

**BIOLOGY DEPARTMENT REPORT
SUMMARY 2018**

Biology Department Annual Report 2018 Summary

The Department of Biology takes responsibility for undergraduate teaching, graduate teaching and research in the life sciences.

The Biology Department offers a popular Major program and operates or contributes to several other Major and Minor programs. It also offers large-enrolment courses to students in other Faculties, especially those intending to enter medical fields. The central principle of the undergraduate program is the design and delivery of courses by professors. Almost all the courses in our programs are given by full-time or affiliated tenure-track academic staff of the Department; we use course lecturers or sessional teachers only in exceptional circumstances. Moreover, all the faculty members participate in undergraduate teaching. The undergraduate program is at the heart of the Biology Department.

Graduate training in the Biology Department is firmly based on the apprentice model: both MSc and PhD programs emphasize laboratory, computer or field research in close collaboration with a faculty member who acts as supervisor. Although coursework makes only a minor contribution to the degree, we have developed a wide range of advanced and specialized courses for graduate students. The graduate program is attractive and highly selective. Financial support for graduate students from Faculty allocations, teaching assistantships and research funds is offered for the duration of the program. Retention rates are high and graduation is timely. Most of our doctoral students succeed in obtaining employment commensurate with their training.

Almost all faculty members are actively engaged in research supported by operating grants from the Tricouncil agencies. Our research programs fall into three clusters of related fields: the Conservation, Ecology, Evolution and Behaviour (CEEB) group, the Cellular, Molecular and Development (CMD) group, and the Neurobiology (Neuro) group. They are supported by a range of facilities, research centres and field stations. Publication rates are high and rising, and faculty members publish many highly-cited papers in high-impact journals. As an indicator of superior research performance, peer-reviewed NSERC and CIHR awards are consistently above the national average. Our members have received many national honours, and the Department includes one FRS, four FRSC, eight CRC holders, two recent Steacie Fellows and one Killam Fellow.

Department members play a full part in the mission and governance of the University. They teach students from many other Faculties, and are closely involved in Field Semester programs. Two members are Associate Deans, and others serve on some of the most important university committees. Several faculty members have made prominent contributions to local, national and international organizations devoted to outreach and policy development.

Teaching and learning

The Biology Department is responsible for core teaching in biology in science and biomedical departments. It delivers large introductory laboratory and lecture courses as well as a full suite of advanced courses. It also has a large graduate program. The statistics underline the extent of undergraduate and graduate teaching undertaken by the Department.

Graduate and undergraduate teaching. 109 students graduated with a Biology BSc degree, and 23 with a BAsC, slightly up from the level of previous years. In all, 384 undergraduate students were enrolled in Biology programs, and the overall enrolment in Biology courses, from all sources, stood at 5996 students. Total enrolment in Biology courses is back to the level of 2015 and 2016, after a slight dip in 2017.

The numbers of MSc and PhD students were 58 and 91, respectively, about the five-year average, with a 10% reduction in PhD students compared to the previous year.

Research and publications

Faculty in the Biology Department continued to push the boundaries of knowledge in 2018. A list of all publications can be found at: <http://biology.mcgill.ca/biopubs2018.html>. Department members published 108 papers in 2018, many of which were published in the top flight of academic journals – *Nature* (plus *Nature Reviews Molecular Cell Biology* and *Nature Ecology & Evolution*), *Proceedings of the National Academy of the USA*, *Current Biology*, *Proceedings of the Royal Society*, and others - and have a very high impact on their field.

Here are three examples of fundamental contributions to biology published in leading journals in general science.

- Ehab Abouheif's lab published another ground-breaking evo-devo paper in *Nature* this year, with former PhD student Rajee Rajakumar as the lead author. Vestigial or rudimentary organs, such as the human appendix, occur in all multicellular organisms and are generally assumed to play little if any functional role. Abouheif and his team discovered that a rudimentary organ in ants – a wing rudiment – plays a key regulatory function: they send signals during development to regulate the size of the head and body to generate the big-headed soldier and supersoldier ants. This means that we can no longer assume that rudimentary organs are functionless, raising the possibility that rudimentary organs in multicellular organisms have important roles during development and evolution. This has broad implications for biology and medicine.

Rajakumar R, Koch S, Couture M, Fave MJ, Lilico-Ouachour A, Chen T, DeBlasis G, Rajakumar A, Ouellette D, Abouheif E (2018) Social regulation of a rudimentary organ generates complex worker caste systems in ants. *Nature*, 562: 574-577.

- **Gary Brouhard** is the first author on a review paper in *Nature Reviews Molecular Cell Biology* that summarizes the state of the art in microtubule dynamics, a core research area of Brouhard's. Microtubules are dynamic polymers that are essential for intracellular organization, organelle trafficking and chromosome segregation – and engage in both biochemical and mechanical dynamic intracellular processes.

Brouhard GJ, Rice LM. (2018) Microtubule dynamics: an interplay of biochemistry and mechanics. *Nature Reviews Molecular Cell Biology* 19: 451-463.

- In a paper published in *PNAS*, **Andrew Hendry** and his postdoc **Vincent Fugère** explored potential anthropogenic impacts on phenotypic selection, the process by which natural selection favours fitness associated with certain phenotypes. Hendry and Fugère analyzed literature from 1999 to 2018 on 37 different species, and found that populations exposed to anthropogenic selection pressures, such as habitat degradation, exhibited no stronger phenotypic selection than control populations, with the potential exception of cod and pike fisheries, which showed strong harvest selection; some human disturbances may reduce selection by increasing fitness and decreasing opportunities for selection, according to the authors. (quoted from *EurekaAlert! AAAS*).

Fugère V, Hendry AP (2018) Human influences on the strength of phenotypic selection. *Proc Natl Acad Sci USA* 115:10070-10075.

Funding. The total research support to Biology faculty through operating and equipment grants, principally from the major science funding agencies (NSERC, CIHR, CFI and FQRNT), amounted to \$8.3M, an average of over \$207,000 per professor. This funding level is slightly down from the previous year and comparable to earlier years if one accounts for the fact that 2015 was a positive anomaly with a major CFI award.

Departmental news and activities

Chair of the Department

Gregor Fussmann (since 2016).

Appointments

Associate Dean in the Faculty of Science

Laura Nilson, Associate Dean of Graduate and Postdoctoral Studies

Tamara Western, Associate Dean, Academic (Jan-Aug 2018), Associate Dean, Education (since Sep. 2018)

Director, Stewart Biology Building

Frieder Schöck

Scientific Director of the CIHR Institute of Genetics

Paul Lasko

Founder and co-Director of the McGill Centre of Islam and Science

Ehab Abouheif

Director of the Quebec Centre for Biodiversity Science

Andrew Gonzalez is Director of the Quebec Centre for Biodiversity Science, an FQRNT-funded and McGill-based network that links researchers from all universities across Quebec, along with hundreds of graduate students and postdocs.

Director of the NSERC CREATE program *Biodiversity, Ecosystem Services and Sustainability*

Andrew Hendry

Director of the joint McGill-Smithsonian Neotropical Environment Option

Brian Leung

Scientific Director, Integrated Quantitative Biology Initiative (IQBI) and Cell Imaging and Analysis Network (CIAN)

Jackie Vogel

Co-Director of the Centre for Applied Mathematics in Bioscience and Medicine

Frédéric Guichard

New faculty

Arnold Hayer (cell biology) arrived in January 2018, **Jennifer Sunday** (global change biology) in April 2018 and Abigail Gerhold (cell biology) in August 2018. We have hired two new professors who will be joining us in the next academic year: Mélanie Guigueno (behavioural ecology) arrives in January 2019 and Laura Pollock (eco-informatics) in August 2019. All start as assistant professors and come with exciting research programs that will sustain our reputation as an internationally renowned full-service biology department.

Honours and Awards

Fellow of the Royal Society

Graham Bell

Fellow of the Royal Society of Canada:

Paul Lasko

Graham Bell

Siegfried Hekimi

Catherine Potvin

Member of the Royal Society of Canada's College of New Artists, Scholars and Scientists

Irene Gregory-Eaves

Ehab Abouheif

Named/Endowed Chair Appointments

Liber Ero Chair in Conservation Biology

Andrew Gonzalez

James McGill Professor

Ehab Abouheif

Graham Bell

Paul Lasko

Strathcona Chair in Zoology

Gregor Fussmann

John & Anne Molson Chair in Genetics

Paul Lasko

Robert Archibald & Catherine Louise Campbell Chair in Developmental Biology

Siegfried Hekimi

Sir William C. Macdonald Chair in Botany

Daniel Schoen

Tier 1 Canada Research Chairs

Lauren Chapman (CRC in Respiratory Ecology and Aquatic Conservation)

Andrew Gonzalez (CRC in Biodiversity)

Andrew Hendry (CRC in Eco-Evolutionary Dynamics)

Catherine Potvin (CRC in Climate Change Mitigation and Tropical Forests)

Tier 2 Canada Research Chairs

Michael Hendricks (CRC in Neurobiology and Behaviour)

Melania Cristescu (CRC in Ecological Genomics of Aquatic Invasions, renewed April 2018)

Irene Gregory-Eaves (CRC in Freshwater Ecology and Global Change)

Rodrigo Reyes-Lamothe (CRC in Chromosome Biology, renewed April 2018)

Killam Fellowship by the Canada Council for the Arts**Andrew Gonzalez** (2016-2018)Leo Yaffe Award for Excellence in Teaching, Faculty of Science**Gary Brouhard** (2018).

This award continues the strong legacy of teaching awards in the Department of Biology and confirms the very high quality of undergraduate teaching offered by the Department. In previous years Biology professors were awarded the Principal's Prize for Excellence in Teaching (Alanna Watt - 2016, Andrew Hendry - 2015, Gary Brouhard - 2014, Laura Nilson - 2012) and the Leo Yaffe Award (Andrew Hendry – 2017).

Principal's Prize for Public Engagement through Media, McGill University**Catherine Potvin****Departmental Retreat**

On December 17th, 2018 at the McGill Faculty Club.

Topic 1: Future of the Department

Topic 2: Biology Curriculum Revision

The future of the Biology Department

The Biology Department is structured around three major axes: (1) **molecular biology** (including cell biology, genetics and development), (2) **ecology and evolution** (including conservation and behaviour) and (3) **neurobiology**. Over the last decade, these axes have tended to move together and even merge, creating hybrid fields such as evolutionary developmental biology or neuroethology. We believe that this trend will continue, in part because new technologies will enable us to pose new questions, or bring more powerful methods to bear on old problems that have resisted solution in the past. A good example is the recently funded and Biology-based CFI network “Integrated Quantitative Biology Initiative” (IQBI) that unites biologists from all axes under the umbrella of quantitative biology.

The Department is in the middle of a **multi-year revision of its curriculum**. What and how we teach in Biology has not been critically evaluated in at least a decade. The process was initiated by Gregor Fussmann and kicked off by hiring a group of special teaching assistants who attended the Biology core courses and reported (in writing) about the content of each course and the degree of harmonization among courses. In 2018, a special Curriculum Task Force, led by Tamara Western and Torsten Bernhardt, has been very effective at identifying strengths and weaknesses of the existing curriculum. We are now entering the phase where we are considering concrete changes to be implemented in 2019 and 2020. The curriculum revision was also the focal topic of the 2018 departmental retreat.

The year 2018 has been challenging for the Biology Department because of the radical **ongoing renovation of the Stewart Biology Building**, brought about by the need to replace aging infrastructure and remove asbestos. In 2017 all occupants had moved out of the West Wing of Stewart Biology and needed to find new research, teaching and administrative spaces elsewhere. The Department is now distributed among the Stewart North Wing and the Bellini Building (under constrained space conditions), the Lyman Duff Building and the Redpath Museum (undergraduate teaching labs), and the Pulp and Paper building (2 research labs). Although redevelopment has begun in the Stewart West Wing, the process will take longer than initially predicted due to the overheated construction market in Montreal. The Department will do everything in its power to minimize the negative impact (particularly on new hires, the delivery of undergraduate teaching and the ability to apply for major infrastructure grants), but Biology needs this work to progress so that we can resume our normal teaching and research activities. The prospect of a new building wing with state-of-the-art research and teaching labs as well as an aquatic animal facility will provide us with a unique opportunity to refresh the academic mission of the Department. We look forward to constructing and designing facilities that will enable us to reinforce our position as a major research department in North America and a major teaching unit within the University.

The Biology Department continues to make an exceptional contribution to McGill University in every area of academic activity. In particular, **the productivity of Biology faculty in 2018 maintained or surpassed previous levels of research output, grant income, undergraduate teaching and graduate training**. Faculty, staff and students will work together to ensure that we remain at the forefront of modern research and teaching in the study of life.