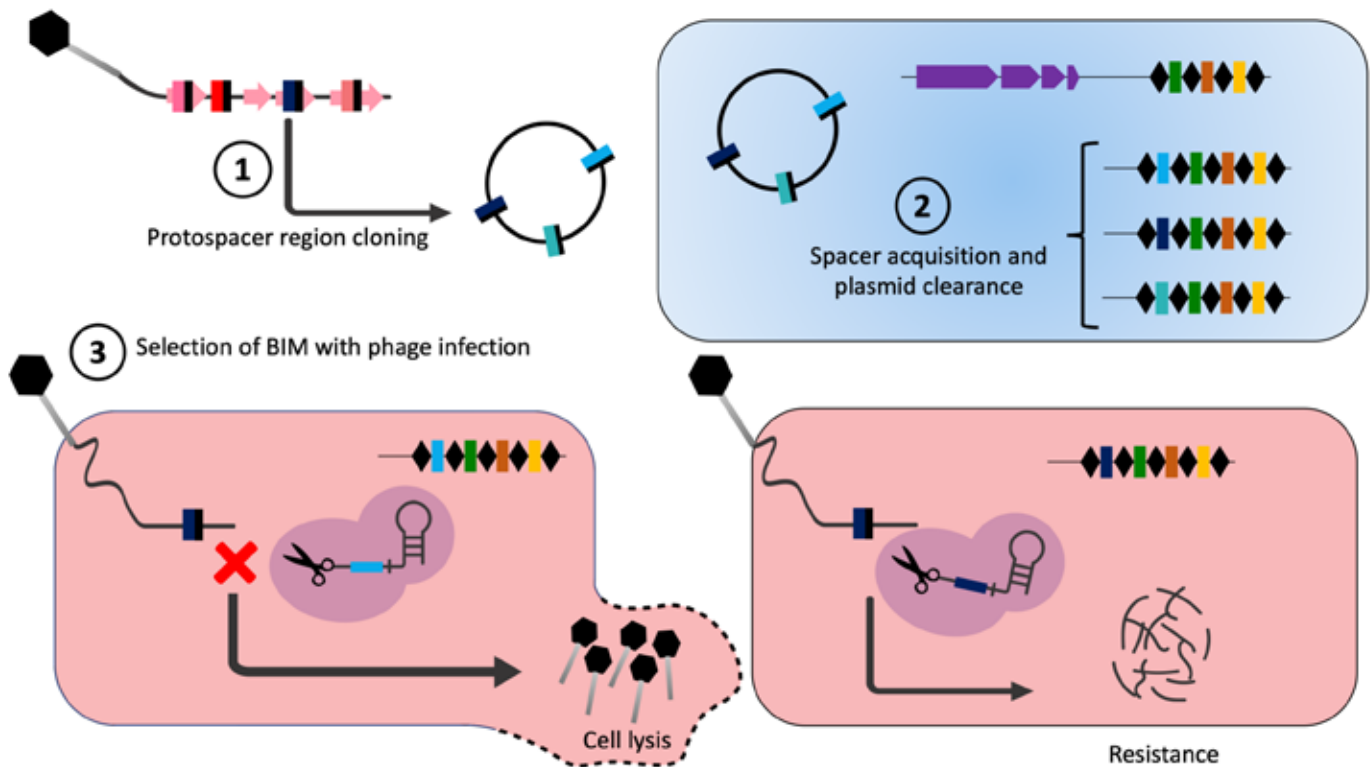


# Bulletin



The Canadian Society for Molecular Biosciences  
La Société Canadienne pour les Biosciences Moléculaires

2020  
[www.csmb-scbm.ca](http://www.csmb-scbm.ca)



# Bulletin



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Molecular Biosciences  
La Société Canadienne pour les  
Biosciences Moléculaires

# 2020

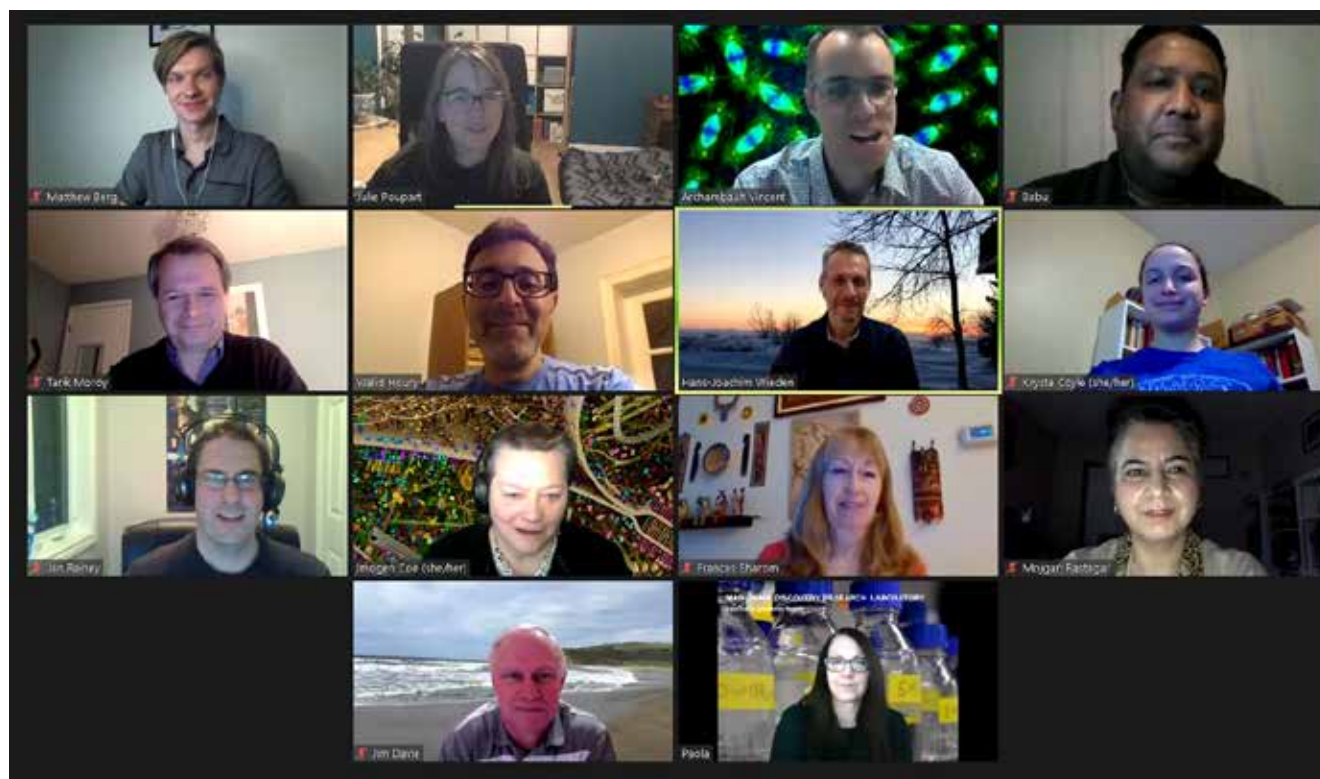
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# CSMB Board for 2020



*The CSMB executive board at the December 2020 Zoom meeting*

## **President/Président**

Dr. Imogen Coe  
Ryerson University  
Department of Chemistry and Biology  
350 Victoria Street  
Toronto, ON M5B 2K3  
Tel: (416) 305-1946  
Email: imogen.coe@ryerson.ca

## **Vice-President/Vice-Président**

**Dr. Hans-Joachim Wieden**  
University of Manitoba  
Faculty of Science Lead for BioSciences  
Entrepreneurship and Industry Partnerships  
Faculty of Science, 45 Chancellors Cir,  
Winnipeg, MB R3T 2N2  
Email: hans-joachim.wieden@umanitoba.ca

## **Past-President/Président Précédent and Chair, Nominating Committee/Président, Comité de mise en candidature**

Dr. Tarik Möröy  
Institut de recherches cliniques de Montreal IRCM  
Laboratory on Hematopoiesis and Cancer  
110 Avenue des Pins Ouest  
Montreal, QC H2W 1R7  
Tel: (514) 987-5501  
E-mail: Tarik.Moroy@ircm.qc.ca

## **Treasurer/Trésorier**

**Dr. Jan Rainey**  
Dalhousie University  
Department of Biochemistry and Molecular Biology  
Tupper Medical Building  
Halifax, NS B3H 1X5  
Tel: (902) 494-4632  
Email: jan.rainey@dal.ca

**Secretary/Secrétaire**

Dr. James Davie  
University of Manitoba  
Room 333A, 745 Bannatyne Avenue  
Basic Medical Sciences Building, Bannatyne Campus  
Winnipeg, MB R3E 0J9  
Tel. (204)272-3174  
Email: jim.davie@umanitoba.ca

**Councillor/Conseiller**

Dr. Vincent Archambault  
IRIC-Université de Montréal  
2950, Chemin de Polytechnique  
Marcelle-Coutu Pavilion  
Montréal, Québec H3C 3J7  
Tel: (514) 343-6111, Ext 15795  
Email: vincent.archambault.1@umontreal.ca

**Councillor/Conseiller**

Dr. Mohan Babu  
Department of Chemistry and Biochemistry  
University of Regina  
3737 Wascana Parkway, LB 244  
Regina, SK S4S 0A2  
Tel: (306) 585-4192  
Email: mohan.babu@uregina.ca

**Councillor/Conseiller**

Dr. Walid A. Houry  
University of Toronto  
Department of Biochemistry, Faculty of Medicine  
661 University Avenue  
MaRS Centre, West Tower, Room 1612  
Toronto, ON M5G 1M1  
Tel: (416) 946-7141  
Email: walid.houry@utoronto.ca

**Councillor/Conseiller**

Dr. Paola Marignani  
Dalhousie University  
Department of Biochemistry and Molecular Biology  
Sir Charles Tupper Medical Building, Rm 9F1  
5850 College Street, PO Box 15000  
Halifax, NS B3H 4R2  
Tel: (902) 292-4307  
Email: Paola.Marignani@dal.ca

**Councillor/Conseiller**

Dr. Mojgan Rastegar  
University of Manitoba  
624-745 Bannatyne Avenue, BMSB  
Winnipeg, MB R3E 0J9  
Tel: (204) 272-3108  
Email: Mojgan.Rastegar@umanitoba.ca

**Councillor/Conseiller**

Dr. Katey Rayner  
Faculty of Medicine, University of Ottawa  
451 Smyth Road, Room 4103  
Ottawa, ON K1H 8M5  
Tel: (613) 696-7350  
Email: krayner@ottawaheart.ca

**Trainee Representative/Représentante des stagiaires****Mr. Matthew Berg, Ph.D. candidate**

Department of Biochemistry  
Western University  
London, ON N6A 5C1  
Tel: (519) 661-3074  
E-mail: mberg2@uwo.ca

**Councillor/Conseiller****Trainee Representative/Représentante des stagiaires**

Dr. Krysta Coyle  
Department of Molecular Biology and Biochemistry  
Simon Fraser University  
South Sciences Building  
8888 University Drive  
Burnaby, B.C. V5A 1S6  
Tel: (778) 782-9648  
E-mail: kcoyle@sfu.ca

**Bulletin Editor/Éditeur du Bulletin**

Dr. Frances Sharom  
University of Guelph  
Department of Molecular and Cellular Biology  
Science Complex, Room 4446  
Guelph, ON N1G 2W1  
Tel: (519) 824-2712  
E-mail: fsharom@uoguelph.ca

**Communications and website/Communications et site internet**

Julie Poupart  
Tel: (514) 912-2405  
E-mail: contact@csmb-scbm.ca

# President's Report 2020

## Dr. Imogen Coe



*CSMB President, Imogen Coe*

The membership of CSMB faced an unprecedented challenge in 2020 which completely changed the nature of our activities, our interactions, and the way we conducted science and research. The global COVID-19 pandemic arrived in Canada in January when the first official case was reported. One of my last events before everything shut down in March was travel to Ottawa, along with President Möröy, CSMB Councillors and Advocacy Committee members, Drs. Paola Marignani, Katey Rayner and Vincent Archambault, to meet with policymakers. By March, all travel had ground to a halt, and many institutions where CSMB members are located had moved to on-line delivery of teaching and modified research activities with, in some cases, restricted access to research infrastructure. The sudden cancellation of the spring CIHR competition created additional stress at the least appropriate moment, and yet the scientific community in Canada, including CSMB members, still managed to mobilize rapidly to support healthcare through the sharing of reagents and supplies. In addition, many scientists found themselves in sometimes unexpected positions of providing expert insights to all sorts of audiences about virology, biochemistry, immunology, cell biology and biomedical research. In April 2020, CSMB President Tarik Möröy was invited to speak on behalf of our members at a briefing on COVID-19 of the House of Commons Standing Committee on Health. This meeting was recorded, and can be viewed on ParlVu. The CBC and the major magazine L'Actualité published articles quoting **CSMB President Tarik Möröy (2018-2020): "He told the House of Commons health committee last week that Canada is the only country that had a major national health research funding agency cancel its grants during the crisis. He acknowledged that Canada was quick to mobilize funds for research related to COVID-19 but worries about the long-term impacts. "We worry that this is at the expense of other health research that then will still be necessary after the pandemic is over," Möröy**

**told the committee (CBC news article can be found here: <https://www.cbc.ca/news/politics/scientists-concerned-non-covid-grants-1.5556491>)**

The importance of science and basic research as a route out of a devastating human health tragedy, locally, nationally and globally has never been so evident. Many CSMB members pivoted to working on COVID-19-related research as CIHR funnelled historic, targeted funding to researchers to support rapid advancements in detection, treatment and basic understanding of this new virus. While the spring competition for CIHR Program Grants was reinstated, funding for other areas of biomedical research remained limited, although NSERC did move rapidly to offer the option of extensions to currently-funded researchers, and to support trainees. Most scientific research conferences were cancelled, including the 63rd Annual CSMB meeting which had been scheduled to take place in Ottawa, and which had already attracted strong support and sponsorship. Everything moved online, including the CSMB board meeting and AGM, which took place virtually in June 2020. At this meeting, Dr. Imogen R. Coe, took over as President of the CSMB, Dr. Tarik Möröy moved to the Past-President position, and Dr. Hans-Joachim Wieden was elected to the Vice-President position (and will take over as president in 2022). The full slate of councillors and committees can be found at <https://csmb-scbm.ca/about-us/csmb-committees/>. We thank all those who put their names forward to serve in any capacity for CSMB, and all who participated in the process of voting. We seek to represent the entire membership of CSMB and are grateful for the contributions of all our members.

Despite the pandemic, the mission of CSMB continues to be the promotion of biomolecular sciences, the support and promotion of our trainees, the organization of scientific meetings with international attendance and

visibility, the support of the implementation of equity, diversity and inclusion standards in academic institutions and sustained engagement in advocacy for science and research with the federal government and Tri-Councils. With science becoming front and centre in the pandemic response, the CSMB executive and advocacy committee committed to seizing the moment to emphasize the central role of science in responding to the devastating global pandemic, and the fact that long-standing basic research from previous decades had resulted in life-saving vaccines today and into the future. We renewed our contract with Temple Scott Associates, a government and public relations firm, which has very effectively facilitated and organized multiple meetings with policy makers. This, perhaps counter-intuitively, became easier as everyone could connect by Zoom (or similar) from across the country. In June 2020, the CSMB submitted a brief (which can be found on the CSMB website) to the Standing Committee on Finance Pre-Budget Consultation in advance of the 2021 budget. Through late 2020 and into 2021, CSMB has increased engagement with politicians and policy makers on social media (with many engaging back), and has met with politicians and stakeholders from all federal parties (Liberal, CPC, Bloc Quebecois, NDP, Green) in person by videoconference. Meetings were held with Senator Lucie Moncion, Senator Doug Black, MP Majid Jowhari, MP Matt Jeneroux, MP Kirsty Duncan, MP Andy Fillmore, Dr. Mona Nemer (Chief Science Advisor), Dr. Mike Strong & Dr. Tammy Clifford (CIHR), MP Sebastian Lemire, MP Mario Simard and MP Michelle Rempel Garner. Following our meeting with Senator Doug Black, he asked a question in the Senate on behalf of CSMB regarding science and research.

Given the heightened activity of CSMB and several other Canadian science societies with respect to advocacy, new CSMB president, Dr. Imogen Coe, led a panel at the Canadian Science Policy Conference in November 2020 on "Roles & Responsibilities of Academic Science Societies in Informing Policy: Lessons & Observations from Around the World". Dr. Coe moderated a panel with Canadian science society presidents, along with two presidents of very large organizations based in Europe and the US. The panelists were **Dr. Stephen B. Heard**, *President, Canadian Society for Ecology*, **Dr. Charles Bourque**, *President, Canadian Association for Neuroscience*, **Dr. Shohini Ghose**, *Past President, Canadian Association of Physicists*, **Dr. Hilary Lappin-Scott**, *President, Federation of European Microbiology Societies (FEMS)*, **Dr. Susan**

**Amara**, *President-elect (President Feb 2021), American Association for the Advancement of Science*. This panel was very well attended by a diverse audience from across Canada and led to interesting and insightful discussions about the importance of an on-going non-partisan relationship with policy makers, the value of continued exchange of information, and the need for the voice of scientists to be heard in policy.

I am writing this update at the end of the first year as President of CSMB, a year during which all CSMB activity and all interactions with the board have been entirely online. All the stories I have heard of scientists juggling on-line teaching and home-schooling, managing restricted access to research infrastructure and agonizing over lost productivity and future funding insecurity reminds me of the need, above all, for kindness. Ultimately, human relationships, those with our research groups, our trainees, our colleagues, our families and friends, and ultimately, with ourselves, need to be intentionally infused with kindness. I particularly empathize with women in science, who, data show, have carried an inordinate burden during the pandemic, and who risk losing more ground in terms of opportunity and success in the scientific enterprise, an enterprise that research already confirms is inequitable. We also know that those from historically marginalized communities are also seeing disproportionate impacts. The pandemic has brought out some of our worst behaviours as human beings, hate-crimes have increased, social inequities have been amplified, careers have been derailed, aspirations have been crushed. As a pragmatic optimist, or an optimistic pragmatist, I am encouraged by the collective efforts of scientists, clinicians, public health experts, epidemiologists and science communicators in facing up to COVID-19 and working together to generate clinical solutions. This remarkable trans-national effort echoes the words of Louis Pasteur: "Science knows no country because knowledge belongs to humanity, and is the torch which illuminates the world". CSMB is committed to the principles of equity, diversity, inclusion and accessibility and continues to advocate for the application of these principles in all aspects of science. We will work to ensure continued support and success of science, and work more effectively with other scientists, other academic disciplines and other sectors (policy makers, business, industry, etc.).

Please stay safe.



# Incoming Members of the CSMB Executive Board

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## **Dr. Mohan Babu, *Councillor***

Dr. Babu is an Associate Professor in the Department of Biochemistry at the University of Regina (UofR), and Associate Member of the Neuroscience Research Cluster at the University of Saskatchewan, with expertise in proteomics, drug discovery, mitochondrial biology, and characterizing molecular interactions in human diseases. He founded the Mitochondrial Systems (mitoSYSTEMS) Research Centre at the UofR to support research labs within and outside the prairies, to address research problems from basic science to clinical and complex systems biology through innovative technologies.

During his appointment at the UofR since 2012, he has led a strong, viable and independent research program, which has yielded measurably high productivity, as judged by high-quality research in peer-reviewed articles in top-tier journals, successfully funded grants, national and international conference/seminar presentations, and the training/mentoring of highly qualified personnel, recruited from Canada and elsewhere. He has one patent and has edited two books (*Prokaryotic Systems Biology*, *Mitochondria in Health and Disease*). His research has been acknowledged with a CIHR new investigator award and a Maud Menten finalist prize. He is a former Secretary-Treasurer of the Canadian Society of Microbiologists, and now serves as an Associate Editor of *BMC Microbiology*, editorial member of *BioEssays* and *Frontiers in Genetics*, as well as the board of directors for the *Canadian National Proteomics Network* (CNPN). With a commitment to knowledge translation, the resources he has created are widely accessible via public databases, and constructs deposited in Addgene are shared with researchers around the world.



### **Dr. Mojgan Rastegar, Councillor**

Dr. Mojgan Rastegar is a Professor of Biochemistry & Medical Genetics, at the University of Manitoba. Dr. Rastegar completed a Ph.D. in Biomedical Sciences (Molecular Biology) at the Université Catholique de Louvain (UCL), Brussels, Belgium, and continued her post-doctoral training at the Hospital for Sick Children (Toronto, Canada), McGill University (Montreal, Canada), and Indiana University-Purdue University (Indianapolis, USA).

Dr. Rastegar's research program is focussed on epigenetic mechanisms that control brain development, and their deregulation in neurodevelopmental disorders such as Rett Syndrome, fetal alcohol spectrum disorders, and autism spectrum disorders. To study disease mechanisms, Dr. Rastegar's laboratory uses a combination of murine and human *in vivo* and *in vitro* systems that include primary neural stem cells, cortical neurons, astrocytes, human brain cell lines, transgenic mice, and post-mortem human brain tissues. The outcome of her research is expected to identify novel therapeutic strategies for rare and common neurodevelopmental disorders that currently have no available cure.

Dr. Rastegar's research program has been supported by national, international, and local funding, and her lab has trained over 50 HQP at all levels. She has published over 50 peer-reviewed papers, and over 120 abstracts. Many of her trainees have been authors of these publications and her students have been successful in obtaining national scholarships including CIHR and NSERC studentships.

Dr. Rastegar is also an Editorial Board member of journals such as *Scientific Reports*, *Frontiers in Genetics*, *Neural Plasticity*, and *Frontiers in Cell & Developmental Biology*, and serves on national grant review panels including CIHR.

# Minutes of the 63<sup>rd</sup> Annual General Meeting 2020

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## *Zoom meeting – Tuesday, June 30, 2020*

46 members in attendance:

**Attendees:** Mojgan Rastegar, Sydnee Calhoun, Greg Fairn, Ryan Perry, Krysta Coyle, Pawan Faris, Paola Marignani, Barbara Karten, Christian Baron, Ute Kothe, Ryan Perry, Hans-Joachim Wieden, Jan Rainey, Julie Poupart, Imogen Coe, John Orlowski, Christopher Beh, Frances Sharom, Dora Capatos, Julie Brill, Jinhong Kim, Paul Young, Matthew Berg, Cordula Enenkel, Danilo Shevkoplyas, Alexander Timoshenko, Tarik Möröy, Sanela Martic, Jim Woodgett, Brad Doble, Fabian Rohden, Erin Mulvihill, Minyoung Oh, Natasha Chang, Harland Brandon, Ray Turner, Dassine Azouaoui, Elizabeth Rideout, Kristi Turton, Michael Downey, Kevin Keough, Jim Davie, Phil Hieter, Michelle Scott, Walid Houry, Ryan Holloway

**1. Welcome and quorum (Möröy)**

**2. Approval of agenda:**

Motion: I. Coe moved and P. Hieter seconded that the agenda was appropriate. All members approved.

**3. Approval of the Minutes of the 62<sup>nd</sup> Annual General Meeting in Montreal, Quebec, June 4, 2019:**

**Motion:** P. Marignani moved and W. Houry seconded that the previous Minutes were appropriate. All members approved.

**4. Business arising from the minutes:**

J. Davie presented that all action items listed in the previous year's AGM had been achieved.

Action item 1: there were discussions with the publisher (Canadian Science Publishing) and the Trainee Committee to revise the award.

Action item 2: Full names and photos of Committee members are provided on our Web site.

**5. President's report:**

T. Möröy reviewed the mandate and vision of the Society.

Theme-orientated meetings did not go forward as planned due to the COVID-19 pandemic.

The committees and members were reviewed. A call was sent out (May 20) for At-Large members to join one of the CSMB Committees. CSMB Executive meetings were reviewed. The AGM was announced on May 30. Activity of Advocacy and Communications committee was presented. T. Möröy congratulated Imogen Coe on receiving the Science Ambassador Award from Partners in Research Canada. CSMB executive travelled to Parliament Hill in Ottawa to promote the full implementation of Canada's Fundamental Science Review. T. Möröy spoke at the House of Commons Standing committee on Health meeting (April 30, 2020). The CSMB statement on Black Lives Matter was presented. T. Möröy acknowledged the role of Temple Scott Association in aiding CSMB interact with the government. T. Möröy thanked the outgoing CSMB board members (Phil Hieter, Michelle Scott and Hans-Joachim Wieden).

**Motion:** Imogen Coe made the motion to formally thank Tarik Möröy for his service as President of CSMB. All were in favour.

## 6. Secretary's report:

J. Davie as Chair of the Awards Committee reported on the Committee's activities this year. The Award evaluation criteria, now on the CSMB website, were revised to be more transparent as to how the applications are evaluated. Applicants to the Jeanne Manery Fisher Memorial Lecture are encouraged to also apply to the Canadian Science Publishing Senior Investigator Award. Except for the Arthur Wynne Gold Medal, self-nominations are now allowed. An update to the CSMB support for graduate student activities was provided. Last year funded four at \$500 each. Several meetings were cancelled due to the COVID-19 pandemic. The recipients of the award were told they could keep the award and notify us when the meeting was next to be held. CSMB membership in IUBMB and programs of interest were mentioned.

### a) Membership report:

Paola Marignani presented the Membership report. A summary of 2020 membership was presented. There was a 46% increase in trainees. However, for several possible reasons there was a 24% decrease in scientists. The provincial distribution of membership was presented. Marignani spoke to an initiative to determine how best CSMB can service the mental wellness needs of our membership. There was a meeting with CMHA and reach-out to Bell Let's Talk.

**b) Trainee report:** Matthew Berg presented the trainee report. Committee membership was presented as well as a review of initiatives (2019 Gairdner Award Articles) and creation of a new trainee travel award. Upcoming initiatives include a CSMB twitter page, 2020 Gairdner Award Articles, CSMB trainees as outreach ambassadors to high schools, and advocacy campaigns to increase public awareness about the importance of government funding for studentships and fellowships from the Tri-Council agencies.

## 7. Treasurer's report:

**a) Presentation of the Accountant's Reviewed Financial Statement:** J. Rainey presented the 2019 CSMB Review Engagement Report. The financial report was prepared by our accountant and reviewed and approved by the Finance and Development Committee and the Board. An overview of the expenses and income for the Society was provided. Efforts were underway on multiple fronts to constrain expenses and improve sustainability.

### b) Acceptance of the Reviewed Financial Statement (2019):

**Motion:** P. Marignani moved and I. Coe seconded that the Financial Statement submitted by the Society be accepted. All members approved.

### c) Approval of Signing Officers:

**Motion:** T. Möröy moved and W. Houry seconded that J. Rainey and J. Davie be approved as Signing Officers on behalf of the Society for the 2020-21 year. All members approved.

## 8. Board membership for 2020-2021

a) P. Hieter reviewed the nomination process by the Nomination Committee and the current Board.

b) 2020 Election slate for Councillors and Executive was presented. The Departing Board Members are P. Hieter, H.-J. Wieden, and M. Scott. The open positions are for the Vice President and two Councillors. The slate of nominees for consideration by Members was presented.

- c) P. Hieter called for nominations from the Floor, and none was received. Nominations were closed.
- d) Members cast their votes electronically for a 5 min period.

**9. Board committees:**

T. Möröy reviewed Committees (Executive, Advocacy & Communication, Membership & Diversity, Finance & Development, Awards, Conference, Nomination and Trainee) and mandates. I. Coe provided an update of the CSMB proposed involvement in the virtual Canadian Science Policy conference. An update on PAGSE was provided.

**10. Meeting reports:**

H.-J. Wieden reviewed the activities of the Conference Committee.

- a) 2019 Montreal meeting was successful scientifically and financially.
- b) Meeting cancellations were listed due to COVID-19 pandemic.
- c) New meeting schedule:

2021 - 64th Annual Meeting “Protein Homeostasis in Health and Disease”  
(Virtual/Hybrid?)

Focus Meeting “Life Science 2021 – A Vision of Education and Career Development”  
(Format and time to be determined)

2022 - 65th Annual Meeting “Membrane Meeting”  
(Banff 2022 - Howard Young (UofA))

2023 - 66th Annual meeting “Metabolic Regulation of Cell Signaling”  
(Ottawa, June 2023)

- d) Virtual CSMB Event (09/2020)  
RNA Biology and Technology - The Current Pandemic and Beyond September 23-25

**11. Other business:**

No other business noted. T. Möröy thanked the members of the Board and particularly Julie Poupart. Adjournment.

## Independent Practitioner's Review Engagement Report

To the Members of  
Canadian Society for Molecular Sciences

I have reviewed the accompanying financial statements of Canadian Society for Molecular Sciences (Canadian Society for Molecular Biosciences) that comprise the statement of financial position as at December 31, 2020, and the statements of operations and changes in net assets and cash flows for the year then ended, and a summary of significant accounting policies and other explanatory information.

### Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with Canadian accounting standards for not-for-profit organizations, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

### Practitioner's Responsibility

My responsibility is to express a conclusion on the accompanying financial statements based on my review. I conducted my review in accordance with Canadian generally accepted standards for review engagements, which require me to comply with relevant ethical requirements.

A review of financial statements in accordance with Canadian generally accepted standards for review engagements is a limited assurance engagement. The practitioner performs procedures, primarily consisting of making inquiries of management and others within the entity, as appropriate, and applying analytical procedures, and evaluates the evidence obtained.

The procedures performed in a review are substantially less in extent than, and vary in nature from, those performed in an audit conducted in accordance with Canadian generally accepted auditing standards. Accordingly, I do not express an audit opinion on these financial statements.

### Conclusion

Based on my review, nothing has come to my attention that causes me to believe that the financial statements do not present fairly, in all material respects, the financial position of Canadian Society for Molecular Sciences (Canadian Society for Molecular Biosciences) as at December 31, 2020, and the results of its operations and its cash flows for the year then ended in accordance with Canadian accounting standards for not-for-profit organizations.

*Numeris CPA*

**Numeris CPA Professional Corporation**  
Chartered Professional Accountant  
Licensed Public Accountant

Ottawa, ON  
June 11, 2021

**Canadian Society for Molecular Sciences**  
**(Canadian Society for Molecular Biosciences)**  
**Statement of Financial Position**  
(Unaudited)  
**As at December 31, 2020**

	<u>2020</u>	<u>2019</u>
<b>Assets</b>		
<b>Current</b>		
Cash	\$ 34,647	\$ 29,900
Marketable securities - short term (note 3)	332,226	301,950
Accounts receivable	2,839	20,738
Prepaid expenses	<u>14,346</u>	<u>14,158</u>
	<u>\$ 384,058</u>	<u>\$ 366,746</u>
<b>Liabilities</b>		
<b>Current</b>		
Accounts payable and accrued liabilities	\$ 7,347	\$ 12,146
Deferred membership fees - short term	<u>10,390</u>	<u>17,652</u>
	17,737	29,798
<b>Deferred membership fees - long term</b>	<u>8,077</u>	<u>5,065</u>
	25,814	34,863
<b>Balance</b>	<u>358,244</u>	<u>331,883</u>
	<u>\$ 384,058</u>	<u>\$ 366,746</u>

See accompanying notes to the financial statements

**Canadian Society for Molecular Sciences**  
**(Canadian Society for Molecular Biosciences)**  
**Statement of Operations**  
**and Changes in Net Assets**  
(Unaudited)  
**Year ended December 31, 2020**

	<u>2020</u>	<u>2019</u>
<b>Revenues</b>		
Membership fees	\$ 22,607	\$ 28,029
Investment income	7,516	7,576
Society awards support	5,000	-
Miscellaneous	2,366	1,125
Annual meeting revenue	-	120,722
	<u>37,489</u>	<u>157,452</u>
<b>Expenditures</b>		
Science advocacy	14,540	14,450
Administrative and communications services	11,840	14,361
Bank, credit card and investment management fees	5,235	5,861
Professional fees	2,400	2,684
Insurance	1,809	1,730
Annual meeting	1,066	69,691
Bulletin	750	750
Student and PDF events and travel awards	500	6,100
Board meetings, AGM, and teleconferencing	467	13,236
Office expenses	129	299
Society awards	-	2,087
	<u>38,736</u>	<u>131,249</u>
<b>Excess (deficiency) of revenues over expenditures before other items</b>	(1,247)	26,203
<b>Other income</b>		
Gain on sale of marketable securities	<u>880</u>	<u>6,618</u>
<b>(Deficiency) excess of revenues over expenditures</b>	(367)	32,821
<b>Net unrealized gain (loss) on marketable securities</b>	<u>26,728</u>	<u>26,038</u>
<b>Excess of revenues over expenditures</b>	26,361	58,859
<b>Balance, beginning of year</b>	<u>331,883</u>	<u>273,024</u>
<b>Balance, end of year</b>	<u>\$ 358,244</u>	<u>\$ 331,883</u>

See accompanying notes to the financial statements



**Canadian Society for Molecular Sciences**  
**(Canadian Society for Molecular Biosciences)**  
**Statement of Cash Flows**  
(Unaudited)  
**Year ended December 31, 2020**

	<u>2020</u>	<u>2019</u>
<b>Operating activities</b>		
Excess of revenues over expenditures	\$ 26,361	\$ 58,859
Adjustment for		
Gain on sale of marketable securities	<u>(880)</u>	<u>(6,618)</u>
	25,481	52,241
Change in non-cash working capital items		
Marketable securities - short term	(29,396)	(29,077)
Accounts receivable	17,899	(13,582)
Prepaid expenses	(188)	(592)
Accounts payable and accrued liabilities	(4,799)	4,992
Deferred membership fees - short term	(7,262)	8,853
Deferred membership fees - long term	<u>3,012</u>	<u>(4,121)</u>
<b>Net increase in cash</b>	4,747	18,714
<b>Cash, beginning of year</b>	<u>29,900</u>	<u>11,186</u>
<b>Cash, end of year</b>	<u>\$ 34,647</u>	<u>\$ 29,900</u>

See accompanying notes to the financial statements

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**Canadian Society for Molecular Sciences**  
**(Canadian Society for Molecular Biosciences)**  
**Notes to the Financial Statements**  
(Unaudited)  
**December 31, 2020**

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**1. Nature of operations**

Canadian Society for Molecular Sciences (was incorporated without share capital in 1979 under Part II of the Canada Corporations Act and is recognized as a not-for-profit organization for income tax purposes. The main objective of the Society is to foster research and education in the molecular biosciences in Canada.

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**2. Significant accounting policies**

The organization applies the Canadian accounting standards for not-for-profit organizations.

**(a) Revenue recognition**

The organization follows the deferral method of accounting for contributions. Restricted contributions are recognized as revenue in the year in which the related expenditures are incurred. Unrestricted contributions are recognized as revenue when received or receivable if the amount to be received can be reasonably estimated and collection is reasonably assured.

**(b) Capital assets**

Capital assets purchased at a cost of less than \$2,000 are expensed in the year of purchase. The Society does not own capital assets at this time.

**(c) Use of estimates**

The preparation of financial statements in conformity with Canadian accounting standards for not-for-profit organizations requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. By their nature, these estimates are subject to measurement uncertainty. The effect of changes in such estimates on the financial statements in future periods could be significant.

**(d) Financial instruments**

The Society initially measures its financial assets and financial liabilities at fair value.

The Society subsequently measures all its financial assets and financial liabilities at amortized cost, except for investments in equity instruments that are quoted in an active market, which are measured at fair value. Changes in fair value are recognized in the statement of operations.

Financial assets measured at amortized cost include cash and accounts receivable. Financial liabilities measured at amortized cost include accounts payable. The organization's financial assets measured at fair value include quoted shares.

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**Canadian Society for Molecular Sciences**  
**(Canadian Society for Molecular Biosciences)**  
**Notes to the Financial Statements**  
(Unaudited)  
**December 31, 2020**

**3. Marketable securities - short term**

CSMB investments are recorded at market value. As required by CICA Section 3856 unrealized gains or losses on the portfolio as a whole at December 31 are recorded as "Net unrealized gains on marketable securities" and included on the Statement of Operations and Changes in Net Assets.

All amounts below are quoted in Canadian dollars.

	2020	2019
Cash and short term investments	\$ 3,022	\$ 1,572
Fixed income	107,307	103,422
Common equity	132,429	128,141
Cash and short term investments (US account)	484	493
Common equity (US account)	88,984	68,322
	\$ 332,226	\$ 301,950

**4. Annual meeting**

	2020	2019
Exhibit & Facility Expenses	\$ -	\$ 30,389
Speaker Travel & Expenses	-	16,912
Receptions & Banquets	-	14,226
Other Annual Meeting Expenses	-	5,764
Award - Posters	-	2,400
Meeting Organizer Fees	1,066	-
	\$ 1,066	\$ 69,691

**5. Financial instruments risks and uncertainties**

The organization's financial instruments that are exposed to concentrations of credit risk consist primarily of cash, accounts receivable and reserve investments. The organization places its cash and reserve investments with high credit quality institutions and believes its exposure to credit risk is not significant.

Market risk is the risk that the value of a financial instrument will fluctuate as a result of changes in market prices, whether the factors are specific to the instrument or all instruments traded in the market. The CSMB is exposed to market risk due to the volatile nature of equity investments.

**6. COVID 19**

On January 30, 2020, the World Health Organization (WHO) announced a global health emergency because of a new strain of coronavirus, the "COVID-19" outbreak. On March 11, 2020 the WHO classified the COVID-19 outbreak as a pandemic, based on the rapid increase in exposure globally.

The Canadian Society for Molecular Sciences monitored the situation and was able to continue some of its operations virtually while cancelling, adapting or postponing programming. The financial health of the organization remained strong during this fiscal year as the Organization continued to receive funding. As such, while the organization closed the fiscal year with a deficit, it has positive working capital and continues to be a going concern.

The effects of the COVID-19 outbreak on the Organization's operational costs for fiscal year 2020 have been reflected in the financial statements. An estimate of the impact of the pandemic on the 2021 fiscal year cannot be reasonably estimated, however the organization continues to actively monitor the situation and adapt its operations and projects to continue delivering on its mandate.

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# Trainee Committee Activities 2020

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## Meet your 2020 CSMB Trainee Representatives



*Dr. Krysta Coyle*



*Matthew Berg*

**Krysta Coyle, post-doctoral fellow,  
Simon Fraser University**

**Matthew Berg, Ph.D. candidate,  
Western University**

## Other at-large Trainee Committee members for 2020 were:



*Karina Baksh*



*Sarah Chadwick*

**Karina Baksh, Ph.D. candidate,  
University of Toronto**

**Sarah Chadwick, Ph.D. candidate,  
University of Western Ontario**



*Farah Qaiser*



*Shawn Shortill*

**Farah Qaiser, Ph.D. candidate,  
University of Toronto**

**Shawn Shortill, M.Sc. candidate,  
University of British Columbia**

## Find us on social media:



<https://csmb-scbm.ca/trainees/>



[facebook.com/CSMB-SCBM](https://facebook.com/CSMB-SCBM)



[@CSMB\\_SCBM](https://twitter.com/CSMB_SCBM)



[csmb-scbm](https://instagram.com/csmb-scbm)

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The Trainee Committee held several meetings in 2020 to plan and execute a number of initiatives, as outlined below:

### **Trainee Twitter account**

A new trainee twitter account was launched in 2020.

@CSMB\_Trainees

Trainee Committee | Promoting the diverse work of trainees in the molecular biosciences across Canada and creating a Canadian trainee community.

The inaugural tweet!

Sep 1, 2020

*Hello world! This is the official twitter of the @CSMB\_SCBM trainee committee. We want to keep you informed about opportunities for Canadian trainees (and trainees in Canada) in the molecular biosciences and keep you updated about the amazing research being done by trainees*

### **Anti-racism statement**

The Committee drafted an anti-racism statement and identified areas for trainee education and involvement in anti-racist initiatives.

### **New trainee travel award**

We developed, and received approval for, a new trainee travel award to encourage participation at non-academic conferences (e.g. science policy or communication events).

### **Gairdner award articles and outreach**

The Gairdner Foundation partnered with CSMB and the Michael Smith Laboratories (MSL) at UBC to produce a series of documents celebrating the science of a selection of the 2019 Canada Gairdner Awardees. They can be viewed here:

<https://gairdner.org/student-student-picturing-gairdner-science-2019/>

Dr. Dave Ng (supervisor of the Advanced Molecular Biology Laboratory at UBC, the educational arm of the MSL) and Dr. Phil Hieter (Past-President of the CSMB) met with the Gairdner Foundation. The Foundation is enthusiastic about continuing the collaboration between Gairdner, CSMB, and MSL in creating education materials around the awardees each year, and interfacing with high school students and teachers. The Gairdner Foundation will work on creating a website that archives all the years and topics, which will provide a growing resource accessible to teachers, students, and the general public.

Dave Ng is coordinating people to write the articles for the 2021 awards, and the Trainee committee is planning to work with Dave to develop a way to use these materials for outreach.

# 2021 CSMB Award Designates

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## ***CSMB New Investigator Award***

The CSMB New Investigator Award recognizes meritorious research in one or more of the fields of biochemistry, molecular or cellular biology in Canada. Recipients have ten years or less of independent research experience, and demonstrate outstanding research accomplishments.



### **Dr. Jean-Philippe Julien**

**Canada Research Chair in Structural Immunology**

**Member, College of the Royal Society of Canada**

**CIFA Azrieli Global Scholar, Molecular Architecture of Life**

**Senior Scientist, Program in Molecular Medicine, The Hospital for Sick Children Research Institute and Associate Professor, Departments of Biochemistry and Immunology, University of Toronto**

Jean-Philippe Julien received his B.Sc. from McGill University, obtained his Ph.D. from the University of Toronto, and trained as a post-doctoral fellow at The Scripps Research Institute. In Fall 2014, he joined the Molecular Medicine Program at the Hospital for Sick Children Research Institute and the Departments of Biochemistry and Immunology at the University of Toronto, where he leads a team of multi-disciplinary researchers. His laboratory focusses on the molecular characterization of antibodies by studies of their interactions with a variety of viral, bacterial, parasitic and cell-surface antigens, providing the atomic blueprints for the development of next-generation therapeutics and vaccines. Notably, he is a Canada Research Chair in Structural Immunology, a CIFAR Azrieli Global Scholar and a Member of the College of the Royal Society of Canada.

Learn more on his webpage: <https://lab.research.sickkids.ca/julien/research/>

# 2021 CSMB Award Designates

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## *Canadian Science Publishing Senior Investigator Award*

This award recognizes a record of outstanding achievement in research in one or more of the fields of biochemistry, molecular or cellular biology, undertaken in Canada by a Canadian scientist.



### **Dr. Peter Davies, FRSC**

**Canada Research Chair in Protein Engineering**

**Professor, School of Medicine, Queen's University**

Peter Davies grew up in Liverpool, U.K., and obtained his B.Sc. in Biochemistry and Soil Science from the University of Wales. His Ph.D. research on the ATPase of oxidative phosphorylation in *E. coli* was done in Phil Bragg's lab at the University of British Columbia in the Department of Biochemistry. After post-doctoral training in Lund, Sweden, with Professor Klaus Mosbach on affinity chromatography, and in Calgary, AB, with Gordon Dixon on protamine mRNA, Peter joined the Department of Biochemistry at Queen's University, Kingston, as an MRC Scholar. Some of his early work was on the cloning and sequencing of fish antifreeze protein genes. A timely sabbatical leave in Michael Smith's lab helped redirect some of this research effort towards protein structure-function relationships. This has been a consistent research theme over the years that he has also applied to calpains, the intracellular cysteine proteases of calcium signalling, and more recently to bacterial adhesins that help their hosts colonize various surfaces. Peter is currently the Canada Research Chair in Protein Engineering in the Department of Biomedical and Molecular Sciences at Queen's with a cross-appointment in the Department of Biology.

Learn more on his webpage: <https://www.peterldavies.com/>



# 2021 CSMB Award Designates

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## ***Jeanne Manery-Fisher Memorial Award***

This award is given in honour of the late Jeanne Manery Fisher, Professor of Biochemistry, University of Toronto. Dr. Fisher was not only an outstanding biochemist, but a remarkable teacher. She was instrumental in creating the Society's Equal Opportunity Committee and fought diligently for the position of women in science. This award recognizes an eminent Canadian woman scientist who has a distinguished career in the fields of biochemistry, molecular or cellular biology or genetics, resulting from her outstanding contributions to research, teaching or society.



### **Dr. Trang Hoang, O.Q., C.M.**

**Officer, Ordre National du Québec; Commander, Ordre de Montréal**

**Principal Investigator, Hematopoiesis and Leukemia Research Unit,  
Institute for Research in Immunology and Cancer (IRIC)**

**Professor, Department of Pharmacology and Physiology, Faculty of  
Medicine, Université de Montréal**

Trang Hoang completed her Ph.D. at the Swiss Cancer Institute in Lausanne, Switzerland, and her post-doctoral training in the Department of Immunology, Cambridge University, U.K., and in Medical Genetics, Ontario Cancer Institute, Toronto. In 1986, she was recruited to the Clinical Research Institute of Montreal. She became Chair of the graduate program of Molecular Biology at Université de Montréal for 15 years, before assuming a position as Chair of the Medical and Scientific Advisory Committee, Leukemia & Lymphoma Society of Canada (LLSC) for five years, until 2017.

Trang Hoang has been a tireless advocate of interdisciplinary research and instilled this distinctive character to the Graduate program in Molecular Biology at the Université de Montréal in the 1990s. In 2003, she contributed with several other colleagues to the creation of IRIC, a cutting-edge research institute that integrates systems biology and translational research. In 2006, she implemented with her colleagues at IRIC the new graduate curriculum in Systems Biology and Cancer at the Université de Montréal, which later received the Award of Excellence in graduate training from the Faculty of Medicine. She has trained 92 students and post-doctoral

fellows, who later held leadership positions in academia, in biotech companies or in governmental agencies, including funding agencies. Throughout her career as a mentor, she has fostered creativity in women and encouraged them to pursue careers in STEM fields. She has served on Canadian and international grant review panels, and on advisory boards of the Québec Health Research Funds (Fonds de Recherche du Québec-Santé) and of the Leukemia & Lymphoma Society of Canada.

Dr. Hoang's research has provided decisive insights into the molecular mechanism of leukemogenesis, initiated by the oncogenic reprogramming of normal precursors into aberrantly self-renewing pre-leukemic stem cells. Replicative stress in these cells leads to the accumulation of additional mutations and converts pre-LSCs into hypercompetitive leukemia-propagating cells. Her current research involves quantitative analysis of chemical-genetic interactions in mammalian cells, using high-throughput functional assays for the systematic identification of pre-LSC vulnerabilities.

Learn more on her webpage: <https://www.irc.ca/en/research/principal-investigators/trang-hoang>

# 2019 Canadian Science Publishing Senior Investigator Award

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## The endless battle between phages and CRISPR-Cas systems in *Streptococcus thermophilus*



Cécile Philippe<sup>1,2</sup> and Sylvain Moineau<sup>1,2,3</sup>

<sup>1</sup>Département de biochimie, de microbiologie, et de bio-informatique, Faculté des sciences et de génie, Université Laval, Québec City, Québec, G1V 0A6, Canada

<sup>2</sup>Groupe de recherche en écologie buccale, Faculté de médecine dentaire, Université Laval, Québec City, Québec, G1V 0A6, Canada

<sup>3</sup>Félix d'Hérelle Reference Center for Bacterial Viruses, Université Laval, Québec City, Québec, G1V 0A6, Canada

Sylvain.Moineau@bcm.ulaval.ca

Summary of the lecture presented by Prof. Sylvain Moineau at the CSMB annual meeting held in Montréal in June 2019 as part of the Canadian Science Publishing Senior Investigator Award

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### Abstract

This review describes the contribution of basic research on phage–bacteria interactions to the understanding of CRISPR–Cas systems and their various applications. It focuses on the natural function of CRISPR–Cas systems as adaptive defense mechanisms against mobile genetic elements such as bacteriophage genomes and plasmids. Some of the advances in the characterization of the type II-A CRISPR–Cas system of *Streptococcus thermophilus* and *Streptococcus pyogenes* led to the development of the CRISPR–Cas9 genome-editing technology. We mostly discuss the 3 stages of the CRISPR–Cas system in *S. thermophilus*, namely the adaptation stage, which is unique to this resistance mechanism; the CRISPR RNA biogenesis; and the DNA-cutting activity

in the interference stage to protect bacteria against phages. Finally, we look into applications of CRISPR–Cas in microbiology, including overcoming limitations in genome editing.

### Résumé

Cette synthèse décrit la contribution de la recherche fondamentale sur les interactions phage-bactérie à la compréhension des systèmes CRISPR–Cas ainsi que ses diverses applications. Elle se concentre sur la fonction naturelle du système CRISPR–Cas en tant que mécanisme de défense adaptative contre les éléments génétiques mobiles tels que les phages et les plasmides. Certaines des avancées dans la caractérisation du système CRISPR–Cas de type II-A de *Streptococcus thermophilus*

et *Streptococcus pyogenes* ont ensuite conduit au développement de la technologie d'édition du génome CRISPR–Cas9. Les auteurs discutent principalement des trois étapes du système CRISPR–Cas chez *S. thermophilus*, à savoir l'étape d'adaptation, qui est unique à ce mécanisme de résistance, la biogenèse de l'ARN CRISPR ainsi que l'activité de coupure de l'ADN dans l'étape d'interférence pour protéger les bactéries contre les phages. Finalement, ils ont examiné les applications du système CRISPR–Cas en microbiologie, notamment pour surmonter les limites de l'édition du génome.

There is still a seemingly exponential increase in the number of publications on clustered regularly interspaced short palindromic repeats (CRISPR) and CRISPR-associated (Cas) proteins, thanks to studies using the CRISPR–Cas9 technology to edit genomes. After the landmark publication of Jinek et al. (2012), CRISPR–Cas9 technology was rapidly adopted by many research laboratories in biological sciences (Cong et al. 2013) and became a powerful tool to edit any region of interest in the genome of a broad range of organisms. The Cas9 nuclease of *Streptococcus pyogenes* (SpCas9) is mostly used for this purpose because it can be directed by a single-guide RNA to bind a gene of interest and can recognize a short protospacer-adjacent motif to cut the DNA. Here, we review the early days of the CRISPR–Cas field in bacterial systems and describe the mode of action that has been instrumental for several CRISPR-based applications.

Bacteriophages (phages) are ubiquitous bacterial predators, as they are found in every ecosystem in which their hosts can thrive (Dion et al. 2020). After their specific adsorption to bacterial host receptors at the cell surface and the delivery of their genome into the cell, some phages will enter into the lytic cycle, where they use the host cell as a factory to produce new virions that are released through cell lysis. Other phages can enter into the lysogenic cycle (Knowles et al. 2016). In the lysogenic cycle, the phage genome integrates into the bacterial chromosome, where it gets replicated along with the host's DNA and persists through successive divisions (Nadeem and Wahl 2017). These prophages can be induced under stressful conditions, such as exposure to chemicals or UV light, leading to excision of the viral genome from the bacterial chromosome and initiation of the lytic cycle (Nanda et al. 2015).

Phages can have positive or negative roles depending on the environment or the hosts they infect (de Melo et al. 2018). In particular, virulent phages, not able to integrate their genome into the bacterial chromosome, can drastically deplete a bacterial population and impact microbial diversity within a given ecosystem. Their capacity to efficiently lyse host cells can also lead to new antibacterials to control pathogens. For example, a mixture of carefully selected virulent phages can be used to prevent microbial contamination of food or perhaps even treat bacterial infections in humans or animals (Oechslin 2018). On the other hand, virulent phages also pose a threat to fermentation and biotechnological processes that rely on bacteria (de Melo et al. 2018). For over 2 decades, the Moineau lab has been studying phage diversity and phage–bacteria interactions in the lactic acid bacteria used in milk fermentation, in particular virulent phages infecting *Lactococcus lactis* and *Streptococcus thermophilus* (Marcó et al. 2012). In the non-sterile cheese and yogurt environments, for example, it is essential to monitor the phage population and to use milk-fermenting bacterial strains that are resistant to phage infection. While studying phage–host interactions and antiviral mechanisms in *S. thermophilus* (Labrie et al. 2010), we and collaborators observed that the CRISPR–Cas system was involved in such resistance to phages. These studies enabled the unravelling of the different stages of CRISPR–Cas systems.

CRISPR–Cas systems were defined in 2002 (Jansen et al. 2002), but they were originally observed in 1987 in the *Escherichia coli* genome as variable regions, now called spacers, located between direct repeats (Ishino et al. 1987; Nakata et al. 1989). Conventionally, CRISPR arrays are represented by this particular pattern of repeat–spacer units (Fig. 1).

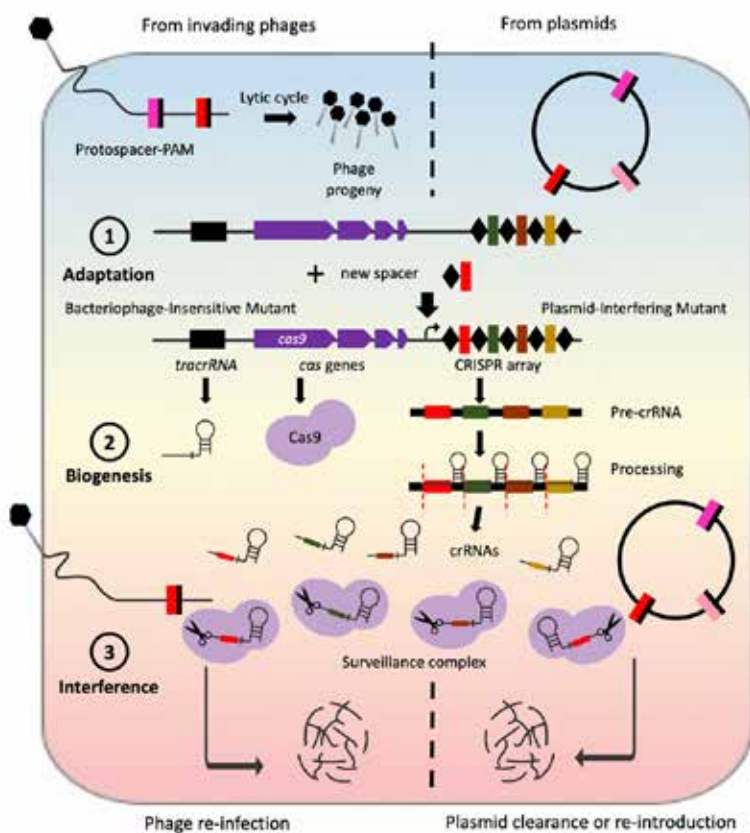
The repeat sequence is often species-specific, while the spacer content, in terms of both number and sequences, is normally strain-specific. CRISPR arrays can now be found in databases of microbial genomes and visualized with various software programs (Dion et al. 2018). These methods, which evaluate spacer diversity, can also be seen as a barcoding system for strain typing. In 2005, 3 research groups established the extrachromosomal origin of spacers after observing that they matched mobile genetic element sequences (Bolotin et al. 2005; Mojica et al. 2005; Pourcel et al. 2005). This concept has now been expanded to virome studies, as matching a viral

contig with a known host spacer can be used to predict the bacterial host of uncharacterized phages (Couvin et al. 2018; Paez-Espino et al. 2019).

CRISPR arrays are often associated with genes that encode diverse groups of Cas proteins. The diversity of these Cas proteins is such that CRISPR–Cas systems are currently categorized into 2 classes, 6 types, and tens of subtypes (Koonin and Makarova 2019; Makarova et al. 2020). With its 4 genes (*cas1*, *cas2*, *csn2*, and *cas9*), type II-A is one of

the simplest types of CRISPR–Cas systems. Interestingly, previous analysis of the CRISPR arrays associated with a type II-A system in *S. thermophilus* strains showed the presence of a few spacers matching phage sequences (Bolotin et al. 2005), suggesting that these spacers may have originated from viral genomes.

Armed with over a decade of phage characterization analyses (Le Marrec et al. 1997; Tremblay and Moineau 1999; Duplessis et al. 2005; Lévesque et al. 2005), phage–host interaction studies (Moineau et al. 1995; Moineau 1999; Duplessis and Moineau 2001; Duplessis et al. 2006), and plasmid biology explorations (Turgeon and Moineau 2001; Turgeon et al. 2004) in *S. thermophilus*, we performed, in collaboration with scientists at Danisco, assays to determine the role of CRISPR–Cas systems in phage and plasmid biology. First, the industrial *S. thermophilus* strain DGCC 7710 (used worldwide in yogurt production) was infected with the virulent phage 2972 (Lévesque et al. 2005) at various phage/bacteria ratios. When plates containing the infected cultures were incubated longer, natural growth of bacteriophage-insensitive mutants (BIMs) was observed. Typically, when a similar assay is performed in several other bacterial species, the phage resistance phenotype is due to receptor mutations (Labrie et al. 2010). However, adsorption assays on these *S. thermophilus* BIMs revealed that phages were still able to adsorb. In fact, additional characterization of these BIMs indicated that the resistance mechanism at play was different than the antiviral systems known at the time in this streptococcal species (Moineau 1999; Deveau et al. 2008). Among other analyses, PCR primers were designed to amplify the CRISPR arrays present in this strain, as the nucleotide sequences of the arrays were available (Horvath et al. 2008).



**Figure 1. Stages of the type II-A CRISPR-Cas mechanism.**

(1) Adaptation corresponds to the integration of a new spacer, originating from an infecting phage or a plasmid, into the CRISPR array. A corresponding protospacer has to be adjacent to a protospacer-adjacent motif (PAM) sequence. (2) In CRISPR RNA (*crRNA*) biogenesis, a trans-activating *crRNA* (*tracrRNA*) binds to part of the repeat sequence of a long *pre-crRNA*. The latter is processed to obtain individual *crRNAs* that bind to *Cas9* to form surveillance complexes. (3) The interference stage consists of target DNA cleavage. CRISPR–Cas provides sequence-specific immunity.

By performing CRISPR PCR, we surprisingly noticed that each BIM generated a PCR product that was larger than that from the wild-type phage-sensitive strain. Sequencing of the PCR products confirmed that the BIMs were derived from the wild-type strain (spacer sequences were identical), but all the BIMs had an additional 66 base pairs (bp) at the 5' end of the CRISPR array (Barrangou et al. 2007). Sequence analysis revealed the 66-bp unit was made of a 36-bp repeat (with a nucleotide sequence identical to the other repeats in the array) and a truly new 30-bp spacer. Remarkably, the new spacer sequences

were often different from one BIM to another and they each perfectly matched a different region of the phage 2972 genome (Barrangou et al. 2007; Deveau et al. 2008).

By measuring the level of phage resistance of each BIM, we confirmed that the acquisition of new phage-derived spacers provided phage resistance (Barrangou et al. 2007). Particularly, modification of the array or knockout of *cas9* (called *cas5* at the time and renamed in Makarova et al. 2011) restored the phage sensitivity phenotype (Barrangou et al. 2007; Garneau et al. 2010). Of note, some of these BIMs were not resistant to another virulent phage called 838. Using the same phage infection assay as above, we generated a second set of BIMs, but this time with phage 838. Perhaps not as surprising but still startling, these new BIMs acquired a second repeat–spacer unit but with a novel spacer, at the 5′ end of the array. Sequence analysis revealed that the second spacer originated from the genome of phage 838.

Over the years, several virulent phages infecting the wild-type strain DGCC 7710 have been collected, making it possible to “vaccinate” this strain against multiple phages. Isolating BIMs and successively challenging them with different phages has allowed the strain to “adapt” (by integrating new spacers), which is why CRISPR–Cas is referred to as an adaptive immune system. When aligned with the wild-type CRISPR array, expanded arrays mostly show the insertion of a new repeat–spacer unit at the 5′ end. Of note, the insertion of new repeat–spacer units in the middle of CRISPR arrays has been observed, albeit rarely (Wei et al. 2015a; Achigar et al. 2017). Nonetheless, this polarity of newly acquired spacers at the 5′ end of the CRISPR array can almost retrace the chronology of past phage infections. Spacers can be acquired not only from virulent phages but also from the genome of phages that have been rendered non-replicative by restriction enzymes or UV treatment (Hynes et al. 2014). Presumably, bacterial cells infected by these “defective” phages have time to select and integrate a new repeat–spacer unit into their CRISPR array, instead of being rapidly killed by fully functional and replicating phages.

Careful analysis of the phage genomes that these spacers came from indicated that spacer acquisition was not random (Deveau et al. 2008). The corresponding sequences in the phage genome are called protospacers, and they are flanked by an intriguing short nucleotide motif. In *S. thermophilus* phages, this short motif is always

present downstream of the protospacer and is called the PAM, for protospacer-adjacent motif (Fig. 1) (Deveau et al. 2008; Horvath et al. 2008; Mojica et al. 2009; Wang et al. 2015). It is now known that this PAM will vary according to the Cas9 protein (Anders et al. 2014; Wang et al. 2015). Cas9 possesses a PAM-interacting domain that has been implicated in the selection of a prespacer precursor (Kim et al. 2020). It also enables the bacteria to differentiate between self (bacterial genome) and non-self (phage or targeted genome) DNA in the interference stage, as the PAM is present next to the protospacer but not the spacer. At the molecular level, the Cas1–Cas2 complex integrates a 30-nt sequence into the array (Nuñez et al. 2014, 2015; Budhathoki et al. 2020), and Csn2 and Cas9 have also been found to be involved in spacer acquisition in vivo (Wei et al. 2015b; Wilkinson et al. 2019). The molecular details of the adaptation stage have been reviewed recently (Mosterd et al. 2021).

Bacteria can also acquire spacers from plasmids (Garneau et al. 2010). The acquisition of new spacers depends on the presence of PAM sequences on the plasmid (Fig. 1). Plasmid targeting has been shown to contribute to plasmid loss, which often occurs in serial passage experiments of host cells, and to the acquisition of an anti-plasmid spacer that prevents the reintroduction of the same plasmid or gene, including antibiotic resistance genes (Garneau et al. 2010; Fig. 1). This anti-plasmid function of CRISPR–Cas systems has been exploited to generate BIMs using a “spacer on demand” strategy (Hynes et al. 2016; Fig. 2). While it is now relatively easy to generate CRISPR BIMs with *S. thermophilus*, it may be time consuming to isolate and select “CRISPRized” strains that have acquired spacers targeting specific phage genes or genomic regions of interest. However, this process can be facilitated and directed by cloning the viral protospacer of interest on a small plasmid (Fig. 2). The cells are then grown without selective pressure, leading to plasmid loss and probable acquisition of the spacer of interest in the CRISPR array. The bacteria containing the desired spacer sequence are selected when challenged with a phage. BIMs harboring this spacer are selected due to their resistance to the phage.

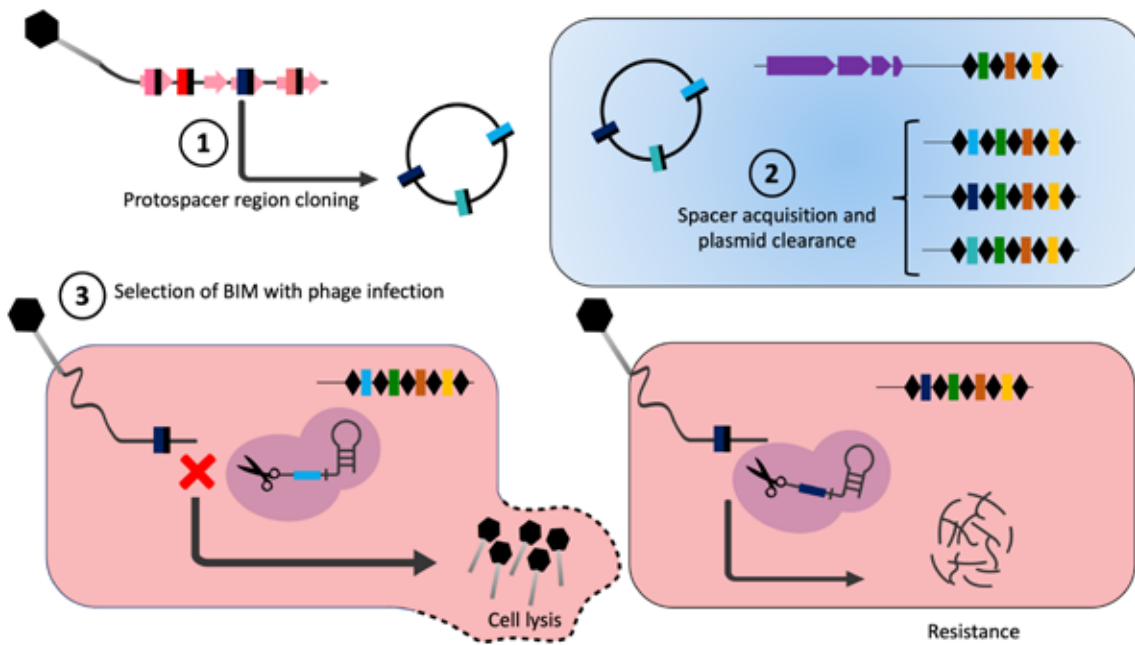
All the above experiments and their detailed protocols have been published (Hynes et al. 2017a) and some of them have even been used in the university classroom with undergraduate students (Trudel et al. 2017). For example, students performed CRISPR–Cas experiments

with a strain of the nonpathogenic bacterium *S. thermophilus* and its virulent phages. They were able to generate CRISPR BIMs after infecting the bacterial strain with phages, to detect spacer acquisition in the CRISPR array of these BIMs using PCR, to sequence the newly acquired spacers, to analyze them using bioinformatics tools, and to determine their target (protospacer) on the phage genome. The students used various skills previously acquired in their curriculum to fully comprehend these experiments and results, and they expressed enthusiasm and provided in-depth discussions in their lab reports. The biological materials to perform these experiments are available at the Félix d’Hérelle Reference Center for Bacterial Viruses of the Université Laval ([www.phage.ulaval.ca](http://www.phage.ulaval.ca)).

The second stage of CRISPR–Cas biology in bacteria is the biogenesis of small RNAs, which involves the expression and maturation of CRISPR RNAs (crRNA). A long RNA molecule (pre-crRNA) is first expressed from the CRISPR array. It is then processed into small RNA molecules. The

processing machinery differs according to the type of CRISPR–Cas system. For example, for type II-A systems, pre-crRNAs are matured with the help of the host RNase III (Deltcheva et al. 2011). Upstream from the CRISPR locus, small trans-encoded RNAs are also produced and are called trans-activating crRNA (tracrRNA). These tracrRNAs match part of the repeat sequence and will bind to it, and this duplex will bind to Cas9 to form the CRISPR surveillance complex (Fig. 1). This complex is similar to the guide RNA used for genome editing with the CRISPR–Cas9 technology. However, in the latter complex, instead of the 2 RNA molecules (crRNA and tracrRNA) being bound to Cas9 as in the natural system, they are linked to each other and only the nonmatching segment of the sequence, called single-guide RNA, is customized to target a specific sequence.

The third and last stage of the CRISPR–Cas system involves cleaving the invading DNA (for type II-A) (Fig. 1). The CRISPR interference stage provides phage resistance or plasmid interference (Garneau et al. 2010). Phage



**Figure 2. The “Spacer on demand” strategy.**

(1) Amplification and cloning of the protospacer and protospacer-adjacent motif (PAM) region into a plasmid. (2) Selection-free culture to achieve plasmid-targeting spacer acquisition and subsequent plasmid loss. (3) Selection of the bacteriophage-insensitive mutant (BIM) by challenging the selection-free culture with the cognate phage.

DNA cleavage has been demonstrated *in vivo* (Garneau et al. 2010; Magadán et al. 2012) through the detection of cut DNA fragments inside the bacterial cell and the identification of the cleavage site, which is located 3 nt upstream of the PAM sequence.

Still, large numbers of phages persist in the environment despite the existence of bacterial resistance mechanisms. These phages are able to overcome several antiphage defenses, including CRISPR–Cas immunity (Samson et al. 2013). This can occur through several means, which include having a genome not targeted by the spacers (absence or deletion of the protospacer) as well as single-nucleotide mutations in the targeted protospacer sequence or in the PAM (Deveau et al. 2008; Levin et al. 2013; Martel and Moineau 2014). It has been shown that escape mutations arise at different frequencies depending on the targets on the phage genome and may even be costly by decreasing the fitness of the phage (Chabas et al. 2019). In the context of this arms race between phages and bacteria, the emergence of escape mutant phages can lead to multiple spacer acquisition events (Pyenson and Marraffini 2020).

Phages can also produce anti-CRISPR proteins (ACRs) that will bind to Cas9 and block its cleavage activity. ACRs were first described in *Pseudomonas* prophages and they blocked the interference activity of type I CRISPR–Cas systems. Since then, numerous families of ACRs with diverse structures and mechanisms have been identified (Wiegand et al. 2020) and even offer new possibilities for genome-editing applications. The first ACR found on a virulent phage (AcrIIA5) was on a phage infecting *S. thermophilus* strains (Hynes et al. 2017b) and it could inhibit a broad range of Cas9 proteins, sparking interest given its potential to control genome editing. The second ACR (AcrIIA6) described in *S. thermophilus* virulent phages (Hynes et al. 2018) targets only St1Cas9 (1 of the 2 Cas9 proteins found in *S. thermophilus*), and our collaborators have recently elucidated most of its mode of action (Fuchsbauer et al. 2019). AcrIIA6 acts as an allosteric inhibitor and forms a dimer that sequesters 2 Cas9 proteins. AcrIIA6 also modifies the dynamics of Cas9 and prevents DNA binding. The presence of ACRs in *S. thermophilus* phages also explains the lack of CRISPR activity observed with specific phage–host pairs (Horvath et al. 2008; Hynes et al. 2017b) and limits the generation of CRISPR BIMs in some cases. However, St1Cas9 variants not susceptible to AcrIIA6 have also been observed

(Fuchsbauer et al. 2019). Moreover, other defense mechanisms can also help *S. thermophilus* to fight back phage infection, such as restriction-modification systems (Dupuis et al. 2013) or a mutation in the host methionine aminopeptidase (Labrie et al. 2019).

The CRISPR–Cas9 technology has also become a powerful tool to better understand phage biology as well as phage–bacteria interactions. Like other genome-editing tools, CRISPR–Cas9 is contributing to assigning a function to viral genes of interest. It is regularly observed that a predicted function cannot be assigned to several phage proteins (Lemay et al. 2017a). To investigate the role of these “hypothetical proteins”, the phage genome can be edited to create a modification and then the impact of the modification on phage replication and phage–bacteria interactions can be studied. To do this, one can exploit the endogenous CRISPR–Cas systems in *S. thermophilus* (Martel and Moineau 2014). A BIM with a spacer that targets the gene of interest is generated naturally or on demand (see Fig. 2). Next, a repair template containing the desired mutation (e.g., a deletion of a gene, a mutation, or gene swapping) is provided on a high-copy plasmid. This BIM carrying the repair template is then challenged with a phage that is targeted by the CRISPR–Cas immunity. While the invading phage genome will be cleaved by Cas9 armed with the tracrRNA and crRNA, the cleaved phage genome can be rescued by homologous recombination with the provided template. The presence of encoded recombinases in phage genomes likely favors such repair, and plaque-forming phage mutants are often readily obtained. Mutant phages can then be purified and replicated on the BIM strain for further investigation (Martel and Moineau 2014).

When a bacterium lacks a CRISPR–Cas system or has an inactive one, it is possible to use an exogenous CRISPR–Cas9 cloned on a low- to medium-copy plasmid to limit Cas9 cell toxicity (Lemay et al. 2017a). This method enabled us to engineer the lactococcal phage p2 genome and revealed that a conserved phage protein was implicated in the reduction of BIM generation (Lemay et al. 2020). This method can be adapted to other bacterial species using compatible plasmids and SpCas9 or other Cas9 variants (each with their respective PAM). Recently, Cas9 of the CRISPR1 locus of *S. thermophilus* (St1Cas9) was used as an exogenous system in genome editing; for example, it was introduced into *Mycobacterium tuberculosis* (Meijers et al. 2020) or mammalian cells

(Agudelo et al. 2020).

To this day, it is still amazing to reflect that this initial project started with the aim of better controlling the milk fermentation process through basic studies of virulent phages. Louis Pasteur once said, “Chance favors only the prepared minds.” It is unclear whether we were really prepared, but the suitable biological materials, protocols, and expertise were clearly available. Many groups ended up participating in unravelling the molecular details of this unique biological system. These findings led to the development of a revolutionary genome-editing tool, which is now part of an ever-expanding and highly diversified toolbox for studies in the biological sciences (Lemay et al. 2017b). Remarkably, even after a decade of CRISPR–Cas research, unique CRISPR–Cas systems are still being discovered in various bacterial or archaeal species or metagenomics projects, and plenty of mysteries abound about their mechanisms and ecological implications.

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# News from Member Departments

## Dalhousie University

Department of Biochemistry and Molecular Biology

Correspondent: Stephen Bearne

Like most universities, Dalhousie's research activities came to a grinding halt at the end of March 2020 with COVID-19 cases numbers growing worldwide. While some researchers returned to the bench by mid-summer to pursue COVID-19-related projects, others had to wait until approved university protocols were put in place to guide the return to research. Despite our being rather fortunate in the "Atlantic bubble" with few cases relative to other regions of Canada, many faculty members were working from home to prepare and deliver on-line courses for the 2020-21 academic year. Of course, students and faculty alike became intimately familiar with *Teams* and *Zoom*!

Despite the pandemic, the Department of Biochemistry & Molecular Biology continued to celebrate and recognize the accomplishments of faculty and trainees. **John Archibald** was awarded the Arthur B. McDonald Chair of Research Excellence. John was also selected to lead one of four international teams of collaborators supported by the Wellcome Sanger Institute and the Gordon and Betty Moore Foundation. **Mike Gray** was awarded fellowship in the American Association for the Advancement of Science (AAAS) "for distinguished contributions to the

field of molecular evolution, particularly in the area of endosymbiosis, organelle origins, molecular biology, and genomics". **Melanie Dobson** retired in August of 2020 and took up a post-retirement appointment. After serving as the Associate Dean of Research in the Faculty of Medicine since 2016, **Roger MacLeod** will be stepping down from that position in June 2021. His common-sense administrative approach helped to greatly reduce the frustration of faculty as they navigated their way through the various pandemic regulations and protocols.



Dr. Sergio Muñoz-Gómez received the Patrick Prize for best Ph.D. thesis (photo courtesy of Sergio Muñoz-Gómez)

The Department continued to celebrate the successes of its students, post-doctoral fellows, and research associates during the past year. **Sergio A. Muñoz-Gómez**, a graduate student with **Andrew Roger** and **Claudio Slamovits**, was awarded the *Patrick Prize* for best Ph.D. thesis. **Jeffrey Simmons**, a graduate student with **Jan Rainey**, received the *Doug Hogue Award*, recognizing "exceptional dedication and achievement in research and intradepartmental student activity".



Dr. John Archibald (photo courtesy of John Archibald)

Dr. Melanie Dobson (photo courtesy of Melanie Dobson)



Jeff Simmons (right) received the Doug Hogue Award and is pictured with Dr. Stephen Bearne (photo courtesy of Heidi MacKinnon)

Our alumni (and anyone else interested) are invited to find out about the latest news and events of the Department of Biochemistry & Molecular Biology at [www.biochem.dal.ca](http://www.biochem.dal.ca)

## Hospital for Sick Children Research Institute, Toronto

**Molecular Medicine Program**  
*Correspondent: Charles Deber*



*Dr. Julie Forman-Kay*

**Dr. Julie Forman-Kay**, Senior Scientist in the Molecular Medicine Program at the Research Institute in the Hospital for Sick Children, and Professor in the Department of Biochemistry, University of Toronto, was named a Fellow of the Royal Society (U.K.) for her internationally-recognized research on intrinsically

disordered protein regions (IDRs), which do not fold into stable structures and are found in over 60% of proteins. Her work has challenged the assumptions that protein function and protein interactions require stable folded structure, changing the understanding of mechanisms of regulatory protein interactions and providing evidence for the critical biological roles of highly dynamic interactions involving IDRs. Her lab has also characterized the phase separation of disordered protein regions, helping to develop a new field that explains how cellular membrane-less organelles are formed via the physical phenomenon of phase separation.

**Dr. P. Lynne Howell**, Senior Scientist in the Molecular Medicine Program in the Research Institute at the Hospital for Sick Children, and Professor in the Department of Biochemistry at the University of Toronto, was elected as a Fellow of the American Crystallography Association (ACA). This honour recognizes her substantial contributions to the structural biology of bacterial exopolysaccharide biosynthetic systems and Type IV pilus assembly, as well as her service and leadership within the crystallographic community. This includes



*Dr. Lynne Howell*

Crystallography (2011-2019).

her roles as Chair of the Canadian Division of the ACA (1996-98), Vice-Chair and Chair of the Biological Macromolecules Special Interest Group (ACA, 1999-2001), Member of the International Union of Crystallography Commission on Biological Macromolecules (2008-2017) and Member of the Canadian National Committee for

## McGill University

**Department of Biochemistry**

*Correspondents: Lawrence Kazak, Natasha Chang, and Maria Vera Ugalde (with Marlene Gilhooly and Christine Laberge)*

The year 2020 marked the McGill Biochemistry Department's centenary. As well, the department is now part of McGill's new School of Biomedical Sciences within the Faculty of Medicine and Health Sciences. While 2020 presented a year of unprecedented challenges, the department quickly adapted to online teaching, devised and carried out strategies to safely perform research activities, and also participated in the fight against COVID-19.

The department mourns the loss of **Maximilian Eivaskhani** (Ph.D. student in Martin Schmeing's lab), who lost his life in June 2020 in a tragic bicycle accident. In honor of Max, a gifted academic and rising scientist, the Faculty of Medicine and Health Sciences has created the Maximilian Eivaskhani Memorial Studentship in support of graduate students in the Centre for Structural Biology. <https://www.mcgill.ca/seedsofchange/project/maximilian-eivaskhani-memorial-fund>

### **Faculty news:**

**Alba Guarné** was appointed Associate Dean of the School of Biomedical Sciences, Faculty of Medicine and Health Sciences. **Martin Schmeing** was promoted to the rank of full Professor.



Leo Shen (M.Sc. graduate from Jerry Pelletier's lab) holding COVID-19 test materials

#### Research news:

In response to the COVID-19 pandemic, a large group of McGill colleagues, including Department of Biochemistry professors (**Martin Schmeing, Alba Guarné, Jerry Pelletier, Albert Berghuis, Bushan Nagar and Kalle Gehring**) came together for a project to create made-in-Canada RT-qPCR tests for SARS-CoV-2. The initiative was funded by grants from McGill Interdisciplinary Initiative in Infection and Immunity (MI4), McGill

Faculty of Science and CED-Q. The initiative was successful and we developed an excellent RT-qPCR test. The team produced a pilot batch of 15,000 tests (including RNA extraction materials, RT-PCR MasterMix and primers & probes specific for SARS-CoV-2) and delivered them to the Optilab testing centre at the McGill University Health Centre, where they were used clinically. In collaboration with the National Research Council, cell lines were developed for large-scale fermentation, so that test production could be scaled to the national level. These kits could prove to be an important resource during the current pandemic and will better equip Canada for future challenges.

<https://www.mcgill.ca/newsroom/article/made-canada-covid-19-test-developed-mcgill-receives-government-support>

Notable breakthroughs published this year include:

Work from **William Pastor's** group demonstrated that naïve human embryonic stem cells can be transdifferentiated into human trophoblast stem cells that exhibit cellular and molecular phenotypes of cells derived from human placenta or blastocyst. This exciting finding establishes a new way of modelling human trophoblast specification (*Stem Cell Reports*. 2020 Jul 14;15(1):198-213).

Work from **Kalle Gehring's** team has found that the ability

of PRL3, a phosphatase implicated in tumorigenesis and metastatic cancer, to bind and inhibit the magnesium transporter CNNM4 is necessary and sufficient to promote metastatic growth. These findings have important implications for the design of PRL inhibitors for cancer (*Journal of Biological Chemistry*. 2020 Aug 14; 295(33):11682-11692).

Cellular senescence is a double-edged sword that, depending on the context, acts as either a potent tumour-protective mechanism or an age-related driver of diseases such as cancer. Recent findings from **Imed Gallouzi's** lab (study led by Ph.D. student Amr Omer) highlight a novel function of the RasGAP SH3-binding protein 1 (G3BP1) in the activation of the senescent-associated secretory phenotype (SASP) that, in turn, mediates cancer growth/progression (*Nature Communications*. 2020 Oct 5;11(1):4979).

**Lawrence Kazak's** team published several high-profile review articles including insights into UCP1-independent thermogenesis (lead author Anna Roesler, who is a recent M.Sc. graduate from the Kazak lab; *Biochemical Journal*. 2020 Feb 14;477(3):709-725); a viewpoint on career pathways in *Nature Metabolism* (2020 Jun;2(6):481-482); review on creatine metabolism (*Nature Reviews Endocrinology*. 2020 Aug;16(8):421-436); and advances in the regulation of adipocyte thermogenesis (lead author Ph.D. candidate Faiz Hussain; *FEBS Journal*. 2020 Aug;287(16):3370-3385).

#### Faculty honours and awards:

These and other research successes were recognized by various honours, including an Honorary Doctorate awarded to **Nahum Sonenberg** from the Institut national de la recherche scientifique (INRS), Quebec, 2020. **David Thomas** was elected Secretary of the Academy of Science to The Royal Society of Canada Council. **Michel Tremblay** received a degree Honoris Causa from the Université de Bordeaux. **Ian Watson** was named CCTG Co-Chair for the melanoma disease working group, and received a 2020 AACR Team Science Award TCGA. **Natasha Chang** was awarded a Young Investigator Award from Cells Tissues Organs.

#### Trainee awards and news:

Congratulations to **Rayelle Itoua Maiga** (Jerry Pelletier lab), **Angelia Bassenden** (Albert Berghuis lab), **Yaakov Elisha Stern** (Morag Park lab), and **Yu (Seby) Chen** (Kalle

Gehring lab) who successfully defended their Ph.D. theses in 2020! **Faiz Hussain** (Lawrence Kazak lab) won for best poster at the 14<sup>th</sup> Annual Montreal Diabetes Research Centre Research Symposium and was awarded a Canderel Graduate Student Fellowship from the Goodman Cancer Research Centre. **Julie Huynh** (Simon Wing lab), **Lama Hatem Abuloghod** (Joe Teodoro lab), **Romina Filippelli** (Natasha Chang lab), **Sandrine Busque** and **Philippe Carle** (Imed Gallouzi lab), **John Read** (Jason Young lab), **Treasa O'Hagan** (Alba Guarné lab) and **Maxime Bellefeuille** (Thomas Duchaine lab) were awarded Canada Graduate Scholarships - Master's awards.

#### Teaching news:

The Biochemistry graduate program continued to do well in 2020. Our numbers are stable; in Fall 2020 we had 144 students, with 44 new admissions. Of our total students, 62 were Masters students and 82 were Doctoral students; 74 were Canadian and 70 international. There were 81 female and 63 male students. We continue to have a diverse and well-balanced student body, which is the heart of the department. The Masters and Doctoral programs proceeded smoothly. Seminar attendance policies were firmly established for graduate students. Our graduate and post-doctoral trainees continue to excel, publishing many first-author papers, and winning scholarships and presentation awards.

#### Student Life:

Both graduate and undergraduate students are organized into societies. The McGill Biochemistry Undergraduate Society (BUGS) organizes a number of academic events each year, including: Career Symposium, Research Awareness Day, How to Get Involved in Research, and a Journal Club. They also have social activities such as "Meet and Greet" for new students, and skiing and skating events. Furthermore, BUGS has recently implemented a "buddy" system in which freshman students are teamed up with a senior biochemistry student. In 2020, BUGS produced a McGill Biochemistry Survival Guide video, which can be found here: <https://www.youtube.com/watch?v=zimnloK1Sko>

The Biochemistry Graduate Student Society (BGSS) similarly organizes events for the graduate students and post-doctoral fellows in the Department. Activities include: BGSS Research Day, career mentoring, and preparation sessions for comprehensive exams and thesis writing.

## McMaster University

### Department of Biochemistry and Biomedical Sciences (BBS)

Correspondent: John Whitney

The year 2020 has presented academic departments across Canada with unprecedented challenges and this was no different for the Department of Biochemistry and Biomedical Sciences (BBS) at McMaster University. However, rather than focussing on the negative aspects of the ongoing global pandemic, I would like to use this update to highlight the many positive news stories coming out of our department over the past year.

Despite research operations being slowed to a standstill during a large portion of 2020, several notable papers were published by members of our department. For example, **Gerry Wright's** lab reported on the development of a synthetic biology platform for the production and discovery of new glycopeptide antibiotics (*Nature Communications*, 2020). **John Whitney's** group determined how membrane protein toxins are delivered between cells during bacterial competition (*eLife*, 2020). **Yingfu Li's** group evolved an RNA-cleaving DNase that is specifically activated by the bacterium *Legionella*, which holds potential for use as a biosensor (*Angewandte Chemie*, 2021). **Brian Coombes'** lab used transposon insertion sequencing to identify the genetic determinants of host colonization by adherent-invasive *Escherichia coli* (*Nature Communications*, 2021) and **Deb Sloboda's** lab discovered that fetal meconium does not have a detectable microbiota before birth (*Nature Microbiology*, 2021).

BBS graduate students continue to be the driving force behind our research enterprise. Every year, our graduate committee awards three BBS Impact Awards to recognize outstanding student publications. This year's winners were Ph.D. candidate **Caressa Tsai** (Coombes Lab) for her paper in Cell Chemical Biology entitled "*Targeting two-component systems uncovers a small-molecule inhibitor of Salmonella virulence*", Ph.D. candidate **Shehryar Ahmad** (Whitney Lab) for his paper in eLife entitled "*Structural basis for effector transmembrane domain recognition by type VI secretion system chaperones*" and Ph.D. candidate **Hiva Mesbahi** (MacNeil Lab) for her paper in Genetics entitled "*Cuticle collagen expression is regulated in response to environmental stimuli by the GATA transcription factor ELT-3 in Caenorhabditis*

*elegans*". At the first ever virtual edition of our Institute for Infectious Disease Research Annual Trainee Day, BBS students **Caressa Tsai** (Ph.D., Coombes Lab) and **Victoria Coles** (M.Sc., Burrows Lab) were awarded Michael Kamin Hart Memorial Scholarships. These awards are made possible by the continued generous support of the Hart family.

Although we had to cancel many of our department's social gatherings in 2020, we are optimistic that the light at the end of the pandemic tunnel is fast approaching. I am hopeful that next year's CSMB newsletter will contain photographic evidence that our department is in the process of returning to its usual vibrant self.

## Ryerson University

### Department of Chemistry and Biology

Correspondent: Michael Olson

The Department of Chemistry and Biology encompasses multi-disciplinary interests in research and education, and is home to almost 40 faculty. Our Chemistry research programs are generally focussed on macromolecular, synthetic and medicinal chemistry. The research interests in Biology enjoy strengths ranging from biochemistry, molecular and cell biology, to genetics, microbiology and environmental biology. The breadth and variety of research interests create an exceptional environment that permits cross-pollination of ideas and an open-concept milieu for learning and teaching. We are also the home department for the Molecular Science Graduate Program, which now hosts over 50 graduate students in the Ph.D. and M.Sc. programs.

#### Graduating students:

Congratulations to the following students who graduated from the Molecular Science Graduate Program in 2020: Joseph Bedard, Sarah Birstonas, Mackenzie Brauer, Hardeep Devgan, Selena Osman, Jeff Pau, Alejandro Saettone, Amir Tehrani, Saba Zafar.

#### Student awards:

**Sindi Mukaj** - 2020 NSERC Undergraduate Student Research Award, and 2020 Ryerson Department of Chemistry and Biology - Biomedical Sciences Research Award; **Sarick Chapagain** - 2020 Ryerson Department of Chemistry and Biology - Biology Research Award.

#### Featured publications:

"Bile salts differentially enhance resistance of enterohemorrhagic *Escherichia coli* O157:H7 to host defence peptides." (*Infection and Immunity*. 2021 89(2):e00719-20)

"Bile salts- and iron-induced PmrAB dependent resistance to CAMPs in enterohemorrhagic *Escherichia coli* O157:H7." (*Microbiology (Reading)*. 2020 166(12):1149-1159).

In these two articles, the Debora Foster lab investigated the molecular basis of bile salt-induced resistance of enterohemorrhagic *E. coli* (EHEC) to cationic antimicrobial peptides including three human defensins, and demonstrated a role for this resistance using a *Galleria mellonella* model of EHEC infection.

"Selection of established tumour cells through narrow diameter micropores enriches for elevated Ras/Raf/MEK/ERK MAPK signalling and enhanced tumour growth." (*Small GTPases*. 2020 22:1-17. doi: 10.1080/21541248.2020.1780108.).

Work from the Michael Olson lab demonstrated that breast cancer cells selected on the basis of their ability to move through narrow gaps had increased basal signalling through the Ras/MAPK pathway, which also increased their tumorigenic properties when grown as orthotopic xenografts.

#### Faculty news:

**Imogen Coe's** term as President of the CSMB commenced in 2020. In addition to the duties of the society, which included advocacy work as detailed in the President's report, Dr. Coe took over as Chair of the NSERC EG1501 Genes, Cells and Molecules panel. Dr. Coe also continued to review for the Cell Physiology panel at CIHR, and worked as a reviewer for the Banting Research Foundation.

**Roberto Botelho** was awarded the Ryerson University Faculty of Science Dean's Service Award, which recognizes exceptional or distinguished service to a department, school, faculty and/or the university. Since joining Ryerson in 2008, Dr. Botelho has displayed an outstanding commitment to Ryerson through his many service contributions. Collectively, Dr. Botelho's contributions facilitated the development of new undergraduate and graduate programs and enhanced the curriculum of previously existing programs, developed networking opportunities for graduate students, increased research intensity and quality in molecular sciences, and helped



develop a vision for health research at Ryerson. Faculty were successful in obtaining funding from numerous agencies. **Costin Antonescu** received a Canada Foundation for Innovation (CFI) Exceptional Opportunities Fund (EOF) award, and two industry-partnered Natural Sciences and Engineering Research Council (NSERC) Alliance grants to work on COVID-19 related projects with key industry leaders to develop ultrasound-based drug-targeted technology (MD Precision), and new drug-repurposing strategies (Cyclica). **Gagan Gupta** was the recipient of a CFI Exceptional Opportunities Fund COVID-19 equipment award. **Dustin Little** received funding from the NSERC Discovery grant program, including a Discovery Launch Supplement, from the CFI John R. Evans Leaders Fund (JELF) and the Ontario Research Fund (ORF), and a Canadian Institutes of Health Research (CIHR) Operating Grant-Canadian 2019 Novel Coronavirus (COVID-19) Rapid Research Funding Opportunity. **Michael Olson** was awarded a CIHR project grant to examine the roles of MICAL1 and protein oxidation in cell signalling and cancer, another CIHR project grant that aims to determine the role of ROCK1 cleavage during apoptosis in liver homeostasis and cancer, an NSERC Discovery grant to study the regulation of the actin cytoskeleton through protein interactions and epigenetic reprogramming, and a Canadian Cancer Society Research Institute Innovation Grant that aims to optimize MRCK inhibitors for glioblastoma therapy.

#### **Special events:**

Our department continues to be a key participant in the activity of Ryerson's SciXchange program, which has as its mission to make science engaging, comprehensible and accessible to the general public. SciXchange aims to increase science literacy and foster critical thinking about scientific issues, and to provide opportunities for members of the community to engage in science through hands-on work and discussion. Events in 2020 included The Stoodis Future Scientist Program that took place in August, which is a free virtual day-program open to First Nations, Inuit and Metis high school students who are interested in STEM. Future scientists learned how their own culture and knowledge can advance their work in STEM fields. The 2020 program was composed of a three-day online experience that included leadership workshops, exploring science opportunities, and engaging with professionals in the field. In addition, Soapbox Science held in November is a novel public outreach platform for promoting women scientists and

the science they do. Using their virtual soapbox, speakers shared cutting-edge research with the general public and engaged curious minds of all ages.

## **Simon Fraser University**

### **Department of Molecular Biology and Biochemistry**

*Correspondent: Christopher Beh*

During this exceptional past year, the Molecular Biology and Biochemistry (MBB) Department at SFU contended with the restrictions on research imposed by the COVID-19 pandemic. Nonetheless, the Department responded to the dire circumstances with research and teaching accomplishments, and by welcoming several new faculty to join our ranks. As always, we are interested in reaching out to all our MBB Department alumni, and ask that they contact us at [mbbalumni@sfu.ca](mailto:mbbalumni@sfu.ca) to keep us informed of all successes and career accomplishments.

#### **New faculty appointments:**

Despite these difficult circumstances, the MBB Department welcomed a large group of new faculty in 2020, whose areas of expertise broaden our research program. **Dr. Lorena Braid** joins us as a new Assistant Professor whose lab studies the identity, function and regulation of human mesenchymal stem/stromal cells. We also welcome **Dr. William Hsiao** as an Associate Professor, both as a member of the MBB Department and the Faculty of Health Science. Dr. Hsiao directs the Public Health Bioinformatics Group, which uses knowledge engineering techniques and bioinformatics to improve data sharing and analysis to study infectious diseases. **Dr. Valentin Jaumouillé** is a new Assistant Professor in the MBB Department who started his lab this past year, studying dynamic mechanisms of immune cells involving the clearance of microbes or malignant cells. **Dr. Amy Lee** also joins us as a new Assistant Professor, and has begun her research on using systems biology to understand relationships between bacterial pathogens and their human hosts. Dr. Lee is specifically interesting in combatting antimicrobial resistance and neonatal sepsis. Starting a research program is challenging even during normal times, but all our new faculty have succeeded regardless of the past year's difficulties.

#### **Department highlights:**

Department efforts have included research on SARS-CoV-2. **Dr. Peter Unrau's** lab has focussed on the development

of new coronavirus testing kits and the possibility of expanding their use for detecting other viruses. **Dr. Fiona Brinkman** has been involved in the “Canadian COVID-19 Genomic Network: VirusSeq Project” for coordinating viral sequencing with associated epidemiological data collection. **Dr. William Hsiao** has contributed to decision tools to inform regulatory measures for COVID-19 preparedness. By using these different approaches, MBB faculty have been directly contributing towards research to combat the pandemic. Of course, other departmental members continue providing the fundamental biological knowledge necessary to understand SARS-CoV-2 as well as other viral and cellular diseases.

#### Student awards and other news:

In addition to the many awards received by the department’s graduate students, special congratulations go out to **Ms. Kristen Gray**, who was awarded the 2020 SWAAC (Senior Women Academic Administrators of Canada) Graduate Student Award of Merit. We are proud of our students and post-docs and their continued successes.

## Trent University

### Molecules, Cells and Systems Research Group

Correspondent: *Carolyn Kapron*



*Prof. Sarah West*

**Prof. Sarah West** (Trent-Fleming School of Nursing, Biology) was appointed as the first Program Director of Trent’s new 4-year Bachelor of Science in Kinesiology degree. The degree’s emphasis on experiential learning and on-campus clinical courses stemming from a close integration with Nursing will lead graduates to diverse career paths, and will equip them with the expertise and skills required to become a Registered Kinesiologist with the College of Kinesiologists of Ontario. Prof. West’s research examines the impact of physical activity on multiple outcomes, including metabolic health and, recently, psychosocial health (as a

recipient of a Social Sciences and Humanities Research Council grant) in various populations, including in children and adults with chronic disease.



*Prof. Sanela Martic*

**Prof. Sanela Martic** (Forensic Science) was awarded an NSERC Alliance COVID-19 grant to work with industry partner Nicoya Life Sciences on a benchtop-based SARS-CoV-2 detection system. The proposed system will use surface plasmon resonance technology to identify specific viral proteins, such as the spike protein that mediates viral entry into human cells. With portable equipment, testing could be carried out on-site, allowing for rapid identification of the virus in a variety of liquids, including blood, saliva or wastewater.



*Josephine Esposto*

M.Sc. student **Josephine Esposto** (Environmental and Life Sciences) from Prof. Martic’s lab attended the virtual 2020 Canadian Science Policy Conference, with support from the Chemical Institute of Canada. She subsequently wrote an article entitled “Political Polarization: What Does it Mean for Science Communication and Decision-Making?”

for the December 2020 issue of the CIC magazine, available at: <https://www.cheminst.ca/magazine/article/political-polarization/>.

Prof. **Holly Bates** (Biology) and **Sarah West** continued their tenure as Teaching Fellows in Trent’s Centre for Teaching and Learning, with a project that focussed on redesigning a large entry-level Anatomy and Physiology course. With the shift to online teaching in 2020, they were able to concentrate on the web versions of these courses and examine approaches to enhance student



Prof. Holly Bates

engagement. They presented the results of these investigations at the Human Anatomy and Physiology Society (HAPS) 34<sup>th</sup> Annual Conference. Their ongoing research is also looking at expanding ways in which undergraduates can gain authentic research experience and develop scientific identity through

methods-based undergraduate research experiences (MUREs).



Megan Aoki

The research of Environmental and Life Sciences Ph.D. student, **Megan Aoki**, who is working with Professors **Neil Emery**, **Craig Brunetti**, and **Robert Huber** of the Biology Department, was highlighted on Trent University's News website in December. Megan, supported by an NSERC-CGSD Scholarship, is investigating cytokinins, which are typically known as plant hormones but are

now recognized as important growth-regulating signalling molecules in a variety of organisms. She has found that cytokinin profiles are dynamically regulated during the life cycle of the social amoeba, *Dictyostelium discoideum*. Her current focus is on expanding our understanding of the key cytokinin biosynthesis and metabolism genes in non-plant organisms.

## Université de Montréal

Department of Biochemistry and Molecular Medicine

Correspondent: Pascale Legault

The Department of Biochemistry and Molecular Medicine of the Faculty of Medicine at the Université de Montréal is a dynamic teaching and research environment. In 2020, our programs in biochemistry and bioinformatics

trained 350 students at the undergraduate level and 180 students at the graduate level. Our students have continued to thrive despite the COVID-19 pandemic and the temporary shutdown of regular research activities on campus during the first 3 months of the pandemic (March 13-June 12, 2020). Our students, personnel and professors have contributed to research efforts to fight the pandemic and have been recognized at several levels for their scientific achievements.

### Efforts to fight the pandemic:



Dr. Nathalie Grandvaux

As part of a series of initiatives to find solutions to the COVID-19 pandemic, the Fonds de recherche du Québec (FRQ) announced in April 2020 the creation of the Québec COVID Network (QCN). The coordination unit of the QCN is co-led by **Nathalie Grandvaux** of the CHUM Research Centre. This year, **Dr. Grandvaux** also gave several interviews and seminars to demystify both SARS-CoV-2 infection

and the COVID-19 pandemic.

In response to a call from the Quebec government, staff members of the department's teaching laboratory (**Shona Teijeiro**, **Sébastien Truche** and **Philippe Lampron**)



Dr. Stephen Michnick

have been committed to helping hospitals in the greater Montreal area by collecting protective equipment and by providing critical reagents to their clinical diagnostic laboratories for SARS-CoV-2 testing.

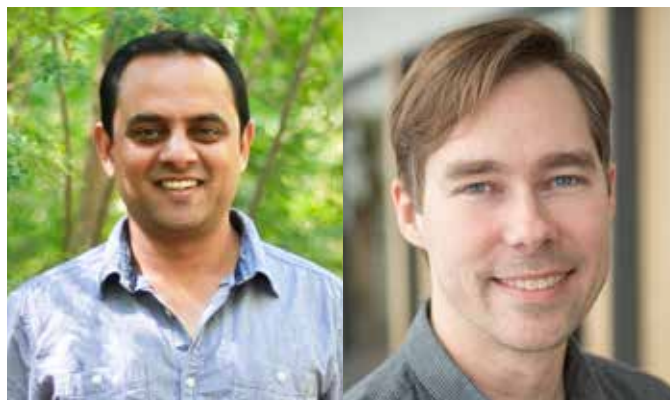
Several researchers have received funds for COVID-19 research. In November 2020, two of five Canadian Foundation for Innovation (CFI) projects awarded at UdeM from the COVID-19 Exceptional Opportunity Fund went to professors of our department, namely to **Nathalie Grandvaux** (co-PI Andrés Finzi; Level-3 containment laboratory for the study and exploitation of the innate immune response in the fight against SARS-CoV-2) and the team of **Stephen Michnick**, **Adrian Serohijos**, **James G. Omichinski** and **Pascale Legault** (Development of therapeutics against and rapid homogeneous assays for SARS CoV-2 based on recombinant antibodies).

#### Faculty honours and awards:

Several faculty members had an outstanding year: **Jacques Drouin** was elected a member of the Canadian Academy of Health Sciences as recognition for his research contributions in developmental biology, senescence and cancer. **Nathalie Grandvaux** was named Assistant Scientific Director for Student and Postdoctoral Affairs at the CHUM Research Centre. **Alain Moreau** won the SOSORT 2020 Research paper award from the International Society for Scoliosis Orthopaedic and Rehabilitation Treatment. **Alain Moreau** also became the director of the new Myalgic Encephalomyelitis/Chronic Fatigue Syndrome **Collaborative Research Centre at CHU Sainte-Justine**. **Mohan Malleshaiah** was awarded the CIHR Maud Menten New Investigator Prize in Genetics since his Project Grant entitled “Unravelling regulatory networks of stem cell states using single cell analysis” was the highest ranked amongst early career investigators in the CIHR Spring 2020 Project Grant competition. **Stephen Michnick** renewed his Tier 1 Canada Research Chair in Cellular Architecture. **Martin Smith** was granted a 4-year Research Scholars-Junior 1 salary award from the Fonds de recherche du Québec-Santé to pursue his research program in real-time genomic and transcriptomic profiling.

#### Grants:

**Christian Baron** and **Gerardo Ferbeyre** (co-PI **Luc DesGroseillers**) both obtained operating grant funding from the Cancer Research Society. **Nathalie Grandvaux** (with co-PI J. Waldisphul), **Mohan Malleshaiah**, **John**



Dr. Mohan Malleshaiah

Dr. Sébastien Lemieux

**Pascal** and **Daniel Zenklusen** (co-PI **M. Oeffinger**) obtained project grant funding from CIHR. **Daniel Zenklusen**, **Marlene Oeffinger** and **Pascale Legault** renewed their NSERC discovery grants. **Sébastien Lemieux** and **Éric Lécuyer** obtained operational funding from IVADO, a Québec-wide collaborative institute in the field of data science. **Sébastien Lemieux** also received grant funding from the “Omics data against cancer” program competition from the Génome Québec, Oncopole and IVADO partnership.

#### Outstanding publications:

Several research accomplishments were celebrated in 2020, only a few of which can be highlighted here. **John Pascal** and colleagues established the impact of clinical anti-cancer inhibitors known as PARP inhibitors on PARP-1 allostery, and demonstrated that allostery can increase potency toward killing cancer cells (*Science* 368, 46, p. eaax6367). In *Molecular Cell* (79: 115-126), **Pascal Chartrand** and collaborators used live-cell and single-molecule microscopy imaging of telomerase RNA to reveal a new mechanistic model for telomere elongation. A research team led by **Alain Moreau** has



Dr. Pascal Chartrand

developed the first molecular diagnostic tool for myalgic encephalomyelitis, also called chronic fatigue syndrome (in the top 100 articles published in *Scientific Reports* in 2020).

#### Events and prizes:

**Vincent Archambault** organized the 31<sup>st</sup> edition of the *Journée Simon-Pierre Noël* (March 3<sup>rd</sup>), a yearly event that commemorates a former professor of the department. A foundation was set up in his name to support graduate student training by providing funds for prizes awarded during this event. We would like to congratulate the 2020 prize winners: **Camille Rochefort-Boulangier** (best presentation and Simon-Pierre Noël Fellow), **Maxime Uriarte** (best presentation by a Ph.D. student) and **Marie-Lorna Paul** (best presentation by a M.Sc. student).

Despite the cancellation of the traditional graduation ceremony, convocation prizes were awarded to two undergraduate students in the program of biochemistry and molecular medicine: **Hugo Mayrand** (Best Academic Performance prize) and **Stéphanie Dufresne** (Emerging Researcher prize).

## Université Laval

### Department of Molecular Biology, Medical Biochemistry and Pathology

*Correspondent: Jean-Yves Masson*

Our department comprises professors working on medical biochemistry and pathology, and mostly doing basic research in molecular and cellular biology. Although 2020 brought several hurdles, one of the key highlights for our department was the recruitment of two professors, **Mélanie Laurin and Anne Gangloff**.

The BMBMP department welcomed **Mélanie Laurin** as a new Associate Professor and faculty member. Mélanie completed her post-doctoral training at the Rockefeller University in New York in the lab of Dr. Elaine Fuchs, a world-renowned pioneer and leading expert in stem cell biology and tissue development. To establish her laboratory, Mélanie has obtained a Scholarship for the Next Generation of Scientists from the Cancer Research Society, and she has since secured operating money from NSERC.



*Mélanie Laurin*

Throughout her training, Mélanie developed significant expertise on the signalling events that regulate cytoskeletal dynamics during tissue development and cancer progression. Notably, she has been particularly interested in the contribution of Rho GTPase signalling networks during these processes. By using a state-of-the-art approach that involves the injection of lentiviral particles into the amniotic cavity of mouse embryos, Mélanie developed the first example of a morphogenesis screen in mammals, which has allowed her to identify a plethora of new regulators of skin development among the Rho GTPase network components (Laurin M., et al. *eLife* 2019). The significant dataset generated from this work, now provides her with a solid foundation for her independent research program. As a result of this study, Mélanie was invited to publish a review article on the new high-throughput approaches allowing the characterization of the complexity of Rho GTPases signalling pathways (Dahmene M. *et al.*, *Cells* 2020). As a new independent investigator, Melanie will now aim to define the molecular mechanisms that orchestrate skin embryonic development and to understand how, when these mechanisms are deregulated, they can contribute to skin cancer progression. To tackle these scientific questions, Mélanie's group is using high-throughput genetic engineering in mouse embryos, combined with cell biology and proteomic approaches. Ultimately, her work will provide a better understanding of the molecular events that orchestrate skin development and skin regeneration. It will also offer an unmatched opportunity for the identification of new therapeutic opportunities for the treatment of aggressive skin cancers.

Our department also welcomed **Anne Gangloff**. Anne is a physician (medical biochemist, lipid specialist)



Anne Gangloff

and a scientist (Ph.D. in molecular endocrinology). Her research interests are both clinical and fundamental. She is principal investigator in a Phase 1 clinical trial supported by the CIHR which studies the effects of cholesterol depletion on top of chemotherapy in patients with metastatic pancreatic adenocarcinomas. The hypothesis being tested

is whether a shortage of cholesterol will slow or stop cancer progression (Gangloff *et al.*, J. Clin. Lipidol. 2017). Animal data suggest that a cholesterol shortage has the potential to increase the response to chemotherapy. Similar studies are being designed for other cancers known to have high cholesterol requirements to sustain growth and metastasis, such as ovarian, prostate and triple negative breast cancers. Dr. Gangloff's research interests also include the study of the blood matrix composition on the bioactivity of circulating hormones and proteins. In diseases such as type 2 diabetes, substantial changes in the composition of blood take place. The impact of these changes on hormones' 3D-structure, interactions and bioactivity has not been studied before. Type 2 diabetes is characterized by insulin resistance; the latter could be explained in part by matrix-triggered changes in the bioactivity of insulin and other proteins (leptin, adipokines, etc). Matrix-triggered changes in the 3D-structure, interaction and bioactivity of hormones and other mediators may also play a role in cancers, therefore several hormones will be studied in normal serum, type 2 diabetes serum, and cancer patient serum.

Congratulations to students and faculty for another year of exemplary achievements, despite Covid-19, only a few of which can be highlighted here:

**Jacques Côté** was elected a Fellow of the Royal Society of Canada. **François Bordeleau and Jean-Yves Masson** obtained Canada Research Chairs in Tumour Mechanobiology and Cellular Mechanoregulation, and DNA Repair and Cancer Therapeutics, respectively.

**Claire Dziengelewski** and **Marc-Antoine Rodrigue** reported in Journal of Cell Biology that the adenoviral protein E4orf4 and the cell polarity protein Par3 interact to induce the rupture of the nucleus, leading to tumour cell death. This work was led by **Josée Lavoie** in collaboration with several professors in the Department: **Patrick Laprise, Darren E. Richard, François Bordeleau** and **Marc-Étienne Huot**.

## University of Alberta

Department of Biochemistry

Correspondent: Joe Casey

### Graduate milestones:

It was great to see so many graduate students press on through the pandemic to complete their graduate degrees in Biochemistry. M.Sc. recipients were Shelaine Fleck (Holger Wille) and Jessi Bak (Howard Young). Receiving their Ph.D. in biochemistry in 2020 were Qian Wang (Marek Michalak), Katherine Badior (Joe Casey), Zelin Fu (Brian Sykes), Ghazaleh Eskandari Sedighi (David Westaway), Joseph Primeau (Howard Young), Zeli Yang (David Brindley), and Mansoore Esmali (Michael Overduin). From March until the end of 2020, all thesis defense seminars and closed-door defenses were held via Zoom. While this was a unique year in which to be a graduate student and to finish a graduate degree, the department was very proud of the perseverance and successes of our trainees.

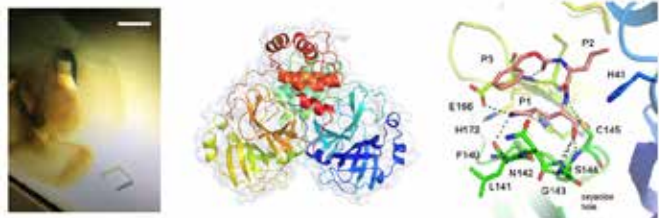
In this year like no other, a highlight was that our colleague from Medical Microbiology and Immunology, **Michael Houghton**, won the Nobel Prize in Medicine. This provided a welcome distraction and we were all proud to be able to interact with one of science's finest!

### Impact of the Covid-19 pandemic:

Like other Canadian universities, University of Alberta was greatly impacted by COVID-19 in 2020. In a matter of days in March we went from hosting international visiting speakers to all classes going online and all labs being shut. Slowly processes were put in place to allow essential research and COVID-19 research to proceed under restrictive safety procedures. As more was learned about COVID-19, all labs were allowed to re-open with many safety procedures in place. Summer students, unfortunately, were not allowed to come to laboratories until the start of July, impacting their research experiences.

### Covid-19 research:

While most labs were winding down during the onset of the pandemic in March 2020, the labs of Drs. **Joanne Lemieux** and **Howard Young** were busy working on a COVID-related project. They used their expertise in protease biochemistry, in collaboration with chemist Dr. John Vederas and virologist Dr. Lorne Tyrrell, all at the University of Alberta. They examined whether a peptide-based inhibitor used to treat a feline form of coronavirus would be effective at inhibiting the main protease of SARS-CoV-2. By April 2020 the team determined that the inhibitor worked in vitro with recombinant protein and also was able to inhibit replication of the live virus in cells. Crystallography was used to examine the mechanism of inhibition. This work was published in Nature Communications in August 2020. The team is currently investigating new derivatives of the drug and working towards clinical trials.



Crystal structure of SARS-CoV-2 Mpro in complex with GC373, showing that the peptide inhibitor binds in the active site pocket

### Department Chair:

**Charles Holmes** completed his 10-year term as Chair of Biochemistry, with the gratitude of the department for a job well done. **Mark Glover** began a term as Chair in July 2020. Mark is a full Professor who has been in the Department of Biochemistry since 1996, following a post-doctoral fellowship at Harvard with Steve Harrison and Ph.D. in Biochemistry with David Pulleyblank.

### Retirements:

Three of our colleagues either retired or moved to a retirement track this year.

**Mike Ellison** became an Assistant Professor in the Department of Biochemistry in 1989 and full Professor in 1996. Throughout Mike's career, he made major contributions to our understanding of ubiquitin and other areas. Mike's sharp mind and creative approaches were much appreciated in the department.

**Dennis Vance** joined the Department of Biochemistry in 1986 as a full Professor, having started his career at U.B.C. Establishing and heading the high-profile Group in Lipids and Lipoproteins, Dennis' career was marked by many awards, including Fellow of the Royal Society of Canada (1996) and Distinguished University Professor (2008). Dennis completed a three-year move toward retirement and is now fully retired, ending a highly successful career. **Chris Bleackley** began a three-year track toward full retirement.

## University of Alberta

### Department of Physiology

Correspondent: *Emmanuelle Cordat*



*Dr. Maria Ioannou in her laboratory*

Although 2020 has been a difficult year for everyone with the worldwide COVID-19 pandemic, the Department of Physiology at the University of Alberta has nevertheless continued its expansion with the exciting recruitment of a new Assistant Professor, **Dr. Maria Ioannou**.

Here is a short statement of Dr. Ioannou's journey so far:

"I obtained my M.Sc. with Dr. Margaret Fahnestock at McMaster University studying proneurotrophins. My Ph.D. was with Dr. Peter McPherson at McGill University, studying the regulation of endosomal transport by Rab GTPases and how they contribute to cancer cell behaviour. My post-doctoral training was with Drs. Zhe Liu and Jennifer Lippincott-Schwartz at the Howard Hughes Medical Institute Janelia Research Campus, where I began studying lipids in the brain. I started my lab as an Assistant Professor at the University of Alberta in May 2019. I am also adjunct with the Department of Cell Biology. My research is focussed on understanding how coupling lipid metabolism between neurons and glia regulates neural health and activity. This includes figuring out the mechanisms of lipid transport during cellular stress, its implication in various neuropathologies and the fate of glial cells after consuming lipids."

Since her arrival in the Department, Dr. Ioannou has already been incredibly successful, as she secured a CIHR Project grant (5 years, 2020-2025), a Heart and Stroke Seed/Catalyst Grant (2 years, 2020-2021), an Amgen Stewart Whitman CLC Young Investigator Award (1 year, 2020-2021) and the Sloan Research fellowship (2021), a prestigious award that highlights the achievements of rising stars in several scientific fields in the U.S. and Canada.

Sadly, in 2020, our Department reports the loss of a longtime colleague, **Dr. Dick Stein**, a Professor who had been in the Department of Physiology for 50 years. Dr. Stein was the founder and then an active member of the current Neuroscience and Mental Health Research Institute at our University. Dr. Stein passed away on November 3, 2020. A tribute to his career in our department can be found here: <https://www.ualberta.ca/physiology/department-news/2020/in-memoriam-dr-richard-b-stein.html>

**On the teaching side**, the Honours Program in the Department of Physiology is thriving, with a record number of 198 undergraduate students currently enrolled. Our graduate program has 42 students, including 17 who received graduate studentships from external sources, including CIHR Vanier Graduate studentships, CIHR Sir Fred Banting Graduate studentships, NSERC Alexander Graham Bell Canada Graduate studentships, MITACS, Lybian North American Scholarships and Graduate Studentships from the China Scholarship Council.

The Department of Physiology at the University of Alberta also offers one of the most exhaustive **online Human Physiology courses** available in Canada, and is therefore attracting a growing number of students from various locations in Canada (Alberta, British Columbia, Ontario) but also in the rest of the world, including students from China, Italy and Turkey. The course enrollment varies from approximately 300 to 500 students per academic year.

Finally, the **QS World Research ranking has placed our Department in 44<sup>th</sup> position worldwide**, a significant achievement illustrating the Department of Physiology's accomplishments, vitality and leadership in today's Physiology.

## University of British Columbia

### Department of Biochemistry and Molecular Biology

*Correspondent: Leonard Foster*

Our department continues its commitment to the principles of equity, diversity and inclusion towards continued development into a well-rounded, world-class research facility.

We are delighted to be able to expand our faculty again this year. In September, **Seth Parker** joined the department from UCSD, and **Ethan Greenblatt** joined us from the Carnegie Institute for Science. With the impacts of COVID-19 on our ability to interact with other people, I am sure that it was a very strange time to start a new job, of any sort! It was also a strange time to leave an old job: in the fall we said a brief goodbye to **Michel Roberge**, who has left the department after nearly 30 years as a faculty member! It was only a brief goodbye because it was done during a regular faculty meeting, with the promise that we would have a more fulsome celebration of his contributions once we are able to have a party again!

There were two big awards for our faculty this year: **Thibault Mayor**, who has long championed out-of-the-box thinking around delivery of teaching, received one of UBC's highest honours for teaching, the Killam Teaching Prize, and one of our newest faculty members, **Sheila Teves**, won a Michael Smith Foundation for Health Research Scholar award. Congratulations to them both!

In addition to all of our efforts to adapt to the new world order under COVID-19, our department played a key role in society's endeavour to develop vaccines against SARS-CoV-2. **Pieter Cullis** has been studying lipid biochemistry for more than 40 years, particularly around the encapsulation of other molecules and cargoes. Several years ago, he launched a start-up company called Acuitas to commercialize encapsulation of mRNA molecules for various therapeutic uses. The first SARS-CoV-2 vaccine to be approved, from Pfizer and BioNTech, uses Acuitas' lipid nanoencapsulation technology! This incredible achievement is a classic example of how many years of basic science research led to an unanticipated application decades after the original research. Hopefully we as scientists, together with our funding partners such as CIHR, can use this as just one example of the value of investing in curiosity-driven, basic research without



the need for an obvious short-term application of the science.



Dr. Ethan Greenblatt

**Dr. Ethan Greenblatt:**

Ethan Greenblatt was born in Virginia and went to the College of William and Mary in Williamsburg, VA, where he received his Bachelor's degree in Chemistry. This was followed by graduate school at Stanford University where he received his Ph.D., working in Ron Kopito's lab on protein quality control pathways. He then did his post-doctoral

studies in Allan Spradling's lab at the Carnegie Institution for Science in Baltimore, Maryland, where he learned *Drosophila* genetics and developmental biology. Outside of the lab, Ethan enjoys playing the piano, running, and exploring the beautiful areas in and around Vancouver with his wife Jennie and their rescue beagle King Louie. He is really excited to join the Department at UBC, and can't wait for the chance to interact with colleagues and students face-to-face (and without masks) post-COVID.

Ethan's research focusses on oocytes (egg cells), which are unique and amazing cells for many reasons. Oocytes maintain their ability to develop into embryos following very long periods of developmental arrest - which last for decades for immature human oocytes. In addition, oocytes grow into the largest animal cells. Fully-grown, mature oocytes rely entirely on a form of post-transcriptional gene expression control which uses stable mRNAs and lacks transcription. This type of gene expression has similarities to translational control in neurons, and mutations in translational control genes underlie prominent reproductive and neuronal disorders such as fragile X-associated primary ovarian insufficiency and fragile X syndrome, which are leading causes of premature ovarian failure and autism respectively.

Ethan hypothesizes that the inability to maintain translation (protein production) from stable mRNAs may contribute to infertility and neurodegeneration. His research studies gene expression in the mature

*Drosophila* (fruit fly) oocyte, combining powerful genetic tools with modern molecular biology approaches such as ribosome profiling and RNA sequencing. His prior studies have shown that translation is unstable during prolonged oocyte storage. Aged *Drosophila* oocytes with reduced translation develop meiotic errors resembling those seen in human IVF clinics. In addition, Ethan found that the *Fmr1* gene, mutated in fragile X disorders, plays a critical role to boost the production of large proteins. Many of the *Fmr1* targets he identified are essential for reproduction and are also associated with individual autism spectrum disorders.

Ethan's lab at U.B.C. will continue to pursue basic questions related to oocyte translational control. These questions include understanding the basis for translational decline during oocyte aging, studying the mechanism of *Fmr1*-dependent translation, and identifying new "pilot light" genes that work to preserve oocytes. His goal is to identify new markers and therapeutic targets for the diagnosis and treatment of human fertility and intellectual disorders.



Dr. Seth Parker

**Dr. Seth Parker:**

Seth Parker recently joined our department, and started a research lab at B.C. Children's Hospital Research Institute in the Fall of 2020. Seth received his B.Sc. in Chemical and Biological Engineering from the University of Colorado at Boulder. He completed his Ph.D. in Bioengineering at the University of California,

San Diego where he developed quantitative methods to study cancer metabolism under the supervision of Dr. Christian Metallo. Before coming to British Columbia, Seth was a post-doctoral fellow at the New York University School of Medicine in the laboratory of Dr. Alec Kimmelman, where he studied alanine transport in pancreatic cancer. His research team applies mass spectrometry-based metabolomics and biochemical/molecular biological techniques to better understand how specific solute carriers (SLCs) permit acquisition of nutrients from the tumour microenvironment, and how targeting these transporters may restrict tumour growth.

# University of Calgary

Department of Biochemistry & Molecular Biology

Cumming School of Medicine

Correspondent: Dr. David Schriemer

2020 was a year of challenge and change for all of us. Our department adjusted quickly and efficiently. Teaching methods, laboratory practices, policies and procedures were revised to accommodate the pandemic. Zoom meetings became commonplace and like everyone, we started collecting many stories of zoom flops and humorous happenings. Somehow it made the whole experience a little more human. Despite all the changes, BMB members remained productive. We could celebrate continued success with grants, publications and trainees graduating. The BMB program had 9 M.Sc. and 5 Ph.D. candidates successfully defend their thesis work in 2020, and 13 new post-doctoral associates joined our labs.

## New faculty member:



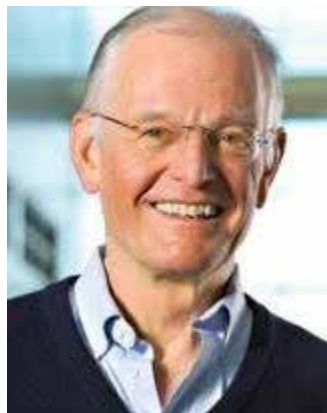
Pierre Billon

**Dr. Pierre Billon** joined the department in November 2020 as a member of the Robson DNA Science Centre. Dr. Billon completed his post-doctoral training in the laboratory of Dr. Alberto Ciccio, at Columbia University Irving Medical Center. His lab studies the mechanisms that promote DNA repair and genome

editing by implementing cutting-edge genome-editing technologies (CRISPR-transposons, base editing and prime editing), high-throughput genetic screens in cell lines and *in vivo*, biochemical assays, cell biology experiments, and mouse models to interrogate and manipulate the cellular mechanisms that protect our genome. Studying and controlling the cellular DNA damage response will not only provide new insights into the mechanisms that promote genome stability to enhance cancer treatments, but will also improve the accuracy, efficiency and safety of modern precision genome-editing technologies for the treatment of human genetic diseases.

## Retirements:

2020 saw two long-serving and cherished faculty



James McGhee

as a post-doctoral fellow, he did ground-breaking work on chromatin structure in gene regulation. At the University of Calgary, Jim undertook a radical change in research direction and started working on transcriptional control of the development of the *C. elegans* gut. For nearly four decades, Jim was a leader in Department of Biochemistry and Molecular Biology, heading research groups and leading initiatives in the Alberta Children's Hospital Research Institute. He was a committed mentor and supportive peer. A champion of junior faculty and trainees, he always encouraged them towards better research questions. Over his career, he published over 90 research articles and was recognized internationally for his work, as reflected in prestigious awards including a Howard Hughes International Scholarship, a CRC Tier 1 Chair, and an AHFMR Scientist.



Paul Mains

to dissect the pathways controlling the actin and microtubule cytoskeletons in the *C. elegans* embryo. In addition to his successful research program, Paul was an outstanding faculty citizen who played many roles

members retire:

**Dr. James McGhee** joined the University of Calgary in 1983 following a Ph.D. at the University of Oregon, and several years as a post-doctoral fellow and staff scientist at the National Institutes of Health in Bethesda. As a Ph.D. student, Jim studied the physical biochemistry of DNA-protein interactions and

**Dr. Paul Mains** was hired in 1989 as an AHFMR Scholar following Ph.D. and post-doctoral training in mouse and *C. elegans* genetics at the University of Washington, the Cold Spring Harbor Lab, and the University of Colorado, Boulder. At the University of Calgary, Paul established a research program that employed exquisite genetic analysis

in service and most notably, in graduate education. A committed mentor, many of Paul's Ph.D. trainees have gone on to run their own research groups. He also headed, at different times, the Biochemistry and Molecular Biology and the Medical Sciences graduate programs, the latter being the largest graduate program at the University. Finally, Paul was a gifted teacher, recognized with awards for both undergraduate and graduate level instruction.

#### **Congratulations:**

While continuing his role as Director of Bioinformatics in the Bachelor of Health Sciences, **Dr. David Anderson** added Program Director of Precision Health in Graduate Science Education to his academic portfolio. This unique program was designed to meet the professional development needs of current and future healthcare practitioners across Canada and internationally. The focus is to strengthen students' knowledge and skills in Precision Health. It supports role integration in areas such as advanced clinical skills, data science, entrepreneurship, organizational leadership, research, education, professional development, and consultation to impact patient, provider, and health system outcomes.

**Dr. Shirin Bonni** stepped into the position of Program Director of Medical Sciences in Graduate Science Education in June. Dr. Bonni brings a wealth of knowledge and ability to the position as she succeeds Dr. Paul Mains in this role.



David Anderson

Shirin Bonni

#### **Department events:**

The annual departmental retreat became a virtual event, much scaled down from previous years. The following faculty members were recognized for their excellence in research and educational achievements:

**Dr. Jim McGhee** - "Schultz Award for General Excellence"; **Dr. Quan Long** - "Leon Browder Rising Star Award"; **Dr. Peng Huang** - "Jonathan Lytton Associate Professor Award"; **Dr. Jonathan Lytton** - "Hans van de Sande Leadership & Service Award"; **Dr. Tara Beattie** - "Education Award"; **Dr. Aditya Mojudar**, (Cobb lab) - "Post-doctoral Award"; **Dr. Rasha Sabouny** (Shutt lab) - "Gordon Dixon Prize"; **Arsheen Rajan** (Huang lab) - "Carol Braat Memorial Award"; **Megha Murali** - "Graduate Student Leadership and Service Award".

Please visit the BMB website to see additional information and updates at <https://cumming.ucalgary.ca/departments/bmb/home>.

## **University of Calgary**

**Department of Biological Sciences**

**Faculty of Science**

*Correspondent: Vanina Zaremborg*

The Biological Sciences Department at the University of Calgary is currently organized in four clusters based on general research and teaching interests. They include Biochemistry, Microbiology, Cell Development & Physiology, and Ecology & Evolutionary Biology.

During this year, several colleagues from Biochemistry have been devoted to service in our Department: **Sergei Noskov** continued in his role of Associate Head - Research, **Elmar Prenner** as Chair of the Biochemistry cluster and **Marie Fraser** as Chair of the Biochemistry program. **Greg Moorhead** stepped in as Associate Department Head for the Graduate Program to cover for a colleague on leave.

This has been a challenging year! When the COVID-19 pandemic hit in March 2020, we quickly had to adapt to new protocols, teaching modalities and venues to communicate. We had to conquer the virtual space, re-imagining hands-on labs and creating valuable learning experiences for our students.

From our virtual trenches we have been battling ignorance and misinformation irresponsibly spread in many instances, by mediocre minds in power. The pandemic pushed the scientific community to respond in record time, and Science has been in the spotlight like never before. Many teams in our Biochemistry group directly contributed to research on SARS-CoV-2.

These are the highlights of the 2020 life-changing year:

The **Lewis** research group has been busy over the past year working on a range of projects related to SARS-CoV2. Some of the highlights from this work include a proteomics-based method for detecting SARS-CoV2 and differentiating the common variants of the virus directly from patient swabs. In addition, the **Lewis** group has been mapping metabolic changes caused by SARS-CoV2 infection, both in clinical cohort studies as well as in cell cultures of the virus. This latter work was made possible by the recent launch of the UCalgary Biosafety Level 3 facility. In addition to these viral projects, the **Lewis** group is proud to announce the first implementation of its microbial diagnostic tools in Alberta clinical diagnostic labs. In partnership with DynaLIFE medical laboratories, they are implementing a new mass spectrometry-based system for rapid detection of urinary tract and bloodstream infections. Launching of the first clinical trial of these tools is scheduled for the summer of 2021.

The **Noskov** lab, in collaboration with the groups of **Peter Tieleman** and Henry Duff, made significant advances in understanding the molecular mechanisms involved in lipid regulation of cardiac ion channel activity. Papers published in *PNAS* and *Nature Communications* describe a combination of experimental and modelling efforts to capture a delicate balance between specific lipid targeting to binding pockets in ion channels and conformational response. The findings detailed in these studies may lay the foundation for a better anti-arrhythmic therapy design. In a collaborative effort with the teams of **Ian Lewis** and Dan Gregson (Alberta Health Services), the Noskov lab has expanded a computational proteomics portal for high-throughput proteomics analysis of COVID-19 samples (nasal swabs) collected from patients in Southern Alberta, contributing to development of rapid diagnostics.

The **Noskov** group welcomed a new graduate student this year (Ms. Laura Maria Castro Gonzales). It took a lot of effort and perseverance on Laura's side to meet all of the regulatory requirements and finally start on her project! Mahdi Mousaei successfully defended his M.Sc. thesis in 2020 and started his new career as a data scientist in industry. Several of the lab's trainees received prestigious awards including Alberta Innovates Ph.D. Scholarships to Mario Valdez Tresanco, Luis Alvarez and Balarama Sridhar Dwadasi, and a Provost Doctoral award

to Kazi Shudipto Amin. Williams Miranda was decorated with a best poster award at the annual Biophysical Society Meeting. **Sergei Noskov** has been appointed as an Associate Editor in *Frontiers in Pharmacology*, and continues his terms as an Associate Editor for *BBA-Biomembranes* and *European Biophysics Journal*. He also serves on the Board of Directors for WestGrid.

**Elmar Prenner** continued his teaching in the Nanoscience minor and the Biochemistry program. A Mitacs Elevate grant and an NSERC Alliance grant on SARS-CoV-2 detection were approved. The main area of research has focussed on membrane interactions of metals and metal nanoparticles. Other areas of research aimed at investigating lipid-based anticancer drugs and nanoparticle-based drug delivery, while new efforts are directed towards studying the impact of vaping and vaping additives on lung surfactant model systems. Applied research dealing with the design of fluorescence instruments resulted in a U.S. patent among other international jurisdictions. Elmar serves on the editorial board of *BBA Biomembranes*.

**Peter Tieleman's** group continued working on lipid-protein interactions, and towards new computational models for large-scale membrane simulations with hundreds of proteins. With no access to the on-campus computer infrastructure, some group members were quite limited in what they could do, while others worked from Kingston, Kosovo, and Kiev. Besian Sejdiu defended his Ph.D. in the summer, with an outstanding thesis. The next year should see some more graduations, more concrete steps in new directions, and re-connecting in person with collaborators outside Calgary.

**Raymond J. Turner**, despite having taken early retirement, remained very active. He received Scientist designation from the International Association of Advanced Materials, Sweden, for Advancement of Material Science and Technology. This was in recognition for his work of the past decade on using metal-resistant bacteria to produce selenium and tellurium nanomaterials. He gave his award virtual talk in July and then presented it to the Department. He intended to be involved in lecturing in a Genomics program in Europe, but COVID restrictions had him stay in Calgary where he put members of his team to work writing and publishing a few meta-data analysis papers on COVID-related issues, as well as some molecular modelling to evaluate if Zn could potentially inhibit the

virus' enzymes. He was also very active writing industry collaborative grants for anti-microbial formulations for high-touch surfaces and medical devices. We also found him actively contributing lectures for graduate student courses, particularly in the OneHealth AMR course delivered across the Canadian community. Finally, he contributed his expertise and experience in an online MOOC Course on Graduate Student Supervision. So, we see Ray continues to be lazy in his retirement.

**Hans Vogel** continues to be very active in his roles of Executive Editor of BBA-Biomembranes, and as Associate Editor of Biometals, and the (Canadian) Biochemistry and Cell Biology journals. On top of his regular editorial and reviewing duties, several special issues were also successfully completed this year. As the current President of the International Biometals Society, he was happy that the biennial meeting in Grenoble in July, which had to be re-scheduled because of the covid pandemic as an online meeting, was very successful and well-attended. Following up on his longstanding research on antimicrobial peptides, this year was also memorable, because he published his first papers on anti-fungal and anti-biofilm activities of several host-defence peptides. Moreover, his research group contributed to a paper that described the role of the calcium regulatory protein calmodulin in brain swelling, which was published in Cell.

**Vanina Zarembeg**'s group continued work on glycerolipid metabolism focussing on diacylglycerol and phosphatidic acid metabolism, and ether lipids. Maxwell Chilije (Ph.D.) defended his doctoral thesis on the "Biochemical characterization of animal DHAPAT". The group published work in *Frontiers in Cell and Developmental Biology* and *Frontiers in Genetics*. Laura Sosa was the recipient of an NSERC-Ph.D. award, as well as Alberta Innovates and Mildred Shaw Book Prize. She also received a 2020 ASBMB award to cover travel and housing expenses to present her work at the 2020 Experimental Biology meeting to be held in San Diego, U.S.A. Unfortunately, the meeting was cancelled due to the pandemic. The group welcomed Mayrene Horta Remedios, who joined the team remotely from Cuba, and made an enormous effort to stay connected while highly committed. **Vanina Zarembeg** currently serves as editorial board member for the *Journal of Biological Chemistry*, and was a member of the NSERC evaluation group Genes, Cells and Molecules in 2020.

During this crazy year many of us have found comfort in music, poetry and nature. Here are some contributions for this report.

Poem from **Robert Edwards** (Senior Instructor Emeritus)

Frog House

There once was a frog  
who lived in a log,  
which was hollow and cozy of course.

The frog and his wife  
were happy in life,  
for they had such a wonderful house.

But it started to rain  
Flashes of lightning came.  
It was a once in a century storm!

The flood in the bog  
squished mud in their log  
and they had to abandon their home.

The wife and the frog  
they found a new log,  
which was hollow but higher of course.

Make it cozy they would.  
They knew that they could.  
They wanted a home not just a house.

(c) r. a. edwards - 2020



Moose in Calgary (image captured by Peter Tieleman)



What is happening on campus when the students are away? (Pictures captured by Marie Fraser)

## University of Guelph

### Department of Molecular and Cellular Biology

Correspondent: Frances Sharom

Like all university departments across Canada, the Department of Molecular and Cellular Biology (MCB) quickly learned how to do many of our activities remotely online, from teaching undergraduate and graduate courses, to graduate student seminars, to meetings and presentations. It has not been ideal, and we all miss interacting in person, but we survived!

#### Faculty news:

We welcomed two new faculty members to the department this year.



Shaun Sanders

**Shaun Sanders** joined the department as an Assistant Professor in June 2020. She received her B.Sc. in Biology from the University of British Columbia (UBC) in 2007 and completed her Ph.D. in Neuroscience, also at UBC, under the supervision of Michael Hayden. During her Ph.D., she was awarded a CIHR Frederick Banting and

Charles Best Canada Masters Award and a CIHR Doctoral Research Award to decipher the pathogenic mechanisms of the neurodegenerative disorder Huntington disease. Dr. Sanders' work during her Ph.D. led to multiple discoveries demonstrating the importance of the protein lipid modification palmitoylation to neuronal function and behaviour, and how aberrant palmitoylation contributes to the pathogenesis of Huntington disease. Dr. Sanders then relocated to Temple University in Philadelphia where she was awarded a post-doctoral fellowship from the Brody Foundation Medical Trust Fund to continue her work in the lab of Gareth Thomas. Her post-doctoral work led to a number of pivotal findings demonstrating the importance of palmitoylation-dependent trafficking of ion channels and signalling complexes in neurons to neuron survival and function. Her new laboratory at the University of Guelph is interested in how proteins get targeted to specific locations in neurons and how that contributes to physiological neuronal function and neuropathological conditions.



Siavash Vahidi

**Siavash Vahidi** also joined the department as an Assistant Professor in June 2020. He has a training background in two distinct fields: structural biology and bioanalytical chemistry. He completed his Ph.D. at the University of Western Ontario working with Lars Konermann. As part of his doctoral research, he expanded the structural

biology toolbox by developing and applying cutting-edge mass spectrometry-based methods for studying protein structure, folding, and conformational dynamics. After completing his Ph.D., Dr. Vahidi was awarded a CIHR post-doctoral fellowship to support his research at the University of Toronto and The Hospital for Sick Children with Lewis Kay. Here, he applied the methyl-TROSY NMR approach to study the allosteric regulation of the ClpP protein degradation system in *E. coli*, *S. aureus*, *N. meningitidis*, and *M. tuberculosis*. Dr. Vahidi also worked extensively with John Rubinstein at SickKids for cryo-EM studies. In his newly-established laboratory at the University of Guelph, Dr. Vahidi continues to push the envelope by taking advantage of an integrative approach in structural biology: combining various methods,

including mass spectrometry and NMR, with the ultimate goal of developing novel TB treatments based on altering the activity of *Mtb* proteasome using allosteric modulators.

**Tariq Akhtar** and **Scott Ryan** were granted tenure and promoted to Associate Professor, while **Steffen Graether** was promoted to full Professor. Congratulations to all!

#### Retirements:

We said a fond farewell to two of our senior faculty members in 2020. Although in-person celebrations were off-limits this year, we wish them both all the best in the next stage of their lives.

**David Josephy** retired on September 1, 2020 after over 37 years of research and teaching, first in the Department of Chemistry and Biochemistry, then later in MCB after the biochemistry group merged with the department when it was established in 2005. David's research is in the field of Molecular Toxicology, including the identification of environmental mutagens; the development and application of bacterial mutagenicity assays; and mechanistic studies of enzymes that catalyze the metabolism of drugs and toxicants. He advised more than 30 graduate students and taught courses in Biochemistry, Molecular Biology, and Toxicology. David is the co-author of the textbook *Molecular Toxicology* (Oxford University Press), and also Co-Editor-in-Chief of the journal *Mutation Research - Genetic Toxicology and Environmental Mutagenesis*.

**Steven Rothstein** retired on March 1, 2020 after many years of using molecular genetic, biochemical and genomic information to understand the regulation of

nitrogen metabolism in *Arabidopsis*, with the goal of improving the nitrogen use efficiency of crop plants. Steven started off his career working with Ciba-Geigy in North Carolina (now part of Syngenta), then came to the University of Guelph as an Industrial Research Chair that was partly funded by Pioneer Hi-Bred. After several years, he returned to Pioneer in Iowa where he was Research Director for agronomic trades. After they were bought by Dupont, he returned to Guelph as a faculty member in Molecular Biology & Genetics, which also merged to form the new MCB department in 2005. Steven was instrumental in facilitating many important contacts and collaborations with the agricultural industry during his years in the department.

We were also very sad to lose one of our most valued staff members to retirement this year. **Debra Flett** retired on June 1, 2020 after almost 31 years as a lab demonstrator. She was instrumental in maintaining the consistency and high quality of our Microbiology Program labs. We thank Debra for her many years of dedicated service and wish her all the best!

#### Research grants:

Despite the challenges of the pandemic, many MCB faculty members were successful in recent grant competitions:

*NSERC Discovery Grant*: **Jennifer Geddes-McAlister, Cezar Khursigara, Baozhong Meng, Stephen Seah, Chris Whitfield, Joseph Yankulov**

*NSERC Research Tools and Instruments (RTI)*: **Nina Jones**

*NSERC Discovery Accelerator Supplement*: **Cezar Khursigara**

*NSERC Covid-19 Alliance Grant*: **Scott Ryan**

*NSERC Discovery Launch Supplement*: **Jennifer Geddes-McAlister**

*New Frontiers in Research Fund Exploration Grant*: **Jennifer Geddes-McAlister**

*CIHR Project grant*: **Georgina Cox**

Georgina's research team has identified *S. aureus* genes needed for attachment of the bacterium to the skin and epithelial surfaces in the body. The project will investigate the molecular basis of mechanisms contributing to this process, which will guide efforts to treat antibiotic-resistant *Staphylococcus* commonly found in hospital and community-acquired infections.



David Josephy

Steven Rothstein

*Jarislowsky Fellowship-Banting Discovery Award:*  
**Jennifer Geddes-McAlister**

This award will be used to pursue research focussed on the discovery of novel anti-fungal agents against cryptococcosis, using state-of-the-art mass spectrometry-based proteomics.

**Melissa Perreault** and **Jasmin Lalonde** both received grants from the *Scottish Rite Charitable Foundation of Canada (SCRF)*. Melissa received funding to explore how sex differences in brain wave patterns and behaviour in autism spectrum disorders may be linked to the GSK-3 cell signalling pathway. She hopes this work will provide critical information on the mechanisms that underlie the known sex imbalance in ASD susceptibility and identify potential novel avenues for therapeutic intervention.

Jasmin's project will be carried out in collaboration with **Jennifer Geddes-McAlister**, a co-applicant on the grant. They will use cerebral "organoids" – three-dimensional miniature brains that are grown in the lab from human stem cells – and high-throughput proteomics to understand how the protein composition of synapses differs between healthy individuals and patients with schizophrenia, and how these differences might be reversed by new treatment strategies.

**Graduate awards:**

Our students continued to excel in attracting external and internal awards and scholarships.  
Congratulations to all!

**NSERC Postgraduate Scholarships (PGS-D):** Alex Anderson, Viola Halder, Madison Wright

**NSERC Canada Graduate Scholarships (CGS-M):** Laura Thompson, Sarah Vancuren

**CIHR Canada Graduate Scholarships (CGS-D):** Avery Robinson

**CIHR Canada Graduate Scholarships (CGS-M):** Greg Higgins

**Ontario Graduate Scholarships:** Brianne Ball, Shoshana Buckhalter, Mariel Burnside, Nathan Doner, Taylor Forrester, Qi Liu, Andrew Riley, Hannah Robeson, Kurt Schroeter, Arjun Sukumaran, Laura Thompson, Sarah Vancuren, Lauren Wensing, Jacob Wilde

**OMAFRA/Ontario Agri-Food Innovation Alliance HQP Scholarship:** Caroline Reisinger

**Canadian Society of Plant Biologists Eastern Regional Director's Award:** Monika Jesionowska

**Parkinson Society Southwestern Ontario Scholarship:** Natale Porte-Trachsel

**Roche Molecular Biochemicals Award of Excellence:** Avery Robinson

**Donald R. Phillips MCB Scholarships:** Liam Doyle, Mark Minow

**Pharmacia MCB Graduate Award:** Karson Theriault

## University of Manitoba

Department of Biochemistry & Medical Genetics  
*Correspondent: Barbara Triggs-Raine*

### The 2020 virtual meetings and farewells:

Over the past year of remote interactions, we have continued to welcome new faces, and wish fond farewells to others as they took on new challenges and opportunities. **Dr. Britt Drögemöller**, Assistant Professor and Tier II CRC Chair in Pharmacogenomics and Precision Medicine joined our Department in April 2020, and to this day, awaits the chance to meet everyone in person! We wished a remote congratulations to **Dr. Gilbert Arthur** who retired in July 2020 after 33 years of service. Dr. Arthur will continue his work on new lipid-based approaches to cancer treatment as a senior scholar. We also had changes in office staff over the past year. We said good-bye to **Ms. Chloe Lepage** who decided to pursue new challenges. Chloe was a great support to our Department but we were delighted to welcome **Ms. Jasmine Brar** who jumped in and met the challenge even with a remote orientation!

### Celebrating outreach:

Efforts to develop a STEM Education Centre in Sierra Leone continued in 2020 under **Dr. Francis Amara's** stewardship, and in late 2020 the building was completed. Dr. Amara organized the funding to create this Centre, which will train science teachers while educating high school students. Dr. Amara expects many UM colleagues will become involved in teaching in Sierra Leone, an effort that will be enabled by their current experience

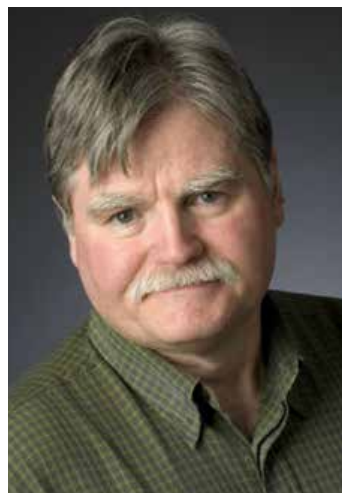


with on-line synchronous and asynchronous teaching.



STEM Education Centre in Sierra Leone

### Faculty awards and recognitions:



Dr. Michael Mowat retires as Professor Emeritus in Department of Biochemistry & Medical Genetics

In 2020, the University conferred the title of Professor Emeritus to **Dr. Michael Mowat**, who had a 35-year career as a cancer researcher in our Department working on tumour suppressor genes. Dr. Mowat is recognized for the high standard of scholarly activity that he demonstrated throughout his career, including seminal publications on the role of TP53 in tumour suppression and cell cycle. Dr. Mowat supervised more than

twenty graduate students and post-doctoral fellows and over 30 undergraduate students. Dr. Mowat continues to be actively involved in research and other scholarly activities.

In June 2020, we were excited with the news that two members of our Department, **Dr. Meaghan Jones** and **Dr. Pingzhao Hu** would share the Manitoba Medical Service Foundation Alan Rouse Basic Science Career Development Research Award! Dr. Meaghan Jones' award is for her project, "Breaking the Link Between Early Life Environment Exposures and Health." Her work focusses on the possibility that epigenetics may leave biological fingerprints in early life that impact our future



Dr. Meaghan Jones wins the MMF Alan Rouse Career Development Award

health. Dr. Pingzhao Hu's award was for his project, "Artificial Intelligence and Genomics-Driven Precision Oncology for Breast Cancer", work that is focussed on identifying novel genes and imaging biomarkers for precision oncology in breast cancer using innovative artificial intelligence approaches. In September 2020, **Dr. Pingzhao Hu** was awarded the Terry G. Falconer Memorial Rh Institute Foundation Emerging Researcher Award in the Interdisciplinary Category. This is awarded to a junior faculty researcher who has made Outstanding Contributions to Scholarship and Research in the Interdisciplinary Category at the University of Manitoba. What a successful year for Dr. Hu!



Dr. Pingzhao Hu wins both the MMSF Alan Rouse and the prestigious Terry G. Falconer Memorial Rh Award

In 2021, **Dr. Francis Amara** will become one of only a few basic scientists to be recognized by the Canadian Association for

Medical Education (CAME) with a Certificate of Merit Award, which recognized his significant contribution to medical education. Dr. Amara has major teaching commitments to the department and provides leadership to his colleagues in the development of new teaching tools and approaches. Several members of our department were also recognized by medical students for their significant contributions to teaching! Congratulations to genetic counsellor **Stephanie Clarke**, as well as **Drs. Francis Amara, Hao Ding, and Mojgan Rastegar** for being nominated by the Med Class of 2023 and/or 2022 for their Inspiration, Innovation, and Mentorship in teaching.

**Jessica Hartley**, Program Director for our M.Sc. program

in genetic counselling, was awarded a 2020 leadership development award through The Winnipeg Foundation's Martha Donovan Fund. She plans to enroll in a program focussing on health academic leadership. It was a big year for the M.Sc. in genetic counselling program as it went through its first full Accreditation Council for Genetic Counselling site visit in February of 2021. The program was accredited for six years, the maximum for a new genetic counselling program!

We were very proud of our researchers who continued to seek funding in this difficult year. **Dr. Tamra Werbowetski-Ogilvie** and her team were successful in the 2020 Spring CIHR Operating Grant competition for a project entitled "Novel therapeutic targets for Group 3 medulloblastoma stem cells." **Dr. Mark Nachtigal (with Drs. Gilbert Arthur, Frank Schweizer and Kirk McManus)** was successful in obtaining a grant from CancerCare Manitoba for "Studies on the mechanism of action of L-diamino-based glycosylated antitumor ether lipids (GAELS) for the treatment of high grade serous ovarian cancer". **Dr. James Davie** was part of a successful Canada-Japan CEEHRC CIHR Team Grant in Advancing Epigenetic Technologies aimed at developing artificial intelligence approaches to understand epigenetics in health. **Dr. Hao Ding** received funding from the University Collaborative Research Program to support studies of "The pathogenic role of microglial activation in PRUNE1 disease".

#### Future leaders:

Departmental trainees at all levels demonstrated their commitment to excellence and innovation in research, acquiring many provincial and national awards in 2020. Graduate student recipients included **Kailee Rutherford, Cassie McDonald, Dorothy Michalski and Natasha Osawa** (CIHR CGS-M); **Michaela Palmer** (NSERC M.Sc. Scholarship), **Khatereh Saei Arezoumand** (Research Manitoba M.Sc. Studentship); **Emily Barker** and **Katharine Chimney** (U of M Fellowship); **Claire Morden** and **Qian Liu** (Women's Health Research Foundation of Canada Graduate Scholarship), **Qian Liu** (Mindel Rady Olenick Fellowship in Human Genetics); **Yong Won Jin** (University of Manitoba President's Graduate Scholarship in Human Genetics).

Undergraduate students were also recognized with many research awards. B.Sc.Med. student **Nada El Tobgy**, working with Dr. Mojgan Rastegar, received the Norman and Margaret Corne Memorial Award for Excellence and

Outstanding Promise in Research during the first summer of the B.Sc.Med. program.

## University of Ottawa

### Department of Cellular and Molecular Medicine

Correspondent: Michael Downey

Since 2016 the Department of Cellular and Molecular Medicine has undergone a surge in recruitment. New hires have strengthened our department by bringing new technical expertise and a wealth of experience. These new hires reflect the diversity of research interests and approaches used within the department.

#### New faculty:



Yannick Benoît

**Dr. Yannick Benoît** – Dr. Benoît was recruited to CMM in 2017 following successful post-doctoral training at Weill Cornell Medical College (New York) and McMaster University. Dr. Benoît's research is focused on epigenetic regulation in human intestinal epithelium and colorectal cancers. Dr.

Benoît has hit the ground running, securing funding from diverse sources and building a fantastic research team operating out of renovated lab space in Roger Guidon Hall.



Daniel Coutu

**Dr. Daniel Coutu** – Dr. Coutu joined the Department in 2018 after successful post-doctoral studies at Helmholtz Zentrum München (Munich, Germany) and ETH Zürich (Basel, Switzerland). Dr. Coutu's research program at the University of Ottawa focuses on skeletal stem cells

for bone, cartilage, tendon and ligament regeneration. He is also interested in the development of new imaging technologies for studying diverse aspects of skeletal biology. Dr. Coutu makes a fantastic addition to a core of CMM researchers focussed on stem cell biology.

**Dr. Damien D'Amours** – Dr. D'Amours joined the department from the University of Montréal in 2017,



Damien D'Amours

expanding an already strong core of researchers at uOttawa making use of the budding yeast model system. As Canada Research Chair in Chromatin Dynamics and Genome Architecture, Dr. D'Amours focusses his considerable talents towards understanding the molecular mechanisms

governing cell cycle progression and the maintenance of genome stability. His most recent research at the University of Ottawa has been published in *PLOS Biology*, *Molecular Cell*, and *Cell Reports*. In 2019, Dr. D'Amours was appointed Associate Director of the Translational and Molecular Medicine program. TMM is a research-intensive undergraduate program that prepares students for graduate studies.



Suresh Gadde

**Dr. Suresh Gadde** – Dr. Gadde joined the department in 2020 after post-doctoral training at the University of Miami and Harvard University, and time as a Research Associate at the University of Ottawa since 2015. He will focus his research program on the development of nanotherapies for a variety

of diseases. We are confident that Dr. Gadde will make a fantastic addition to the department.



Arezu Jahani-Asl

**Dr. Arezu Jahani-Asl** – Dr. Jahani-Asl joins the Department of Cellular and Molecular Medicine in summer 2021 after 5 years at McGill University and the Lady Davis Institute for Medical Research. Her research program focusses on elucidating the molecular

mechanisms that regulate brain pathogenesis including neurological diseases and the rare brain cancer glioblastoma. Recent work from Dr. Jahni-Asl's group has been published in *Nature Communications*.

**Dr. Maxime Rousseaux**—Dr. Rousseaux completed his post-doctoral studies with Dr. Huda Zoghbi at Baylor College



Maxime Rousseaux

of Medicine, before being recruited to the Department of Cellular and Molecular Medicine. His research team is using high-throughput functional genomics to provide new insights into neurodegenerative disorders such as Parkinson's and ALS. Dr. Rousseaux holds the

Canada Research Chair in Personalized Genomics of Neurodegeneration.



Katalin Tóth

**Dr. Katalin Tóth** – Dr. Tóth joins the Department of Cellular and Molecular Medicine as a full Professor after 20 years at Université Laval. Dr. Tóth's research program at the University of Ottawa will investigate cell communication and signalling networks in the brain, with a focus on the

hippocampal network. Her research team will use a suite of animal models, advanced imaging, electrophysiology and computational modelling. Dr. Tóth is currently recruiting graduate students and post-doctoral fellows with experience in neurobiology research.

#### Retirements:



Dale Corbett

**Dr. Dale Corbett** – Dr. Corbett came to Ottawa in 2010 after 5 years at Harvard University and 25 years at Memorial University of Newfoundland. His research program focussed on stroke recovery with an emphasis on the therapeutic impact of exercise and pharmacological

interventions. With over 200 publications and nearly 16,000 citations over his career, Dale has undoubtedly left a strong mark on the field. As Professor Emeritus, he will continue to mentor new principal investigators in CMM and the Brain and Mind Research Institute at the University of Ottawa.

**Dr. Jean-Marc Renaud** – Dr. Renaud was a faculty member at University of Ottawa since 1991, with a



Jean-Marc Renaud

research focus on skeletal muscle fatigue, hyperkalemic periodic paralysis, skeletal muscle diseases, and muscle denervation. He has published over 82 papers and held funding from NSERC and CIHR for over 40 years. Dr. Renaud made seminal contributions to the field and to the research

community at the University of Ottawa. He served as director of the CMM graduate program for 15 years. As Professor Emeritus he is continuing his research and his collaboration with members of the Neuromuscular Disease Center.

**Other news:**

**Dr. David Park** has left the department, joining the Hotchkiss Brain Institute at the University of Calgary. Dr. Park was the inaugural director of the Faculty of Medicine’s Brain and Mind Research Institute, which brought together dozens of the University of Ottawa faculty focussed on basic and clinical research related to neurobiology and brain health. Replacing Dr. Park is **Dr. Ruth Slack**, who brings a wealth of leadership experience to this new position. We are confident that the Brain and Mind Research Institute is in excellent hands.

**Dr. Bernard Jasmin**, full Professor in CMM, was appointed to the Dean of the Faculty of Medicine in 2018. This appointment followed an interim appointment in 2017, and 8 years as Vice-Dean, Research. Dr. Jasmin continues to pull double duty, with an active research program focussed on neuromuscular disorders such as Duchenne muscular dystrophy (DMD). The role of Vice-Dean, Research has now been taken on by **Dr. Jocelyn Côté**, full Professor in CMM and a faculty member for over 15 years.

## University of Toronto

### Department of Biochemistry

Correspondent: Alex Palazzo

**Faculty news:**

This past year was a challenging one for the Biochemistry Department. Due to the pandemic, many of our departmental functions were cancelled, delayed, or moved online. Despite all these challenges, the faculty

and trainees learned to adapt to the new situations, and tasks that seemed impossible before the pandemic, such as delivering online courses, or conducting a faculty search. Here are some of the newsworthy events of 2020:



Lewis Kay

Our esteemed colleague, **Lewis Kay**, was elected to the National Academy of Sciences for his remarkable work on multidimensional NMR. This is a rare achievement, especially for a non-American working outside the U.S.

Together with the Krembil Foundation, Brain Canada awarded a Platform Support Grant (PSG) to a team spearheaded by **Liliana Attisano**. She will be receiving \$1,425,000 to support the Applied Organoid Core (ApOC), an organoid production platform for modelling human brain development and disorders.

**Julie Forman-Kay** and **Simon Sharpe** received more than \$1.6 million to build on the SickKids Structural and Biophysical Core (SBC) facility. These new funds will support critical enhancements to cutting-edge research, knowledge creation, and training across biology and biophysics, including immunogen design for improved vaccines; inhibition of multidrug-resistant bacteria; targeting cardiovascular diseases; and roles of phase-separation in neurological disorders and cancer.

**P. Lynne Howell** and **John Rubinstein** were awarded more than \$7.5 million for a project called the Single Particle CryoEM Analysis Project (SPaCEMAP), which funds new electron cryomicroscopy (cryoEM) equipment. CryoEM is now enabling determination of the atomic structures of molecules that have evaded traditional approaches.

**David Andrews** was selected as one of six investigators in the world to join the Novartis Institutes for BioMedical Research (NIBR) Global Scholars Program. The competitive program, which received over 700 proposals in 2020, includes funding of USD \$1M over three years and drug-hunting expertise from a dedicated NIBR scientific collaborator.

**Reinhart Reithmeier** was a member of an Expert Panel

convened by the Council of Canadian Academies on “*The Labour Market Transition of PhD Graduates*”. The key findings include:

- Ph.D. graduates bring valued skills to a wide range of sectors, although these skills are often not fully recognized outside academia
- The number of Ph.D. graduates in Canada is increasing, yet lags behind other OECD countries who have more robust R&D investment
- Ph.D. graduates face a period of precarious employment as post-doctoral fellows, sessional lecturers and contract employees
- The challenges faced by Ph.D. graduates have implications for wellness, and vary across academic disciplines and by gender
- Canada’s Ph.D. graduates are (and sometimes must be) globally mobile
- Academic culture must change and modernize to support diverse career paths
- <https://cca-reports.ca/reports/the-labour-market-transition-of-phd-graduates/>

The Graduate Professional Development (GPD) program at University of Toronto continues to lead innovative programming throughout 2020. Articles for 2020 include 1) the Canadian Science Policy Conference (CSPC) editorial “Training the next generation of scientists right now: challenges and suggestions” with Ph.D. students Ashton Trotman-Grant, Chloe Mitchell, 2) University Affairs “Pivoting Your Graduate Work During Covid-19” with Ph.D. students Alexa Fitzpatrick, Simoun Icho, Andrew Zhai, Yoojin Choi, and 3) Inside Higher Education’s Carpe Careers “Everyday tips for equity-minded scholars.”

The GPD course was expanded this year to the Institute of Medical Sciences by Yoojin Choi and Reinhart Reithmeier. In addition, the GPD course in Biochemistry and Immunology continued to be co-facilitated via the students-as-partners model by previous GPD students-turned-mentor Justin Pogmore, Nicholas Demers, Karina Baksh and Anthony Wong. The annual Higher Education Teaching Group Workshop Series also implemented a students-as-partners model with Chloe Mitchell, Nancy Amr Hamdy, Krishana S. and Michelle Dubinsky, bringing an unprecedented 30+ students in the virtual learning space. GPD course implementation also grew into the national Science to Business Academy and the University of Manitoba, facilitated by Andrew Tse, Sarah Turner and Mateo Tomczyk. Dr. Nana Lee also launched an

additional course called Design Thinking for Scientists which empowers graduate students to build skills for creative scientific solutions and entrepreneurship.

In January 2020, **Walid Houry** was the lead organizer for the Keystone Symposia conference on ‘AAA+ Proteins: From Atomic Structures to Organisms’ in Granlibakken Tahoe, Lake Tahoe, California.



Nana Lee

Selected speaking engagements for Dr. **Nana Lee** include: 1) Graduate Career Consortium Conference “Assessing the impact of curricular graduate professional development using complementary quantitative and qualitative measures” with Helen Miliotis, Rebecca Laposa, Yoojin

Choi, Reinhart Reithmeier, 2) CIHR Trainee Workshop for Canadian Student Health Research Forum (CSHRF), 3) Beyond Science Initiative Global Conference, 4) Korean Canadian Scientists Toronto Meeting, 5) Western University, 6) Women in STEM and 7) GPD Day at U of T Scarborough. She welcomes all educators and students to freely access her teachings at Temerty Faculty of Medicine GLSE YouTube GPD playlist. Her workshop for CSHRF will remain as a resource to all until July 2021.

### In Memoriam



Deborah Zamble

We want to acknowledge the untimely death of Prof. **Deborah Zamble** (1971-2020). She studied how bacteria sensed nickel and worked on the structure of nickel metalloproteins. Prof. Zamble was the recipient of numerous awards, including the Queen Elizabeth Diamond Jubilee Medal and an Alfred P. Sloan Research Fellowship, and a Canada Research Chair in Biological Chemistry (2001-2010). She served on the editorial boards of the Journal of Biological

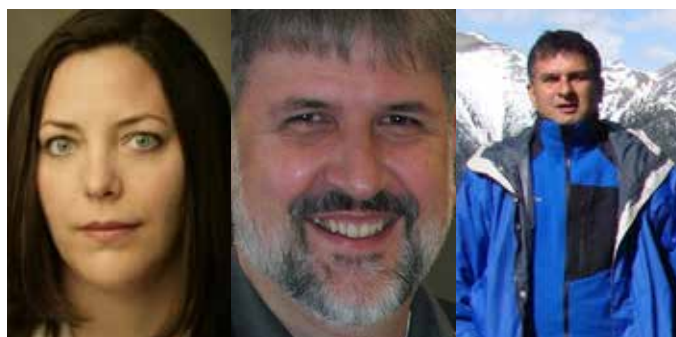
Chemistry, Metallomics, the Journal of Inorganic Biochemistry, and on the Board of the Royal Canadian Institute for the Advancement of Science. In 2018 she was elected to the Council of the Society of Biological Inorganic Chemistry. Although her primary appointment was in the Chemistry Department, Deborah was an active member of the Biochemistry Department, serving on the Graduate Committee, on many students' supervisory committees, and as a mentor to biochemistry graduate students. Deborah was sharp, enthusiastic, and always willing to lend a helping hand. She had a love of food and this was reflected in a course she taught in the chemistry department, *Science of the Modern Kitchen* (CHM 209H). We will miss her.

#### Awards:

**Karen Maxwell** was awarded the 2020 NSERC John C. Polanyi Award for her pioneering work investigating how bacteria like *Streptomyces* fight off phages by producing small molecules. This breakthrough not only reveals new biology about bacterial-phage interactions, but it also opens a new way to screen for drugs that could be useful for the treatment of human cancers and viral infections.

**Oliver Ernst** was the recipient of the 2020 Konrad Adenauer Research Award given out by The Humboldt Foundation. This award honours researchers from Canada whose fundamental discoveries and findings have helped shape their discipline beyond their immediate research area, and whose personality and research have contributed to strengthening academic and cultural relations between Germany and Canada.

**Alexio Muise** was awarded the Crohn's and Colitis Canada 2020 Research Leadership Award. The Muise lab has been performing ground-breaking work into the genetic causes of Inflammatory Bowel Syndrome and has published several important studies in the past few years.



Karen Maxwell

Oliver Ernst

Alexio Muise

**Greg Fairn** received the 2020 CSMB New Investigator Award. His lab has performed pioneering research in determining how membrane biochemistry, and organelle dynamics, affect cell physiology, especially in regulating vesicular trafficking, receptor signalling, phagocytosis, efferocytosis and host-fungal interactions.

**Tae Hun Kim**, a post-doctoral fellow in the Forman-Kay and Kay labs received the H.L. Holmes award in 2020, and the 2020 SickKids Andrew Sass-Kortsak award.

#### Promotions:

In 2020, **Jean-Philippe Julien** was promoted to Associate Professor and **Roula Andreopoulos** was promoted to Professor, Teaching Stream. Congratulations to them both!

#### Research highlights:

**Bogner C., Kale J., ... Andrews DW. Allosteric Regulation of BH3 proteins in Bcl-xL complexes enables switch-like activation of Bax. Mol Cell 2020 77:901-912**

The Andrews lab provide the first evidence that the complexes of Bcl-2 family proteins, which regulate mitochondrial outer membrane permeabilization and thereby cell death, are not necessarily dimeric. Instead, Bax binds a pre-existing membrane bound hetero-trimer consisting of a dimer of Bcl-XL and one tBid, promoting an allosteric change in the complex that lifts tBid away from the membrane enabling the bound tBid to activate Bax to kill the cell.

**Tsang, B., Pritišanac, I., Scherer, S.W., Moses, A.M., Forman-Kay, J.D., Phase separation as a missing mechanism for interpretation of disease mutations. Cell (2020) 183:1742-1756**

In this publication, a collaborative Toronto team spearheaded by Julie Forman-Kay put forward both general and specific hypotheses for how mutations in proteins with intrinsic disordered regions lead to pathology in complex diseases, particularly in autism spectrum disorder (ASD) and cancer.

**Palazzo, A.F, and Koonin, E.V. Functional long non-coding RNAs evolve from junk transcripts. Cell (2020) 183: 1151-1161**

Professor Alex Palazzo and his collaborator, Eugene Koonin from the NIH, have advanced a new theory on how biological complexity evolves. Most scientists assume that novel genes evolve as a direct consequence of natural selection, but Palazzo and Koonin present

evidence that a different process, called Constructive Neutral Evolution, or CNE for short, is likely responsible for the generation of novel non-coding RNA genes. Moreover, this process requires an overabundance of junk DNA that is transcribed into junk RNA.

**Yao, Z., Aboualizadeh, F. ... and Stgljar, I. Split Intein-Mediated Protein Ligation for detecting protein-protein interactions and their inhibition. *Nat Comm* (2020) 11: 2440**

The Stgljar lab developed a new technique, called Split Intein-Mediated Protein Ligation (SIMPL), where two test proteins are fused to two halves of intein, a protein that promotes “protein splicing”. When the two test proteins interact, the intein protein activates a splicing reaction, resulting in the fusion of the two test proteins.

**Lee, H., ... Taipale, M., Recognition of Semaphorin Proteins by *P. sordellii* Lethal toxin reveals principles of receptor specificity in Clostridial toxins. *Cell* (2020) 182(2):345-356.**

In this multi-lab collaboration, spearheaded by the Taipale lab (Molecular Genetics, UofT), and involving several labs in the Biochemistry Department (Melnyk, Julien and Rubinstein labs), a CRISPR/Cas9 screen was conducted to find the receptor of the *Paeniclostridium sordellii* lethal toxin (TcsL), which causes a highly lethal toxic shock syndrome associated with gynecological bacterial infections. They not only find that the receptor is the semaphorins SEMA6A and SEMA6B, but also solve a 3.3 Å cryo-EM structure and determine how this toxin is related to the *C. difficile* toxin, TcdB.

**Abbas, Y.M., Wu, D., Bueler, S.A., Robinson, C.V., and Rubinstein, J.L. Structure of V-ATPase from the mammalian brain. *Science* (2020) 367:1240-1246**

The Rubinstein lab reported the first high-resolution structure of a mammalian V-ATPase. These ATP hydrolysis-driven proton pumps are essential for acidification of endosomes, lysosomes, and the trans-Golgi network, as well as for acid secretion by osteoclasts, kidney intercalated cells, and some tumour cells.

**Schormann W, Hariharan S, Andrews DW. A reference library for assigning protein subcellular localizations by image-based machine learning. *J Cell Biol.* (2020) 219(3):e201904090.**

The Andrews lab acquired >1.2 million confocal micrographs of EGFP fusion proteins localized at key

cell organelles in murine and human cells from which morphology and statistical features were measured. Machine learning algorithms they developed that use these features to permit automated assignment of the localization of other proteins and dyes in both cell types with higher accuracy than human observers enabled the Andrews lab to study the targeting motifs in tail-anchored membrane proteins.

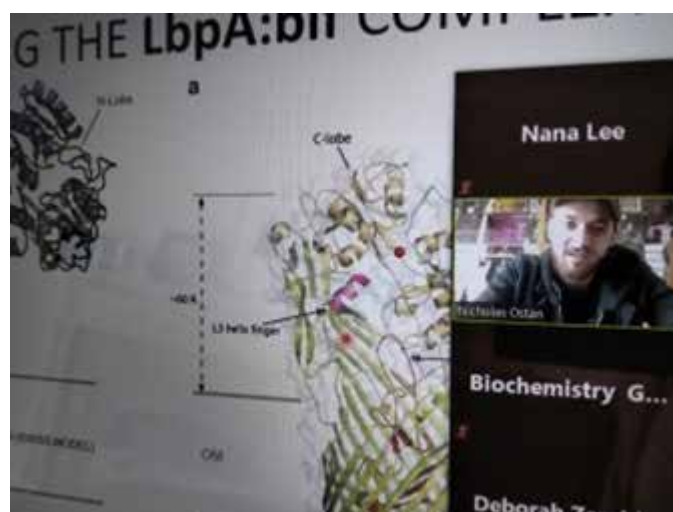
**Saraon, P., Snider, J., ... Stgljar, I. A drug discovery platform to identify compounds that inhibit EGFR triple mutants. *Nature Chem. Biol.* (2020) 16:577–586**

The Stgljar lab used the mammalian membrane two-hybrid drug screening (MaMTH-DS), a technique that they previously pioneered, to identify new compounds that inhibit the activity of oncoproteins that cause breast cancer. In this case they found four compounds that inhibit the dimerization of the epidermal growth factor receptor (EGFR), which is commonly mutated in non-small-cell lung cancers that have become resistant to conventional chemotherapeutic reagents.

#### Departmental events:

Due to the ongoing pandemic, many department-wide functions were either cancelled or switched to an online format. By March 25, our department was one of the first to move its student seminars online.

Although we had to cancel our annual departmental retreat, we had an online awards event on December 2<sup>nd</sup>, 2020 to celebrate the achievements of our students and post-doctoral fellows. Award recipients each gave



Online seminar delivered by Nicholas Ostan from Trevor Moraes' lab

a 10-minute presentation on their work. The awards included:

Connell Award for Top Graduate Student Publication of 2019: **Brandon McLeod** from Jean-Philippe Julien's lab  
David A. Scott Award: **Nick Demers** from Peter Kim's lab  
Centennial Award in honour of Sela Cheifetz: **Kathleen Orrell** from Roman Melnyk's lab  
Connell Award for Best All-Round Postdoctoral Fellow: **Eduarne Rujas** from Jean-Philippe Julien's lab

## University of Toronto

### Department of Cell and Systems Biology

Correspondent: Neil Macpherson

#### Research discoveries in CSB:

The **Guttman** and **Desveaux** labs collaborated on a monumental publication in February's *Science* investigating plant immunity against bacterial infection. In a study encompassing over 500 effector proteins from the bacteria *Pseudomonas syringae*, they identified novel instances of bacterial effectors triggering immune responses in the model plant *Arabidopsis*. They found that this defence system is surprisingly common in wild plants like *Arabidopsis*; further study could improve strategies to protect domesticated crops against pathogens.

An April publication in *Brain* from Dean **Melanie Woodin** and Prof. **Junchul Kim** showed that they could delay the onset of Amyotrophic Lateral Sclerosis (ALS) in mice. Their teams targeted SOD1\*G93A neurons in motor cortex with an engineered protein designed to correct cortical hyperexcitability. Suppressing hyperexcitability delayed the neuronal degeneration characteristic of ALS.



Witchweed

A *Nature Plants* article published in May by Prof. **Shelley Lumba** unearthed an unusual signalling pathway which causes the parasitic witchweed plant to germinate when it detects a potential host. Lumba's discovery will be crucial in the fight against witchweed infestation, which has devastating

effects on crop growth.

July saw the publication of a *PLoS Biology* study by Prof. **Jennifer Mitchell** which revealed changes in gene expression associated with term labour in mice. Mitchell, Prof. Oksana Shynlova, and CSB graduate students Virlana Schuka and Luis Abatti, identified epigenetic changes that modify DNA packaging and turn on specific genes in the days leading up to labour. Their research sheds light on how cells prepare to undergo contraction and how this process may occur prematurely.

An October *Genome Research* study from the **Calarco** lab revealed key features of alternatively spliced RNAs in the nematode worm *C. elegans*. Co-authors Bina Koterniak and Pallavi Pilaka recorded alternative splicing across different organs of *C. elegans*. They identified key regulatory features across worm species, suggesting that alternative splicing in vertebrates may act in a similar way.

Prof. **Daphne Goring** and new Ph.D. graduate Francis Lee demonstrated in *J Exp Bot* that two subgroups of receptor-like kinases promote early compatible pollen responses in the *Arabidopsis thaliana* pistil.

Prof. **Maurice Ringuette** revealed in *Dev Biol* that the predicted collagen-binding domains of Drosophila SPARC are essential for survival and for collagen IV distribution and assembly into basement membranes.

Enzymatic studies in the **Christendat** lab demonstrated in *Environ Microbiol* that QuiC2 represents a functionally distinct class of dehydroshikimate dehydratases identified in *Listeria* species including *Listeria monocytogenes*.

Prof. **John Peever's** lab found that activation of SLD neurons in both narcoleptic and normal mice promotes cataplexy, whereas SLD silencing prevents cataplexy, in a paper in *Current Biology*. This region of the brain therefore couples arousal state and motor activity during REM sleep and wakefulness. Prof. Peever dreams of helping Parkinson's patients by applying this new understanding of the SLD to tune their muscle tension during wakefulness.

Prof. **Mounir Abou-Haider** and collaborators showed in *Vaccine* that a bivalent HCV peptide vaccine elicits pan-genotypic neutralizing antibodies in mice.

**Faculty and staff recognized for innovation and service:**



In June 2020, Prof. **Melody Neumann** received the 2020 D2L Innovation Award in Teaching and Learning for her contributions in developing Team Up! – a free active-learning tool which allows students to collaborate with peers and solve problems in class. Team Up!’s innovative approach to promoting student engagement has been praised by instructors, particularly in large classes or online settings where instructor to student interactions are limited.

While Prof. Neumann’s innovative teaching strategies made waves in undergraduate courses, CSB’s Undergraduate Coordinator **Janet Mannone** was recognized for her commitment to undergraduate learning in November with the 35 Year Long Service Award from U of T. Mannone has years of experience helping CSB undergraduate students navigate educational paths and advising instructors to deliver excellent CSB courses and programs.

CSB’s Chief Administrative Officer **Tamar Mamourian** was also recognized for the 35 Year Long Service Award in November 2020. Mamourian’s expertise and commitment to excellence has been invaluable to CSB staff, faculty, and students, and she has guided us through the complicated procedures of closure and of reopening at reduced capacity.

Teaching Technician **Lisa Matchett** received double awards this year, with the Dean’s Award for staff members whose excellent contribution to technical services has improved teaching and research, and the USW 1998 Health & Safety Award for fostering and promoting health, safety, and environmental issues.

**Building excellence and community in CSB:**



*Nicholas Provart*

This experienced administrative team received a new Chair in 2020 with the appointment of Prof. **Nicholas Provart**. Provart’s deep knowledge of U of T began in his undergraduate years and continued with his professorial appointment in 2002 as part of the Department of Botany. Provart combines innovative computational analysis with wet lab techniques to produce novel research, for which he

was awarded the 2020 Clarivate Web of Science Highly Cited Researcher award. As the new CSB Chair, Provart will build on the Department’s academic excellence, encourage diversity and inclusivity, and promote science outreach to the community.



*Prof. Vincent Tropepe*

The previous Chair, Prof. **Vincent Tropepe** was appointed Vice-Dean, Research of the Faculty of Arts & Science. As Vice-Dean his main responsibility is to support and enhance the research mission of the Faculty, including funding for new faculty members, providing support for external research funding, managing the Canada Research Chairs in the Faculty, facilitating commercialization opportunities and providing oversight for the various research units within the Faculty.



*Prof. Jessica Pressey*

We are fortunate to have recruited neuroscientist Dr. **Jessica Pressey** to CSB as an Assistant Professor, Teaching-Stream. Prof. Pressey graduated with a Ph.D. from Dean Woodin’s lab in 2015 and completed post-doctoral research at INSERM’s Institut du Fer à Moulin in Paris, France. Her field of expertise is synaptic transmission, neuroplasticity, and brain development and as such she will be a valuable addition to CSB’s teaching programs.

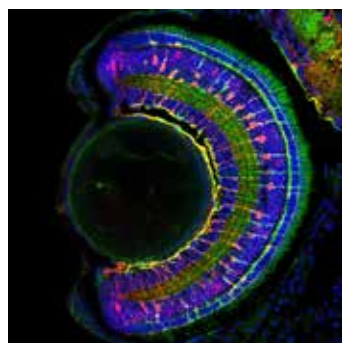
To mark December’s holiday of giving, graduate students in the CSB held an online gathering and raffle. Prizes were drawn, and over \$800 was raised for the CHUM FM Christmas Wish Toy Drive. On behalf of the department, the Chair stepped up to double this donation for the Toronto Food Bank. Despite this year’s trials, CSB graduate students ended 2020 by connecting with one another and giving back to the community.

In Memoriam  
We were sad to hear of the passing of CSB’s Prof. Emerita

**Betty Ida Roots**, Prof. Emeritus **Stephen Tobe** and Prof. Emeritus **Mike Barrett**. Please follow the links on their names to read more about the legacy they leave to science.

#### Awards for pursuing innovative research:

Prof. **Alan Moses** has been renewed for his position as Canada Research Chair, recognizing that he will be leading further advances in his field. He is working to decrypt the pattern behind the enigmatic “intrinsically disordered” regions (IDR) within proteins. Moses’ lab makes testable predictions about the function of residues within IDR by examining the overall qualities retained by these regions during evolution.



A zebrafish eye

Vice-Dean **Vincent Tropepe** has received funding from Fighting Blindness Canada to conduct research using zebrafish to study Usher syndrome, a genetic condition that results in hearing and vision loss. The Tropepe lab will characterize the subcellular defects that underscore photoreceptor degeneration, identify protocadherin-binding proteins to reveal novel mechanisms for photoreceptor maintenance, and catalogue the different forms of protocadherin to identify ones that will prevent retinal degeneration as a potential gene therapy.

CSB Prof. **Sergey Plotnikov** has been awarded XSeed funding to identify protein targets that can accelerate wound healing. The XSeed program catalyzes cross-disciplinary partnerships between investigators from the Faculty of Applied Science and Engineering and other faculties. The team will investigate how talin, a core protein in focal adhesions, allows cells to move to the site of an injury, thereby closing the wound.

Dr. **Ian Tobias** was awarded a Provost’s Post-doctoral Fellowship to study how development of stem cells differs between species, in Prof. Jennifer Mitchell’s laboratory. Tobias will determine how enhancer-bound transcriptional activators have changed as animals evolved into different species, and how this affects stem

cell differentiation.

Ph.D. student **Miranda de St.-Rome** of Dean Woodin’s lab was awarded a CIHR Frederick Banting and Charles Best Canada Graduate Scholarship, honouring and recognizing her hard work and academic merits.

We look forward to making 2021 another year of stunning discoveries and outstanding service!

## University of Toronto

### Department of Molecular Genetics

Correspondent: *Barbara Funnell*

The Covid-19 pandemic is an unprecedented event in our lifetimes and, as with all universities and research institutions world-wide, has been and continues to be the biggest challenge we face. Following a complete shutdown in March 2020, the campus and hospital nodes resumed research activities in June at reduced capacity. We continue to operate in this way, with physical distancing, masks and proper PPE, and disinfection protocols essential to our fight against Covid-19.

#### Leadership transitions in Molecular Genetics:

There are several recent leadership changes in the Department. **Dr. Leah Cowen** has stepped down as Chair to become the University of Toronto’s Associate Vice-President, Research. **Dr. Timothy Hughes** has assumed departmental leadership as Interim Chair. **Cheryl Shuman** has retired as the Director of the Genetic Counselling M.Sc. Program, a role she has held since 1998 when the program began. We applaud her exemplary service to the development and continued strength of the program. We welcome **Stacy Hewson**, a Genetic Counsellor who specializes in metabolic genetic disorders, as the new GC Program Director.

#### Welcome to new faculty:



Dr. Hartland Jackson

**Dr. Hartland Jackson** is an Investigator at the Lunenfeld-Tanenbaum Research Institute (LTRI) and Associate Scientist in the Ontario Institute for Cancer Research (OICR). He joined the Department as an Assistant Professor in July 2020. He completed his Ph.D. in Medical Biophysics at U of T, and his



*Dr. Brian Kalish*

*Dr. Rafael Montenegro Burke*



*Dr. Jüri Reimand*

*Dr. Ji-Young Youn*

post-doctoral training in Quantitative Biomedicine at the University of Zurich. Research in the Jackson lab involves the use of mass cytometry for highly multiplexed imaging of tumour tissues, and the development of methods for the analysis of spatially-resolved single cell data.

**Dr. Brian Kalish** is a Neonatologist and Scientist-Track Investigator at the SickKids Research Institute, and joined the Department as an Assistant Professor in January 2021. He received his M.D. and did his post-doctoral training at Harvard Medical School. His research program seeks to understand how pregnancy and early life experience shapes neurodevelopment and plasticity. The Kalish lab leverages cutting-edge molecular neuroscience and genomics to address fundamental questions at the intersection of neurodevelopment and reproductive biology.

**Dr. Rafael Montenegro Burke** joined the Department as an Assistant Professor in September 2020, in the Donnelly Centre for Cellular & Biomolecular Research. He trained at Vanderbilt University for his Ph.D., and at the Scripps Research Institute in California for post-doctoral work. His lab studies global metabolic changes and maps new metabolites in different pathways using mass spectrometry and bioinformatic methods. His research focusses on the development of strategies for novel metabolite characterization, and their impact on cell function in health and disease.

**Dr. Jüri Reimand** is an Investigator at the Ontario Institute for Cancer Research (OICR), and joined the Department as an Assistant Professor in March 2020. He completed his Ph.D. in computer science at the University of Tartu, and his post-doctoral training at the Donnelly Centre with Gary Bader. His lab focusses on computational biology and cancer research; they design statistical and machine-

learning methods to analyze complex multi-omics datasets of many cancer types. The goal is to discover driver mechanisms of disease, pathways and networks, and innovative biomarkers, by jointly analyzing datasets through the central dogma of molecular biology.

**Dr. Ji-Young Youn** is a Scientist in the Molecular Medicine Program at the SickKids Research Institute. She joined the Department as an Assistant Professor in July 2020. Ji-Young is a MoGen alumna; she received her Ph.D. with Brenda Andrews at the Donnelly Centre, and did post-doctoral training with Anne-Claude Gingras at the Lunenfeld-Tanenbaum Research Institute (LTRI). Her lab studies biomolecular condensates that organize subcellular systems and govern their ability to deal with stress. Using proteomics, genomics, and cell biological tools, her team investigates their organization, dynamics, and function. This work provides novel strategies to understand and treat neurodegenerative disorders, cancer and infectious diseases.

#### **Faculty highlights and awards:**

**Dr. Brenda Andrews** and **Dr. Lewis Kay** were elected to the **U.S. National Academy of Sciences** as international members in 2020. Dr. Andrews, a University Professor, is a Professor in Molecular Genetics, and former and founding Director of the Donnelly Centre for Cellular and Biomolecular Research. Dr. Kay, a University Professor, is Professor of Molecular Genetics, Chemistry and Biochemistry at U of T, and a senior scientist at SickKids Research Institute.

**Dr. Anne-Claude Gingras** was elected an **EMBO Associate Member in 2020**, in recognition of her remarkable achievements in Life Sciences. Work in the Gingras lab develops and applies experimental and computational proteomics approaches for the discovery of protein-

protein interactions and subcellular organization in vertebrates.

**Dr. John Dick** has been elected to the **National Academy of Medicine (NAM)**, which is one of three academies that comprise the National Academies of Sciences, Engineering, and Medicine in the U.S. John is globally recognized for his discovery of and study of leukemia stem cells, contributions that have helped shape the understanding of cancer and reveal new strategies for curing the disease.

**Dr. Leah Cowen** has been elected a **Fellow of the American Association for the Advancement of Science (AAAS)**. She was recognized for “distinguished contributions in the field of microbial genomics, particularly for using functional and chemical genomic analyses to identify vulnerabilities in fungal pathogens”.

**Dr. Howard Lipshitz** has been appointed the new **Editor in Chief of *Genetics***, the flagship journal of the Genetics Society of America, effective January 2021. Howard is a Professor and former Chair of the Department, where his current research focusses on post-transcriptional regulation of gene expression in *Drosophila*.

**Dr. Scott Gray-Owen** has received a **Minister of College and Universities’ Award of Excellence** for his extraordinary contributions to the COVID-19 response in Ontario. The Gray-Owen lab used the CL3 high-tech containment lab to test the efficacy of an antimicrobial coating for face masks developed by Quebec company I3 BioMedical Inc. He found the coating deactivated more than 99 per cent of the virus that causes COVID-19 within minutes, greatly reducing the risk that health-care workers could be exposed to the virus by touching and adjusting their masks.

**Dr. James Ellis** and **Dr. Stephen Scherer**, alongside SickKids researchers Dr. Seema Mital, Dr. Binita Kamath, Dr. Norman Rosenblum and Dr. Steve Prescott, are winners of the **Janet Rossant Research Innovation Prize in 2020**. The team was honoured for their work generating a high-quality resource of versatile induced pluripotent stem cell (iPSC) lines for use in disease modelling studies. The Janet Rossant Research Innovation Prize was launched in 2018, and is named in honour of Dr. Janet Rossant, Senior Scientist and Emeritus Chief of Research of SickKids and Professor of Molecular Genetics.

#### **Canada Research Chairs:**

Four faculty members from Molecular Genetics were awarded Canada Research Chairs in 2020:

**Dr. Kieran Campbell** - Tier 2 Canada Research Chair in Machine Learning in Translational Biomedicine.

**Dr. Timothy Hughes** - Tier 1 Canada Research Chair in Decoding Gene Regulation.

**Dr. Hartland Jackson** - Tier 2 Canada Research Chair in Systems Pathology.

**Dr. Julie Lefebvre** - Tier 2 Canada Research Chair in Developmental Neural Circuitry.



Jhenielle Campbell

Madeline Beer

#### **Trainee Awards:**

**Jhenielle Campbell** and **Madeline Beer** are the inaugural recipients of the **David Dime Family Catalyst Fund - Catalyzing the Talent Pipeline Scholarships**. Jhenielle has joined the Navarre lab, and Madeline has joined the Claycomb lab, for their graduate studies in Molecular Genetics. This new scholarship is generously supported by the family of the late Dr. David Dime. David was the founder of Toronto Research Chemicals, which he started in 1983 in a small space on the 4th floor of the Medical Sciences Building. Together with his wife, Elisa Nuyten, and his children, Julian, Sophia, and Camille Dime, he established this Catalyst Fund to support innovative and exploratory research and training in the Department of Molecular Genetics.



Nicole Liang

**Nicole Liang** has been awarded the **Jane Engelberg Memorial Fellowship** for her project: “Next Generation Sequencing-based Newborn Screening: Parental Preferences for Identifiable Target Conditions”. Nicole is a 2nd year M.Sc. student in the Genetic

Counselling Program. The Jane Engelberg Memorial Fellowship (JEMF), established in 1991 is a highly prestigious award of the National Society of Genetic Counselors.

Molecular Genetics also has several competitive awards and fellowships, given annually or biannually to our graduate students. Congratulations to all recipients! They are:

- Kali Iyer** (Cowen lab): L.W. MacPherson Award
- Danica Chaharlangi** (Navarre lab): Roman Pakula Award
- Francesco Zangari** (Gingras lab): Norman Bethune Award
- Nicola Case** (Cowen lab): Eric Hani Fellowship

#### Staff awards:



*Kwame Diko*

**Kwame Diko** has been awarded a **Staff Impact Award in the Temerty Faculty of Medicine**. Kwame joined our administrative team as Student Services Assistant in November 2019. He received the **2020 New Employee Award** in recognition of

his outstanding contributions in supporting students and faculty to overcome the challenges associated with remote learning. Shortly after starting in his role, he quickly engaged with the department's community and demonstrated innovation and initiative in responding to the high volume of curriculum inquiries in a timely manner and improving communication with students.

#### Community and education updates:

Despite the pandemic, we continued to hold our community and education events in Molecular Genetics in 2020, transitioning to online presentations, such as with our graduate student seminar series, meetings, and social gatherings.

**The 5th MoGen Career Development Symposium** was held on Monday, June 15, 2020 on Zoom. We invited over 30 alumni as mentors from around the globe for the event. Six mentors agreed to be featured in short video interviews that we posted for the participants: Dr. Jennifer Cao, Scientist (Biomarkers), Gilead Sciences; Dr. Joby McKenzie, Managing Director, Babylon Health Canada; Dr. Jonathan Millman, Assistant Section Head,

Ontario Centre of Forensic Sciences; Dr. Rebecca Shapiro, Assistant Professor, University of Guelph; Dr. Jeff Sharom, Senior Policy Advisor, Ontario Ministry of Health; and Dr. Vanita Sood, Global Head of Drug Disposition & Design (3D) at EMD Serono, Inc.

The afternoon included three round-table discussions in which alumni were "seated" in breakout rooms with small groups of trainees. These discussions were followed by two "focussed learning" sessions, presenting career skills to our trainees: "Optimizing your LinkedIn profile" by Dr. Amanda Veri, and "Connecting the Dots: Expanding and Optimizing Your Network" by Dr. Bruce Seet. The event was very well attended; over 180 of our trainee, faculty, and alumni community participated in the symposium. It was an unqualified success.

#### M.H.Sc. in Medical Genomics program update:

The Medical Genomics program is now in its third year, and our Year Two students recently started their semester-long practicum placements. The Medical Genomics program has partnered with sites throughout Ontario (and the world) enabling students to work with leaders in genomics research, diagnostics, and policy.

Despite the global pandemic, the number of positions available to students has more than doubled since last year. The most popular positions for the Class of 2021 involve genomic variant analysis and bioinformatics. A number of students are also engaged in projects focussing on policy, strategic planning and commercial development related to genomics. The program established a number of exciting new placements this year, including Canada's Genomics Enterprise & The Centre for Applied Genomics, Illumina Canada, The Centre for Computational Medicine and many more!

#### Equity, Diversity, and Inclusion in Molecular Genetics:

The Molecular Genetics Graduate Student Association's (GSA) new Equity, Diversity, and Inclusion (EDI) Committee aims to represent the graduate students' priorities, as well as invoke thoughtful conversations regarding EDI-related issues within the department and our communities. The GSA stands in solidarity with the Indigenous, Black and racialized communities fighting for social justice in Canada, the U.S., and internationally. The goals are to raise awareness in our own department. For example, the GSA initiated a Land Acknowledgement series at student seminars. Participating in land acknowledgement is a

way to recognize the enduring presence and resilience of Indigenous peoples in this area for time immemorial.

## University of Toronto Mississauga

### Department of Chemical and Physical Sciences

*Correspondent: Voula Kanelis*

The department of Chemical and Physical Sciences (CPS) at the University of Toronto Mississauga (UTM) is excited to welcome **Dr. Alana Ogata** (<https://www.utm.utoronto.ca/cps/people/alana-ogata>), who will develop single-molecule bioanalytical sensors for detection of disease. Dr. Ogata joins the growing biological and bioanalytical focussed groups in CPS, highlighted below.

The **Kanelis** group continue to make advances in the structural biology of ABC transporters, having recently published their cryo-EM structure of Ycf1p, which at the time of publication was the most complete model of a monomeric ABCC protein. **Sarah Bickers** presented her work at the 8<sup>th</sup> FEBS Special Meeting for ABC Proteins in Austria in March 2020, where she was awarded the “ABC2020 Young Investigator Award for Best Poster Bullet Presentation”. As part of the award, she had the opportunity to ride in a bobsled with members of the Austrian Olympic Bobsled team – a rare opportunity indeed and a great prize. Congratulations Sarah! Congratulations also go to **Jonathan Sayewich** who completed his M.Sc. degree in April 2021. Dr. Kanelis continues to direct the Amgen Biotechnology Experience (ABE) along with her colleague Dr. Chatfield (Biology). Although COVID-19 presented challenges in bringing the program into schools, ABE@UTM adopted the LabXChange platform and thus was able to provide virtual ABE labs to students across the GTA and beyond.

**David McMillen’s** laboratory hosted an M.D./Ph.D. student from the University of the Philippines, who extended and refined previous work in the lab to produce an engineered yeast surface display system capable of detecting malaria antibodies in blood samples, and displaying yes/no results through visible differences in agglutination of the cells. **Dr. Cruz’s** successful tests show promise for development into a low-cost, yeast-based blood testing system, and she recently defended her Ph.D. thesis, putting her a few revisions away from completing her M.D./Ph.D. programme! The lab received CIHR funding to extend this same approach to the detection of COVID-19 antibodies, and they are working

on ironing out some bugs in the surface display levels for antigen targets.

Congrats to **Jacob van Reet** and **Keith Taverner** from **Scott Prosser’s** lab, who graduated in spring 2020! Keith marked the occasion with a drive across Canada back to his native B.C., though he is remotely working with the group to finish a few papers. Jake also hopes to move west once the pandemic settles down a bit. The rest of the lab have been eking out experiments (remotely at least), writing papers, and perfecting the art of Zoom virtual backgrounds.

**Sarah Rauscher** and colleagues continue their research in the development of accurate and efficient simulation methods to study protein dynamics in all-atom detail. Please see <https://rauscher-group.physics.utoronto.ca> for more information and recent papers.

**Jumi Shin** and colleagues made it through a year of Covid. They published two papers: one describes their latest designer protein that targets the E-box DNA sequence involved in >50% of cancers (doi/10.1021/acschembio.0c00684) and the other is a how-to guide for continuous evolution (doi/10.1021/acsomega.0c03508). They are also designing minimalist proteins (50-90 aa) that target much larger DNA sites comprising 28-40 bp and which could be used for synthetic biology applications. **Duan Tan** completed his M.Sc. in Chemistry, and **Raneem Akel** succeeded in a challenging first year and is moving into the Ph.D. stream.

Please check out <https://www.utm.utoronto.ca/cps/people/faculty> to learn about the pioneering work of the groups of **Andrew Beharry** and **Patrick Gunning**

## University of Toronto at Scarborough

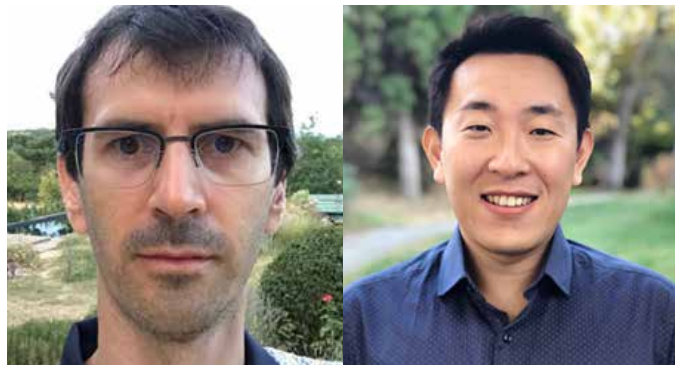
### Department of Biological Sciences

*Correspondent: Rongmin Zhao*

#### Department highlights in the past year:

The interests and expertise of the faculty in our department cover the full breadth of biology, from the molecular and cellular details of development, metabolism and disease, to the physiology and behaviour of organisms, and the ecology of populations and ecosystems. Our faculty maintain very active research activity and have been supervising most of the graduate students on campus.

Our graduate students are enrolled in graduate programs from the Departments of Cell & Systems Biology, Ecology and Evolutionary Biology at the St. George campus, or the Department of Environmental and Physical Sciences at the Scarborough campus. Despite only minimal on-campus activity in the past year, we still made a significant achievement. Led by the department chair, **Dr. Andrew Mason**, an external review on our research programs, initiatives, undergraduate programs, and potential complement plans was conducted, including a virtual campus visit by the review committee. An overall review of the department can be found at <https://www.youtube.com/watch?v=KYB2bDAIqyk>



Guillaume Filion

Yan Wang

**New faculty appointments:**

**Dr. Guillaume Filion** recently joined the department with part of his previous research team from Spain; he works in Computational Genomics & Epigenomics. Dr. Filion has a long-standing interest in the regulation of gene expression. He studies how HIV is detected and shut down by the genome of the host, and how regulatory networks are modulated by chromatin. He also develops high-throughput technologies and dedicated algorithms to study these processes at a genome-wide scale.

**Dr. Yan Wang**, another member working in Computational Genomics with a focus in Evolutionary Genomics, also joined the department. The Wang group studies the genomic evolution of microbial fungi and their intimate interactions with symbiotic partners. His laboratory uses insects and gut-dwelling fungi as the model to study adaptation, evolution, horizontal gene transfer, and host specificity, by integrating modern genomic approaches with traditional phylogenetic methods.

**Dr. Minoru Koyama**, another recent hire, is a neuroscientist interested in the neuronal basis of behavioural development. His lab uses advanced optical and genetic techniques in zebrafish to reveal neural circuit designs that enable animals to develop increasingly complex behaviours after birth.

Lastly, **Dr. Cosima Porteus** joined us most recently as a comparative physiologist. The focus of her laboratory is to understand how fish sense, interact with and respond to their environment, linking environmental changes or challenges to whole animal physiology, behaviour and ecology.

**Faculty and graduate student achievements:**

It has been very successful for many of our faculty in



The Guzzo group's Biosafety Level 3 research facility

Because most in-person activities were moved online, it has been a good opportunity for us to renovate some critical research and teaching facilities. Some of the core facilities in the heavily used and shared Centre for the Neurobiology of Stress have been well-renovated. A Biosafety Level 3 research facility has been built and established, particularly for the HIV research currently led by

**Dr. Christina Guzzo**. Her team investigates the molecular mechanisms of HIV-1 control and pathogenesis, with the goal of identifying new vulnerabilities of the virus that may lead to novel targets for therapy and prevention.



Christina Guzzo



Minoru Koyama



Cosima Porteus

2020. **Dr. Maydianne Andrade** has been elected to the American Academy of Arts & Sciences. **Dr. Aarthi Ashok** was promoted to full Professor and was also a recipient of the President’s Teaching Award of the year. **Dr. Nick Mandrak** won the Principal’s Research Award, in recognition of his outstanding and influential contributions to biodiversity and conservation.

Our graduate students also made great achievements. **Nicholas Guilbeault** from the Thiele lab won the Vietnamese Canadian Community Graduate Award in Zoology. **Laxsha Thaya** from the Guzzo lab won the Duncan L. Gellatly Memorial Fellowship in Virology Research. **Ahmad Israwi** from the Nash lab received the Alfred and Florence Aiken and Dorothy Woods Memorial Graduate Scholarship. **Yi-Ting Jeff Chen** from the Gonzales-Vigil group, which works on plant very long fatty acids, received a Valerie Anderson Award and the Joan M. Coleman Ontario Graduate Scholarship. Particularly, **Laabiah Wasim** from the Treanor group received the Ian Brown Graduate Paper Award in the category of Cellular and Molecular Biology, and Physiology. This award was specifically named in memory of Dr. Brown who passed away in 2020. He was a Professor at the Scarborough campus from 1971 and had been very active in neuroscience research for nearly 50 years.

## University of Waterloo

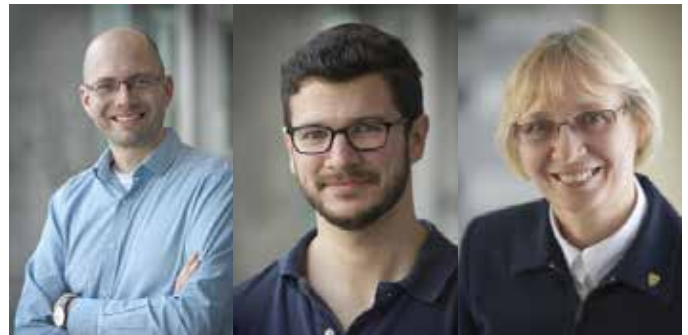
Department of Biology

Correspondent: *Bernie Duncker*

### Faculty news:

As for everyone else, 2020 was a year of challenges and disruptions for researchers in the Biology Department at the University of Waterloo, with many labs shut down from March through July, and covid safety-related

limitations in place before most research activities had resumed. That said, 2020 did produce some success stories worth celebrating. **Josh Neufeld** was named a member of the Royal Society of Canada’s College of New Scholars, Artists and Scientists, while **Andrew Doxey** and **Zoya Leonenko** were appointed as UW University Research Chairs. We also expressed our gratitude to **Hugh Broders** for his leadership as Department Chair over the past four years, with **Kirsten Muller** taking the reins in January 2021.



Josh Neufeld

Andrew Doxey

Zoya Leonenko

### Student news:

Our students once again did us proud, being recognized for their excellence on multiple fronts. Our **iGEM** (International Genetically Engineered Machine) team received Gold standing, and their initiative on recovering heavy metals from wastewater also received the award for best Manufacturing Project at the undergraduate level. **Matthew Schmitz** was named the Alumni Gold Medal Winner for having the highest cumulative undergraduate average for the Faculty of Science 2020 graduating class. Ph.D. candidate **Nikhil George** was the recipient of the Ambassador Award from the Canadian Society of Microbiologists, while Ph.D. student **Spencer Weinstein** won a prestigious NSERC Vanier Scholarship.



Nikhil George

Spencer Weinstein



### Retirements:

Finally, as 2020 came to an end we paid tribute to long-serving Microbiology Faculty Lecturer **Barbara Butler**, who started in the UW Biology Department as an undergraduate student in the early 1970s and has been with us ever since.

## Western University

### Department of Biochemistry

Correspondents: *Greg Gloor, Lynn Weir*

### Faculty news:

The following faculty members obtained national and provincial funding for research: **Chris Brandl** (NSERC Discovery Grant), **Ilka Heinemann** (Rare Diseases Network Catalyst Grant), **Bogumil Karas** (NSERC RTI Grant), **Gilles Lajoie** (CFI JELF; NSERC Discovery Grant), **Shawn Li** (Canadian Cancer Society Innovation Grant; Ontario Government COVID-19 Funding; NSERC RTI Grant), **David Litchfield** (NSERC Discovery Grant), **Caroline Schild-Poulter** (CIHR Project Grant), and **Gary Shaw** (Heart & Stroke Foundation Grant-in-Aid of Research).

Several faculty also received awards in recognition of their accomplishments in research and service: **Chris Brandl**, Emeritus Professor (Faculty Award of Excellence - Lifetime Achievement Award, Schulich School of Medicine & Dentistry, Western), **Murray Huff** (The Mentor of Women Award, American Heart Association), and **Marlys Koschinsky** (Canadian Academy of Health Sciences Fellow).

**Dervla Connaughton** (primary appointment in Medicine) was cross-appointed to Biochemistry.

**David Edgell**, **Greg Gloor**, and **Bogumil Karas**, along with graduate students **Sam Slattery** and **Daniel Giguere**, were featured on Western's website for the development of a COVID-19 test kit. David also talked on the CTV News Network about creating an antibody test for COVID-19. **Rob Hegele** discussed using DNA technology to combat strokes and heart attacks (YouTube video). **Murray Huff's** research on nobiletin, a compound that reduces obesity in mice, was featured on Western's website. **Shawn Li** was interviewed on CBC Radio's London Morning about rapid testing for COVID-19. **Peter Rogan** was interviewed on Scientific Sense for modelling COVID-19 transmission through the lens of geostatistical sampling.

**Nileeka Balasuriya** (former trainee), **Shawn Li**, **Pat O'Donoghue**, and colleagues, published in *J Biol Chem* regarding phosphorylation of AKT1. Accolades include Editor's Pick (top 2%); on the front cover; and viewed 1044 times online, placing it among the top 50 most-viewed papers for May to June.

**David O'Gorman** was part of a study team who researched biomarkers for the prognosis and diagnosis of COVID-19. They published 5 papers in *Critical Care Explor* and *Intensive Care Med Exp*.

### Trainee accomplishments:

The following trainees received awards: **Benjamin Joris** (Dean's Research Scholarship), **Jeremy Lant** (CIHR Silver Award, Canadian Student Health Research Forum; **Dr. Bishnu D. Sanwal** Graduate Performance Award, Biochemistry), and **Julieta Lazarte** (Cobban Student Award in Heart and Stroke Research, Schulich School of Medicine & Dentistry, Western). **Britney Messam**, **Tasnim Reza**, and **Shanshan (Jenny) Zhong** received Translational Breast Cancer Research Unit Traineeships (London Health Sciences Centre).

### Retirements:

**Murray Huff** retired this year to become an Emeritus Professor in the Departments of Biochemistry and Medicine. We gratefully acknowledge his contributions to the department.

**Barb Green**, Graduate Program Assistant, retired after 40 years of service. She received the Staff Award of Excellence (Spirit Award) from the Schulich School of Medicine & Dentistry at Western, and we thank her for her hard work, loyalty, and commitment. We welcomed **Rachel Garcia**, our new Administrative Assistant in the fall.

# CSMB-Sponsored Events 2020

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## **Graduate events**

The CSMB provides financial support to graduate student societies for a variety of activities related to biochemistry, molecular biology, cell biology or genetics. Examples of supported activities include (but are not restricted to) the following:

**Scientific Symposium Days**, with invited scientists speaking on subjects in the areas of biochemistry, molecular biology, cell biology or genetics.

**Student Research Conferences**, where students display their research as posters, or give oral presentations.

**Career Fairs or Career Workshops** in areas related to biochemistry, molecular biology, cell biology or genetics.

*The society will support **up to six** events each year, to a **maximum of \$500** per event, on a competitive basis. Student organizations seeking financial support under this program should contact the society Secretary with a short description of the planned event, and the amount of funding requested. The request should also include a Regular Member of the Society as a Sponsor/Coordinator, working with the Student Organization. Requests will be accepted twice each year (up to 3 possible awards for each competition), with deadlines of **February 15** and **September 15**.*

Several trainee-led activities were funded by the CSMB for the year 2020. Unfortunately, most of them had to be cancelled due to the pandemic, and will likely be offered in 2021, either in-person or online. One enterprising group immediately pivoted to an online format, see below, which was highly successful. We congratulate them on this achievement!

## **University of Toronto Toronto RNA Enthusiasts' Day (TRENd)**

First, the Toronto RNA Enthusiasts' Day (TRENd) Organizing Committee would like to thank the CSMB again for supporting our symposium. We appreciate your support, which helped us transition our event to an online format this year.

TRENd is a student-led and trainee-focussed symposium based at the University of Toronto which aims to bring together RNA biologists to network and share their amazing science. The event is organized by graduate students at the University of Toronto across mul-

ti-ple departments within the Faculty of Medicine, along with faculty members Dr. Julie Claycomb and Dr. John Calarco.

In past years, TRENd was a day-long event held in downtown Toronto. However, since we could not hold TRENd in-person this year, we took the opportunity to move our event online and expand our reach outside Canada and the United States. Over 200 people registered for our event, which was held over Zoom across two afternoons, July 29 and 30, 2020. We succeeded

# CSMB-Sponsored Events 2020



in making our event world-wide, as trainees and scientists tuned in from not only Canada and the United States, but also from Europe, South America, and Australia!

Our programming featured great talks from a total of 14 graduate students and post-doctoral fellows from Toronto, Montréal, Laval, Vancouver, New York, Maryland, Massachusetts, and even Paris! We also had a fantastic keynote presentation from Dr. Laura Landweber, a professor at Columbia University; and an educa-

tional seminar on publishing from Dr. April Pawluk, a scientific editor at Cell Press. Despite not being able to interact in-person, our attendees really engaged with our presenters, asking lots of questions and talking about our event on Twitter.

The TREnD Organizing Committee is proud to have been able to foster really interesting discussions about RNA biology this year despite the less than optimal circumstances.



