteroloboseids amoeba 'BB2' and Pharyngomonas kirbyi*  
Youssef, Noor: Master's student (completed 09/2016; now PhD student) – Bielawski  
Zhao, Dandan: NSERC Undergraduate Summer Student – Roger lab

## **PRESENTATIONS BY CGEB TRAINEES**

[Presentations by students listed in Section 2.4 above, and PDFs listed in Section 2.1.5. All were talks, unless indicated otherwise.]

*NOTE: Select list only – additional presentations by previous trainees (now gone) were not all available for inclusion in this report.*

Tyler Brunet: A logic of mechanistic chemistry. Philosophy Colloquium, Dalhousie University, March 10, 2017.

Jan de Vries: Land plant terrestrialization and what we can learn from Chara. International Plant and Animal Genome Conference XXV, San Diego, CA, January 3-20, 2017.

Gavin Douglas: Assessing the relative contribution of genetics and the microbiome for predicting pediatric Crohn's disease. International Society for Microbial Ecology, Montreal, August 23, 2016. Contributed poster.

Katherine Dunn, R Sigall-Boneh, JP Bielawski, D Turner, J Van Limbergen, A Levine: Crohn's disease exclusion diet and partial enteral nutrition (CDED+PEN) vs exclusive enteral nutrition (EEN). Microbiome changes of a randomized clinical trial (RCT) in pediatric CD: remission is associated with similar structural + functional profiles, February 2017. Journal of Crohn's and Colitis 11(suppl\_1):S29-S29 [Digital oral presentation].

Katherine Dunn, R Sigall-Boneh, JP Bielawski, D Turner, J Van Limbergen, A Levine: Crohn's disease exclusion diet and partial enteral nutrition (CDED+PEN) vs exclusive enteral nutrition (EEN). Microbiome changes of a randomized clinical trial (RCT) in pediatric CD: remission is associated with similar structural + functional profiles. Digestive Disease Week, Chicago, May 2017.

Yana Eglit: Aliens within the mundane: the hunt for lost and new eukaryotes. Biology Organization of Graduate Students Seminar Series, Dalhousie University, January 13, 2017.

Laura Eme: Rooting the tree of eukaryotes. Annual Meeting of the American Society of Microbiology, Boston, July 19-23, 2016.

Mike Hall: Breaking down the OTU. Statistical Challenges and Opportunities for the Analysis of Microbiome Data Workshop, Canadian Statistical Sciences Institute, University of Manitoba, May 10-11, 2017.

Mike Hall: Time-Series Clustering of Marker Genes Reveals Ecological Dynamics. Canadian Society of Microbiologists Conference, University of Waterloo, June 20-23, 2017. Presentation and poster.

Andrew Inkpen: Ecology in the Age of Humans. Department of Philosophy, University of Wisconsin, Stevens Point, October 2016.

Andrew Inkpen: When ecology needs economics and economics needs ecology: Interdisciplinary exchange in the age of humans. PSA: Philosophy of Science Association, Atlanta, Georgia, November 2016.

Andrew Inkpen: What's Wrong with the Received View of Molecular Homology? Centre for Comparative Genomics and Evolutionary Bioinformatics Seminar, Dalhousie University, December 2016.

Andrew Inkpen: Molecular phylogenetics and the perennial problem of homology. Philosophy Colloquium, Dalhousie University, December, 2016.

Andrew Inkpen: Toward a New Account of Ecosystem Function. Function and Biological Explanation, Acadia University, June 2017.

A. MacLellan, J. Connors, B. MacIntyre, G. Douglas, KA Dunn, JP Bielawski, A Noble, G. Mahdi, M. Rashid, A Otley, L. Cahill, M. Langille, J Van Limbergen: Fibre intake is associated with microbiome changes in pediatric Crohn's disease patients following induction of remission induction with exclusive enteral nutrition (EEN). Digestive Disease Week, Chicago, May 2017. Contributed Poster.

J. Scott McCain, Carolyn Kachuk, Erin Bertrand: End-to-end Metaproteomics: Advances in sample processing and mass spectrometry bioinformatics for environmental microbiology. Canadian Society for Microbiologists 2017, Waterloo, Ontario, June 20-23, 2017. Contributed Poster.

Kira More: The cellular identity, phylogenetic placement, and autecology of marine vampyrellid amoebae from cultured isolates. Science Atlantic Biology Conference, St. Francis Xavier University, March 10-12, 2017.

Zaahirah Qazi: Using contact entropy to find functionally important residues in Enolase super family. Annual Dalhousie Computer Science In-House Conference (DCSI), Halifax, September 2016.

Praveen Nadukkalam Ravindran: A graph based data structure for fast and efficient assembling of short read Restriction-Site Associated DNA sequences with informed choice of parameter settings. High Performance Computing Symposium (HPCS), Kingston, Ontario, June 6-9, 2017.

Dayana Salas-Leiva, Kolisko, M., Curtis, B., Eme L., Kamikawa R., Roger A.: A draft genome of the anaerobic flagellate *Carpediemonas membranifera*, a free-living relative of metamonad parasites. Annual Meeting of the Canadian Institute for Advanced Research – Integrated Microbial Biodiversity Program, Whistler, BC, June 6-9, 2017. Contributed Poster.

Donika Shala: Assessing the effects of lighting regimes on the productivity of a microalgae reactor. Biochemistry and Molecular Biology Seminar Series, Dalhousie University, May 17, 2017.

Shannon Sibbald: Genomic footprints in the cryptomonad *Goniomonas* – evidence for photosynthetic ancestry? Biochemistry and Molecular Biology Seminar Series, Dalhousie University, May 24, 2017.

Emma Sylvester: Applications of Random Forest for SNP selection in individual assignment of Atlantic Salmon (*Salmo salar*). Annual Dalhousie Computer Science In-House Conference (DCSI), Halifax, September 2016.

Emma Sylvester: Novel computational approaches for SNP selection in individual assignment of Atlantic Salmon (*Salmo salar*). CCFR (Canadian Conference for Fisheries Research), Montreal, January 2017.

Emma Sylvester: Exploring the use of random forest for SNP selection in genetic population assignment. Evolution Meeting, Portland, OR, June 2017.

Dandan Zhao: A two-loci CRISPR/Cas9 “knock-in” strategy for tagging and selecting cells with Bir-APML using puromycin resistance. Biochemistry and Molecular Biology Honours Student Research Presentations, Dalhousie University, March 30, 2017.

## 2.5 MEDIA ENGAGEMENT / PUBLIC AWARENESS / EDUCATION

John M. Archibald:

- Invited NSIS Public Lecture. Nova Scotian Institute of Science, Natural History Museum December 5, 2016. Title: *Molecular clocks: using DNA to infer evolution.*

Robert Beiko:

- Text Interview – Metagenomes and antimicrobial resistance, FRAM DINSHAW, Halifax Chronicle Herald, Sept. 15, 2016. <https://goo.gl/y8UCHp>

W. Ford Doolittle:

- Interviewed on “*CBC Radio – The Current*”, January 4, 2017 <http://www.cbc.ca/radio/popup/audio/listen.html?autoPlay=true&mediaIds=847324739777>
- Interviewed on “*CBC Radio Ideas*”, May 25, 2017 (this followed receipt of the 2017 Killam Prize)
- Invited Phyloseminar – March 28, 2017. Title: Darwinizing Gaia <https://www.youtube.com/watch?v=sYV2UlzayAg>

Morgan Langille:

- 2017/05/31: Genome Atlantic Sequence Genomics Bulletin
  - [“New frontier of microbiomics generates lots of research buzz”](#)
  - [“Growing demand keeps local sequencing facility hopping”](#)
- 2017/01/17: Interview with “*CBC Radio, Information Morning Show*”, Halifax

- 2017/01/04: “N.B.-born medical researcher attracting global attention for his work with human bacteria”:
  - [Online](#): Telegraph Journal
  - In print: Telegraph Journal, Saint John, NB, Canada
  - In print: The Daily Gleaner, Fredericton, NB, Canada
  - In print: The Kings County Record, Sussex, NB

Andrew Roger:

- Invited Phyloseminar - October 7, 2016. Title: Combating phylogenetic artefacts by modeling site-specific substitution processes with mixture models and approximations  
<https://www.youtube.com/watch?v=eK2lgV4JdM8>

## 2.6 OUTREACH STRATEGY

- see Section 1.2 (Current Year’s Activities – E. CGEB Seminar Series, and F. Meeting/Symposia Sponsorship)

## 2.7 TECHNOLOGY DEVELOPMENT, PATENT OR COMMERCIALIZATION

### Patents:

M. Saito and E. Bertrand (2016). Cobalamin Acquisition Protein and Use Thereof.  
US Patent [9,234,012](#)

### Updates on CGEB Developed Software:

*Microbiome Helper*: [https://github.com/mlangill/microbiome\\_helper](https://github.com/mlangill/microbiome_helper)

Bioinformatic pipelines, standard operating procedures, and tutorials for 16S and metagenomic data.

*Proteus*: <https://bitbucket.org/EvoWorks>

A large program under development that implements a wide variety of Markov models for molecular data that can be applied to real data in either a maximum likelihood or Bayesian inference framework (currently > 70,000 lines of code).

## SECTION 3 – FINANCIAL INFORMATION

### Summary of CGEB Funding Sources:

- I. Tula Foundation
- II. Herzberg - CGEB Trainee Fellowships & CGEB administration support
- III. Dalhousie University - Faculties of Medicine, Science, Computer Science, and VP-Academic & Provost

### Annual Operating/Administration Funds in Reporting Year:

#### I. TULA FOUNDATION

A. *Administration/Seminar Series/Student Travel* (\$50,000 per annum): this includes \$25,000 for CGEB administration, \$15,000 for seminar series speakers, and \$10,000 for trainees travel to meetings. This support from the Tula Foundation commenced in July 2007, with an 8-year commitment from 2007-2015. Aggregate over 8 years: \$400,000. There are currently some residual funds remaining from the original Tula funding that are being used for seminar series speakers and student travel to meetings in this reporting period.

B. *Traineeships (for Postdocs & PhD students)*: these were 5-years of funding slots awarded to each CGEB faculty for a postdoc or PhD trainee, including research allowance. A few of the PI's labs still had some residual funds remaining in this reporting period (i.e. Slamovits lab, Blouin lab, Beiko lab).

#### II. HERZBERG-CGEB FELLOWSHIPS / SCHOLARSHIPS AND CGEB ADMINISTRATION SUPPORT

In 2014 CGEB member Dr. W. Ford Doolittle pledged to support a new CGEB Trainee Fellowship/Scholarship program from funds awarded to him as part of the NSERC Herzberg Gold Medal Award. This program has provided majority support for stipends of graduate students and postdoctoral fellowships for the five years of his award (2014-2019). These fellowships are awarded on a competitive basis to applicants in the CGEB community (including Members and Associates).

- \$35,000 p.a. for 2 years for postdoctoral fellowships
- \$15,000 for 2 years for M.Sc. and up to 5 years for Ph.D. student stipends

The remaining stipend of the trainee is contributed by the trainee supervisor from grants awarded to them. In this funding period, two M.Sc. students were supported by Herzberg stipends: Ms. Eyre Nomi (Comp. Sci.) and Mr. Tyler Brunet (Comp.Sci.), one PhD student: Ms. Yun Cai (Math/Stats), and two postdoctoral fellowships: Dr. Dayana Salas-Leiva, Biochem. and Dr. Anna Asman, Biochem.

Dr. Doolittle has also pledged \$34,000 p.a. towards supporting a portion of the CGEB administrator's salary from 2015-2019, with a subsequent 1 year extension to March 31, 2020.



### III. DALHOUSIE UNIVERSITY

The Faculties of Medicine, Science, and Computer Science, and Office of the VP-Academic & Provost initially collectively committed funding for Years 1-7 (i.e. 2008-2015) to at least match the funds from the Tula Foundation for CGEB administration. On March 14<sup>th</sup>, 2014 Dr. John Newhook obtained a commitment from each of the Deans for an additional four more years of funding (April 2015-April 2019), to coincide with Dr. Ford Doolittle’s Herzberg Award funding contribution toward CGEB trainees and administration (see II. above).

#### Summary of Institutional Support Commitments to CGEB:

<b>Fiscal Year April 1 – March 31</b>	<b>Faculty of Medicine</b>	<b>Provost &amp; VP Academic</b>	<b>Faculty of Science</b>	<b>Faculty of Computer Science</b>	<b>TOTAL</b>
Year 1: 2008-2009	\$15,000	\$10,000	N/A	N/A	<b>\$25,000</b>
Year 2: 2009-2010	\$15,000	\$10,000	\$1,000	\$1,000	<b>\$27,000</b>
Year 3: 2010-2011	\$10,000	\$10,000	\$6,000	\$3,000	<b>\$29,000</b>
Year 4: 2011-2012	\$10,000	\$10,000	\$7,000	\$4,000	<b>\$31,000</b>
Year 5: 2012-2013	\$10,000	\$10,000	\$8,000	\$5,000	<b>\$33,000</b>
Year 6: 2013-2014	\$10,000	\$10,000	\$8,000	\$5,000	<b>\$33,000</b>
Year 7: 2014-2015	\$10,000	\$10,000	\$8,000	\$5,000	<b>\$33,000</b>
Year 8: 2015-2016	\$10,000	\$10,000	\$8,000	\$5,000	<b>\$33,000</b>
Year 9: 2016-2017	\$10,000	\$10,000	\$8,000	\$5,000	<b>\$33,000</b>
Year 10: 2017-2018	\$10,000	\$10,000	\$8,000	\$5,000	<b>\$33,000</b>
Year 11: 2018-2019	\$10,000	\$10,000	\$8,000	\$5,000	<b>\$33,000</b>

### IV. OTHER – CGEB NEW OPPORTUNITIES FUND

Another source of funds available to finance specific CGEB activities is the *CGEB New Opportunities Fund*. This ‘special purpose account’ (68292) was originally opened to receive transfers of revenue that was previously generated from CGEB members’ activities (i.e. scientific meetings). The current balance in this account is \$28,000. The purpose of this fund is to provide additional partial funding or ‘seed’ monies for CGEB activities, the costs of which either exceed existing allocated funds (e.g. the Trainee Travel to Meeting fund, the Seminar Series fund), or one-time events/activities/opportunities that fall within the CGEB mandate (*see Section 1.2 – F. for meeting events sponsored in 2016-17*). To date these funds have also been used for costs associated with recruitment of trainees to CGEB labs (e.g. interview travel costs), occasional public lecture sponsorship, as well as the initial CGEB website design.

## 3.2 RESEARCH FUNDING AND AWARDS TO CGEB FACULTY MEMBERS

### 3.2.1 Current External Research Grants and other Funding

Collectively, CGEB faculty received (including ongoing awards) of ~\$3,495,000 from external research grants and other awards during this reporting period. Grants involving collaborative CGEB members as co-applicants were only counted once (i.e. for the primary P.I.) to obtain the above total.

#### John Archibald

- 2017-2019 **Gordon and Betty Moore Foundation**—*Laboratory systems for studying gene transfer in eukaryotes*: \$368,375 CDN over 2.5 years
- 2014-2019 **NSERC Discovery Grant**—*Endosymbiosis and genome evolution in eukaryotic microbes*: \$85,000/year for 5 years
- 2012-2017 **Canadian Institute for Advanced Research, Integrated Microbial Biodiversity Program**—research allowance for program senior fellows: \$24,000/year for 5 years

#### Robert Beiko

- 2016-2020 **Genome Canada – Large Scale Applied Research Project Competition - Natural Resources and the Environment: Sector Challenges – Genomic Solutions**: Managing microbial corrosion in Canadian offshore and onshore oil production operations: \$7 million over 4 years (co-applicant with Lisa Gieg, P.I.)
- 2015-2020 **NSERC Strategic Network Grant**: *CHONe II: Conservation strategies for Canada’s changing oceans*: \$4,980,000 [\$45,000 to R.Beiko] (P.I. – P. Snelgrove, with 30 co-applicants incl. R. Beiko)
- 2016-2018 **Aga Khan University - Internal Research Grant**: *The maternal and neonatal microbiota correlates of premature labor and adverse neonatal outcomes*: \$25,000 [co-applicant with Rod Adam, P.I.]
- 2016-2018 **Genome Canada Operating Grant - Bioinformatics and Computational Biology Competition**: *Rapid prediction of antimicrobial resistance from metagenomic samples: data, models and methods*: \$250,000 (P.I. - R. Beiko, with Andrew McArthur & Fiona Brinkman)
- 2016-2017 **Springboard Atlantic**: *Novel Chlamydia vaccine antigen developed by computational algorithms*: \$20,000 (co-applicants R. Beiko, Jun Wang, Mat Kallada)
- 2013-2017 **NSERC Strategic Project Grants**: *Genomics approaches to the management of mixed stock fisheries in Canada*: \$593,000 over 3 years [\$100,000 to R.Beiko] (P.I. – P. Bentzen, with co-applicants I. Bradbury & R. Beiko)
- 2012-2017 **Canada Research Chair (Tier 2) in Bioinformatics**: \$100,000/year
- 2012-2017 **NSERC Discovery Grant**: *Untangling the complex geographic and evolutionary patterns of microbes*: \$33,000/year

### Erin Bertrand

- 2017-2022 **OFI (Ocean Frontier Institute) – North West Atlantic Microbial Observatory:** \$1,262,499 over 5 years (co-investigator with 3 others)
- 2017-2020 **Simons Foundation – Early Career Investigator:** *Quantitative Marine Microbial Ecology:* \$720,000 over 3 years
- 2015-2020 **NSERC – Discovery Grant:** *Micronutrient-based interactions in marine microbial communities:* \$32,000/year
- 2015-2020 **Canada Research Chair (Tier 2) in Marine Microbial Proteomics:** \$100,000/yr

### Joseph Bielawski

- 2016-2018 **Nova Scotia Health Research Foundation:** *Role of fecal microbiome in optimizing asparaginase therapy in childhood acute lymphoblastic leukemia:* \$149,833 over 2 years (co-applicant)
- 2015-2020 **NSERC – Discovery Grant:** *A general framework for modeling functional divergence at the molecular level, and investigating relationships to phenotype:* \$21,000/year
- 2015-2017 **Schulich Ocean Studies Centre:** *Dynamics of complex microbial communities and metabolic potential during the spring bloom in the Gulf of Aqaba, Red Sea:* \$150,000 over 2 years (co-P.I.)

### Christian Blouin

- 2016-2021 **NSERC – Discovery Grant:** Novel approaches to protein engineering based on geometric and modularity analyses: \$23,000/year
- 2015-2017 **Nova Scotia Health Research Foundation – Scotia Support Training Grant:** *Enzymology and molecular simulations:* \$66,000 over 2 years

### W. Ford Doolittle

- 2014-2019 **NSERC – Gerhard Herzberg Canada Gold Medal for Science and Engineering:** \$1,000,000 over 5 years

### Morgan Langille

- 2017-2020 **Nova Scotia Health Research Foundation - Establishment Grant:** *Role of fecal microbiome profiling in optimizing asparaginase therapy in childhood acute lymphoblastic leukemia:* \$150,000 over 3 years (co-applicant with P.I. Ketan Kulkarni)
- 2017 **DMRF Molly Appeal:** *Translating microbiome analysis to the clinic:* \$200,000 (co-applicant with P.I. Andrew Makrigiannis)
- 2017 **Picchione Lecture Series:** Funding to host public lecture with eight panelists entitled *Using genetics to find new treatments of disease:* \$8,000
- 2016 – 2021 **Canada Research Chair (Tier 2) in Human Microbiomics:** \$100,000/year
- 2016 – 2021 **Canada Foundation for Innovation: John R. Evans Leaders Fund – Integrating, classifying, and inferring the human microbiome:** \$312,395 over 5 years

- 2016 – 2021 **NSERC Discovery Grant:** *Integrating and modeling host-microbiome interactions:* \$150,000 over 5 years
- 2016 – 2018 **NSERC Collaborative and Research Development Grant – Improving metagenomic inference and sample classification in inflammatory bowel disease:** \$120,000 over 2 years
- 2016 **Innovacorp: Productivity and Innovation Voucher Program – Microbiome assessment of the production of coconut kefir:** \$15,000
- 2016 **Nova Scotia Department of Agriculture - Research Acceleration - Rhizo-microbiome as a tool for understanding *V. angustifolium*-microbe interaction:** \$40,000 for one year (co-applicant with P.I. - Svetlana Yurgel)
- 2016 **Occupational Health and Safety Futures Research Funding Program - Exposure to welding fume and the effect on the human respiratory microbiome:** \$45,000 for one year (co-applicant with P.I.s - Anil Adishes & Jeremy Beach)
- 2015-2020 **Canada Foundation for Innovation - Innovation Fund – Research program for rare pediatric diseases:** \$21,000,000 over 5 years (collaborator with P.I. – Kym Boycott)
- 2015-2018 **Canadian Breast Cancer Foundation - Identification of genes which determine paclitaxel sensitivity and resistance in breast cancer:** \$150,000 over 3 years (collaborator with P.I. - Paola Marcato)
- 2015-2017 **Nova Scotia Department of Agriculture - Research Acceleration:** *Evaluation of bacterial and fungal diversity in natural and managed blueberry habitats:* \$76,000 over 2 years (co-applicant with P.I. – Svetlana Yurgel)
- 2014-2019 **Canadian Institutes of Health Research - Team Grant - Restitution Enhancement in Arthritis and Chronic Heart disease:** \$2,500,000 over 5 years (collaborator with P.I. – Jean Marshall)

### Andrew Roger

- 2016-2021 **NSERC Discovery Grant – Phylogenomic approaches to inferring ancient relationships amongst eukaryotes:** \$51,000/year for 5 years
- 2015-2020 **Canadian Institutes of Health Research, Transitional Operating Grant – Anaerobic eukaryotic microbes and the human microbiome: a genomic and metagenomic study:** \$144,993/year (A. Roger, P.I., with co-applicant A. Simpson)
- 2015-2017 **Nova Scotia Health Research Foundation, Scotia Support Grant,** \$24,750/year for 2 years – “*Genomic and metagenomic approaches to elucidating the roles of protozoan parasites in the human gut microbiome*”
- 2012-2017 **Canadian Institute for Advanced Research - Program in Integrated Microbial Biodiversity—** research allowance for program senior fellows: \$24,000/year
- 2010-2017 **Canada Research Chair (Tier 1) in Comparative Genomics and Evolutionary Bioinformatics:** \$200,000/year (includes 7-yr. salary award, 20% of which is research allowance)

### Alastair Simpson

- 2014-2019 **NSERC Discovery Grant:** *Linking microscopy-based identities to molecular identities for problem- or problematic protozoa:* \$27,000/year
- 2016 **NSERC Research Tools Grant:** \$58,576 (co-applicant with P.I. – Sophia Stone)
- 2012-2017 **Canadian Institute for Advanced Research - Program in Integrated Microbial Biodiversity** – research allowance for program senior fellows: \$24,000/year

### Claudio Slamovits

- 2015-2020 **NSERC Discovery Grant:** *Genome evolution and radical lifestyle changes in eukaryotic microbes:* \$30,000/year
- 2015-2016 **Gordon and Betty Moore Foundation:** *Experimental Model Systems:* \$157,163 USD with \$69,750 USD assigned to Slamovits (co-applicant: José Fernández-Robledo, Bigelow Laboratory for Ocean Sciences)
- 2012-2017 **Canadian Institute for Advanced Research - Program in Integrated Microbial Biodiversity** – research allowance for program members: \$24,000/year

### Ed Susko

- 2014-2019 **NSERC – Discovery Grant:** *Statistical methods for molecular evolution:* \$23,000/year

### **3.2.2 Honours, Awards, Distinctions Received [or Currently Held] by CGEB Faculty**

Here we list new awards received in 2016-2017, as well as ongoing salaried fellowships and scholarships, and lifetime fellowships and honorary memberships.

#### John Archibald

- Elected Member, College of New Scholars, Artists and Scientists of the Royal Society of Canada (2016-2021)
- University Research Professorship, Dalhousie University (2016-2021)
- Senior Fellow, Canadian Institute for Advanced Research - Integrated Microbial Biodiversity Program (2012-2017)
- Fellow, American Academy of Microbiology (2015-present)

#### Robert Beiko

- Canada Research Chair (Tier II) in Bioinformatics (2007-2017)

#### Erin Bertrand

- Simons Foundation Early Career Investigator Award in Marine Microbial Ecology and Evolution Award (2017-2020)
- Canada Research Chair (Tier 2) in Marine Microbial Proteomics (2015-2020)

Joseph Bielawski

- Co-director, North American Workshop on Molecular Evolution, Marine Biological Laboratory (MBL), Woods Hole, MA (2016-2017)

W. Ford Doolittle

- Killam Prize in the Natural Sciences from the Canada Council for the Arts (2017)
- SMBE Motoo Kimura Lifetime Contribution Award, Society for Molecular Biology and Evolution (2017)
- NSERC Gerhard Herzberg Canada Gold Medal for Science and Engineering (funding award 2014-2019)
- Elected Member, The Norwegian Academy (2009-present)
- Institute Fellow, Canadian Institute for Advanced Research (2008-present)
- Member, U.S. National Academy of Sciences (2002-present)
- Fellow, American Academy of Microbiology (1999-present)
- Fellow, Royal Society of Canada (1991-present)
- Fellow, American Association for the Advancement of Science (1985-present)

Michael Gray

- Fellow, American Academy of Microbiology (2013-present)
- Fellow, Royal Society of Canada (1996-present)

Morgan Langille

- Canada Research Chair (Tier 2) in Human Microbiomics (2016-2021)
- Chair Elect (3 yr. term), American Society of Microbiology – Division R: Evolutionary and Genomic Microbiology (2015-2018)

Andrew Roger

- 2017 Max Forman Senior Research Prize from Dalhousie Medical Research Foundation
- Canada Research Chair (Tier I) in Comparative Genomics and Evolutionary Bioinformatics (2010-2017)
- Senior Fellow, Canadian Institute for Advanced Research - Integrated Microbial Biodiversity Program (2012-2017)
- Fellow, American Academy of Microbiology (2014-present)
- Fellow, Royal Society of Canada (2012-present)

Alastair Simpson

- Vice-President, International Society of Protistologists (2016 – 2017)
- Senior Fellow, Canadian Institute for Advanced Research - Integrated Microbial Biodiversity Program (2012-2017)

Claudio Slamovits

- Scholar, Canadian Institute for Advanced Research - Integrated Microbial Biodiversity Program (2012-2017)

Ed Susko

- Awarded Killam Professor of Mathematics and Statistics (2015-2020)