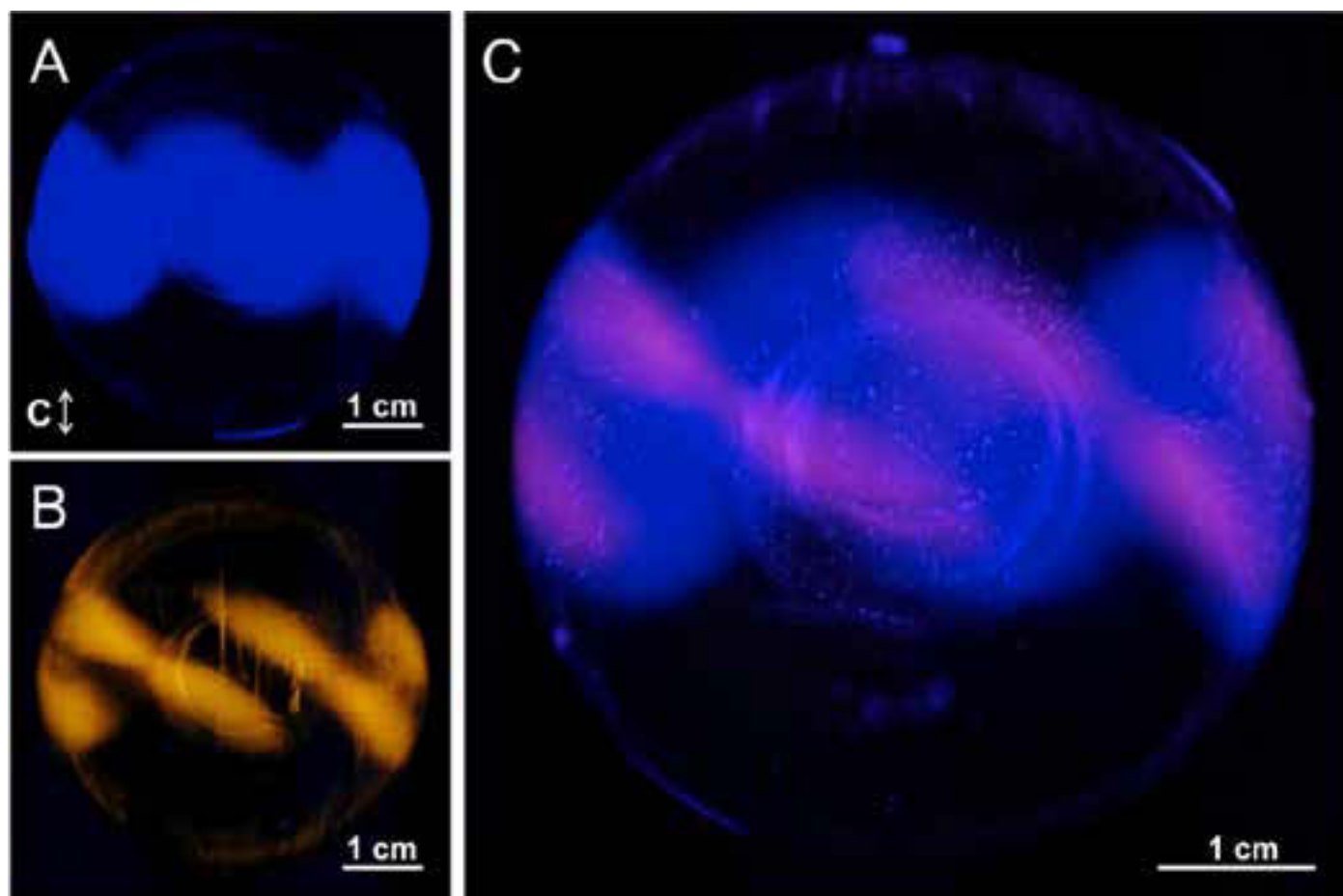


Bulletin



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

2021

www.csmb-scbm.ca



Bulletin



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

2021

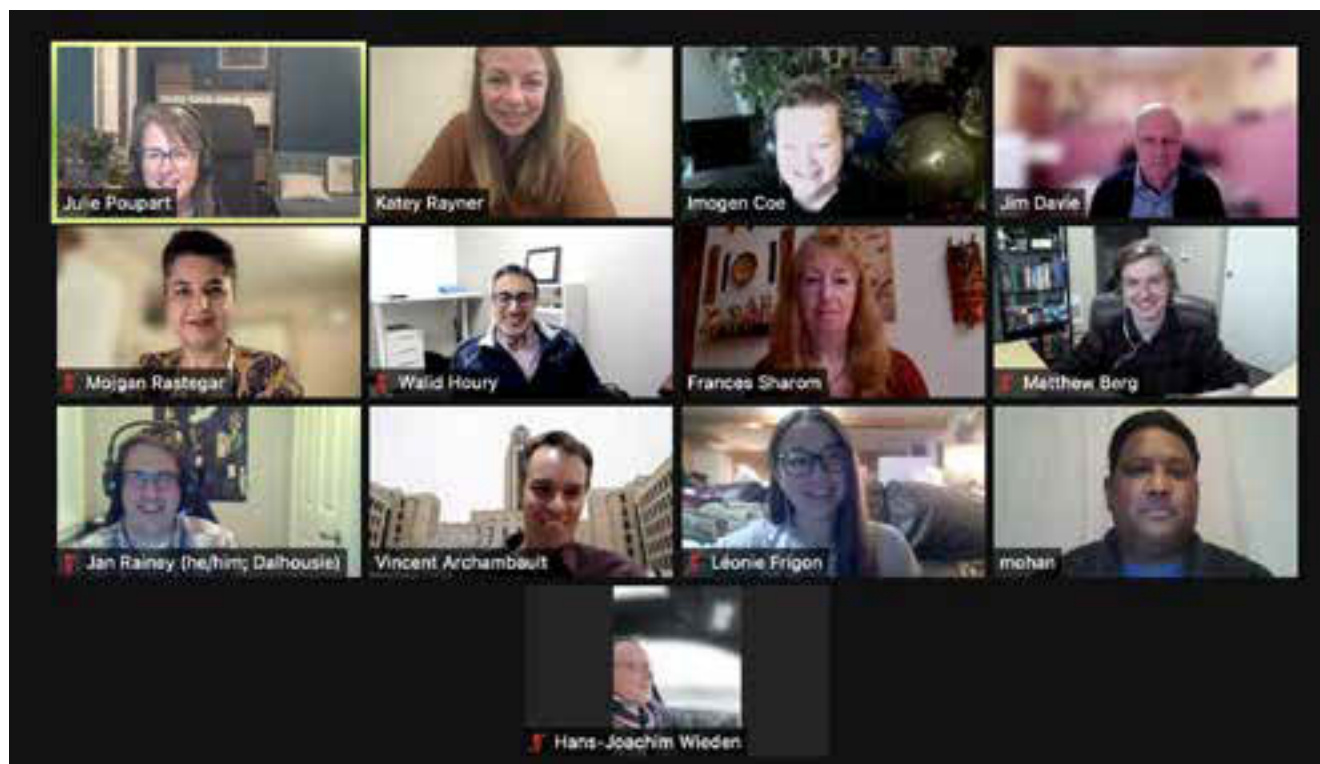
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Table of Contents

CSMB Board for 2021	4
President's Report 2021	6
Incoming Members of the Executive Board	8
Léonie Frigon, Councillor, Trainee Representative	8
Minutes of the 64th Annual General Meeting 2021	9
Financial Statement 2021	12
64th CSMB Annual Meeting, virtual platform	19
Meeting Report: "Protein Homeostasis"	19
Life Sciences Career Expo (LSCE) 2021	24
Trainee Committee Activities 2021	25
2022 CSMB Award Designates	27
CSMB New Investigator Award: Trushar Patel	27
Canadian Science Publishing Senior Investigator Award: Katherine Borden	28
Jeanne Manery-Fisher Memorial Award: Kristin Baetz	29
Arthur Wynne Gold Medal: Reinhart Reithmeier	30
Award Article 2021	31
Canadian Science Publishing Senior Investigator Award: Peter L. Davies "Reflections on antifreeze proteins and their evolution"	
News from Member Departments	44
Dalhousie University	44
Hospital for Sick Children Research Institute	45
McGill University	46
McMaster University	48

Queen’s University	49
Simon Fraser University	51
Toronto Metropolitan University	52
Université de Montréal	54
Université de Sherbrooke	56
University of British Columbia	57
University of Guelph	58
University of Manitoba	61
University of Ottawa	64
Cellular and Molecular Medicine	64
University of Toronto	65
Biochemistry	65
Cell and Systems Biology	68
Molecular Genetics	72
University of Toronto Mississauga	75
University of Victoria	77
University of Waterloo	77
CSMB-Sponsored Events	79

CSMB Board for 2021



The CSMB executive board at the December 2021 Zoom meeting

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President's Report

Dr. Imogen Coe



CSMB President, Imogen Coe

CSMB continued to pursue as much as was feasible in 2021 given the on-going challenges of the global COVID-19 pandemic and its impact on scientific activities.

Our board meetings were held in the virtual world, our conferences shifted to on-line or were canceled, and research activities of members varied from “constrained” to “shifted priorities” to “mostly back to normal” for some.



Attendees at CSMB Board Meeting, June 2021

The inequitable impact of COVID19 on the lives and productivity of CSMB members that have identified were amplified, and the source of much discussion in various places, although with relatively little in the way of long-term solutions proposed. I have heard and read much about the substantial and varied impacts on research careers of those with young families or care-giving responsibilities, those with family members in front-line healthcare situations, those dealing with long-COVID, and many others who have been challenged by this unprecedented pandemic. These are new realities that

we need to be sensitive to in our assessment of research impact as members of review committees at all levels, in our thinking about accessibility, and our understanding of what constitutes research excellence in contexts that have never before been experienced.

While our main bi-annual conference was cancelled in 2020, we went ahead with a Life Science Career Expo in 2021 as a virtual event, and this proved to be a huge success, due, at least in part, to the increased accessibility of the on-line format for attendees from around the globe.



The virtual Life Sciences Career Expo 2021 was a huge success

The CSMB continued advocacy on behalf of the research community (broadly defined) with the assistance of our government relations partner, Temple Scott Associates. Our persistent and relentless advocacy work over the past few years was recognized at the national level by Research Canada, with the organizational Leadership in Advocacy Award for 2021 going to CSMB for “being outstanding champions of health research” and for “going above and beyond what is expected of health research advocates”. This recognition was particularly gratifying given the many volunteer hours given up by CSMB board members, meeting with policy makers, explaining the scientific enterprise and working to build long-term relationships with those in all parties and in positions (either now or in the future) to influence research policy. In 2021, we (the Advocacy and Government Relations Committee) met with Michelle Rempel Garner, MP, Julie Vignola MP, Luc Theriault MP, Mario Simard MP, Tony Baldinelli MP, Maxime Blancette-Joncas MP, Richard Cannings, MP, and the director of the Office of the Official Leader of the Opposition. In all cases, there was significant

interest in what we had to say, opportunities to educate parliamentarians about how science is done, and explain the importance of increased investments. In addition, the CSMB submitted a brief to the Standing Committee on Finance as part of the pre-budget consultation in advance of the 2021 budget and supported the brief of PAGSE (of which CSMB is a member). We also met with NSERC President, Dr. Alejandro Adem, and Dr. Danika Goosney, VP - Research Grants and Scholarships (having met with Dr. Mike Strong, President of CIHR and Dr. Mona Nemer, CSA, in December 2020).

In collaboration with others such as Evidence for Democracy, we tried to raise the issue of science and research funding as a talking point for the surprise federal election in Fall 2021 but there was very little attention overall and, as with the outcome, nothing much seemed to change. We continue to meet with policy makers and will continue to advocate for increased investments in the funding councils to support, in particular, trainees and early career researchers, but importantly, the entire ecosystem. This would seem to be an urgent priority in the face of future pandemics and challenges to our health and economic wellbeing. We sponsored the novel Science Meets Parliament 2021 event which included meetings with Dr. Mona Nemer and others in government

and were represented by our board member, Dr. Vincent Archambault.

We were also pleased to see the new Standing Committee on Science and Research get up and running in 2021, chaired by Dr. Kirsty Duncan, and we have put in several requests to present information to them depending on their areas of interest and investigation.

We encourage all CSMB members to engage with local and national policy makers; we can provide supports and opportunities to find out more and get involved.

We continued to run our awards programs in 2021, conducting a virtual review, but without the ability to have the awardees present at a CSMB event. However, we warmly congratulate Dr. Jean-Philippe Julien (CSMB New Investigator Award), Dr. Peter Davies (CSP Senior Investigator Award) and Dr. Trang Hoang (Jeanne Manery-Fisher Memorial Award) for these prestigious recognitions.

With a certain trepidation, we aimed for our first in-person conference in two years, with international attendees and invited speakers, by hosting the 65th CSMB Meeting focussed on Membrane Proteins in Health and Disease, in Banff, from April 6-10th, 2022 (more on this in future bulletins). As we started 2022, we shared our congratulations with former CSMB executive members as they undertook major new leadership roles; Dr. Kristin Baetz (CSMB President 2015-2017) as the new Dean of the Faculty of Science at the University of Calgary, and Dr. Christian Baron (CSMB VP 2015-2017) as VP - Research Programs at CIHR. We were fortunate to have both present at the conference in Banff.

We look forward to re-connecting in three-dimensions, in the real world, in real time, as we move back to in-person activities. There is no doubt that human beings are social animals and while technology can serve us very well, and increase accessibility and opportunity, we clearly still crave human connections in the real world. Remember that we welcome all those who conduct research under the broad umbrella of molecular biosciences, and encourage cross-disciplinary interactions between geneticists, biochemists, cell biologists, biophysicists, molecular biologists and many, many more.

With best wishes for good health and successful science.



CSMB has been actively reporting our activities on Twitter and other social media

Incoming Members of the CSMB Executive Board



Léonie Frigon, *Councillor, Trainee Representative*

Léonie Frigon is a Ph.D. candidate in biochemistry and molecular medicine at the Université de Montréal, under the supervision of Dr. John Pascal. Her research interests are focused on structural biology. She is mainly interested in structural biology in order to understand the mechanism of action of the studied proteins. She started her research at the master's level before transferring to the Ph.D. program. Her current research project aims at studying the structure and mechanism of the PARP4 protein.

As a CSMB graduate student representative, Léonie aims to increase the visibility of Canadian trainees in fundamental research, and to advocate for better support of the fundamental sciences research programs in Canada.

Minutes of the 64th Annual General Meeting 2021

Zoom meeting – Thursday, June 17, 2021

38 members in attendance:

Attendees: Timothy Audas, Mohan Babu, Matthew Berg, Jan Braun, Michael Charette, Imogen Coe, James Davie, Cordula Enenkel, Léonie Frigon, Phil Hieter, Walid Houry, Kevin Keough, Jyh-Yeuan Lee, Tyra Lewis, Paola Marignani, Sanela Martić, Thibault Mayor, Donovan McDonald, Sue-Ann Mok, Tarik Mörröy, Jan Rainey, Mojgan Rastegar, Nahum Sonenberg, Hans-Joachim Wieden, Rongmin Zhao, Damayantee Das, Julie Brill, Saeid Shahidi, Kinza Khan, Christiane Bilodeau, Trang Hoang, Jimmy Lu, Bing-Ru Yan, Krysta Coyle, Raelyn Brassard, C. Thomson, Gergely Lukacs, Joanne Lemieux

1. Welcome and quorum (Coe)

2. Approval of agenda (Coe):

Motion: Motion: P. Marignani moved and W. Houry seconded that the agenda was appropriate. All members approved.

3. Approval of the Minutes of the 63rd Annual General Meeting (June 30, 2020, Zoom meeting) (Davie):

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

4. Business arising from the minutes (Davie):

No business arising from the Minutes.

5. President's report:

Coe reviewed the membership on the Board. The mission of CSMB continues to be the same as before. We renewed our contract with Temple Scott Associates, a government and public relations firm, and they have very effectively facilitated and organized multiple meetings with policy makers. 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 Québécois, NDP, Green) in person by videoconference. 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". Coe encouraged members to join us if they were interested in these activities. Coe announced that CSMB was awarded the Leadership in Advocacy Award at Research Canada in the organization category. Coe thanked T. Mörröy for driving this nomination and Dr. Jim Woodgett and Dr. Christian Baron for their letters of support.

6. Award Committee's report (Davie):

Davie reviewed the process by which CSMB receives and evaluates nominations for awards. The awards available in the next competition were listed. The award winners in 2021 were Peter Davies (Canadian Science Publishing Senior Investigator Award), Trang Hoang (CSMB Jeanne Manery Fisher Memorial Lecture) and Jean-Philippe Julien (CSMB New Investigator Award). The Awards Committee has been dissolved. The Board will now

review nominations and decide who will receive the award in each category. Graduate student activity support will be reviewed by Conference Committee.

7. Membership and Diversity Committee's report (Marignani):

We had a modest increase in membership. Marignani highlighted the changes in membership since 2019, with decreases in fellows being the greatest. Reasons for decreases are unclear; however, the COVID-19 pandemic may have played a role. She encouraged members to promote membership in CSMB among their colleagues. She hopes to increase diversity. Planning is under way to introduce a CSMB Lecture series this Fall which will consist of PI and trainee talks. Whether the lecture series will be available to non-members is under discussion. T. Möröy spoke to the importance of increasing membership numbers in our advocacy efforts. T. Hoang asked how we could reach out to the community and expand membership. In response, individuals could announce activities/successes of CSMB. Ideas to promote CSMB and increase awareness were discussed. Coe encouraged meetings with politicians.

8. Trainee Committee's report (Berg):

Berg gave a review of Trainee Committee membership and called for others to join them. The Trainee Committee did interviews of Gairdner awardees. The Gairdner Foundation is collaborating with CSMB in creating educational materials around the awardees each year and interfacing with high school students and teachers. A Trainee Twitter account was initiated, which promotes the work that the trainees do. Berg highlighted the Professional Development Webinars. Plans for the coming year were presented.

9. Treasurer's report (Rainey):

a) Presentation of the Accountant's Reviewed Financial Statement:

Rainey presented the 2020 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.

b) Acceptance of the Reviewed Financial Statement (2020):

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

c) Approval of Signing Officers:

Motion: P. Marignani moved and W. Houry seconded that J. Rainey and J. Davie be approved as Signing Officers on behalf of the Society for the 2021-22 year. All members approved.

10. Board membership for 2021-2022 (Möröy):

a) Review of current Board members

Möröy reviewed the nomination process by the Nomination Committee, the current Board and listed those whose term on the Board had ended. Léonie Frigon has joined the Trainee Committee. The Board members renewing their positions were listed.

11. Board committees (Coe):

Coe highlighted the revisions to the CSMB Committees. The Awards committee was being dissolved and a new committee, the Communication and Publications Committee, was formed. Davie highlighted the terms of reference for this committee and spoke about CSMB's relationship with and support received from Canadian Science Publishing (CSP). The CSP journals Biochemistry & Cell Biology and Genome are the official journals of CSMB.

12. Conference Committee's report (Wieden):

a) 2020 Meeting cancellation:

Wieden presented issues with regards to the COVID-19 pandemic and the cancellation of the meeting. Presence of the society was done via a partnership with the Riboclub.

b) Focus meeting "Life Science Career Expo 2021":

The focus meeting on Life Science Career Expo 2021 led by W. Houry was successful (500 registrants).

c) Meeting schedule update:

The next annual meeting will be held in Banff, "65th CSMB Meeting: Membrane Proteins in Health and Disease". Joanne Lemieux presented the highlights of the planned meeting. Concerns with possible continuation of the pandemic and alternate plans were discussed.

13. Other business:

No other business was noted. Coe welcomed further feedback from the membership and requested that they help with the drive to increase membership. Coe thanked the members of the Board.

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, 2021, 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, 2021, 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.



Ottawa, ON
June 8, 2022

Numeris CPA Professional Corporation
Chartered Professional Accountant
Licensed Public Accountant

Canadian Society for Molecular Sciences
(Canadian Society for Molecular Biosciences)
Statement of Financial Position
(Unaudited)
As at December 31, 2021

	<u>2021</u>	<u>2020</u>
Assets		
Current		
Cash	\$ 35,239	\$ 34,647
Marketable securities - short term (note 3)	372,546	332,226
Accounts receivable	625	2,839
Prepaid expenses	<u>11,876</u>	<u>14,346</u>
	<u>\$ 420,286</u>	<u>\$ 384,058</u>
Liabilities		
Current		
Accounts payable and accrued liabilities	\$ 8,086	\$ 7,347
Deferred membership fees - short term	<u>6,838</u>	<u>5,377</u>
	14,924	12,724
Deferred membership fees - long term	<u>13,639</u>	<u>13,090</u>
	28,563	25,814
Balance	<u>391,723</u>	<u>358,244</u>
	<u>\$ 420,286</u>	<u>\$ 384,058</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, 2021

	<u>2021</u>	<u>2020</u>
Revenues		
Annual meeting revenue	\$ 55,048	\$ -
Membership fees	18,490	22,607
Society awards support	5,000	5,000
Investment income	2,512	7,516
Miscellaneous	<u>1,700</u>	<u>2,366</u>
	<u>82,750</u>	<u>37,489</u>
Expenditures		
Annual meeting	36,841	1,066
Science advocacy	16,570	14,540
Office and administration	9,396	10,239
Bank, credit card and investment management fees	5,741	5,235
Professional fees	2,400	2,400
Insurance	1,808	1,809
Membership charges	1,670	1,730
Student and PDF events and travel awards	1,500	500
Website	600	-
Board meetings, AGM, and teleconferencing	209	467
Bulletin	<u>-</u>	<u>750</u>
	<u>76,735</u>	<u>38,736</u>
Excess (deficiency) of revenues over expenditures before other items	6,015	(1,247)
Other income		
Gain on sale of marketable securities	<u>54,582</u>	<u>880</u>
Excess (deficiency) of revenues over expenditures	60,597	(367)
Net unrealized gain (loss) on marketable securities	<u>(27,118)</u>	<u>26,728</u>
Excess of revenues over expenditures	33,479	26,361
Balance, beginning of year	<u>358,244</u>	<u>331,883</u>
Balance, end of year	<u>\$ 391,723</u>	<u>\$ 358,244</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, 2021

	<u>2021</u>	<u>2020</u>
Operating activities		
Excess of revenues over expenditures	\$ 33,479	\$ 26,361
Adjustment for		
Gain on sale of marketable securities	<u>(54,582)</u>	<u>(880)</u>
	(21,103)	25,481
Change in non-cash working capital items		
Marketable securities - short term	14,262	(29,396)
Accounts receivable	2,214	17,899
Prepaid expenses	2,470	(188)
Accounts payable and accrued liabilities	739	(4,799)
Deferred membership fees - short term	1,461	5,377
Deferred membership fees - long term	<u>549</u>	<u>(9,627)</u>
Net increase in cash	592	4,747
Cash, beginning of year	<u>34,647</u>	<u>29,900</u>
Cash, end of year	<u>\$ 35,239</u>	<u>\$ 34,647</u>

See accompanying notes to the financial statements

Canadian Society for Molecular Sciences
(Canadian Society for Molecular Biosciences)
Notes to the Financial Statements
(Unaudited)
December 31, 2021

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.

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.

Membership fees are recognized as revenue on a fiscal basis from January 1 to December 31. Membership fees received in the current year, applicable to the next fiscal year, are deferred and will be recognized as revenue in the year to which they pertain.

Conference, Sponsorship and Workshop fees are recognized as revenue when the events are held.

Interest income is recognized as revenue when earned. Dividends and distributions are recorded as revenue when declared. Realized gains and losses are recognized as income when transactions occur. Unrealized gains and losses which reflect the changes in fair value during the period are recognized at each reporting date and are included in current period income.

(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 and disclosure of contingent assets and liabilities at the balance sheet date and the reported amounts of revenues and expenses during the year. Actual results could differ from those estimates.

Canadian Society for Molecular Sciences
(Canadian Society for Molecular Biosciences)
Notes to the Financial Statements
(Unaudited)
December 31, 2021

2. Significant accounting policies, continued

(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.

3. Marketable securities - short term

CSMB investments are recorded at market value. As required by CPA Canada Handbook 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.

	<u>2021</u>	<u>2020</u>
Cash and short term investments	\$ 17,291	\$ 3,022
Fixed income	119,547	107,307
Common equity	204,785	132,429
Cash and short term investments (US account)	30,923	484
Common equity (US account)	<u>-</u>	<u>88,984</u>
	<u>\$ 372,546</u>	<u>\$ 332,226</u>

4. Annual meeting

	<u>2021</u>	<u>2020</u>
Local organizing committee	\$ 15,297	\$ -
Digital event expenses	13,100	-
Speaker Travel & Expenses	7,040	-
Other Annual Meeting Expenses	1,404	-
Meeting Organizer Fees	<u>-</u>	<u>1,066</u>
	<u>\$ 36,841</u>	<u>\$ 1,066</u>

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 2021 have been reflected in the financial statements. An estimate of the impact of the pandemic on the 2022 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.

Meeting Report: The 64th Annual Meeting of the CSMB 2021

Protein Homeostasis

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Walid A. Houry, Ph.D., Department of Biochemistry, University of Toronto

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Scope of the conference

The 64th Annual Conference of the Canadian Society of Molecular Biosciences (CSMB), which was held virtually June 14-17, 2021 (<https://event.fourwaves.com/csmb-prince-2021/pages>) was organized by Dr. Janice Braun (Department of Biochemistry and Molecular Biology, University of Calgary), Dr. Cordula Enenkel (Department of Biochemistry, University of Toronto), Dr. Paul LaPointe (Department of Cell Biology, University of Alberta), Dr. Thibault Mayor (Department of Biochemistry and Molecular Biology, University of British Columbia), Dr. Sue-Ann Mok (Department of Biochemistry, University of Alberta), Dr. Jason Young (Department of Biochemistry, McGill University), Dr. Walid A. Houry (Department of Biochemistry, University of Toronto) and Dr. El Bachir Affar (Département de biochimie et médecine moléculaire, Université de Montréal).

The organization of this meeting was built on the first successful PRinCE (Proteostasis Researchers in Canada, Eh) symposium that was held in June 2019 in Toronto. The focus of the conference was on protein homeostasis and brought together a growing network of researchers working in the field of protein homeostasis in Canada and internationally. The conference, in a four-day program, addressed new concepts and research directions relevant to molecular chaperones, protein folding/misfolding, protein degradation, neurodegeneration, liquid-liquid phase separation, cellular stress response, ubiquitin proteasome system, autophagy, proteomics, and protein and peptide science. About 245 scientists participated

to the meeting with 44 talks by investigators, 24 talks by trainees and 111 posters.

Oral presentations by internationally renowned investigators

The conference benefited from an outstanding group of invited speakers including Canadian and internationally renowned scientists.

Prof. David Ron, University of Cambridge, U.K., discussed the regulation of endoplasmic reticulum (ER) Proteostasis as the keynote speaker. In particular, he described how post-translational mechanisms orchestrate the balance between chaperone activity and the abundance of unfolded proteins. Dr. Ron exemplified this aspect by analysing the post-translational modifications of the ER Hsp70 BiP, which highlights the importance of rapid proteostatic control in response to physiological fluctuations of activity.

Prof. Ivan Đikić, Goethe University, Frankfurt, described a multi-institutional collaboration to develop effective therapeutic drugs against the SARS-CoV-2, the causative agent of COVID-19. His team focused on papain-like protease (PLpro), an enzyme required for viral replication, and provided a structural and functional characterization of this protease. They also established that inhibition of SCoV2-PLpro impairs the viral replication in infected cells. Dr. Đikić highlighted how sharing ideas, tools and reagents between colleagues across countries has been instrumental in making rapid advances. He also

emphasized that this approach promotes the sense of purpose, inspires trainees and demonstrates the rewarding character of science.

Prof. Julie Forman-Kay, Hospital for Sick Children and University of Toronto, talked about the biochemistry and biophysics of protein and protein-RNA phase separation that underlies many cellular biomolecular condensates. Focusing on low complexity intrinsically disordered protein regions from FMRP, CAPRIN1 and EWS, she demonstrated effects of post-translational modifications (phosphorylation, methylation, O-GlcNAcylation) on phase separation propensity, multi-phase behaviour and material properties due to overall chain properties or blocking specific interactions identified to be drivers of phase separation by NMR. She showed that FMRP and CAPRIN1 phase behaviour regulates mRNA translation to protein and deadenylation *in vitro*, and linked these results to understanding activity-dependent translational regulation at neuronal synapses.

Prof. Judith Frydman, Stanford University, described how chaperone function provides a framework to understand the link between protein misfolding and human diseases. She dissected the molecular events that underlie the co-translational proteostasis during virus infection and provided evidence that this could be a platform for developing novel antiviral strategies.

Prof. Kalle Gehring, McGill University, outlined studies of the E3 ubiquitin ligase, parkin. Mutations in parkin are the second most frequent cause of familial forms of Parkinson's disease. Normally inactive in the cytosol, parkin is activated on the outer membrane of damaged mitochondria as part of a quality control system. Parkin activation leads to the ubiquitination of mitochondrial proteins and the removal of the mitochondria through autophagy. Prof. Gehring explained that parkin is activated in two steps, recruitment to mitochondria and phosphorylation by PINK1, and that understanding the pathway opens new perspectives for the development of treatments for Parkinson's disease.

Prof. Gergely Lukacs, McGill University, and collaborators delineated the significance of intra- and inter-domain communication in CFTR (mis)folding. They used the powerful hydrogen deuterium exchange mass spectrometry technique with a combination of biochemical and *in silico* techniques to characterize the

CFTR allosteric folding/misfolding at peptide, domain and full-length channel levels and demonstrated the reversal of CFTR misfolding by allosteric correctors. The long-range conformational coupling, mediated by selective domain-domain interfaces, is consistent with the role of conformational selection or induced fit interdomain allostery during the posttranslational folding of CFTR and MRP1, members of the ABC-transporter superfamily.

Prof. Claude Perreault, Université de Montréal, presented the fundamental process of self and non-self discrimination. Endogenous peptides, presented by major histocompatibility complex class I (MHC-I) molecules, represent the major determinants of self for CD8 T lymphocytes. The biogenesis of these MHC-I peptides, known as the immunopeptidome, is regulated by specific features of transcripts and proteins that affect canonical and non-canonical translation and proteasomal degradation. Cryptic proteins are translated as efficiently as canonical proteins, have more predicted disordered residues and lower stability, and critically generate MHC-I peptides 5-fold more efficiently per translation event.

Prof. Elizabeth Meiering, University of Waterloo, described the molecular mechanisms of native and aberrant self-association of wild-type and ALS mutant SOD1s.

Prof. Sabine Gilch, University of Calgary, presented evidence indicating that quaternary structure of scrapie prion protein (PrP^{Sc}) dictates biochemical properties of prions and disease pathogenesis. They demonstrate that clinical signs of prion disease, distribution of prion protein aggregates and their protease resistance differed between mice inoculated with low and high molecular weight PrP^{Sc} aggregates. Upon passage in the same mouse model, biochemical differences were no longer found; however, the specific clinical signs were transmissible. Their data indicate that the complexity of PrP^{Sc} aggregates is involved in determining region-specific replication of prions in the brain and the clinical presentation of disease.

Prof. Rina Rosenzweig, Weizmann Institute of Science, presented on the effects of molecular chaperones on the aggregation and fibril formation of microtubule-associated tau protein, which has been associated with a number of neurodegenerative conditions such as Alzheimer's disease and frontotemporal dementia.

She described the roles of different chaperones in the inhibition of tau amyloid formation at varying points in the process. This exemplifies how the diversity and complementarity of chaperones acts to prevent protein aggregation.

Prof. Peter St. George-Hyslop, University of Toronto, presented on the role of physiological and pathological of intrinsically disordered proteins in neurodegenerative diseases.

Finally, Prof. Nobuhiko Tokuriki, University of British Columbia, presented on how cellular environments can influence the state of proteins and enzymes and outlined how metal availability can influence the evolvability of metallo-enzymes, thus shaping the adaptive landscape of the processes involving these enzymes.

In addition, oral presentations were selected from the submitted abstracts of participating PIs and trainees. These covered a wide spectrum of topics on protein homeostasis, including chaperones and protein folding, protein misfolding and disease, protein aggregation, quality control and stress signalling, protein degradation, viral infections, and liquid phase separation, as well as development of new bioinformatics tools and research protocols.

Two poster sessions were organized using the interactive Gathertown virtual platform. Although virtual, this offered an exceptional experience and forum for interactions and discussions.

Science, policy and society

Notably, we were delighted that Dr. Mona Nemer, the Chief Science Advisor of Canada, participated in a panel discussion on the Future of Science in Canada. Dr. Nemer discussed science policy, COVID-19 and other subjects of interest. She was interviewed by Dr. Janice Braun and Dr. Walid A. Houry. Dr. Nemer also answered questions from the audience.

The conference also featured several pre-recorded interviews with trainees, researchers, representatives and stakeholders of the Canadian scientific research community, which were shown during the meeting. These videos can be found at <https://www.youtube.com/channel/UCzYo9frmFINgrJ5q99HSObQ>. The goal was to increase awareness about the importance of science and

to discuss socio-scientific issues, including the impact of COVID-19 on biomedical research and the general pursuit of science in Canada.

The videos are:

- (a) CSMB-PRinCE trailer.
- (b) Krysta Coyle and Matt Berg Interview the Organizers of the Life Sciences Career Expo (LSCE) Alaa Alsaafin, Jenna van Leeuwen and Maria Mercado.
- (c) Kyle Miller and Anna Bradford Interview the Creative Destruction Labs (CDL) Rockies Ag Stream Manager, Anita Ludwar.
- (d) Paul Lapointe Interviews High School Student and 2020 Breakthrough Junior Challenge Winner, Maryam Tsegaye.
- (e) Sue-Ann Mok Interviews 2020 Nobel Laureate, Michael Houghton.
- (f) Alexander Kurtesi Shares her Outlook as a Science Undergraduate.
- (g) Cristobal Marrero Winkens and Christopher Chang Interviews Chronic Wasting Disease Researcher Hermann Schatzl.
- (h) Matt Berg and Krysta Coyle Interview Science Policy Spokesperson Farah Kaiser.
- (i) Jennifer Krahn Interviews the Founder of the ARSACS Foundation, Sonia Gobeil.
- (j) Wendy Ingram, founder of Dragonfly Mental Health, Richard Harland, Elva Diaz, Elcin Unal and Randy Schekman speak about Breaking the Stigma of Mental Health in Academia.
- (j) Jasmine Ryu Won Kang provides a 2020-2021 undergraduate perspective
- (k) Mila Gushul-Leclaire and Malik Affar interview El Bachir Affar about the academic research career path.
- (l) Jason Keelor and Emilie Crowther Interview Science Communicators Trevor Day and Raj Bhardwaj.
- (m) Morgan Towriss and Jessica Schaub: conversation between two Indigenous students in STEM.

CSMB 2021 awardees

Dr. Trang Hoang, Jeanne Manery-Fisher Memorial Award

Dr. Trang Hoang is Principal Investigator and Director of the Laboratory of Hematopoiesis and Leukemia, Institute for Research in Immunology and Cancer (IRIC) at the Université de Montréal (UdeM). She completed her Ph.D. at the Swiss Cancer Institute in Lausanne, Switzerland, and her post-doctoral training in the Department of

Immunology at Cambridge University, U.K., and in Medical Genetics at the Ontario Cancer Institute in Toronto. Her research is consistently published in top-tier journals. Dr. Hoang is an Officer of the National Order of Québec (Ordre National du Québec, 2019) and a Commander of the Order of Montréal (Ordre de Montréal, 2019) for her pivotal work in acute lymphoblastic leukemia and for developing and nurturing multidisciplinary skills in cancer research to train the next generation of scientists. 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.

Dr. Jean-Philippe Julien, CSMB New Investigator Award

Dr. 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.

Dr. Peter Davies, Canadian Science Publishing Senior Investigator Award

Dr. 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 UBC 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.

EDI and trainees

We highlight that central to our meeting was the Canadian strategy on Equity, Diversity and Inclusion in science. We have greatly promoted a respectful environment in our conference that is inclusive of all origins, genders and sexual orientations. In addition to scientific criteria, the geographic location of institutions across Canada was prioritized.

The Natural Sciences and Engineering Research Council of Canada (NSERC) also participated, and offered a booth for interaction with PIs and trainees to know more about NSERC mission and values, as well as the current and future NSERC funding programs.

To promote training, we selected three trainee talk awards and eight trainee poster awards. The talk awards are cash awards sponsored by ThermoFisher Scientific and Nanostics. Poster awardees received one-on-one coaching with Jay Ingram, renowned science communicator. All talk and poster awardees have received a half-day science communication workshop.

Finally, Dr. Paul LaPointe (University of Alberta), one of the co-organizers, created an augmented reality application to view proteostasis-related structures named "PRinCE2021 AR". The app is available for download from the Google and Apple app stores. There are printable flashcards that trigger the 3D objects and animations. These can be downloaded from the conference website (<https://event.fourwaves.com/csmb-prince-2021/pages>) and from Gathertown (<https://gather.town/i/NsXOivdK>).

In memoriam

We dedicate this report to the memory of our dear friend and colleague, Dr. Jason Young, whose untimely passing away touched all of us. Jason, with his deep insights and hard work, was a key organizer of this meeting. His research focussed on understanding the molecular mechanisms used by chaperones and co-chaperones to prevent protein misfolding and aggregation. He made several important contributions to our understanding of the molecular pathways that underlie the functions of three major chaperones: Hsp40, Hsp70 and Hsp90. In addition to being an accomplished scientist, Jason was a caring and generous colleague and a wonderful collaborator. He will be very much missed.

Life Sciences Career Expo (LSCE) 2021

Correspondent: Alaa Alsaafin

Alaa Alsaafin was one of the co-organizers of LSCE 2021. Alaa is the current President of the UofT student society LSCDS (<https://lscds.org/our-team/>).

In May 2021, a group of graduate students from the Life Sciences Career Development Society (LSCDS) (**Jenna van Leeuwen, Alaa Alsaafin, Kevin Kuang, Maria Mercado**) and faculty members (**Nana Lee, Reinhart Reithmeier, Roula Andreopoulos**) at the University of Toronto in partnership with the CSMB (**Walid A. Houry**) organized the Life Sciences Career Expo (LSCE) 2021.

This national, virtual, multi-day career conference welcomed more than 450 trainees from multiple countries, doubling the number of attendees anticipated when it was originally planned to take place in person in May 2020. The LSCE offered professional development opportunities for trainees in different career development stages, including keynote panels, career panels, professional skills workshops, and job simulations workshops. The event also hosted over 40 companies to connect with attendees through informational interviews, company spotlight presentations, and virtual booths!

This exciting event was helpful both to attendees and student organizers as they expanded their professional networks and honed their transferrable skills. In a post-conference survey, over 90 per cent of respondents reported that the LSCE expanded their knowledge about diverse career opportunities and over 95 per cent said they would recommend the conference to a colleague. Building on this success, LSCE 2022 will be held again in May of 2022! This three-day conference will allow trainees to experience the different stages of career evaluation: Day 1 (virtual; career exploration), Day 2 (virtual; job searching), and Day 3 (hybrid; job seeking and networking). Follow them on [LinkedIn](#) and [Twitter](#) and check their [website](#) for updates on participating speakers and companies!

Trainee Committee Activities 2021

Meet your 2021 CSMB Trainee Representatives

Dr. Matthew Berg, Ph.D., University of Washington
Léonie Frigon, Ph.D. candidate, Université de Montréal



Dr. Matthew Berg



Léonie Frigon

Other at-large Trainee Committee members for 2021 were:

Karina Baksh, Ph.D. candidate, University of Toronto
Aishwarya Sriraman, Ph.D. candidate, University of Alberta
Sina Heravi, M.Sc. candidate, Memorial University of Newfoundland

Welcome to new Trainee Representatives:

In 2021, the trainee committee said goodbye to co-chair **Krysta Coyle**. We thank Krysta for her hard work leading the committee and wish her all the best. We also welcomed **Léonie Frigon**, an M.Sc. candidate at Université de Montréal, to the position of co-chair.

We also said goodbye and welcomed some new at-large members. We thank **Sarah Chadwick, Farah Qaiser**

and **Shawn Shorthill** for all their contributions to the committee and are excited to work with **Aishwarya Sriraman**, a Ph.D. candidate at the University of Alberta, and **Sina Heravi**, an M.Sc. candidate at Memorial University.



Karina Baksh



Aishwarya Sriraman



Sina Heravi

Professional Development Webinars:

This year, the trainee committee hosted three webinars in collaboration with Toronto Metropolitan University. The first workshop discussed writing the perfect CV that accurately reflects and highlights your skills. The second, hosted by Dr. Imogen Coe, covered grant writing with an EDI perspective. Dr. Coe encouraged attendees to self-reflect and suggested that when writing an EDI statement, include your lived experiences, be explicit about stating your values, and present evidence of how your actions align with your values in the past, present and future. The last webinar hosted by the trainee committee was about job hunting and pivoting during Covid-19. This webinar was a panel discussion featuring:

Find us on social media:



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



facebook.com/CSMB-SCBM



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

(1) Chinmaya Sadangi, a communication and marketing specialist at Cyclica; (2) Mackenzie Brauer, an accounts manager at Advanced Chemistry Development, Inc; and (3) Vivan Leung, a medical writer and learning solutions designer at Metrix.

Gairdner Award articles:

In collaboration with the Michael Smith Laboratories (MSL) at UBC and the Gairdner foundation, CSMB trainees put together short articles highlighting the science of the 2021 Canada Gairdner awardees. This year, the articles were accompanied by short videos voiced over by the trainee authors of each article. The materials, including lesson plans for high school science classes, can be viewed here: <https://gairdner.org/2021s-award-winning-research-in-the-classroom/>

CSMB Trainee interviews for CSMB Protein Homeostasis Conference:

The trainee committee was asked to help put together a series of interviews to be played during breaks at the CSMB 2021 Protein Homeostasis conference. Matt and Krysta interviewed Farah about her work in science policy. Farah told them what she most enjoys about science policy, how other trainees can get involved and how supervisors can support their trainees in science-adjacent activities. Matt and Krysta also interviewed the organizers of the Life Sciences Career Expo 2021 and heard about their visions for the expo and all the logistics that go into setting up an event like that. A trailer of all the interviews can be viewed here: <https://www.youtube.com/watch?v=8gWVlsc96CQ> and each interview is available on the Proteostasis Canada twitter page: (<https://www.youtube.com/channel/UCzYo9frmFINgrJ5q99HS0bQ>).

Trainee Twitter account - @CSMB_Trainees:

The Trainee Committee continues to use our Twitter account to advertise our events and initiatives to trainees. We also want to use this as a platform to highlight science from Canadian trainees. If you have papers published, we want to hear about it! Send us a message on our Twitter account (@CSMB_Trainees) and we will highlight your paper on our Twitter page. Also, if you are organizing an event for trainees, let us know and we will promote that too.

2022 CSMB Award Designates

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.



Trushar Patel, Ph.D.

Canada Research Chair in RNA and Protein Biophysics
Associate Professor, Department of Chemistry and Biochemistry,
University of Lethbridge

Dr. Trushar Patel is an emerging leader in the biophysical characterization of nucleic acids, proteins and their complexes. He employs interdisciplinary techniques to understand the communication events between viral nucleic acids and human proteins that play vital roles in viral replication. Information on the specific sites of host proteins that communicate with viral nucleic acids will ultimately allow the development of therapeutics that prevent host-viral communication. His lab is also investigating the structures and interactions of human and viral non-coding RNAs by integrating computational and structural-biophysical methods.

Dr. Patel obtained a B.Sc. and M.Sc. in biotechnology from India, and a Ph.D. from the University of Nottingham, U.K. Subsequently, he joined the University of Manitoba to pursue post-doctoral studies. The main focus of his Ph.D. and post-doctoral studies was to study solution structure and interactions of plant polysaccharides and human extracellular matrix proteins, respectively. After completing his studies in Manitoba, he moved to the U.K.

and joined the University of Birmingham to study human cytoskeleton protein dynamics. His work was supported by post-doctoral fellowships from the Manitoba Institute of Child Health (2008) and the Canadian Institutes of Health Research (2010). He also received the Marie Skłodowska-Curie fellowship (2013) from the European Union.

Dr. Patel started his career as an independent investigator at the University of Lethbridge in 2016. He has published 80 articles and 26 editorials to date. He is also one of the editors of the European Biophysics Journal and has been very active in training the next generation of researchers, with scientific and science-policy-related conference-organizing activities and EDI initiatives. Recently, Dr. Patel was also named the 2022 Young Investigator of the Biophysical Society of Canada.

For additional information, please visit <https://trpatel.com>

2022 CSMB Award Designates

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.



Katherine L.B. Borden, Ph.D.

Canada Research Chair in Molecular Biology of the Cell Nucleus
Professor, Department of Pathology and Cell Biology
University of Montreal
Principal Investigator, Institute for Research in Immunology
and Cancer (IRIC)
University of Lethbridge

Katherine Borden received her Ph.D. in Molecular Biophysics and Biochemistry from Yale University with Professor Fred Richards, where she studied protein biochemistry, NMR and biophysical methods. She carried out her post-doctoral training in London, U.K., at the then National Institute for Medical Research (now the Crick Institute) with Professor Andrew Lane and the then Imperial Cancer Research Fund (now Cancer Research U.K.) with Professors Paul Freemont and Ellen Solomon. There, she developed her trademark approach tying structure and biophysics with cell and molecular biology. She returned to Canada for her first faculty position at Dalhousie University as Assistant Professor, and was subsequently recruited to Mount Sinai School of Medicine in New York City, where she further developed her ideas around RNA export and processing and their role in cancer. Then, in 2004, she was recruited back to Montreal (to IRIC), where she is now a full professor and has continued to expand her studies on RNA biology and cancer. She was a Scholar of the Leukemia and Lymphoma Society USA and has been further honoured as a Stohlman Scholar of the society. She was also a recipient of the Distinguished Scientist award of the

Canadian Society of Clinical Investigation, amongst other distinctions.

Dr. Borden's research transformed our view of the mechanisms by which dysregulated RNA metabolism contributes to oncogenic transformation using the RNA cap-binding protein eIF4E as a model system. Her studies identified novel modes of action for eIF4E particularly related to its oncogenic properties. This foundational work led to her discovery of means to target these processes in patients. She spearheaded the first clinical trials targeting these pathways that led to objective clinical responses in some refractory/relapsed leukemia patients. This work provided proof-of-principle that the eIF4E and related pathways could be targeted in humans and further, that this led to clinical benefit. Dr. Borden founded and continues to chair the Equity, Diversity and Inclusion committee at IRIC. She is active in development of plans to improve issues and is implementing initiatives to engage local indigenous students in STEM.

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

2022 CSMB Award Designates

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.



Kristin Baetz, Ph.D.

**Dean, Faculty of Science, and Professor, Biological Sciences,
University of Calgary**

Kristin Baetz began her research career as a high school student, where she had the opportunity to work in Dr. Gill Wu's lab at the University of Toronto. This early exposure to research started her down the research career path. She received her B.Sc. in Biochemistry from Queen's University and next obtained her Ph.D. from the University of Toronto (2000), where she worked in lab of Dr. Brenda Andrews and discovered her love of yeast as a model organism. After post-doctoral training in yeast functional genomics with Dr. Phil Hieter at UBC, Kristin joined the Department of Biochemistry, Microbiology and Immunology at the University of Ottawa in 2005.

Kristin's research program exploits the model organism *Saccharomyces cerevisiae* and a variety of systems biology approaches to studies relevant to human diseases. Presently her lab is focussing on how lysine acetyltransferases impact chromosome stability, stress response and lipid homeostasis. She also applies system biology approaches to improve industrial yeast for bioproduct fermentation. Kristin was a CRC Tier II (2005-2015) and Ontario Early Research Award Recipient, but she believes her greatest accomplishment is mentoring

the next generation of scientists, disruptors and leaders.

In addition to her research program, Kristin has held multiple leadership positions. She was the Director of the Ottawa Institute of Systems Biology (2012-2019), and the Assistant Dean of Research and Special Projects (2019-2021) at the Faculty of Medicine, University of Ottawa. In January 2022, Kristin was appointed the Dean of the Faculty of Science at the University of Calgary. Kristin served on the board of the Canadian Society of Molecular Biosciences including as President (2015-2017), where she advocated for sustainable funding for Canadian researchers. She is a board member of Research Canada (2018-present), a national advocacy alliance dedicated to advancing health research, and she has served on the Ontario Research Fund Advisory Board (2017-2018). Kristin is also a tireless advocate for equity, diversity and inclusion in STEM, participating in and organizing events at both the local and national level. Further, through her leadership positions and advocacy roles, she seeks to ensure policies are in place to create a research ecosystem in Canada where everyone can not just participate in Science, but thrive.

2022 CSMB Award Designates

Arthur Wynne Gold Medal

The Canadian Society for Molecular Biosciences (CSMB) Arthur Wynne Gold Medal is presented by the CSMB to an individual who has made a major contribution to molecular biosciences in Canada over their career. The Medal is named in honour of Professor Arthur M. Wynne, the first President of the Society, and was initiated in 2007 to celebrate the 50th Anniversary of CSMB. The recipient is presented with a plaque depicting the likeness of Professor Wynne.



Reinhart Reithmeier, Ph.D.

Professor, Department of Biochemistry, University of Toronto

Reinhart Reithmeier is a Professor in the Department of Biochemistry at the University of Toronto, and is known internationally for his research on membrane proteins in human health and disease. He obtained his B.Sc. at Carleton University, his Ph.D. at the University of British Columbia, and did post-doctoral training at Harvard University and the University of Toronto. An award-winning lecturer and graduate mentor, Dr. Reithmeier enjoys teaching introductory biochemistry to over 1,000 undergraduate students, as well as upper level and graduate courses. Dr. Reithmeier was Chair of Biochemistry from 2002-2013 and served on numerous research panels and as the University CIHR Delegate. He was on the executive of the Canadian Society for Molecular Biosciences from 2006-2009. As Special Advisor in the University of Toronto School of Graduate Studies, he led the 10,000 PhDs Project and the Healthy Labs Initiative. From 2016 to 2020, Dr. Reithmeier served

as an executive member of the Royal Canadian Institute for Science, a venerable organization whose mission is to bring science to the public. Dr. Reithmeier's leadership was also recognized in 2012 by his election as a Fellow of the Canadian Academy of Health Sciences.

Website: <http://biochemistry.utoronto.ca/person/reinhart-af-reithmeier/>

2021 Canadian Science Publishing Senior Investigator Award

Reflections on antifreeze proteins and their evolution

Peter L. Davies

Canada Research Chair in Protein Engineering;
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Abstract

The discovery of radically different antifreeze proteins (AFPs) in fishes during the 1970s and 80s suggested these proteins had recently and independently evolved to protect teleosts from freezing in icy seawater. Early forays into the isolation and characterization of AFP genes in these fish showed they were massively amplified, often in long tandem repeats. The work of many labs in the 1980s onward led to the discovery and characterization of AFPs in other kingdoms such as insects, plants, and many different microorganisms. The distinct ice binding property that these ice-binding proteins (IBPs) share has facilitated their purification through adsorption to ice, and the ability to produce recombinant versions of IBPs has enabled their structural characterization and the mapping of their ice-binding sites using site-directed mutagenesis. One hypothesis for their ice affinity is that the ice-binding site organizes surface waters into an ice-like pattern that freezes the protein onto ice. With access now to a rapidly expanding database of genomic sequences it has been possible to trace the origins of some fish AFPs through the process of gene duplication and divergence, and to even show the horizontal transfer of an AFP gene from one species to another.

In graduate school it is not just what you get to know, it is also who you get to know

As an undergraduate student at the University of Wales I was captivated by an article I read in the second volume of *Essays in Biochemistry* (Dixon 1966). This 1966 review by Gordon H. Dixon (GHD) was on “Mechanisms of protein evolution”. It struck me as a fascinating topic to research. Later, having applied to do graduate studies in the Department of Biochemistry at UBC, I learned that GHD had left Toronto to join the faculty in Vancouver. Being rather naive I assumed one could simply join the lab of your choice upon arrival. Instead, as places for new students had been filled, I was assigned to the lab of Philip D. Bragg, a relatively new Assistant Professor. Phil was a great mentor who worked hard at the bench and was always on hand to give good advice and encouragement. Eventually I settled on a satisfying thesis topic of isolating and characterizing the ATPase of oxidative phosphorylation in *Escherichia coli* (Davies and Bragg 1972). During this exploration I was continually struck by how similar this enzyme was to the mitochondrial ATPase - not being aware at the time of the emerging endosymbiosis theory (Margulis 1970)!

Graduate students from the relatively new, lightly equipped Bragg lab were often sent to other labs to borrow equipment and supplies. I routinely volunteered to fill our carboy with ddH₂O from the still in Dr. Zbarsky's lab just across the hallway, as this gave me ~10 minutes to chat with the lovely Lucille Waung who was doing her M.Sc. there. Phil did, however, have one piece of new equipment - a Beckmann ultracentrifuge - on which I was glad to assist Ms. Waung in balancing the swinging bucket rotor. Phil had a strict rule that whoever was using the ultracentrifuge had to stand in front of it until it reached its cruising speed – another 15 minutes of chatting time! This worked out well for us and I am happy to report we celebrated our Golden Wedding Anniversary in December 2021.

GHD's lab at UBC was a hive of activity until late in the evening, after which grad students and PDFs went off for a beer at the Cecil Hotel. I made a lot of friends there and followed their projects on histone modification and the early search for protamine mRNA with great interest. But it was not until my second post-doctoral experience that I got to work with Gordon upon his return to Canada after he had spent two years at the University of Sussex in the UK. By this time, it was realized that eukaryotic mRNAs had poly(A) tails that allowed their selective isolation on oligo(dT) cellulose (Aviv and Leder 1972). These were the early days of molecular biology, and GHD's lab at the Foothills Hospital in Calgary was a good place to learn mRNA isolation, reverse transcription, and some simple DNA sequencing.

Antifreeze protein research on the aptly named winter flounder

In 1977, I began my faculty position at Queen's University with the goal of studying messenger ribonucleoprotein particles in muscle. But I was soon approached by Choy Hew, one of the former grad students I knew from GHD's lab at UBC. Choy had taken up a faculty position at the Memorial University of Newfoundland three years earlier to study insulin synthesis in cod. But after a bitterly cold snap in early winter, ice formed in an outdoor seawater tank and killed the Atlantic cod (*Gadus morhua*) that he was using for his experiments, while leaving winter flounder (*Pseudopleuronectes americanus*) unscathed. The explanation for this lay in the protection winter flounder had from antifreeze proteins (AFPs) that had been discovered five years earlier in Antarctic fishes (DeVries and Wohlschlag 1969). Ironically, cod also have AFPs of

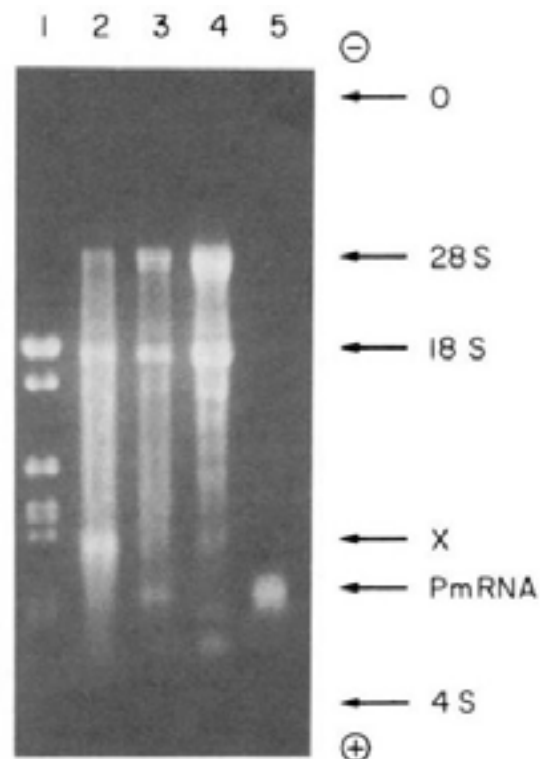


Figure 1. Electrophoresis of fish RNAs on a methyl mercury agarose gel

Lane 1 - poly (A)- RNA; lane 2 - poly (A) + RNA from flounder liver polysomes after one passage through oligo(dT) cellulose; lane 3 - poly (A) + RNA from flounder liver polysomes after two passages through oligo(dT) cellulose; lane 4 - rainbow trout protamine mRNA standard (PmRNA); lane 5 - liver total RNA illustrating the migration of 28S and 18S ribosomal RNAs. X indicates the migration of the putative winter flounder mRNA. Reproduced with permission from Davies and Hew 1980.

the same type - antifreeze glycoproteins (AFGPs) - found in most Antarctic fishes but at that point in the winter the cod had not yet built up a sufficient concentration to protect themselves from freezing (Fletcher et al. 1989). Based on my rudimentary molecular biology skills Choy suggested we work together on fish AFPs beginning with those from the flounder. In one of our first experiments, we saw an intense band of poly(A⁺) RNA in flounder liver that matched the expected size of the AFP mRNA (Figure 1) (Davies and Hew 1980). This seasonally expressed mRNA made up ~0.5% of the total liver RNA in the late fall but was barely detectable in the summer months (Pickett et al. 1983). Cloning and sequencing of the AFP cDNA yielded the amino acid sequence of the AFP pre-protein and provided a DNA probe for screening

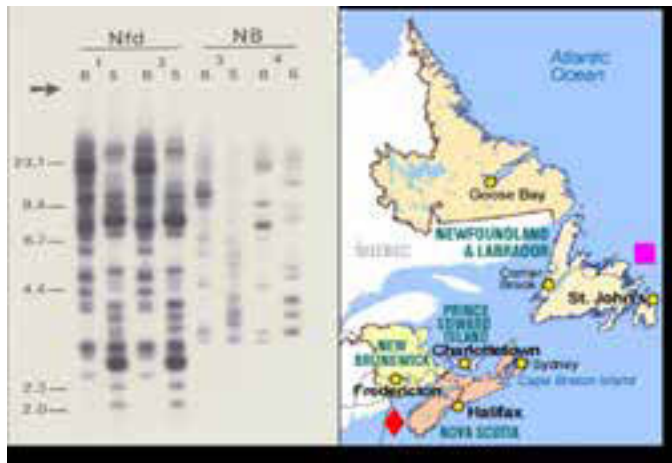


Figure 2. Population differences in the type III AFP gene family of ocean pout from two locations in the Maritimes

Testis DNAs from four individuals were digested with *Bam*HI (B) or *Sst*I (S) and were Southern blotted. The blots were probed with type III AFP cDNA. Individual fish (1 and 2) from Newfoundland (Nfd) were collected near St. John's (mauve square on right), where the pout produce 20 mg/mL of AFP in their blood. Individual fish (3 and 4) from New Brunswick (NB) were collected from the Bay of Fundy (red diamond in bottom lefthand corner), where they produce 3 mg/mL of AFP in their blood. Adapted from Hew et al. 1988.

home-made genomic libraries, from which we isolated AFP genes and mapped their loci (Davies et al. 1982). The flounder AFP genes were present as a large multigene family with many of the genes being tandemly amplified. It seemed to us as if the fish had been under intense selective pressure to produce enough AFP to survive in shallow icy seawater (Scott et al. 1985).

Recent evolution of different AFP types in marine fishes

Meanwhile, in the 1980s, new AFPs were being discovered, including those found by Choy in other fishes from Newfoundland waters (Li et al. 1985; Slaughter et al. 1981). These were put into the same pipeline of mRNA isolation, cloning, sequencing, and genomic library screening. In each case, genomic Southern blotting and mapping of genomic clones showed that these AFPs were also encoded by multigene families where sections had been tandemly amplified (Scott et al. 1988a). One of the most amazing discoveries came from comparing the Southern blots of ocean pout (*Macrozoarces americanus*) from two different locations in the Maritimes (Hew et al. 1988). Pout from the relatively sheltered waters

of the Bay of Fundy, NB, had 30-40 copies of the type III AFP gene, but those from the colder waters of Newfoundland had ~150 copies (Figure 2). Based on these blots alone, the two populations could well have been different species. But when the blots were stripped and re-probed with a β -tubulin cDNA, the dozen new tubulin gene hybridization signals were indistinguishable between the two populations. Since then, we have seen other examples of AFP multigene families expanding or contracting to meet the demand for protective amounts of AFP (Graham et al. in press).

In total, four different types of AFPs (types I, II, III and the original AFGP type) have been found to protect fishes from freezing (Fletcher et al. 2001), but their scattered distribution within the phylogenetic tree of teleosts was puzzling (Figure 3). Some types (all but the monophyletic type III) were interspersed between other types, suggesting complex scenarios of gene gain and loss (Scott et al. 1986). It has taken much effort and advances in DNA sequencing and genome assembly to get a clearer picture of what is going on. What was apparent early on was that AFPs had independently evolved on several occasions relatively recently during the 200-million-year radiation of teleost species. On researching the climate record of Earth over this period, it became clear that AFPs had not been needed until the last 30 Ma when sea level glaciation began as Antarctica arrived at the South Pole, and sometime after that in the Arctic when the pinching off of the Bering Strait restricted ocean circulation to the North Pole. By this time, teleost families and even genera were well established. We now realize that the alanine-rich, alpha-helical type I AFPs have convergently evolved on four occasions in different branches of teleosts (Graham et al. 2013) and the AFGPs have independently evolved in fishes from opposite poles of the Earth (Chen et al. 1997a). Most strikingly of all, the lectin-like type II AFPs appear in three widely diverged branches of teleosts as a result of lateral gene transfer (Graham and Davies 2021). That four different AFPs have recently evolved in fishes on at least ten occasions is an unprecedented example of adaptation to a new niche - that of icy seawater.

Structure-function analysis of fish AFPs: mapping the ice-binding site by mutagenesis

Another aspect of this fascinating evolutionary story lies in how radically different proteins have arisen to bind to the same ligand - ice. AFPs are extremely soluble in water

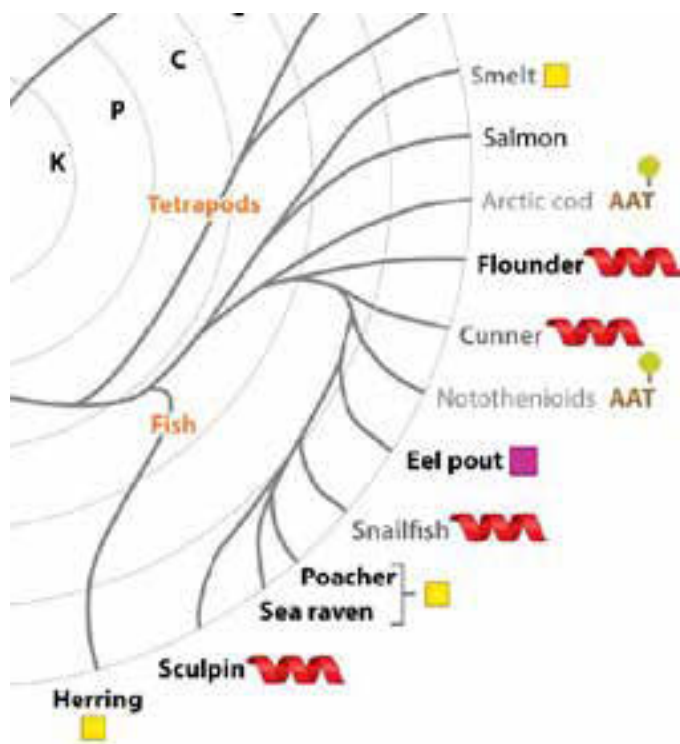


Figure 3. Phylogenetic tree of fishes that produce AFPs
AAT (brown) represents antifreeze glycoproteins; red coils are alanine-rich alpha-helical type I AFPs; yellow squares are lectin-like type II AFPs; the purple square represents a β -clip type III AFP fold. Salmon, like most fishes, does not produce an AFP. Adapted from Bar Dolev et al. 2016.

and yet bind irreversibly to its frozen state. Interest in this protein structure-function mystery was sparked during my first sabbatical leave in 1987-88, which for family reasons we took back in Vancouver at UBC. Mike Smith graciously hosted my visit, and I was greatly impressed how his group and collaborators were able to dissect the role of individual amino acids in cytochrome *c* using site-directed mutagenesis, X-ray crystallography, and expression studies in yeast. On my return to Queen's, our group set about synthesizing and expressing a gene for the 65-residue type III AFP in *E. coli* (Chao et al. 1993). After obtaining an NMR structure for the type III AFP in collaboration with Brian Sykes's lab (Sonnichsen et al. 1993), we undertook site-directed mutagenesis experiments to map the ice-binding site. By aligning and comparing the sequences of many type III AFP isoforms it was possible to identify the conserved amino acids and guess at their roles. Some were internal residues needed for the protein fold whereas others that were outward-pointing tended to cluster together on one part of the

protein's surface. The latter residues were targeted for mutagenesis on the hunch that they formed the ice-binding site (IBS). This was confirmed when amino acid replacements led to reduced freezing point depression and changes in the ice crystal shape (Chao et al. 1994). The realization that the IBSs of AFP types I and III were more hydrophobic than the other surfaces of the proteins (Sonnichsen et al. 1996) called into question the proposed mechanism that AFPs bound to ice through a set of hydrogen bonds that matched the ice lattice (DeVries and Lin 1977). Another argument against the 'hydrogen bonding hypothesis' was that the ice lattice was covered with a thin layer of water molecules that were neither ice nor bulk solvent. This quasi-liquid layer would prevent direct hydrogen bonding of AFPs to the ice lattice.

Hyperactivity in insects AFPs that bind the basal plane of ice

Given the limited number of fish AFPs for IBS analysis this proved to be an opportune time to team up with Virginia Walker from the Department of Biology at Queen's to isolate and characterize some insect antifreeze proteins. Several insect species over-wintering at sub-zero temperatures were known to produce AFPs but these proteins had not been adequately purified for characterization. We were able to isolate AFPs from spruce budworm (*Choristoneura fumiferana*) moth larvae (Tyshenko et al. 1997) and from *Tenebrio molitor* beetle larvae (Graham et al. 1997). When these AFPs were fully purified we realized they were ~10 times more active on a mg/mL basis than the fish AFPs, and hence they were labelled 'hyperactive'. The basis for this exceptional activity is the ability of these insect AFPs to also bind to the basal plane of ice. In the 1990s, Charlie Knight, an atmospheric scientist at the National Center for Atmospheric Research, Boulder, CO, had developed an 'ice etching' technique using a large single hemispherical ice crystal to determine which ice planes the AFPs bound (Knight et al. 1991). Once the crystal had been overgrown by a few mm in the presence of a solution of AFP the ice hemisphere was removed, rinsed, and allowed to sublime in a freezer until the bound AFP was uncovered as a white patch of protein powder on a particular plane (or planes) of ice. One adaptation we made to this method was to attach fluorescent tags to the AFPs to eliminate the need for sublimation (Basu et al. 2014) and to permit more than one AFP (with different fluorescent tags) to be imaged on the same ice crystal (Figure 4). Almost every

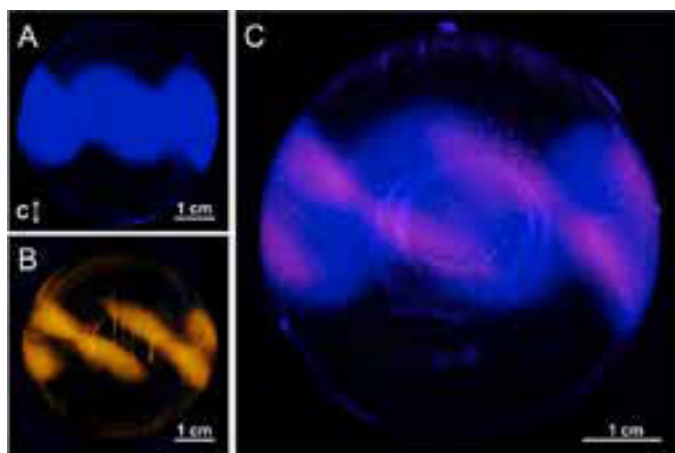


Figure 4. Images of fluorescently labeled IBPs binding to a hemispherical single crystal of ice with its c-axis in the vertical orientation

Pacific Blue-labeled type III AFP (A); TRITC-labeled type I AFP (B); a mixture of the two labeled AFPs (C) showing the distinction in their binding planes. Reproduced with permission from Basu et al. 2014.

hyperactive AFP we have examined has bound to the basal plane in addition to prism or pyramidal planes of ice (Mok et al. 2010).

Ice affinity purification in the search for novel IBPs

Another outcome of learning this technique was the development of ice affinity purification (IAP) (Kuiper et al. 2003). We reasoned that if Charlie Knight was able to physically see the AFP after sublimation as a powder on the ice hemisphere, then this would allow us to purify ‘ice-binding proteins’ (IBPs) from the thousands of other proteins in a crude extract of any organism. Note the use of the new term: ‘ice-binding protein’. This became necessary when ‘AFPs’ were discovered in plants where their role is to inhibit ice recrystallization rather than to prevent freezing (Urrutia et al. 1992), and in bacterial adhesins where ice-binding can anchor the microorganism to ice (Guo et al. 2012). AFP now applies to an IBP that functions to protect their host (like freeze-intolerant fish and insects) from freezing. IAP became a game-changing methodology in the search for new AFPs, especially in tiny winter-active arthropods like the springtails (*Hypogastrura harveyi*) that we found on snowbanks at the Queen’s University Biological Station (Graham and Davies 2005). With several thousand of these ‘snow fleas’ needed to make up a gram of tissue, an efficient extraction method was essential. IAP was effective at excluding non-IBPs into the liquid fraction,

which could be back-extracted to improve yields, while the ice fraction can be reextracted to increase purity. Another novel AFP, the first from a fly, was extracted by IAP from Lake Ontario midges (chironomids) that are almost as small as the springtails (Basu et al. 2015). In these examples, the pipeline of discovery was IAP followed by tandem MS sequencing and transcriptome analysis. A gene encoding the mature AFP was synthesized for expression in *E. coli* and the recombinant protein was purified from the bacterial lysate by IAP in sufficient quantities for characterization and structural analysis by X-ray crystallography. Ironically, I had spent the first year of my post-doctoral studies in Professor Klaus Mosbach’s laboratory at the University of Lund, Sweden, where they specialized in affinity chromatography. It really should not have taken me 20 years to introduce IAP!

Searching for common properties in ice-binding sites from different IBPs

There are now crystal structures for 13 different IBPs from fish, arthropods, plants, and microorganisms (Figure 5), and robust models for at least two more. NMR too has played a key role in discovering new IBP folds (Gronwald et al. 1998; Sonnichsen et al. 1993). This technique has also pointed out some discrepancies in how well the ice-binding site from a crystal structure matches the situation in solution at the working temperature of the IBP (Gronwald et al. 1996). From these studies we now have a much better idea of what constitutes an ice-binding site. These surfaces are extensive, flat, and somewhat hydrophobic (Davies 2014). The first two insect AFPs (beetle and moth), which were structurally characterized in papers published back-to-back in *Nature* (Graether et al. 2000; Liou et al. 2000), are beta-solenoids stabilized by disulfide bonds where the IBS is a remarkably flat beta sheet from which two parallel ranks of Thr emerge. Although these two solenoids are not homologous, they have evolved a similar IBS where the distances between Thr side chains within TxT motifs, both on and between parallel beta strands, match the distances between O atoms in the ice lattice (Figure 6). The significance of this match, when direct hydrogen bonding between AFP and ice lattice had been ruled out, took longer to fathom. Given the hydrophobicity of the IBS relative to other surfaces of the AFP we wondered if the release of constrained waters from the IBS on binding to ice was the driving force for adsorption. Fortunately, several computational scientists were on the case and proposed that the IBS ordered ice-like waters that could

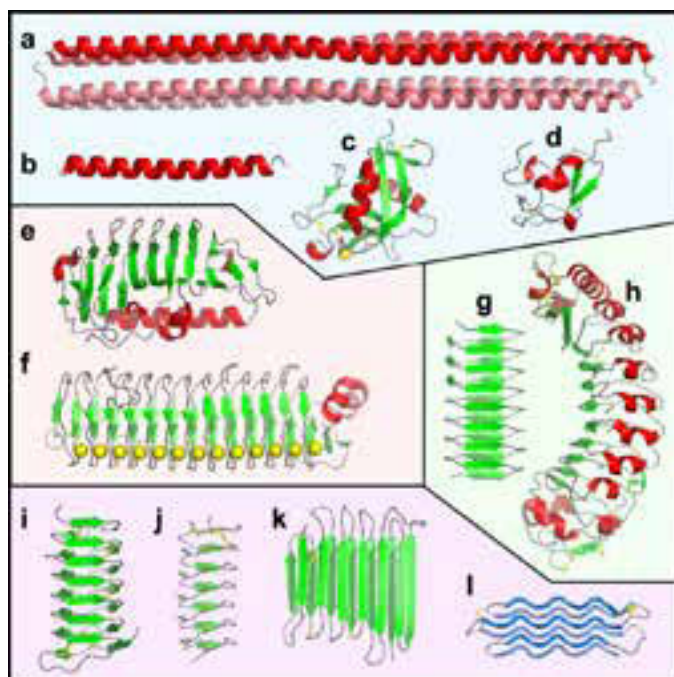


Figure 5. Crystal structures of IBPs from fish (a-d), microorganisms (e,f), plants (g,h), and arthropods (i-l) Secondary structure elements are represented by red coils (alpha helix), green arrows (beta strands), blue ribbon (polyproline type II helix), grey strands (coil), and gold spheres denote calcium ions. PDB codes for the structures shown are: 4KE2 (a), 1WFA (b), 2PY2 (c), 1AME (d), 3VN3 (e), 3P4G (f) 3ULT (g), 6W78 (h), 1M8N (i), 1EZG (j), 4DT5 (k), 2PNE (l). Adapted from Davies 2014.

merge with the quasi-liquid layer around the ice lattice (Gallagher and Sharp 2003; Nutt and Smith 2008). Once the merger was achieved, the ice-like waters would then freeze the AFP to the ice surface. The 2008 article by Nutt and Smith had a persuasive visualization of spruce budworm AFP binding to ice by this mechanism.

FDo ice-binding sites order waters into an ice-like pattern?

At that time, evidence for ordered waters on the IBS was fragmentary. When AFPs crystallized, they usually did so with their IBS forming a protein-protein contact surface due to its flatness and hydrophobicity, which tended to exclude waters from the interacting area. Eventually, we crystallized a bacterial hyperactive IBP that had one IBS in the four-molecule unit cell fully exposed to solvent. On its surface we found over 50 ice-like waters, with many of them organized around the methyl groups of a rank of Thr, where some of these waters were hydrogen bonded to the Thr OH groups, or to amide groups on a

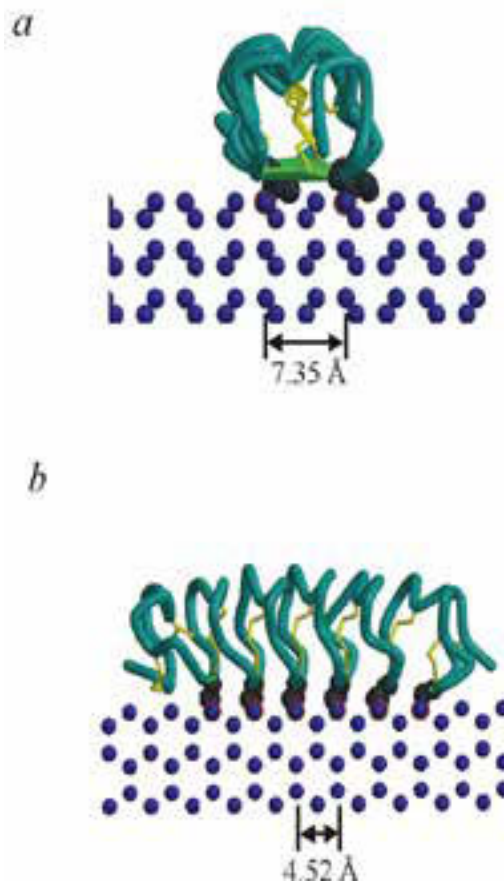


Figure 6. Crystal structure of *Tenebrio molitor* AFP (1EZG) aligned to the ice lattice

a) End-on view of the solenoid showing the match of oxygen atoms (red perimeter) from threonine side chains in the TxT motif and a bound water to oxygen atoms on the primary prism plane of ice. b) Side view of the solenoid showing the match of oxygen atoms (red perimeter) from threonine side chains in neighbouring coils of the solenoid to oxygen atoms on the primary prism plane of ice. Reproduced with permission from Liou et al. 2000.

parallel array of Asn, or to the nearby peptide backbone (Garnham et al. 2011a). These waters matched closely to lattice waters on both the primary prism and basal planes of ice. Since then, we have found another particularly good example of an insect AFP crystallizing with its large, flat IBS exposed to solvent and with waters matching closely to the same two planes (Ye et al. 2020). Although these waters have been observed in protein crystals at liquid nitrogen temperatures, it is not clear what their occupancy is at the 0 °C working temperature of AFPs. An NMR study suggested that the residence time of surface waters on the IBS of an insect AFP was not significantly longer than those of water molecules on other surfaces

(Modig et al. 2010). Also, some simulation studies have come to a similar conclusion (Hudait et al. 2018). Nevertheless, the crystallography studies do suggest there is a propensity for ice-like waters to occupy the IBS. If, when the IBP approaches the quasi-liquid layer, there are sufficient of these waters in place (a quorum), then binding can occur. This might explain why expanding the area of the IBS results in disproportionally large increases in antifreeze activity (Leinälä et al. 2002), because the quorum of ice-like waters required for binding is easier to achieve. Clearly, additional studies are needed to probe the mechanism of adsorption of IBPs to ice.

Ice nucleating and ice-binding proteins have opposite functions but might use a shared mechanism

The study of bacterial ice nucleation proteins (INPs) might shed light on ways in which ice-binding proteins interact with both water and ice. It is well known that some bacterial pathogens, like *Pseudomonas syringae*, can cause frost damage to plants at sub-zero temperatures as high as -2 °C (Lindow et al. 1982; Maki et al. 1974). They are thought to trigger this 'heterogeneous' ice nucleation by forming aggregates of INPs anchored in the bacterial outer membrane that give an ice-like structure to the water they are in contact with. In the absence of ice nucleators, water clusters do not get large enough to trigger freezing until temperatures reach as low as -38 °C, which is the temperature of homogeneous ice nucleation. Although there are currently no solved structures for INPs, there are models, particularly for the central region containing 50 to 80 tandem 16-residue repeats. These models suggest that each repeat comprises one turn of a beta-solenoid (Garnham et al. 2011b; Graether and Jia 2001). What is particularly exciting about these models is that they resemble an extremely long insect AFP with the same putative water-organizing motifs in parallel arrays along the length of the solenoid. There are three ranks of external Thr, two of which form the common TxT motif on parallel beta strands, and one rank of stacked Tyr. Originally the Tyr were thought to form a dimerization motif (Garnham et al. 2011b). But since that proposal was made, midge AFP has been discovered to have an IBS comprising seven stacked Tyr (Basu et al. 2016) that can also be considered a water-organizing motif. We think that AFPs and INPs might work by the same mechanism of ordering ice-like waters on their surfaces, and that size is responsible for their opposite roles. AFPs are small and simply require enough ice-like waters to independently adsorb to a seed ice crystal and prevent its further

growth by the Kelvin effect (Knight 2000; Kuiper et al. 2015) whereas the larger INPs, which aggregate together to form patches, organize sufficient ice-like waters to initiate ice nucleation.

The case for irreversible binding of AFPs to ice

Some other tenets of the AFP mechanism of action have been difficult to establish. One is the idea that AFPs bind irreversibly to ice. Critics surmised that if there was an on-rate for AFP binding to ice there should also be an off-rate. But if AFPs left the ice surface, even for an instant, then water would join the ice lattice before the AFP could rebind and the ice crystal would slowly grow and eventually kill the organism. The ability to make recombinant IBP with fluorescent tags like GFP was invaluable for these studies. The first person to inquire about such a probe was Ido Braslavsky, with whom we have had an extremely productive collaboration. Ido's expertise extended into microfluidic systems where it was possible to form and manipulate a single ice crystal with fine temperature control under a microscope. When an ice crystal was formed and stabilized in the presence of GFP-tagged type III AFP, the sides of the hexagonal bipyramidal crystal were green from surface-adsorbed AFP (Pertaya et al. 2007). By shining a laser on the surface, it was possible to form a dark spot where the GFP tag had been bleached, without damaging the AFP. The crystal was maintained for days at a temperature between its melting and freezing points and despite being surrounded by soluble GFP-tagged AFP, the bleached spot never turned green, showing that no exchange of AFPs occurred on the ice surface. Another neat demonstration facilitated by IBP tagging was of melting hysteresis where the surface adsorption of an IBP raises the experimental melting point above the equilibrium melting point (Knight and DeVries 1989). In one example, a GFP-tagged IBP was able to raise the melting point by >0.4 °C, at which point the superheating of the ice crystal was so great that when it finally melted, the crystal vanished rapidly, leaving behind a haze of fluorescence (Celik et al. 2010).

Gene duplication and divergence spawns new IBPs

During these protein structure-function and mechanistic studies we maintained a keen interest in how the diversity of IBPs has arisen. These evolutionary events have become easier to investigate as the databases of protein and DNA sequences have expanded exponentially in the post-human genome sequence era. BLAST searching using the ocean pout type III AFP showed it to

be a homologue of the C-terminal domain of sialic acid synthetase (Baardsnes and Davies 2001), a connection also made in the first extensive report of the human genome sequence (Lander et al. 2001). Christina Cheng, who studies a related species of eel pout, has documented how the DNA for this domain was duplicated to another locus in the genome, where it picked up a signal sequence for protein export, then underwent rapid expansion of gene copy number (Deng et al. 2010). But how the IBS of this AFP arose and became efficient enough to drive the amplification by natural selection is still not clear in this example or others.

For globular AFPs with a 3-dimensional fold it has been reasonably straightforward to find the progenitor proteins. Type II AFPs were quickly recognized as being descended from Ca^{2+} -dependent lectins (Ewart and Fletcher 1993). Indeed, it was possible to accurately homology model the sea raven type II AFP from rat mannose-binding protein based on only 19% sequence identity (Sonnichsen et al. 1995). Another example is the carrot (*Daucus carota*) IBP, which is a homologue of a plant polygalacturonase-inhibiting protein (Worrall et al. 1998). However, the origins of simple repetitive IBPs have been much harder to figure out. One notable success from Christina Cheng's lab was tracing the origins of the AFGPs in the Nototheniid fishes of the Antarctic Ocean. These linear polypeptides have the repeating sequence of Ala-Ala- Thr with a disaccharide attached to the Thr OH group and are derived by proteolytic processing of much longer polyproteins (Chen et al. 1997a). The origin of the tri-peptide repeat comes from a 9-bp intronic sequence in the trypsinogen gene that has undergone massive amplification (Chen et al. 1997b). This accounts for the unusual tissue-specific expression of the AFGPs. They are produced by the pancreas, secreted into the digestive tract, and absorbed from there into the circulation (Cheng et al. 2006). The other occurrence of AFGPs is in Northern cods, a distinct branch of teleost fishes far removed from the Notothenioids (Figure 3). In this case new genomic sequences were mined by the Cheng lab and confirmed that the cod AFGPs arose from a completely different source despite their proteins being almost indistinguishable (Zhuang et al. 2018).

This remarkable example of gene convergence from different origins has parallels in the four branches of teleosts that have independently evolved the type I AFPs (Figure 3) (Graham et al. 2013). We have recently

completed a study on the origin of the gene in righteye flounders using starry flounder (*Platichthys stellatus*) as the model fish. We found the gene for its type I AFP has arisen from a duplication of the locus coding for an antiviral protein. The original locus then gave rise to the AFP gene. Here there was extensive conservation of untranslated sequence and flanking DNA but very little if any retention of the coding region. As occurred with the AFGP-producing fishes there seems to have been rapid expansion of a short peptide sequence followed by gene duplication, divergence, and amplification to produce a multigene family (Graham et al. in press). The order of the genes in the AFP locus matches their evolutionary development, with skin-specific isoforms being the first to be produced as a defence against inoculative freezing from contact with ice in seawater. This was followed by development of a large isoform that was secreted into the blood, after which smaller versions of the circulating protein evolved, perhaps to diffuse more widely through the body and provide freeze resistance to all compartments. The timing of this gene evolution occurred within the Cenozoic ice ages some time after the split of halibuts from other righteye flounders because the Atlantic halibut has only one copy of the antiviral gene locus that retained its original function and location and no AFP genes.

Vertebrate to vertebrate horizontal transfer of fish AFP genes

An earlier investigation of type II AFPs, which are found in three widely spaced branches of teleosts (Figure 3), came up with some extraordinary findings. These lectin-like AFPs in herrings, sea raven and smelt were remarkably similar in having 10 cysteines in identical locations (Graham et al. 2008). All other lectin-like sequences known at that time had no more than eight Cys, and with most having only four or six. The herring and smelt type II AFPs were 85% identical in sequence even though these species had been apart for over 200 million years. This observation drove us to sequence their genes where we found that even introns and untranslated regions were over 90% conserved, which is what you might expect for different species in the same genus, but certainly not from fish belonging to different orders. The only reasonable explanation was that the AFP gene had been recently passed between herring and smelt by lateral gene transfer. We had the hardest time trying to publish these exciting results that a gene had been passed from vertebrate to vertebrate. The split reviews we got back

from one submission illustrate this point. Two said that lateral gene transfer happens all the time and is no longer novel. The other two reviews said this transfer could not possibly have happened - we must be mistaken! A follow-up study four years later showed there was a single copy of the AFP gene in the rainbow smelt (*Osmerus mordax*) and that the gene synteny of this locus indicated the gene had been recently transferred into the smelt (Graham et al. 2012). In other words, the AFP gene was missing in this locus in several close relatives of the rainbow smelt that retained the same order of flanking genes. The steady accumulation of genomic sequences has paid off here too because we were recently able to access the Atlantic herring (*Clupea harengus*) genome sequence (Pettersson et al. 2019). From this we deduced the length of the herring sequence that had been transferred to the smelt (Graham and Davies 2021). Moreover, in that transferred sequence was a transposon peculiar to the herring that was not found elsewhere in smelts. Thus, the herring DNA had been fortuitously tagged prior to transfer. The other conclusion from the synteny of the two AFP gene loci in herring compared to its close relatives was that the AFP gene did not originate in the herring either, but that it too has been transferred in from another species, most likely from the third branch of fish that produce type II AFPs.

As for the mechanism of lateral gene transfer between two fish in the wild, we favour the hypothesis that fragments of herring DNA were able to piggy-back on the smelt sperm during fertilization of their eggs. This method has been used to make transgenic fish in the laboratory (Lavitrano et al. 2006). It may work because the foreign DNA is transported into the fish egg through the micropyle where the sperm enter and where the male and female pronuclei meet, which is the ideal location for incorporation of DNA into the new nucleus. We were aware of this possibility when Choy Hew, Garth Fletcher and I set out in the 1980s to make transgenic Atlantic salmon (*Salmo salar*) that were freeze-resistant by producing winter flounder AFP. The flounder AFP gene was microinjected through the micropyle of the salmon eggs immediately after fertilization by chemically delaying the hardening of the chorion (Hew et al. 1992). About 3% of the hatchlings contained the transgene, but many of these were mosaics due to delayed incorporation of the AFP gene into the rapidly dividing embryonic cells, and so it took another generation to obtain Mendelian inheritance. Between starting this project and obtaining

transgenic salmon, we learned that winter flounder needed at least 30 copies of this gene to produce enough AFP (Scott et al. 1988b), whereas we had only introduced one copy into the salmon! For organisms like fish that practice external fertilization in a medium that contains DNA of virtually every species that lives there, it is quite likely that foreign DNA/genes do get incorporated into fertilized eggs. However, these rare events might never be detected if they do not confer a selective advantage to the recipient. Another candidate for lateral gene transfer between fish might be the protamine genes that GHD spent much of his career studying. Some fish retain histones in their sperm and others replace them with protamines. However, the distribution of protamines in fishes does not seem to follow a clear phylogenetic pattern and should be investigated to see if lateral gene transfer has been at work.

Acknowledgments

I am grateful to the Canadian Society for Molecular Biosciences for the 2021 Canadian Science Publishing Senior Investigator Award and to the colleagues who put forward my nomination. A big thank you to my many mentors and collaborators, only a few of whom I have been able to mention by name here. Our successes have been driven by the wonderful trainees and research associates who have powered the lab for over 40 years and made so many exciting discoveries. Please allow me to single out Mrs. Sherry Gauthier, who trained a generation of grad students as our lab den mother for over 30 years, and Dr. Laurie Graham, whose scientific insight and rigor are second to none. We greatly appreciate funding from CIHR, and its forerunner, the MRC, in support of this basic research. Lastly, I give special thanks to my wife, Lucille, for her patience, understanding, and encouragement that have allowed me to enjoy a career in science. As a high school Chemistry teacher and author of Chemistry textbooks she has guided many students into science, some of whom I have interacted with at Queen's.

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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 and teaching activities slowly returned to the "new normal" over the course of the academic year with a mixture of both in-person and remote classes resuming in September 2021. There was a slight hiccup as examinations were abruptly converted to online formats when the "fourth wave" of COVID struck in late December. Fortunately, research activities, for the most part, returned to their pre-pandemic levels despite the scarcity of plastic pipette tips! The graduate students were exceptionally pleased to be able to hold their **Graduate Student Research Day** in-person this year.



Poster session at the 2021 Graduate Student Research Day
(photo courtesy of Jeff Simmons)



Dr. Jan Rainey
(photo courtesy of Jan Rainey)

The Department of Biochemistry & Molecular Biology continued to celebrate and recognize the accomplishments of faculty and trainees. **Jan Rainey** was awarded a CFI JELF with matching funds from Research Nova Scotia and additional support from the Faculty of Medicine to establish a 600 MHz NMR spectrometer facility in



Mr. Paul Briggs
(photo courtesy of Heidi MacKinnon)

the Faculty of Medicine. Having been with the Department since 1985 and serving as an Instructor since 2008, **Paul Briggs** retired in June 2021. Paul was the recipient of the 2021 Department of Biochemistry & Molecular Biology *Excellence in Teaching Award* for his outstanding commitment, dedication, and innovation in the teaching and development of the laboratory exercises in our 2nd-year and 3rd-year courses. Paul's generosity with his time was greatly appreciated by his students and fellow faculty. His engagement and knowledge of academic processes and protocols will be missed, not to mention his role as the departmental "computer guru" and all-around "handyman" over the years.



Dr. Shawn Xiong
(photo courtesy of Shawn Xiong)

The Department was delighted to recruit **Shawn Xiong** as an Instructor. In addition, the Department was pleased to recruit **Geoffrey Hesketh** for its Translational Metabolism position. Geoff will be starting his appointment on July 1, 2022.

Aaron Woblistin, a graduate student with **Barbara Karten**, was awarded the *Beth Gourley Travel Award*.

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.



Aaron Woblistin receiving the Beth Gourley Travel Award with Dr. Barbara Karten (supervisor) and Dr. Stephen Bearne (Head) (photo courtesy of Heidi MacKinnon)

This will be my last CSMB report since I will be stepping down after serving 10 years as the Department Head. I thank the faculty and staff for all their support during this time; it has been a pleasure to work with everyone – to adapt a phrase from a once popular soldiers' ballad, "Old Heads never die, they just fade away".

Hospital for Sick Children Research Institute, Toronto

Molecular Medicine Program

Correspondent: Charles Deber



Dr. Julie Forman-Kay

Dr. Julie Forman-Kay, Senior Scientist and Department Head in the Molecular Medicine Program at the Research Institute at the Hospital for Sick Children, and Professor in the Department of Biochemistry, University of Toronto, was named the 2022 Biophysical Society of Canada Fellow. Dr.

Forman-Kay is a pioneer in elucidating the relationships among structure, dynamics, and function of intrinsically disordered proteins and biomolecular phase separation. She will be presenting a plenary lecture at the Biophysical Society of Canada meeting.

Dr. Jean-Philippe Julien, Senior Scientist, Molecular Medicine Program at the Hospital for Sick Children



Dr. Jean-Philippe Julien

Research Institute, and Associate Professor in the Departments of Biochemistry and Immunology at the University of Toronto, delivered a lecture at the Canadian Society for Molecular Biosciences 2021 annual meeting in recognition of his CSMB New Investigator Award. In a further distinction,

Dr. Julien gave the W.H. and W.L. Bragg Prize Lecture at the International Union of Crystallography IUCr 2021 meeting for his recognition as an outstanding early-career crystallographer. Also in 2021, Dr. Julien was named one of Canada's Top 40 Under 40®, recognized for his contributions to antibody research and commitment to research translation. Dr. Julien's laboratory focusses on the characterization of antibodies and immune receptors involved in health and disease by using a combination of biochemical, biophysical, immunological, and structural techniques.



Dr. Cliff Lingwood

Dr. Cliff Lingwood, Senior Scientist Emeritus in the Program in Molecular Medicine at the Hospital for Sick Children Research Institute, and Professor Emeritus in the Departments of Biochemistry and Laboratory Medicine and Pathobiology at the University of Toronto, some years ago started a

company (ViroCarb Inc.) to develop new treatments for HIV. Traction has increased following the licensing of a new patented class of inhibitors of viral mRNA processing which have proven highly effective against Covid-19. A detailed description of this recent advance can be found at <https://moleculargenetics.utoronto.ca/news/small-molecule-exhibits-pan-antiviral-activity-adjusting-host-cell-environment>.

Dr. John Rubinstein, Senior Scientist in the Program in Molecular Medicine at the Hospital for Sick Children



Dr. John Rubinstein

Research Institute, and Professor in the Departments of Biochemistry and Medical Biophysics at the University of Toronto, was awarded renewal of his Tier 1 Canada Research Chair in Electron Cryomicroscopy for a final seven-year term. With this award, Dr. Rubinstein will develop methods to use

cryo-EM to investigate the structure and dynamics of large membrane protein complexes involved in biological energy conversion. His research program will include understanding how proton pumping V-type ATPases are regulated during loading of synaptic vesicles, and studying how respiratory complexes can be targeted in mycobacterial infection. A picture of mycobacterial ATP synthase bound to the TB drug bedaquiline (adapted from Guo, Courbon, et al. 2021, *Nature* 589, 143-147) can be seen at: https://www.dropbox.com/s/ng4wdk2zpcc9tad/mycobacterial_F1Fo.pdf?dl=0.



Dr. Ji-Young Youn

Dr. **Ji-Young Youn**, Scientist in the Molecular Medicine Program at the Hospital for Sick Children Research Institute, and Assistant Professor in the Department of Molecular Genetics at the University of Toronto, has been awarded a Tier II Canada Research Chair in Membraneless Organelle Proteomics. Her research

involves a type of membraneless organelles, called stress granules, that rapidly respond to cellular needs by regulating biological processes in stressful conditions. Dr. Youn and her group are interested in understanding how several hundreds of proteins concentrate into stress granules and how they are organized and in elucidating the relationship between stress granules and disease, specifically neurodegenerative diseases such as amyotrophic lateral sclerosis (ALS) and frontotemporal dementia (FTD). The lab employs discovery-based proteomics techniques and cell biological tools to study these questions.

McGill University

Department of Biochemistry

Correspondents: Lawrence Kazak, Natasha Chang, and Maria Vera Ugalde (with Briana Blair and Christine Laberge)

2021 was a truly exciting and successful research year for the department while we were still adapting to the second year of COVID-19 challenges.

Faculty news:

The department welcomes incoming Assistant Professor, **Katherine Cockburn**, whose lab applies cutting-edge live fluorescence microscopy approaches to study stem cells in skin regeneration and disease. The department congratulates **Ian Watson** on his promotion to Associate Professor.

Research news:

Lawrence Kazak's team published a paper in *Nature* on adipocyte thermogenesis. Janane Rahbani, a post-doctoral fellow in the Kazak lab, led the study which identified a key effector protein of a thermogenic pathway called the futile creatine cycle: *Nature* 2021 Feb 590(7846):480-485. Also in *Nature*, the Kazak lab co-authored work on the identification of the second effector protein of the futile creatine cycle: *Nature* 2021 May 593(7860):580-585. In addition, the Kazak lab co-authored work in *Cell Metabolism* on obesity-accelerated breast cancer: *Cell Metab.* 2021 Mar 2;33(3):499-512.

Nahum Sonenberg's team published a paper in *Nature* on how the antidepressant actions of ketamine engage cell-specific translation via eIF4E: *Nature* 2021 Jan 21;81(2):398-407.e4. In addition, the Sonenberg lab published two papers in *Mol. Cell* and one paper in *Nucleic Acids Res.* on different aspects of the regulation of mRNA translation.

Work from **Maxime Bouchard's** lab has revealed how the formation of tissues proceeds through a progression of different progenitors. This understanding is important for the generation of organ replacement in regenerative medicine but also in identifying regulators of progenitor progression leading to tissue morphogenesis and potentially cancer progression: *Nature Commun.* 2021 May 12(1):2627.

Three other fundamental papers were published in *Nature Commun.* from the labs of **Kally Gehring** "Crystal

structure of an archaeal CorB magnesium transporter”, **Albert Berghuis** “Structural and functional insights into esterase-mediated macrolide resistance”, and **Sidong Huang** “SMARCA4/2 loss inhibits chemotherapy-induced apoptosis by restricting IP3R3-mediated Ca²⁺ flux to mitochondria”.

Work from **Arnim Pause** found that Folliculin impairs breast tumor growth by repressing TFE3-dependent induction of the Warburg effect and angiogenesis. These findings have important implications for the treatment of breast cancer (*J. Clin. Invest.* 2021 Nov 15;131(22):e144871).

The team of **Selena Sagan** discovered three distinct resistance mechanisms based on alterations in RNA structure by which the hepatitis C virus evades miR-122-based therapies: *Proc. Natl. Acad. Sci. USA* 2021 Aug 17;118(33):e2103671118.

The team of **Thomas Duchaine** published its discovery on the role of microRNA-mediated translation repression through GYF-1 and IFE-4 in *C. elegans* development: *Nucleic Acids Res.* 2021 May 21;49(9):4803-4815.

Work from **Imed Gallouzi’s** lab found that the pharmacological or genetic inhibition of iNOS prevents cachexia-mediated muscle wasting and its associated metabolism defects: *EMBO Mol. Med.* 2021 Jul 7;13(7):e13591.

The team of **Martin Schmeing** revealed the structure and function of the amino acid polymerase cyanophycin synthetase: *Nat. Chem. Biol.* 2021 Oct;17(10):1101-1110.

Faculty honours and awards:

These and other research successes were recognized by honours and awards, including **Natasha Chang**, who was awarded a FRQS Research Scholar-Junior 1. **Morag Park** received the Armand-Frappier Prix du Québec, and **Michel Tremblay** received the Wilder-Penfield Prix du Québec, which are the most prestigious prizes offered by the Québec Government. **Morag Park** was also honoured by the Ordre du Québec. **Ian Watson** received the MI4 Innovates Pfizer Early Career Investigation Award.

Trainee awards and news:

Congratulations to **Faiz Hussain** (Lawrence Kazak lab) for receiving an internal studentship from the faculty

of medicine at McGill, a Canderel Studentship, and a Rolande and Marcel Gosselin Graduate Studentship. Post-doctoral fellow **Janane Rahbani** (Lawrence Kazak lab) received a CIHR post-doctoral fellowship and **Celia Alecki** (Maria Vera Ugalde lab) received a FRQS post-doctoral fellowship. Ph.D. student **Suleima Jacob-Tomas** (Maria Vera Ugalde lab) was awarded a Vanier Canada Graduate Scholarship. From Selena Sagan’s lab, **Michelle Manolya Sag** received a CanHepC fellowship. Several students were awarded FRQS Graduate Fellowships; **Marylin Rheault** (Selena Sagan lab), **Philippe Carle** (Imed Gallouzi lab), **Romina Filippelli** (Natasha Chang lab), **Marina Fukano** (Morag Park lab), **Kayla Heney** (Ian Watson lab), **YunYun (Anna) Shen** (Peter Siegel lab), **Mara Whitford** (Luke McCaffrey lab), and **Tianxiao (Peter) Yang** (Alba Guarné lab).

Teaching news:

The Biochemistry graduate program continued to do well in 2021. Our numbers are stable; in Fall 2021 we had 157 students, with 37 new admissions. Of our total students, 68 were Master’s students and 89 were Doctoral students; 83 were Canadian and 74 international. There were 94 female and 63 male students. We continue to have a diverse and well-balanced student body, which is the heart of the department. The Master’s 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 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 crowdfunding to financially support BIOC/IHI undergraduate students undertaking a summer research project in the department.

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

Correspondent: John Whitney

2021 was another challenging year for the faculty, staff and students in the Department of Biochemistry and Biomedical Sciences (BBS) at McMaster University, as successive waves of the pandemic continued to present personal and professional challenges to our members. However, there does appear to be light at the end of the tunnel with in-person conferences slated to resume in the summer of 2022.

New faculty member:



Dr. Jonathan Stokes joins the faculty in the Department of Biochemistry & Biomedical Sciences as an Assistant Professor

In 2021, we welcomed our newest faculty member, **Dr. Jonathan Stokes**, who joins us after completing their post-doctoral fellowship in Jim Collins' Lab at MIT. Jon's research interests lie at the interface of microbial chemical biology and artificial intelligence, and their newly formed group will use to this expertise to identify and characterize new small molecules with unique antimicrobial

properties. Dr. Stokes has an outstanding track record as a trainee with lead author studies in *Cell Chemical Biology*, *eLife*, *Nature Microbiology*, and *Cell*, and we look forward to seeing the Stokes lab make exciting discoveries in the coming years.

Faculty research:

Over the past year, several notable papers were published by BBS faculty members and their trainees. For example, **Jonathan Schertzer's** lab discovered that the molecular properties of bacterial lipopolysaccharides greatly influence the effects these molecules have on metabolic endotoxemia (*Cell Reports*, 2021). Within our Institute for Infectious Disease Research (IIDR), **Gerry Wright's** lab discovered a new class of bacterial protease inhibitors

synthesized by the gene products of a biosynthetic gene cluster found in *Streptomyces cattleya* and related soil-dwelling bacteria (*Nature Microbiology*, 2022). **Brian Coombes'** lab found that psychological stress impairs protective gut mucosal immunity against colonising pathobionts including adherent-invasive *Escherichia coli* (*Nature Communications*, 2021). The lab of **Matthew Miller**, along with collaborators in our Pathology Department, reported the development of an inhaled SARS-CoV-2 vaccine (*Cell*, 2020).

Honours and awards:

There were also a number of significant accomplishments achieved by our faculty and students in 2021. **Lori Burrows** was elected to the Canadian Academy of Health Sciences and was named a Tier 1 Canada Research Chair in Microbe-Surface Interactions (a long overdue award, in the opinion of this correspondent). **John Whitney** was named a 2021 Investigator in the Pathogenesis of Infectious Disease by the US-based Burroughs Wellcome Fund (BWF-PATH), becoming the first BWF-PATH awardee at a Canadian Institution since 2009. Among our graduate student community, Former Wright lab Ph.D. student **Elizabeth Culp** won the Governor General's Academic Gold Medal for her doctoral work.

Every year, our graduate committee awards several BBS Impact Awards to recognize outstanding student publications. This year's winners were Ph.D. candidate **Basma Ahmed** (Steinberg Lab) for her paper in *Cell Reports Medicine* entitled "*Lower brown adipose tissue activity is associated with non-alcoholic fatty liver disease but not changes in the gut microbiota*", Ph.D. candidate **Tim Klein** (Whitney Lab) for his paper in *Structure* entitled "*Structure of the extracellular region of the bacterial type VIIb secretion system subunit EsaA*", Ph.D. candidates **Amany Al-Anany** and **Rabia Fatima** (Hynes Lab) for their co-first author paper in *Cell Reports* entitled "*Temperate phage-antibiotic synergy eradicates bacteria through depletion of lysogens*" and Ph.D. candidate Hannah Stacey (Miller Lab) for her paper in *PNAS* entitled "*IgA Potentiates NETosis in response to viral infection*". At the second consecutive virtual edition of our Institute for Infectious Disease Research Annual Trainee Day, BBS students **Shehryar Ahmad** (Ph.D., Whitney Lab) and **Meghan Pepler** (M.Sc., Elliot Lab) were awarded Michael Kamin Hart Memorial Scholarships. These awards are made possible by the continued generous support of the Hart family.

We once again had to cancel many of our department's social gatherings in 2021 but I am much more optimistic that by this time next year, I will be reporting on the return of the many in-person events that our department traditionally holds.

Queen's University

Department of Biomedical and Molecular Sciences

Correspondents: John Allingham and Lynne Postovit

The Department of Biomedical and Molecular Sciences (DBMS) currently has more than 55 full-time faculty members (including cross-appointees), as well as a significant number of adjunct faculty. These members represent a diverse community of experts in cancer, cardiovascular disease, neuroscience, reproduction, immune surveillance, virus-host interactions, computational biology, and structural biology. With this broad expertise, DBMS provides undergraduate (>18,000 course enrolments) and graduate (>500 course enrolments) students with a comprehensive and integrative education, involving state-of-the-art research experiences spanning fundamental molecular mechanisms to translational patient-oriented research. While COVID-19 presented another year of unprecedented challenges for research and teaching in 2021, DBMS remained resilient and resourceful, enabling significant accomplishments by its faculty and trainees to continue.

Department funding and promotion highlights:

Nine DBMS faculty received CIHR Project grants in 2021 totalling over \$8 million to support their research programs for 5 years. Dr. **Mark Ormiston** will study the putative role of the bone morphogenetic protein-9 (BMP9) as an angioproliferative switch in pulmonary arterial hypertension (PAH), with the goal of developing new treatments for PAH. Dr. **Louise Winn's** funding will allow her to investigate the ways in which benzene disrupts the development of early blood cell formation *in utero*, which will help create more effective monitoring strategies and improve human health assessments that ultimately increase the prevention of childhood cancers. Dr. **Andrew Craig** and co-applicant Dr. Tomas Babak (Queen's Department of Biology) will use functional genomic screening methods to define new genetic susceptibilities in several high-risk cancers, including breast, pancreatic and brain cancers, and then leverage

these results to test new forms of targeted therapy in these cancer models using clinically approved drugs. Dr. **Fernanda De Felice** received a grant to investigate the role of a novel hormone boosted by physical exercise in memory processes, and determine if a gene therapy approach that increases this hormone can combat loss of brain function in individuals with Alzheimer's disease. Dr. **Chandra Tayade** will investigate endocannabinoids as a novel therapeutic for endometriosis and Dr. **Jason Gallivan** will study the role of cognitive brain networks in human motor learning. Dr. **Qingling Duan** secured funding to identify novel risk factors of asthma in young children in order to inform on mitigation strategies to reduce the burden of asthma and other chronic respiratory diseases. Dr. **Lois Mulligan** will investigate the regulation of RET receptor-mediated tumour cell dissemination. Finally, Dr. **Sheela Abraham** was funded to study the roles of hematopoietic stem cells and extracellular vesicles in leukemia, and was awarded the Canadian Institutes for Health Research Early Career Award in Cancer Prize (\$25,000) for the top ranked cancer grant in the competition.

Other notable new research funding for DBMS faculty included NSERC Discovery Grants awarded to Drs. **Anna Panchenko**, **Alan Lomax**, and **Sam Basta**, a Craig H. Nielson grant and a Brain Canada Foundation grant awarded to Dr. **Nader Ghasemlou**, and a Bladder Cancer Canada grant to Dr. **Madhuri Koti**.

The department also congratulated Drs. **Katrina Gee**, **Alan Lomax**, **Maha Othman**, **Chandra Tayade**, **John Allingham** and **Andrew Craig** on their promotions to the rank of full Professor.

Notable breakthroughs:

Drs. **Andrew Craig**, **John Allingham**, and P. Andy Evans (Queen's Department of Chemistry) published a multidisciplinary study in JACS describing their concise and scalable route to synthesizing an actin cytoskeleton-severing toxin that potently impairs the migratory and invasive activities of metastatic breast and ovarian cancer cells. Dr. **Lynne Postovit's** lab and their collaborators published a research article in Neoplasia on the role of the embryonic protein NODAL in regulating the breast tumour microenvironment by reprogramming cancer-derived secretomes. A study from recent Ph.D. graduate Dr. **Paulina Brzezinska** in Dr. Don Maurice's lab was published in JBC that defines reciprocal regulation of



Lynne Postovit

store-operated calcium channels and cyclic AMP signalling networks in arterial smooth muscle cells. Dr. **Bruce Banfield** published a study in PLoS Pathogens showing how the viral tegument protein UL21 regulates phosphorylation in the nuclear egress complex for Herpes Simplex Virus,

and Dr. **Peter Davies** published a study in Cell Reports that demonstrated his lab's ability to use short peptides to block bacterial adhesion to host cells.

Honours and awards for trainees and faculty:

Graduate students and post-doctoral fellows continue to be key driving forces behind our department's research enterprise. In 2021, our graduate and post-doctoral trainees excelled at publishing many first-author papers, and winning scholarships and presentation awards.



Mandy Turner

Dr. **Mandy Turner** was the 2021 recipient of one of two Governor General's Academic Gold Medals awarded by Queen's University. Dr. Turner completed her Ph.D. program in April 2021, which was carried out under the mentorship of Drs. Rachel Holden and Michael Adams. DBMS congratulates Mandy on

this significant acknowledgement of the excellence of her research and wishes her all the best in her future endeavors!

Congratulations were also extended to **Isabelle Grenier** (Dr. Sheela Abraham's lab), **Emma LeBlanc** (Dr. Che Colpitt's lab), and **Ryan Kirkpatrick** (Dr. Doug Munoz's lab), who were all recipients of Vanier Scholarships. Overall, our graduates were very successful in being chosen for national, provincial, and Queen's University awards in 2021, and they continued to receive many accolades for their research.



Peter Davies

Many of our faculty received recognitions for their scholarly achievements as well. The department congratulated Dr. **Peter Davies**, a Tier 1 Canada Research Chair in Protein Engineering, for receiving the CSMB Canadian Science Publishing Senior Investigator Award in 2021. DBMS was also

excited to celebrate selection of Dr. **Kimberly Dunham-Snary** as its Tier 2 Canada Research Chair in Mitochondrial and Metabolic Regulation in Health and Disease.

Recruitments and retirements:

We are excited to announce that Dr. **Eva Kaufmann** joined DBMS as our Tier 2 Canada Research Chair in Immunology and Inflammation, and that Dr. **Fernanda De Felice** joined DBMS as an Associate Professor at the Centre for Neurosciences Studies, where her research will focus on Neurobiology of Aging and Dementia.



Keith Poole

At the same time, we will greatly miss the important intellectual and teaching contributions of Dr. **Keith Poole** and Dr. **Graham Côté**, who retired after 33 and 37 years of service at Queen's University, respectively. Keith's prolific research career studying adaptive stress responses as determinants of antibiotic resistance

in *Pseudomonas aeruginosa* and how to counter them earned worldwide recognition and was the springboard for many talented young scientists. Graham holds broad acclaim as a "true biochemist" by the research communities studying myosin motor proteins and their catalytic regulators, and he was a major contributor to the success of both the undergraduate Biochemistry Degree program and the Fields of Specialization that are offered in the M.Sc. and Ph.D. degree programs by DBMS. We are very proud of the many achievements by Keith and Graham as members of our department, and



Graham Côté

we wish them a happy and healthy retirement.

To find out more about the latest news and events of the Department of Biomedical and Molecular Sciences at Queen's University, please consider visiting the following webpage: <https://dbms.queensu.ca/>

Simon Fraser University

Department of Molecular Biology and Biochemistry

Correspondent: Christopher Beh

Like other campuses across the country, SFU and the MBB Department were dealing with the ebbs and flows of the ongoing COVID-19 pandemic during 2021. Adjustments to pedagogy and restrictions on research muted some activities and delayed others. However, despite these challenges, the MBB Department can report several successes during these extraordinary times.

Faculty promotions:

During the past year, Drs. **Mark Brockman** and **Jonathan Choy** were both promoted to full Professor. Dr. Brockman's research involves determining cellular immune responses to HIV. Dr. Choy's research is focussed on both T cell responses that cause organ damage as well as nitric oxide cell signalling. The MBB Department is also pleased to announce that Drs. **Ryan Conder** and **Valentina Marchetti**, both from *Stemcell Technologies*, joined the MBB Department as adjunct faculty. At *Stemcell*, Dr. Conder is the Director of Epithelial and Organoid Systems and Dr. Marchetti is a senior scientist. In other news, Assistant Professor Dr. **Ly Vu** leaves the MBB Department, and we wish her continued success in her new ventures.

Department highlights:

Despite problems posed by the pandemic, the MBB Department continued to generate notable research contributions of which a few are discussed here.

The CBC Books spring reading list for 2021 included Dr. **Lynne Quarmby's** memoir entitled "*Watermelon*

Snow," which details past and present realities of climate change. In terms of biotechnology, the MBB Department was actively involved in the fight against COVID-19 and in a new technology protecting against transplant rejection. Dr. **Peter Unrau** worked with a local company, *Lumex Instruments*, to develop a rapid COVID-19 test. Dr. **Jonathan Choy** was involved in a collaboration to develop a polymer for protecting blood vessels after organ transplantation.

Miscellaneous news:

During 2021 our MBB Department had a momentous transition in leadership in which Dr. **Nancy Hawkins**, our Department Chair for the past 6 years, passed her duties on to Dr. **Lisa Craig**. Under Dr. Hawkins' tenure as MBB Chair, the Department welcomed several new faculty members, and expanded the breadth and scope of research at SFU. Dr. Craig takes over the reins of the MBB Department's administration and confronts new challenges to teaching and research posed by the ongoing pandemic. Dr. Hawkins transfers to the position of Associate Dean Academic in the SFU Faculty of Science, where associate MBB faculty member Dr. **Michael Silverman** is the acting Dean of Science *pro tem*. Dr. Silverman now oversees the daily operations of the SFU Faculty of Science while the next Dean of Science is sought.

Student and staff awards:

In addition to our faculty, students and staff are, of course, key to the success of the department's success. Our students have done extremely well in the past year as shown by the large number of accolades and awards. Some notable examples of student and staff achievements are highlighted below.

Dr. **Kin Lam Wong** received the "*Dean of Graduate Studies Convocation Medal*" for his achievements in 2021. As a Ph.D. student in Dr. **Esther Verheyen's** lab, Dr. Wong's doctoral thesis examined interactions in between nutrient sensing and metabolic regulation by Hipk signalling. Dr. Wong is currently a post-doctoral researcher at Stanford University investigating neural development in flies.

Congratulations to **Deidre de Jong-Wong** for her SFU "*Staff Achievement Award*" in the work performance category. Ms. De Jong-Wong is a critical resource for the maintenance of research facilities in the both the MBB

Department and Department of Biomedical Physiology and Kinesiology.

A former SFU undergraduate student, Dr. **Alexandra Newton** now a Professor of Pharmacology at the University of California, San Diego, will serve as the president of the *International Union of Biochemistry and Molecular Biology*.

Our department is proud of all our former students; we are always interested in alumni successes and career accomplishments, and ask to be updated by contacting us at mbbalumni@sfu.ca.

Toronto Metropolitan 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 members. 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 creates 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 Ph.D. and M.Sc. programs.

Graduating students:

Congratulations to the following students who graduated from the Molecular Science Graduate Program in 2021: Fawwaz Azam, Rachele Carafa, Nora Dannah, Donald Fernandes, Karol Golian, Mariya Nikol Leshchysyn, Sahana Sritharan.

Student awards:

Congratulations to the following undergraduate students for winning awards in 2021:

Awards for Women in Chemistry and Biology: Biology - **Samantha Hernandez**; Biomedical Sciences - **Ramisa**

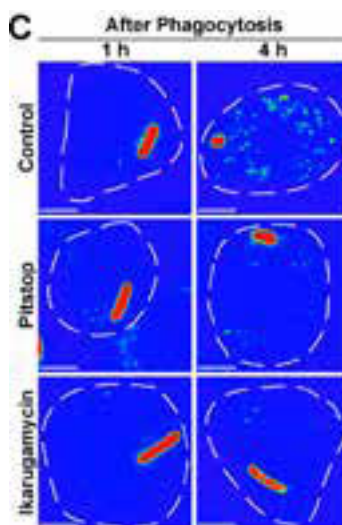
Razi. Bruce Beauchamp Memorial Award: Biomedical Sciences (Hons.) - **Mihir Pandya**. Chemistry and Biology Faculty Awards: Biology Awards - **James Truong** and **Maria Pagcatipunan**; Biology Research Award - **Anthony Tay**; Biomedical Sciences Awards - **Larry Nguyen** and **Sophia Kim**; Biomedical Sciences Research Awards - **Mihir Pandya** and **Samantha Sanayhie**. Chemistry and Biology Faculty Awards - Department of Chemistry and Biology Excellence Awards: Biomedical Sciences - **Aleen Shakeel** and **Nazli Robin**. Healthy Heart Centre Science Award: Biomedical Sciences - **Suha Suleman Lalani**. Jason Ji Award in Environmental Science: Biology - **Aleksandra Panariti**. Sarwan S. Sahota Award: Biomedical Sciences - **Michelle Morgovsky**.

Graduate student awards included **Melissa Iazzi** winning the Young Investigator Award from the European Cystic Fibrosis Society, and **Fatima Lukmani** and **Christian Vieira** winning a MITACS Accelerate Entrepreneur Award.

Featured publications:

"Phagosome resolution regenerates lysosomes and maintains the degradative capacity in phagocytes." (*J. Cell Biol.* (2021) 220 (9): e202005072.)

In collaboration with Dr. Mauricio Terebiznik at UT Scarborough, the **Roberto Botelho** group solved an outstanding question in phagosome biology - what is the ultimate fate of a phagosome after particle digestion? Often, studies of phagosome maturation stopped at whether phagosomes fused or not with lysosomes, or if an engulfed bacterium was killed or not. But rarely was the question addressed of "what do you do with a phagosome after killing a bug?". Some assumed that the phagosome was exocytosed based on protist biology. However, work published by Lancaster, Fountain *et al.* in *J. Cell Biol.* showed that phagosomes fragment via several mechanisms, including a clathrin-dependent process. These phagosome-derived fragments were then shown to be reformed lysosomes and that this was needed to



see *J. Cell Biol.* (2021) 220 (9): e202005072

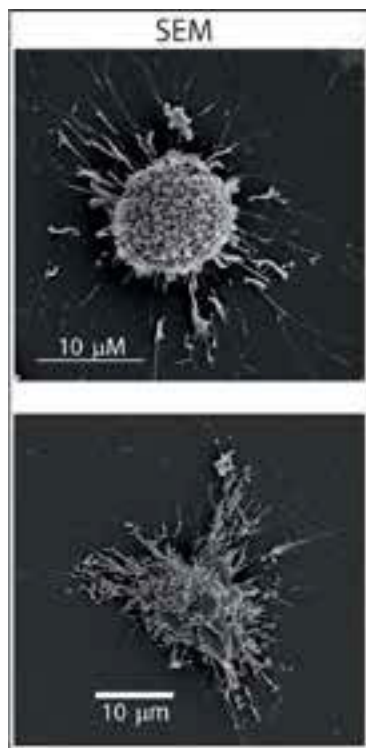
ensure continued degradation capacity of macrophages in subsequent rounds of phagocytosis.

“Defective apoptotic cell contractility provokes sterile inflammation leading to liver damage and tumour suppression.” (Elife. 2021 Apr 19;10:e61983. doi: 10.7554/eLife.61983.).

Work from the **Michael Olson** lab demonstrated that caspase-mediated cleavage of the ROCK1 kinase is essential for the generation of actin-myosin contractile force during apoptotic cell death. In mice expressing the caspase-resistant form of ROCK1, damage induced by a liver specific toxin was amplified by neutrophils to a greater extent than in wild-type mice.

“MICAL1 regulates actin cytoskeleton organization, directional cell migration and the growth of human breast cancer cells as orthotopic xenograft tumours.” (Cancer Lett. 2021 Oct 28;519:226-236. doi: 10.1016/j.canlet.2021.07.039.).

Research from the **Michael Olson** lab determined that the MICAL1 monooxygenase contributes to the growth of breast cancer tumours, and plays important roles in the ability of breast cancer cells to move in a directional manner through the regulation of actin-myosin cytoskeleton organization.



See *eLife* 2021 Apr 19;10:e61983. doi: 10.7554/eLife.61983

Faculty news:

The Department of Chemistry and Biology welcomes **Darius Rackus**, who received his M.Sc. (Hons.) in Natural Sciences, from Durham University. He remained at Durham to complete his M.Sc. in Chemistry and Biological Sciences before moving to the University of Toronto, where he completed his Ph.D. in Chemistry under the supervision of Dr. Aaron Wheeler. Following this, he then conducted his post-doctoral work in the Faculty of Pharmacy



Darius Rackus

develops microfluidic tools for biological, medical, and chemical analysis. In particular, his laboratory will tackle challenges in single cell analysis by developing fully integrated analytical platforms.



Mojca Mattiazzi Usaj

at the University of Toronto with Dr. Keith Pardee before joining the laboratory of Dr. Petra Dittrich at ETH Zurich as a Banting Fellow. In January 2021, he established the Miniaturization in Bioanalysis Laboratory in the Department of Chemistry and Biology at Toronto Metropolitan University, where he develops microfluidic tools for biological, medical, and chemical analysis. In particular, his laboratory will tackle challenges in single cell analysis by developing fully integrated analytical platforms.

The Department of Chemistry and Biology also welcomes **Mojca Mattiazzi Usaj**, who received her Ph.D. from the University of Ljubljana. She conducted her post-doctoral work and then continued as a research associate at the Terrence Donnelly Centre for Cellular and Biomolecular Research at the University of Toronto, in the labs of Drs. Brenda Andrews and Charlie Boone. Dr. Mattiazzi Usaj joined the Department of Chemistry and Biology at Toronto Metropolitan University as an Assistant Professor in January 2021. Her research focusses on understanding the relationship between genotype and phenotype, and the causes and consequences of phenotypic heterogeneity in a population of genetically identical cells. Also of particular interest to the lab is the process of endocytic trafficking, where they are aiming to understand how endocytic trafficking is regulated and integrated in the cellular network.

Grant funding:

Faculty members were successful in obtaining funding from numerous agencies:

Mojca Mattiazzi Usaj was awarded an NSERC Discovery

Grant and Discovery Launch Supplement, with the aim of understanding how phenotypic differences among genetically identical individuals arise from interactions between environmental, stochastic, and physiological sources of variation, and how these differences affect cellular responses and decision making.

Gagan Gupta was awarded an NFRF Exploration grant that will combine genetic code expansion, synthetic chemistry and proximity proteomics to track drug interactions inside cells.

Michael Olson was awarded a grant from the Ontario Institute for Cancer Research from their Cancer Therapeutics Innovation Pipeline Early Accelerator program. The MICAL1 monooxygenase will be studied to determine how important its activity is in breast cancer, and biochemical assays appropriate for high throughput screening will be developed. He was also awarded a grant from the OvCAN/Ovarian Cancer Canada-Cancer Research Society Funding Program to examine the role of the MRCK kinases in high grade serous ovarian cancer, with the objective of defining pathways promoting cell proliferation and mechanisms of drug resistance.

Roberto Botelho, Costin Antonescu and **Michael Olson** obtained a Cancer Research Society Operating Grant to study the importance of acyltransferases like LCLAT1/LYCAT which control phosphoinositide acyl specificity in cancer survival, proliferation, and migration. While phosphoinositide signalling has been linked to cancer biology for decades, the role and regulation of acyl chain specificity of phosphoinositides in cancer is essentially unexplored. This grant and research may shine light on this open question and lead to unexplored therapeutic targets in the form of acyltransferases.

Special events:

Our department continues to be a key participant in the activity of Toronto Metropolitan's SciXchange program, which has as its mission making science engaging, comprehensible and accessible to the general public. SciXchange aims to increase science literacy and foster critical thinking about scientific issues, and provide opportunities for members of the community to engage in science through hands-on work and discussion. Events in 2021 included Soapbox Science, which is a novel public outreach platform for promoting women, identifying scientists and the science they do. This event usually

takes place at the Toronto Harbourfront, but it was transitioned online instead and was able to reach cities that were not previously engaged. Using their virtual soapbox, speakers shared cutting-edge research with the general public and engaged curious minds of all ages. After a pause of Science Rendezvous in 2020, it came back virtually in May 2021 to showcase the research and stories of a network of researchers, professors, and students. There were exciting shared interactive activities about medical imaging, social justice in STEM, and climate change research. Activities also included ways to see and incorporate science into our daily lives, such as exploring the ecosystems in local neighborhoods

Université de Montréal

Département de biochimie et médecine moléculaire

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 the 2021-2022 academic year, our programs in biochemistry and bioinformatics trained 370 undergraduate students and 200 graduate students, as well as 10 students in a specialized clinical biochemistry post-doctoral program.

New faculty members:

We are delighted to welcome two new Clinical Assistant Professors to our Clinical Biochemistry Program, **Vincent De Guire** and **Pierre-Olivier Héту**. Professor De Guire is located at the Maisonneuve-Rosemont Hospital (HMR) and Professor Héту is at the Centre Hospitalier de l'Université de Montréal (CHUM). They will play a key role in our Post-doctoral Training Program in Clinical Biochemistry at both the teaching and management



Vincent De Guire



Pierre-Olivier Héту

levels. **Professor De Guire** is a specialist in the clinical utility of microRNAs, commercialization of technologies, and quality improvement in laboratory medicine, which he pursues at HMR through collaborations with the academic research community. In 2020, he co-founded Anasens, a medical diagnostic platform to enable patients to measure a wide range of biomarkers with a single drop of blood and help them to manage their chronic health conditions safely at home. **Professor Héту**'s expertise centres on methodologic development and research in the pharmacology and toxicology section, which he performs in the Chromatography and Mass Spectrometry Laboratory at CHUM.

A Nobel prize winner joins the faculty:

We were deeply honored to welcome Professor **Sidney Altman** as an Adjunct Professor to the Department of Biochemistry and Molecular Medicine in the Fall of 2021. **Professor Altman**, a Professor in the Department of Molecular, Cellular and Developmental biology at Yale University, shared the 1989 Nobel Prize in Chemistry with Thomas R. Cech for discovering the catalytic properties of RNA. Regrettably, Professor Altman passed away on April 5, 2022. Nevertheless, the department was able to benefit considerably from his strong expertise in RNA biology during his short period in the department.

Promotion and integration (as of June 1st, 2021):

Adrian Serohijos became Associate Professor. Professor Serohijos holds a Canada Research Chair in Evolutionary Biophysics & Population Dynamics and is recognized as a rising star in molecular evolution. He is pursuing world-class research activities in the fields of genomics, bioinformatics and biophysics applied to the study of molecular evolution and population dynamics.

In addition, **Sebastien Lemieux**, Principal Investigator at the Institute for Research in Immunology and Cancer (IRIC), was integrated into the department as an Associate Professor. Professor Lemieux is pursuing cutting-edge research activities at the interface of artificial intelligence and bioinformatics applied to precision medicine.

Other changes in faculty status:

Professor **Jurgen Sygusch**, who has been in the department since 1992 and is an expert in crystallography, retired in February 2021. He was subsequently nominated to the position of Adjunct Professor, through which he will maintain his research activities and continue to teach.

Professor **Christian Baron**, a specialist in the molecular mechanisms of bacterial virulence, has accepted a new position as Vice President, Research - Programs at CIHR. This is a highly strategic position for biomedical research in Canada.

Faculty honours and awards:



Michel Bouvier

Michel Bouvier, Professor and Director General of IRIC, is the 2021 recipient of the prestigious **Killam Prize in Health Sciences**. Among the most prestigious research awards in Canada, the Killam Prizes are presented each year by the Canada Council for the Arts to Canadian researchers who have

demonstrated excellence and made a significant impact in their field. Michel Bouvier holds a Canada Research Chair in Cellular Signalling and Molecular Pharmacology. He is a world-renowned expert in cell signalling and molecular pharmacology who has made several major breakthroughs in the field of G protein-coupled receptors.



Jacques Drouin

Jacques Drouin, Professor and Director of the Molecular Genetics Research Unit at IRCM, is the 2021 recipient of the prestigious **Rolf Gaillard Prize from the European Neuro Endocrine Association (ENEA)**. Funded by the *Foundation for Research in Endocrinology, Diabetology and*

Metabolism, the Rolf Gaillard Prize is awarded to a member of ENEA who has distinguished him/herself by a set of exceptional contributions in fundamental or clinical research in the field of neuroendocrinology. Professor Drouin's contributions focus on the molecular basis of the function, development, and pathologies of the pituitary gland. He identified transcription factors involved in hormonal deficiencies and glucocorticoid feedback mechanisms involved in the hormonal

resistance of adenomas that cause Cushing disease.

Professor **Stephen Michnick** renewed his Tier 1 Canada Research Chair in Cellular Architecture and Dynamics.

CIHR grants:

Several researchers obtained grant support from CIHR through the Project grant competition:

Vincent Archambault for his project *Understanding nuclear envelope reformation after mitosis using Drosophila*; **Nicole Francis** for her project *Macromolecular organization by biomolecular condensation in Polycomb mechanism and function*; **James G. Omichinski** for his project *Studies of transient complexes that regulate PML nuclear bodies*; **Christian Baron** for his project *Structural and functional characterization of type IV secretion system pili*; **Éric Lécuyer** for two projects, one as a sole PI, *Defining the functions and mechanisms of centrosomal RNA localization*, and one in collaboration with **Pascal Chartrand**, *Defining the repertoires and functional impacts of RNA binding proteins that undergo sequestration by toxic repeat RNA*; and **Michel Bouvier** as a co-investigator on the project of Sebastien Carreno *Exploring the repertoire of GPCRs to identify and characterize new receptors that can promote cancer cell invasion and metastasis*.

Other grants:

Vincent Archambault and **Mohan Malleshaiah** (in collaboration with **Gerardo Ferbeyre**) secured operational funding from the Cancer Research Society. Both **Christian Baron** (in collaboration with Andrés Finzi) and **Nathalie Grandvaux** (in collaboration with Roger Lippé) received internal funding for emerging collaborative projects through the Combating COVID-19 Program: from prevention to control. **Michel Bouvier** received funding as co-principal investigator on a large grant from the Fonds d'accélération de collaborations en Santé (FACS) through the Quebec Ministère Économie et Innovation (PI: Philippe Sarret). **Jacques Drouin** and **Sébastien Lemieux** independently received grant funding from the "Omics data against cancer" program competition from the Génome Québec, Oncopole and IVADO partnership. **Gerardo Ferbeyre** obtained Innovation Grant funding from the Canadian Cancer Society. **Sébastien Lemieux** and **Stephen Michnick** each received a Discovery Grant from NSERC. **Alain Moreau** received funding as a PI for three projects approved by the Open Medicine Foundation (Canada and Canada/USA) and as a co-PI on

two CIHR projects. **James G. Omichinski** is a co-PI on a group project funded by the Defense Threat Reduction Agency (USA). **John Pascal** is a co-PI on two projects funded by the National Cancer Institute (NIH). **Martin Smith** is a co-PI on a project from the Canadian COVID-19 Immunity Task Force & Vaccine Surveillance Reference Group.

Events and prizes:

Vincent Archambault organized the 32nd edition of the *Journée Simon-Pierre Noël* (March 2nd, 2021), an annual event that honours a former professor in the department. A foundation has been set up in Professor Noël's name to support graduate student training and to provide funds for prizes awarded during this event. During this special day, graduate students from the biochemistry and bioinformatics programs give presentations which illustrate the depth and breadth of scientific research in the department. We would like to congratulate the 2021 prize winners: **Anthony Lemieux** (Best Presentation and Simon-Pierre Noël Fellow), **Jingjing Li** (Best Presentation by a Ph.D. student) and **Adem Hadjabdelhafid-Parisien** (Best Presentation by a M.Sc. student).

Convocation prizes were awarded in 2021 to two undergraduate students in the program of Biochemistry and Molecular Medicine: **Katia Hitache** (Best Academic Performance Prize) and **Stella Cellier-Goetghebeur** (Emerging Researcher Prize).

Université de Sherbrooke

Département de biochimie et génomique fonctionnelle

Correspondent: Michelle Scott

Department activities:

Our 27th annual graduate symposium held virtually in March 2021, co-organized by our graduate student reps, **Étienne Fafard-Couture**, **Ines Khatir** and **Cécilia Légaré**, as well as by Prof. **Pierre Lavigne**, was a success. Prof. Simon Girard from the Université du Québec à Chicoutimi, our keynote speaker, discussed the great power of small populations, while Camille Rochefort-Boulanger, an invited Ph.D. student from the Université de Montréal, presented on using artificial intelligence to analyze genomics data for diagnostic of complex diseases. 12 UdeS graduate students from the department presented their research. The finalists were the following: **Étienne Fafard-Couture** from the Scott group won the first prize,

Noé Guilloy from the Roucou group won the second prize, while **Andrée-Anne Clément** from the Bouchard group won the third. **Hoang Dong Nguyen** from the Scott group won the prize for the best video capsule promoting his talk.

May 2021 saw the UdeS and Bishop's University co-host the ACFAS conference (previously known as the Association Francophone pour le Savoir) and several members of the department were involved in the organization including Profs. **Benoit Laurent**, **François Bachand** and **Xavier Roucou**, who hosted day-long conference tracks on RNA and functional genomics.

Nominations, prizes and distinctions:

Prof. **Luigi Bouchard** was nominated as the Scientific Director and the Director of Strategic Development of the Biobank of Genome Québec and the CIUSSS Saguenay-Lac-Saint-Jean.

Prof. **Xavier Roucou** renewed his position as departmental chair for another term. The department is very grateful for his service!

Prof. **Roucou's** research was acknowledged by a Prix de la recherche et de la création from the UdeS, while Prof. **Michelle Scott** was awarded the Prix Tremplin en recherche et creation for her research and the prix RECMUS for the quality of her training environment. Prof. **François Bachand** was awarded the Jean-de-Margerie prize for the best publication in the Faculty.

M.Sc. student **Gaspard Reulet** from the Scott group won the Pierre-Chailler departmental prize for best student of the year while Ph.D. student **Simon Boudreault** from Martin Bisailon's group was awarded the Prix Engagement for his involvement in the faculty.

University of British Columbia

Department of Biochemistry and Molecular Biology

Correspondent: Leonard Foster

Our department acknowledges that we are fortunate to be able to live, teach, research, and play on the traditional, ancestral and unceded territories of the xwməθkwəy̓əm (Musqueam), Skwxwú7mesh (Squamish) and Səlilwətaʔ/Selilwitulh (Tsleil-Waututh) Nations.



Dr. Lindsay Rogers

Our department welcomed **Dr. Lindsay Rogers** as a tenure-track Educational Leadership faculty this year after several years of teaching for us as an instructor. Dr. Rogers received her undergraduate degree from Queen's University and Ph.D. from the University of British Columbia in our own

department. Her research interests lie in the fields of environmental science and environmental health where biochemical understanding can elucidate complex and often controversial global issues. She is also leading biomedical visualization projects to develop immersive learning technology and elucidate complex cellular networks.

We were also sad to say goodbye to several long-serving colleagues in the past year. **Lawrence McIntosh**, **Michel Roberge** and **Robert Maurus** all retired in the past year. Lawrence and Michel started at nearly the same time and are ending their careers at roughly the same time, too. Both have been fixtures in the department and have worked behind the scenes to support the Head in many aspects of the role, so I will certainly miss their counsel! Both are currently enjoying the ski season in BC. Robert Maurus has been a major contributor to our undergraduate program for several years, having been the primary teacher for several of our large third-year courses. We wish all our former colleagues many happy years in retirement!

There have been many notable research successes this year. Easily the biggest comes courtesy of the COVID-19 pandemic – **Pieter Cullis** has received several awards recognizing his critical role in developing the delivery technology behind nucleic acid-based medicines, particularly the COVID-19 mRNA vaccines. This lifetime of contributions to basic science, leading to life-saving applied technology, has been recognized by several large international awards this year, the highlights being the VinFuture Prize and the Prince Mahidol Prize. One other local impact of Pieter's life's work is seen in the Vancouver biotech sector: several lipid nanoparticle companies, together with other success stories such as AbCellera,

cannot find employees, or Highly Qualified Personnel, in Canadian funding parlance, fast enough. This has led to fabulous job opportunities for our department's graduates.

Other notable awards this year include Michael Smith Foundation Scholar awards to **Ethan Greenblatt** and **Annie Ciernia**.

University of Guelph

Department of Molecular and Cellular Biology

Correspondent: Frances Sharom

The second year of the pandemic saw the MCB department continuing to deal with rotating public health measures and other disruptions. However, we are now used to dealing with many activities remotely. It has not been ideal, and we all miss interacting in person, but we not only survived, we thrived!

Marc Coppolino was re-appointed as Chair of the Department for a two-year extension until April 30, 2023. We thank Marc for his ongoing contributions and dedication to the department during these difficult pandemic years.

Happy 5th Anniversary to the MCB MBIOT Program!

Born of Professor Emeritus **Steven Rothstein's** vision, deftly administrated by **Carol Hannam**, and currently overseen by **Ian Tetlow**, our course-based Master in Biotechnology program has seen students take on projects with close to 30 companies and industry organizations. With 76 graduates, who are now pursuing a wide variety of careers, the success of this program is something to celebrate.



Matthew Sorbara

New faculty:

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

Matthew Sorbara joined MCB as a tenure-track Assistant Professor on September 1, 2021. Dr. Sorbara completed his Ph.D. at the University of Toronto, with Dana

Philpott. He undertook post-doctoral studies, first with Stephen Girardin at the University of Toronto, and subsequently with Eric Pamer at the Memorial Sloan-Kettering Cancer Centre in New York, then at the Duchossois Family Institute, University of Chicago. As a member of our department, Dr. Sorbara plans to use genomic and metabolomic approaches to develop consortia of commensal organisms that can be used as treatments to inhibit colonization of antibiotic resistant Enterobacteriaceae in the gut.



Yang Xu

Yang Xu joined MCB as a tenure-track Assistant Professor on January 1, 2022. Dr. Xu completed her Ph.D. at the University of Alberta, with Randall Weselake and Jocelyn Ozga. She then completed a post-doctoral fellowship with Guanqun Chen at the University of Alberta before moving to Michigan State University

to conduct post-doctoral work with Christoph Benning, where she is studying lipid metabolism in chloroplast membranes and lipid droplets. As a member of our department, Dr. Xu plans to study lipid trafficking, storage and metabolism in plants and microalgae with a goal of producing designer oils in these systems.

Staff appointments and retirements:

Charlotte de Araujo joined MCB as our new Undergraduate Teaching Coordinator in early January. She is assisting with coordination of the senior research project courses and other work as we continue to adapt and manage courses in online delivery. Charlotte comes to us most recently from the Department of Integrative Biology, where she was also a teaching coordinator. Charlotte completed her Ph.D. in Cell & Systems Biology at the University of Toronto. She brings a wealth of teaching and course coordination experience and has expertise in supporting student learning through her various contract lecturer and sessional positions. We welcome Charlotte as a valued member of our team!

We welcomed **Jillian Cockwell** as the new Graduate Program Assistant, and **Laura Faris** joined MCB as our new Administrative Services Assistant. Sophia Zhang is

our new Wash-Up Technician.

We were very sad to lose two of our most valued staff members to retirement this year.

Bertilla Moroni retired from MCB in mid-May 2021. Bertilla decided that the time was right to move on to her next chapter and we are happy that she will have more time to spend with family. She has been with the University since 2003 and was Graduate Program Assistant in the department since 2016. Over the years, Bertilla has provided exemplary support to students, faculty and staff, first in her role as Administrative Services Assistant and then with her transition to Graduate Program Assistant. Her commitment to MCB graduate students and graduate programs has been outstanding and we are going to miss her many contributions. Bertilla also led efforts for the United Way drive for many years and was the organizing force behind our very successful annual raffle. She has been very generous with her time and effort and always willing to go the extra mile to provide support to others. It goes without saying that she will be greatly missed by faculty and fellow staff members, and most certainly by graduate students.

Rohan Van Twest retired at the end of December 2021. Rohan has been a lab demonstrator in MCB since 1981, so we are losing the longest serving staff member in the department. For the past 40 years Rohan has been a well-respected lab demonstrator in our main introductory microbiology courses, including Introduction to Microbiology and Introduction to Microbial Culture & Physiology. He has provided consistent guidance in teaching undergrad students the foundations in microbiology lab work and it goes without saying that his impact on our undergraduate students has been profound. Both his colleagues and the TAs he has supervised over the years have benefitted from his knowledge and expertise. Rohan will be greatly missed by students, faculty, and staff.

Retirements:

We said a fond farewell to 4 senior faculty members in 2021; **Rod Merrill**, **Annette Nassuth**, **Lucy Mutharia** and **Richard (Dick) Mosser**. We wish them all the best for a happy and healthy retirement.

Rod's recent research is in the general area of protein structure and dynamics and is specifically focussed on



Rod Merrill



Annette Nassuth

the biochemistry of bacterial toxins involved in disease. His lab has used biophysical and biochemical techniques, including fluorescence and optical spectroscopy, data mining, bioinformatics, and enzymology to study the structure and dynamic properties of bacterial colicins and various novel ADP-ribosyltransferase toxins.

Annette is an expert in the effects of biotic and abiotic stress on plants at the cellular, biochemical and molecular levels. The objective of her research was to identify the changes occurring in plant cells upon exposure to stress and which of these changes help the plant increase its tolerance to the stress. A major focus for many years was the investigation of freezing stress tolerance in grapevines. Annette served for many years as the Virology Section editor for the Canadian Journal of Plant Pathology.

Lucy's recent research focussed on *Mycobacterium avium* subspecies *paratuberculosis* to understand at the molecular level the genes and properties that enable this bacterium to grow within mammalian macrophages. She is currently on the Board of the IAP, the American Society



Lucy Mutharia



Dick Mosser

of Microbiology (ASM) and the Canadian Society for Microbiology. She is also a member of the Editorial Board for the Journal of Clinical Microbiology, and a member of the ASM Task Force for Africa. She was recognized by the YM-YWCA as one of the “Women of Distinction” for 2017.

Dick’s research during his years at Guelph sought to uncover the mechanisms controlling the survival of cells under stress. The focus of his research team was on how heat shock triggers the apoptotic program and how this process is inhibited by the heat shock protein hsp70.

Faculty awards and honours:

Congratulations go out to **John Dawson**, who was awarded a prestigious National 3M Teaching Fellowship which celebrates extraordinary educational leadership and contributions to post-secondary teaching and learning. The following testimonial is taken from their website:

“John Dawson is a teacher who “refuses to let the students get away with just going through the motions of biochemistry!” He welcomes fun, inquiry and reflection into his classroom. For decades Professor Dawson has been engaging students in the art and craft of creative problem solving in Biochemistry and Biology Education with contagious enthusiasm and caring for his students’ learning. From the earliest phase of John’s career, he has been actively involved in improving the curriculum and the learning environment at the University of Guelph. An innovative, early adopter of technology in the classroom he has developed tools such as an open-source textbook to eliminate the high cost of textbooks, and sparked the renowned peer evaluation, assessment, and review (PEAR) tool. Recently, as the founding director of the College of Biological Sciences’ Office of Educational Scholarship and Practice, John has empowered his colleagues to go beyond the norms of their discipline. He shares his innovative classroom practices to benefit learners and colleagues alike, both on campus and through his extensive publications on the Scholarship of Teaching and Learning.”

John also received the 2021 John Bell Award for outstanding contributions to education at the University of Guelph.

Rebecca Shapiro was appointed as a CIFAR Azrieli Global Scholar with CIFAR’s Fungal Kingdom: Threats and

Opportunities program, which seeks to understand the unique aspects of fungal biology to both mitigate their threats and harness their extraordinary potential. Her research team focusses on human-associated fungal pathogens, such as *Candida* species.

Research grants:

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

NSERC Discovery Grant: **Jaideep Mathur, Scott Ryan, Shaun Sanders, Siavash Vahidi, Terry Van Raay**

NSERC Research Tools and Instruments (RTI): **Georgina Cox** (with Rebecca Shapiro and Chris Whitfield); **John Dawson** (with Jasmin Lalonde, Jennifer Geddes-McAlister, Jim Uniacke, Cezar Khursigara, and Marc Coppolino)

CIHR Project grant: **Siavash Vahidi** received a 5-year grant, entitled *Mechanisms of Allosteric Regulation of M. tuberculosis Proteosome Function*. He was also awarded the Bhagirath Singh Early Career Prize in Infection and Immunity.

Cancer Research Society: **Nina Jones, Marc Coppolino and Jim Uniacke**

Brain Canada: **Jasmin Lalonde**

Graduate awards:

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

NSERC Postgraduate Scholarships (PGS-D): **Laura Thompson**

NSERC Canada Graduate Scholarships (CGS-M): **James Goetz, Victoria Wilson**

Ontario Graduate Scholarships: **Brianna Ball, Sarah Kirsh, Nathan Doner, Natalie Porte-Trachsel, Nicholas Prudhomme, Arjun Sukumaran, Laura Thompson, Jacob Wilde, Shawn Zhu**

MCB Plant Science Travel Grant: **Victoria Butler, Nathan Doner**

Roche Molecular Biochemicals Award of Excellence: **Laura Thompson**

Donald R. Phillips MCB Scholarships: **Steven Kelly, Rachel-Karson Theriault**

Pharmacia MCB Graduate Award: **Tristen Hewitt**

Congratulations to **Nathan Doner** (Ph.D. student, Rob Mullen's lab), who was awarded the Canadian Society of Plant Biologists (CSPB) **President's Award** for his presentation entitled "Identifying new lipid droplet proteins in *Arabidopsis thaliana*: ERD7 localizes to lipid droplets via its senescence domain" at the CSPB Virtual Meeting that was held in June 2021. He also won the Director's Award for his poster presentation entitled "Arabidopsis LIPID DROPLET PROTEIN OF SEEDS controls lipid droplet size and number in seeds and seedlings", at the recent CSPB Eastern Regional Meeting held in November 2021.

The 16th annual Graduate Student Symposium (GSS) took place on May 5-7, 2021, showcasing graduate student research taking place across the College of Biological Science. Central events were Student Presentations and self-guided Poster Presentations.

University of Manitoba

Department of Biochemistry and Medical Genetics

Correspondent: Barbara Triggs-Raine

2021 Academic life in a pandemic:

Although the past year of meetings and teaching were primarily remote the department did not stagnate! We were extremely excited to welcome our first pandemic recruit, Assistant Professor **Dr. Robert Beattie**. Dr. Beattie joined our department in August of 2021 and soon got an opportunity to meet several of his colleagues in person when University of Manitoba faculty went on strike in November. Robert is now setting up his lab where he will apply MADM (Mosaic Analysis with Double Markers) technology to understand how large gene modules

contribute to complex tissues such as the brain, in a cell-type-specific way. Dual-coloured MADM labelling provides a direct readout of gene dosage effects on cell lineage, morphology, and function in the same tissue. He aims to apply these technologies to dissect neural disorders such as autism and schizophrenia at single-cell resolution.



Welcome to the University of Manitoba, Dr. Beattie!



UMFA early career researchers meet on the picket line

We bid farewell to **Dr. Spencer Gibson** in August as he moved to the University of Alberta as the Dianne and Irving Kipnes Chair in Lymphatic Disorders. **Dr. Jeffrey Wigle** accepted the position of Associate Head of the Department effective Aug. 1, 2021. In December of 2021, **Dr. Louise Simard** retired after 12 years of service to the Department as Head and two years as Acting Dean/Associate Dean of Graduate Studies. Dr. Simard made many contributions in these positions but one she is very

proud of is establishing the Masters in Genetic Counselling program in our department. We wish both Spencer and Louise our best as they move onto new challenges. We said good-bye to **Ms. Jasmine Brar** and welcomed **Ms. Fadumo Osman**, who quickly and effectively took over the academic programs portfolio. Thank you, Fadumo!



Best wishes to Dr. Louise Simard on her retirement!

Celebrating outreach:

For those of you who may have been following **Dr. Francis Amara's** journey ([Kenema-STEM Philanthropy Network | Facebook](#)), as he coordinated the funding and building of a STEM Education Centre in Sierra Leone, this Centre is now functioning with a Buddy program for blossoming scientists and training of science teachers. Although the pandemic interrupted some planned visits, in November of 2021 Dr. Amara visited Sierra Leone to open the Centre to the public, launched the STEM Clubs, and delivered a workshop to secondary school teachers on how to use a light microscope and capture digital images with a mobile phone. Dr. Amara also continues to serve as the International Union of Biochemistry and Molecular Biology Ambassador to Africa.



Primary school pupils learning basic computer skills



Teacher training on light microscopy and imaging with a cell phone

Drs. Britt Drögemöller and **Galen Wright** were awarded one-year Carnegie African Diaspora Fellowships to collaborate with Stellenbosch University in South Africa. The fellowship program pairs African-born scholars in North America with institutions in Africa. This fellowship is focussed on developing graduate training workshops and collaborations to facilitate the improved diagnosis and treatment of neurological disease in understudied populations.

Dr. Meaghan Jones continued to provide leadership to the early career investigator community at the national level as Co-Chair of the Association of Canadian Early Career Health Researchers and at the local faculty level.

Genetic counselling students did not let COVID19 get in the way of their outreach to support groups for the Alzheimer society, Manitoba Neurofibromatosis Support Group, and Sisler High School.

Faculty awards and recognition:

In 2021, **Dr. Pingzhao Hu** was recognized with two awards for graduate student mentorship; the University of Manitoba Graduate Students' Association Teaching Award and the Ed Kroeger Mentorship Award. Dr. Hu was supervising 11 graduate students (5 Ph.D. and 6 M.Sc.) and 5 undergraduate students with 20 peer-reviewed

journal publications (Dr. Hu is the corresponding author for 12 of them).

Several members of our department were recognized by medical students for their significant contributions to teaching! **Dr. Francis Amara** Med I-Pre-Clerkship Nominees (Class of 2023) Inspiration, Innovation; **Dr. Francis Amara** Med II-Pre-Clerkship Nominees (Class of 2022) Inspiration; **Ms. Stephanie Clarke** Med I (Class of 2023) Inspiration, Innovation; **Dr. Hao Ding** Med I (Class of 2023), Inspiration, Innovation, Mentorship; and **Dr. Mojgan Rastegar** Med I (Class of 2023) Inspiration. **Drs. Mojgan Rastegar** and **Kirk McManus** were promoted to full Professor.



Dr. Pingzhao Hu and lab members

Dr. Mark Nachtigal completed his first 5-year term as Director, Interdisciplinary Health Program (IHP), Rady Faculty of Health Sciences in 2021, and was reappointed for a second 5-year term starting January 2022. Ms. Shenna Fauni (student in Dr. Jones' laboratory; see Future Leaders) is a graduate of the IHP. On the research front, Dr. Nachtigal continues to expand the Manitoba Ovarian

Cancer Research Program (MOCRCP) that is co-led by Drs. Kirk McManus and Alon Altman (OB/GYN) and includes membership from BMG personnel, Dr. Britt Drögemöller and Ally Farrell (student in McManus laboratory).



Dr. Mark Nachtigal was re-appointed as Director of Interdisciplinary Health Program

Dr. Cheryl Rockman-Greenberg is the UM lead for the new Canadian Prairie Metabolic Network, which will

use genomics-based tools to rapidly diagnose patients with rare hereditary metabolic disorders. The network received \$2.1 million in funding through Genome Canada.

Dr. James Davie received funding from Cancer Manitoba Foundation (Protein arginine methyltransferase directed epigenetic networks), is a co-investigator on a CIHR Emerging COVID-19 Research Gaps and Priorities Funding Opportunity grant (*Determine how the interaction between SARS-CoV-2 spike protein and angiotensin-converting enzyme 2 (ACE2) affects viral spread and the severity of COVID-19 outcomes*) and co-applicant on a CIHR grant (*Oligonucleotide-bioconjugate mediated repression of the HOXA9 gene to treat mixed-lineage leukemia*). **Dr. Britt Drögemöller** was awarded a CIHR Early Career Investigator in Maternal, Reproductive, Child & Youth Health Operating Grant, a Research Manitoba New Investigator Operating Grant, and a Health Sciences Centre Foundation General Operating Grant. These funds will be used to support work aimed at predicting and preventing hearing loss caused by the chemotherapeutic agent, cisplatin. **Dr. Geoff Hicks** was awarded a contract from Manitoba Liquor and Lotteries to study FASD. **Dr. Pingzhao Hu** was awarded five-year funding by NSERC for his research project entitled *Flexible and robust deep learning models for integrative analysis of single-cell RNA sequencing data*. He was also awarded one-year funding from the University Research Grants Program and by Mitacs for his research project titled *Deep Learning Models for Compound Design*. **Dr. Meaghan Jones** is a co-investigator on a large team grant to study the developmental origins of youth onset Type 2 diabetes with the goal of preventing early kidney disease. **Dr. Tamra Ogilvie** received funding from the Rally Foundation for Childhood Cancer to study novel combination therapies for SHH medulloblastoma. **Dr. Mojgan Rastegar**, received the Ontario Rett Syndrome Association (ORSA) Hope Award.

Future leaders:

Departmental trainees at all levels demonstrated their commitment to excellence and innovation in research, acquiring many provincial and national awards in 2021! Of particular note, M.Sc. student **Tasnim Beacon**, who completed her Master of Science with Dr. James Davie, received the Governor General's Gold Medal. It was awarded for outstanding achievement at the master's level.



Dr. James Davie and Tasnim Beacon at Asilomar 2019

We are also proud of our many other successful awardees, including: **Mehrafarin Ashiri** (Research Manitoba M.Sc.); **Emily Barker** (U of Manitoba fellowship-M.Sc.; CIHR Canada Graduate Scholarship-M.Sc.); **Stephanie Borlase** (Dean of Graduate Studies Poster Award, Manitoba Student Research Poster Competition); **Rubi**

Campos Gudiño (U of Manitoba fellowship-M.Sc.); **Shivam Chadha** (CIHR Canada Graduate Scholarship-M.Sc.); **Katherine Chimney** (U of Manitoba Emerging Leader Award; CIHR Canada Graduate Scholarship-M.Sc.); **Shenna Fauni** (U of Manitoba fellowship-M.Sc.); **Lucile Jeusset** (Manitoba Medical Service Foundation Ph.D. Award, Rt. Hon. Don Mazankowski Award in Oncology, Nancie J Mauro Graduate Scholarship in Oncology Research); **Samantha Lee** (Asthma Canada-CAAIF Graduate Research Award, CHRD Bronze medal for Ph.D. posters); **Chloe LePage** and **Tasnim Beacon** were both awarded the 2020 Simon and Sarah Israels Thesis prize from CancerCare Manitoba Research Institute; **Qian Liu** (Caroline A Cope Award, CANSSI Ontario STAGE HostSeq Project Fellowship, Research Manitoba-CancerCare Manitoba Foundation-Ph.D. studentship Award); **Michelle Morello** (U of Manitoba fellowship-M.Sc.); **Nicole Neudorf** (Research Manitoba/CancerCare Manitoba Studentship); **Michaela Palmer** (Dean of the Rady Faculty of Health Sciences Graduate Student Achievement Prize; Emil and Lynette Hain Award; Manitoba Medical Service Foundation Ph.D. Award); **Kailee Rutherford** (Research Manitoba/CancerCare Manitoba Studentship; MMSF Poster Award, Silver Medal CIHR Poster Competition); **Narin Sheri** (CIHR Canada Graduate Scholarship-M.Sc.; Faculty of Graduate Studies research completion award); **MacKenzie Wilke** (CIHR Canada Graduate Scholarship-M.Sc. and a VADA training stipend); **Maria Vas** (CIHR Canadian Graduate Scholarship M.Sc.; NSGC Pediatric/Clinical Genetics SIG Grant Award; NSGC Student/New Member SIG Grant Award).

University of Ottawa

Department of Cellular and Molecular Medicine

Correspondent: Michael Downey



David Lohnes

2022 marks the last year of service for Dr. **David Lohnes**, Professor, as chair of the Cellular and Molecular Medicine (CMM) Department. Over his 12 years as chair, Dr. Lohnes has overseen the recruitment of 27 core members of the department. Dr. Lohnes has provided exceptional leadership in reshaping

the department with a focus on research intensiveness and training excellence. During his tenure as chair, Dr. Lohnes also directed the Transgenic Core Facility and ran a productive CIHR-funded research program focussed on mammalian development. The members of CMM thank Dr. Lohnes for his service. The next chair will certainly have big shoes to fill!



Armen Saghatelian

Dr. **Armen Saghatelian**, currently full Professor at Université Laval, will join CMM and the University of Ottawa Brain & Mind Research Institute in 2022. Dr. Saghatelian runs a vibrant research program focussed on mechanisms of neurogenesis, with implications for the understanding and treatment of

neurodegenerative and neurodevelopmental disorders.

Drs. **Ryan Russell** and **Maxime Rousseaux** have opened a new on-site Genome Editing and Molecular Biology (GEM) facility. The new facility is dedicated to providing genome editing and cDNA cloning services. Services are available to researchers at the University of Ottawa as well as outside academic and industrial partners. Visit <https://med.uottawa.ca/core-facilities/facilities/gem> for more information on this exciting new development at the University of Ottawa.



Genome Editing and Molecular Biology (GEM) facility

In other core news, the Transmission Electron Microscopy (TEM) Core Facility has ramped up services throughout 2021, providing unique imaging (JEOL JEM-1400flash microscope) and tissue processing solutions, in partnership with the Children's Hospital of Eastern Ontario's EORLA Laboratory. The TEM core provides training for use of the main instrument, as well as training for sample preparation and processing. The TEM Core Facility is located at the Faculty of Medicine, in the Roger Guindon Hall. If you are interested in TEM Core services, visit <https://med.uottawa.ca/core-facilities/facilities/tem>.



TEM Core main instrument, JEOL's JEM-1400Flash



Balwant Tuana

Dr. **Balwant Tuana**, Professor, has taken over the reins of the graduate program as Director in 2021. Dr. Tuana builds on the work of Dr. Nadine Wiper-Bergeron, and will oversee changes to the graduate program which include introduction of a one year course-based M.Sc. to complement our current two year thesis-

based option, as well as the introduction of new graduate courses to reflect the growing expertise of diverse faculty and interests of incoming trainees.

University of Toronto

Department of Biochemistry

Correspondent: Alex Palazzo

As all of you very well know, 2021 was a trying year. Despite this, the Biochemistry Department at the University of Toronto had much to be proud about and many of our faculty members and trainees reached new career milestones.

Faculty news:



Justin Nodwell

First off, we would like to congratulate Professor **Justin Nodwell**, the former Chair of our Department, who was promoted to Vice Dean, Research & Graduate Education in the Temerty Faculty of Medicine at the University of Toronto. At the Departmental level, he has been replaced by **Liliana Attisano** who is the current Interim Chair and

Graduate Chair of the Department of Biochemistry. We are currently undergoing a search for a new chair who should be in place by the end of 2022/early 2023.



Stephane Angers at the Donnelly Centre for Cellular and Biomolecular Research

Professor **Stephane Angers** was appointed director of the Donnelly Centre for Cellular and Biomolecular Research for a five-year term beginning September 1, 2021. This marks the first time that the head of this institute has a direct affiliation with the Biochemistry Department.

We are pleased to announce that effective



Michael Norris

April 1st 2022, **Michael Norris** will be joining our Department as an Assistant Professor. Dr. Norris is a Ph.D. alumnus of the University of Toronto, where he completed his thesis under the supervision of Theo Moraes. He then moved to San Diego where he was a post-doctoral fellow in the lab of Erica

Ollmann Saphire, first at the Scripps Research Institute and later at the La Jolla Institute for Immunology. His new lab will use structural biology (X-ray crystallography and electron cryomicroscopy), functional biochemistry, cellular biology, and basic virology to understand the molecular mechanisms driving the assembly and budding of pathogenic RNA viruses. His research will provide critical insight into key mechanisms promoting the infectious and deadly nature of these viruses and will lay the foundation for the development of much-needed therapeutics.

Reinhart Reithmeier served as a member of an Expert Panel convened by the Council of Canadian Academies on “*The Labour Market Transition of PhD Graduates*”. The panel’s report can be read at https://www.cca-reports.ca/wp-content/uploads/2021/01/Degrees-of-Success-FullReport_EN.pdf

Dr. **Joel C. Watts** has received promotion, effective July 1, 2021, to the rank of Associate Professor, Department of Biochemistry.

Professor **Walid A. Houry** was appointed as a member of the Academic Board of the Governing Council of the University of Toronto representing the Faculty of Medicine.

On November 10, 11 and 12, Professor **Alex Palazzo** along with Jomon Joseph (National Centre for Cell Science, Pune) co-organized a Workshop on RanBP2/Nup358 and Acute Necrotizing Encephalopathy (ANE). Four separate missense mutations in RanBP2/Nup358 cause ANE, whereby in response to influenza infection, carriers experience a massive secretion of cytokines, known as a “cytokine storm”, which causes seizures,

neuropathology, coma, and a high rate of mortality. This workshop brought together clinicians, basic researchers and ANE patients.

Together with Drs. Jennifer Edward, Odile Harrison and Stijn van der Veen, Professor **Trevor Moraes** co-organized the NgoRS (N. gonorrhoeae Research Society) Conference 2022 which took place January 10-14, 2022. Pre-recorded lectures followed by live question & answers allowed spirited discussions with over 150 participants from around the world (including 188 registrants from Australia, Germany, USA, UK, Europe and Africa). The conference covered a wide range of basic science and clinical research aspects of *Neisseria gonorrhoeae* and gonorrheal infections including structural biology, infection models and potential new therapeutics and vaccines.

Professor **Walid A. Houry** was involved in organizing several meetings in 2021, including as co-lead organizer of the 64th annual CSMB 2021/2nd PRinCE meeting on Protein Homeostasis, co-lead organizer of the Life Science Career Expo 2021 meeting in Toronto, and co-lead organizer of the Cold Spring Harbor Asia conference on Frontiers of biomedicine empowered by computational approaches and biophysical principles, Virtual.

Awards and honours:



Julie Forman-Kay

Professor **Julie Forman-Kay** was elected as a Fellow of the Royal Society in recognition of her internationally renowned studies of the dynamic structures, interactions and functions of intrinsically disordered proteins.

Professor **Jean-Philippe Julien** was awarded the 2021 CSMB New

Investigator Award for his group's efforts in 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.



Reinhart Reithmeier (left) with his former Ph.D. graduate student, Joe Casey (right).

Professor **Reinhart Reithmeier** was awarded the Wynne Medal from the CSMB for his landmark studies on membrane proteins in human health and disease.

Professor **Trevor Moraes** won the Excellence in Undergraduate Laboratory Teaching in Life Sciences Award by the Temerty Faculty of Medicine at the University of Toronto.

This award for excellence in teaching recognizes Trevor's efforts in our fourth year Biochemistry Specialist lab course.

Professors **Julie Forman-Kay**, **Simon Sharpe**, **P. Lynne Howell** and **John Rubinstein** were awarded CFI funds to help bring new technology to SickKids.

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

Research highlights:

Alderson, T. R. and Kay, L. E. (2021) NMR spectroscopy captures the essential role of dynamics in regulating biomolecular function, *Cell* 184(3), pp. 577-595. A great review co-authored by **Lewis Kay** on how NMR can be used to understand molecular dynamics.

Chen, A., Ulloa Severino, L., Panagiotou, T. C., Moraes, T. F., Yuen, D. A., Lavoie, B. D. and Wilde, A. (2021) Inhibition of polar actin assembly by astral microtubules is required for cytokinesis, *Nat Commun* 12(1), pp. 2409. Beautiful work by the **Wilde lab** on how astral microtubules regulate actin polymerization in dividing cells to generate local tension release on the membranes at the extreme polar ends of a dividing cell.

Guo, H., Courbon, G. M., Bueler, S. A., Mai, J., Liu, J. and Rubinstein, J. L. (2021) Structure of mycobacterial ATP synthase bound to the tuberculosis drug bedaquiline, *Nature* 589(7840), pp. 143-147. Great cryo-EM work

from the **Rubinstein lab** which allows them to obtain a molecular look at how the drug bedaquiline inhibits the mycobacterial ATP synthase.

Han, S. ... and Schuurmans, C. (2021) Proneural genes define ground-state rules to regulate neurogenic patterning and cortical folding, *Neuron* 109(18), pp. 2847-2863.e11 In this tour de force, the **Schuurmans lab** employs mice and human-derived organoids to define molecular pathways that help to define neural progenitor cell pools.

Rizzolo, ... and Houry, W. A. (2021) Functional cooperativity between the trigger factor chaperone and the ClpXP proteolytic complex, *Nat Commun* 12(1), pp. 281. In this work by the **Houry lab**, they uncover the role of the ribosome-associated trigger factor in targeting about 2% of the proteome for ClpX-dependent decay in *E. coli*.

Rujas, E., ... Julien, J. P. (2021) Multivalency transforms SARS-CoV-2 antibodies into ultrapotent neutralizers, *Nat Commun* 12(1), pp. 3661. By engineering a multivalent platform, the **Julien lab** increases the potency of anti-spike proteins for therapeutic use.

Shah, M., Taylor, V. L., Bona, D., Tsao, Y., Stanley, S. Y., Pimentel-Elardo, S. M., McCallum, M., Bondy-Denomy, J., Howell, P. L., Nodwell, J. R., Davidson, A. R., Moraes, T. F. and Maxwell, K. L. (2021) A phage-encoded anti-activator inhibits quorum sensing in *Pseudomonas aeruginosa*, *Mol Cell* 81(3), pp. 571-583.e6. In this collaborative paper from several labs in the Biochemistry department, spearheaded by the **Moraes** and **Maxwell labs**, the role of the phage-encoded Aqs1 protein is uncovered. Remarkably, despite its small size (69 amino acids) it reprograms the host cell in two separate ways.

Shen, Q., Wang, Y. E., Truong, M., Mahadevan, K., Wu, J. J., Zhang, H., Li, J., Smith, H. W., Smibert, C. A. and Palazzo, A. F. (2021) RanBP2/Nup358 enhances miRNA activity by sumoylating Argonautes, *PLoS Genet*, 17(2), pp. e1009378. In this work, the **Palazzo lab** demonstrates that in the nucleus Argonaute proteins are loaded onto mRNAs encoding cytokines. Once these complexes are exported across the nuclear pore, Argonaute must be SUMOylated to silence the mRNA in the cytoplasm. This work may explain why mutations in RanBP2 cause cytokine storms.

Wang, L. ... and Muise, A. M. (2021) Gain-of-function variants in SYK cause immune dysregulation and systemic inflammation in humans and mice *Nat Genet*, 53(4), pp. 500-510. The **Muise lab** uncovers a gain of function mutation, where SYK becomes constitutively active, which results in colitis, arthritis and dermatitis, and diffuse large B cell lymphomas. This work suggests that individuals bearing these mutations could be treated with inhibitors of the SYK pathway.

Yao, Z. ... and Stagljar, I. (2021) A homogeneous split-luciferase assay for rapid and sensitive detection of anti-SARS CoV-2 antibodies, *Nat Commun*, 12(1), pp. 1806. The **Stagljar lab** develops a rapid and sensitive assay for SARS CoV2 antibody screening.

Departmental events:

This past September we held our first virtual Departmental "Retreat". It featured talks from faculty and trainees, and two online poster sessions, one where faculty presented and a second where trainees presented. We even held an in-person meet-up at Queen's Park so that the new grad students could mingle with faculty and senior grad students. In the midst of all these events, our trainee awards were given out.



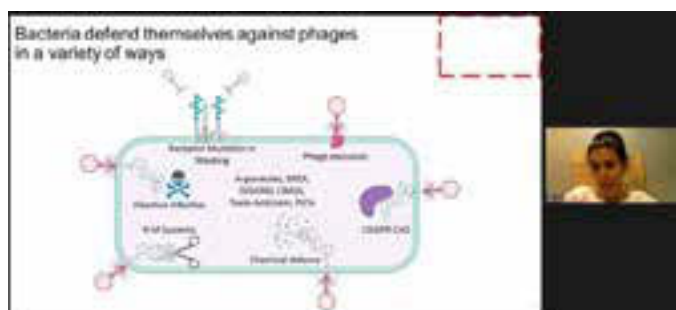
Departmental Retreat - outdoor social in Queen's Park.

The Connell Award for Top Graduate Student Publication of 2020 was awarded to **Eliza Lee** from the Palazzo lab for her publication "TPR is required for the efficient nuclear export of mRNAs and lncRNAs from short and intron-poor genes" *Nucleic Acids Res* 2020 48: 11645-11663.

The David A. Scott Award for the best all-round Biochemistry graduate student, using as criteria performance at seminars, readiness and willingness to assist fellow graduate students and staff, and abilities as a teaching assistant, was awarded to **Simoun Icho** from the Melnyk lab.

The Centennial Award in honour of Sela Cheifetz, given to the top Ph.D. student in the Biochemistry Graduate Program, was awarded to **Sungwon Hwang** from the Maxwell lab.

The Connell Award for Best All-Round Postdoctoral Fellow for excellence in research, leadership within the laboratory and the Biochemistry community, scientific communication and outreach, and contributions including presentations and intellectual property, was awarded to **Veronique Taylor** from the Maxwell lab.



Veronique Taylor, recipient of the 2021 Connell Award for Best All-Round Postdoctoral Fellow, talking about her work on bacterial phages

The Outstanding Ph.D. Thesis in Biochemistry Award was awarded to **Anan Chen** from the Wilde lab for his thesis "Dissecting the biological roles of two actin networks during cytokinesis".

Finally, The Pfizer Graduate Scholarship was awarded to **Yifan Eva Wang** from the Palazzo lab to pursue her work on the role of the nucleoporin RanBP2 in regulating the translation of cytokine mRNAs.

University of Toronto

Department of Cell and Systems Biology

Correspondent: Neil Macpherson

New faculty members:

Shelley Lumba was appointed as Assistant Professor in Plant Systems Biology. Lumba primarily studies molecular mechanisms of dormancy and germination as a way to alleviate hunger. As published in *PNAS*, her lab uses systems biology approaches to elucidate signalling networks underlying germination in *A. thaliana* and in parasitic plants, such as *Striga hermonthica*.

Kenneth Yip was appointed as an Assistant Professor,

Teaching Stream. He has been a Sessional Lecturer for foundational biology courses, as well as instructing advanced third- and fourth-year courses. He conducts research in cancer drug discovery and translational genomics.



Welcome to Professors Lumba, Yip and Sarpal!

Ritu Sarpal has been appointed as an Assistant Professor, Teaching Stream. She has been teaching advanced courses in the Stem Cells and Developmental Biology Program as a Sessional Lecturer. Sarpal conducts research on the mechanisms that allow epithelial cells to adhere to each other.

Changing of the guard for CSB staff:



Tamar Mamourian has retired

We said a fond farewell to several of our staff in 2021 and welcomed new colleagues.

A tearful goodbye party was held for Chief Administrative Officer **Tamar Mamourian**, who left a devoted and effective team to her successor **Ben Eldridge**. Her final advice was to "Sign Up! Show Up! Never Give Up!"

Long time undergraduate staff members **Janet Mannone** and **Peggy Salmon** retired happily. Janet and Peggy supported thousands of students at U of T for over 35 years each. They provided valuable guidance and support to allow TAs and instructors to deliver excellent CSB courses and programs. Their roles have been ably taken on by **Melisa Casco** and **Nalini Dominique-Guyah**

Chair's Assistant Monica Mc Sheim has moved on to the Vice-Provost's office, but our Chair, Nick Provart is now ably assisted by **Julia Rosefield**.

Our graduate team has a new member to assist **Ian Buglass**. By bringing her own experience completing an M.Sc. during the pandemic, **Madison Marshall** is giving extra insight to the support she provides our graduate students.

Welcome to all our new staff!

Our staff is dedicated to the constant improvement of the Department. Chief Horticulturalist **Bill Cole** has been working to replace the old yellow sodium lamps in our greenhouses with more energy efficient bulbs. He has sourced LED panels that use less energy, emit less heat and provide a better spectrum of red and blue light for the plants. Following successful trials in a test greenhouse, we will move forward to replace all the old lights, with accompanying reductions in energy use.



UofT greenhouses will be getting an update

Our graduate students were generous in donating their time to record videos detailing their research programs.



Prof. Calarco and his green RBPs

Kathryn McTavish, Amir Arellano-Saab and Tara McDonnell described their work in microbiology, structural biology and developmental biology, and spoke about their paths to becoming researchers in our department.

Awards to CSB researchers:

Prof. **John Calarco** has been granted a Connaught New Researcher Award to publish a detailed atlas of RNA binding proteins (RBPs). His lab will use advanced microscopy techniques to create an atlas with the precise location of specific labelled RBPs within each cell of the *C. elegans* nervous system. By combining information on RBP location with expression of genes containing RBP-binding sequences, a deeper understanding of the evolution of neuronal diversity and a more accurate representation of gene expression in the nervous system will be developed.

Prof. **Arneet Saltzman**'s lab are working towards their long-term goal of understanding the mechanisms and pathways of chromatin organization that maintain robust development and fertility. She has received a CIHR project grant to advance the goal of translating this research on trans-generational effects into public health interventions.

Prof. **Ulrich Tepass** earned support from the Cancer Research Society to investigate the effects of cell division on epithelial structure. His work in *Drosophila* imaginal disks involves understanding how mitosis can impact epithelial integrity leading to tumour development. Tepass' studies on the Crumbs transmembrane protein have found that a highly active epithelial polarity machinery is necessary to maintain the epithelium during cell division.

Natalie Hoffmann and **Eduardo Ramirez-Rodriguez** of the McFarlane lab won awards for their research on cell wall biosynthesis at the annual Canadian Society of Plant Biologists (CSPB) meeting. Hoffmann described how disrupting manufacture of xyloglucan snarled cell wall secretion, including at the Golgi. Ramirez-Rodriguez investigated signalling proteins activated under cell wall



Award winners Natalie Hoffmann and Eduardo Ramirez-Rodriguez



Hone-Buske Award winner
Dr. Julia Gauberg

stress. They both enjoyed the chance to connect with fellow plant scientists virtually at CSPB.

The Hone-Buske Award for outstanding graduate student paper went to (now Dr.) **Julia Gauberg** of the Senatore lab who revealed insights into how the nervous system evolved. Even though the millimetre size

seawater animal *Trichoplax* diverged long ago from the common ancestor with humans, Gauberg's multi-species analysis in JBC identified calcium channels in *Trichoplax* called Ca_v2 that are very similar to presynaptic calcium channels expressed in human nerve cells. Gauberg found that TCa_v2 is relatively insensitive to heavy metals and neurotoxins compared to the human channels. One of her most fascinating results is that human Ca_v2 can be regulated by *Trichoplax* G-proteins, whereas *Trichoplax* Ca_v2 is unresponsive to the same *Trichoplax* G-proteins.

Research news:



Prof. Vincent Tropepe

Prof. **Vincent Tropepe** has focussed on using zebrafish to model blindness associated with Usher Syndrome by studying *Pcdh15b*, which is homologous to a protocadherin linked to deaf/blindness in humans. His student (now Dr.) **Amanda Miles** and co-authors revealed in *Disease Models & Mechanisms* that rod and

cone photoreceptor integrity is compromised in zebrafish *pcdh15b* mutants and also found structural defects in synapses of *pcdh15b* mutant photoreceptors. Miles wrote about the role of our aquatics facility in facilitating their research, highlighting the collaborative nature of the facility and the role of Prof. **Ashley Bruce** in making sure the facility runs well. Tropepe was grateful to receive generous funding from the Usher 1F Collaborative Fund to continue this work.

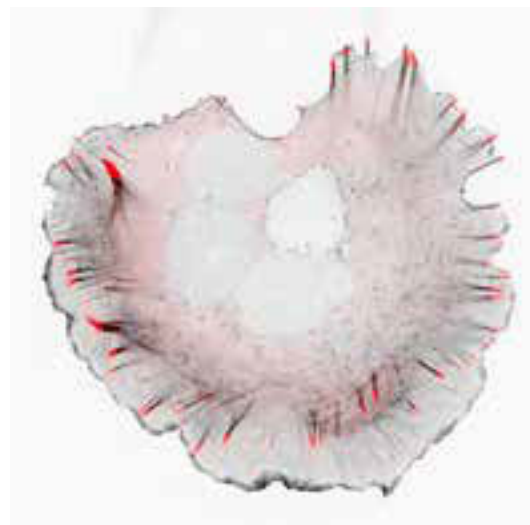


Dr. Gurdeep Singh

Gurdeep Singh from Professor **Jennifer Mitchell's** laboratory challenges the view that there are "master regulators" required for gene regulation in a paper for Genome Research. Using machine learning to reveal sequences conserved in enhancer regions, (now Dr.) **Singh** and co-authors showed

that gene transcription can be precisely regulated *in vivo* by a diverse suite of factors without any specific master regulators.

In a paper from Dev. Cell, **Fernando Valencia** in **Sergey Plotnikov's lab** determined that cells respond to internal forces by activating Dia1 proteins at force-bearing focal adhesions, which dampens tension on the actin cytoskeleton and helps the cell control its shape and maintain its integrity. By combining live-cell imaging



OVCAR-3 cell with actin labelled grey and focal adhesions in red

with mathematical modelling, Valencia showed that actin polymerization at focal adhesions exhibits pulsatile dynamics. They conclude that activity of mDia1 dampens the mechanical tension on the stress fibers through spikes of mDia1 activity triggered by contractile forces. Plotnikov's studies earned him a CIHR project grant to continue this work.

Senescence is crucial for ending the life cycle of plants and for survival under unfavourable conditions. The **Yoshioka lab** showed that multiple MAP kinases regulate the function and turnover of the mitochondrial triphosphate tunnel metalloenzyme protein TTM1 during senescence-associated cell death. Their paper in *The Plant Journal* reveals a novel link between mitochondria and programmed cell death.

In studies of the shikimate synthesis enzyme DAHPS, Profs. **Dinesh Christendat** and **Nicholas Provart** propose tyrosine modulates shikimate pathway flux, and therefore the available chorismate pool, for downstream pathways within the chloroplast. This work from **Michael Kanaris** and others was published in *The Plant Journal*.

Sonhita Chakraborty and co-authors in the **Nambara** and **Yoshioka** labs demonstrated in *Plant Physiology* that the Ca^{2+} signal generated by cyclic nucleotide-gated ion channel CNGC2 is part of negative feedback regulation of auxin homeostasis in which CNGC2 balances cellular auxin perception by influencing auxin biosynthesis.

Prof. **Les Buck** and student **Nariman Hossein-Javaheri** showed in a paper from *J. Neurophys.* that the combination of anoxia and inhibition of GABA receptors induces seizure-like activities in goldfish telencephalic pyramidal and stellate neurons. Importantly, to prevent seizure-like activity, an intact GABA-mediated inhibitory pathway is required.

In studies of zebrafish gastrula during epiboly described in *eLife*, (now Dr.) **Morley Willoughby** in Prof. **Ashley Bruce's** lab found that Rab25 GTPase localized to mitotic structures such as centromeres and cytokinetic midbodies in dividing cells. Transient cytokinetic bridges are cleaved during abscission in dividing cells; further experiments in this paper demonstrate Rab25 likely coordinates abscission through endomembrane trafficking in the epithelium of the gastrula during epiboly. Although zebrafish Rab11 is a paralog of Rab25, Rab25 has developed a unique function during abscission distinct from Rab11.

Across the syncytial *Drosophila* embryo surface, smooth interfaces form between expanding Arp2/3-based actin caps and surrounding actomyosin networks. In the **Harris lab**, (now Dr.) **Medha Sharma** found that forming a smooth and circular boundary of the surrounding



Dr. Medha Sharma

actomyosin domain requires Arp2/3 *in vivo*. Sharma reconstituted the interacting networks between actin caps and surrounding actomyosin networks using node-based models. The resulting paper in *eLife* demonstrated how a smooth structure can emerge from the lateral interaction of irregular active materials.

The Winklbauer lab made stunning discoveries on gastrulation in 2021. Dr. **Martina Nagel** of the **Winklbauer lab** puzzled for 30 years about the mechanism of mesoderm migration. As an undergraduate, she observed the leading-edge mesoderm (LEM) migrate across the blastocoel roof (BCR) in the *Xenopus* gastrula without mixing cells. Over time Nagel has developed the tools to understand the signals passing between these shingled sheets and to probe how they stay separate. With the use of novel live X-ray imaging techniques, she finally cracked this conundrum, as revealed in *Development*. Rather than sliding over adjacent tissue, Nagel observed persistent oriented protrusions in LEM cells regularly detaching from external substratum, tiptoeing across the BCR. Winklbauer student (now Dr.) **Debanjan Barua** has given a new twist to the way embryonic cells stick to each other through studies of the sugar coating in the developing *Xenopus* gastrula. Barua showed that syndecans in the glycocalyx mediate cell-cell attachment across significantly large distances between cells, distinct from the role of cadherins. These ground-breaking results

in *PNAS* demonstrated that each component of the glycocalyx is unique in its modulation of cell-cell contacts in gastrula tissues.

Flooding by seawater in the Amazon basin 15 million years ago provided an opportunity for marine species carried along with the flood to



Prof. Rudi Winklbauer



Prof. Belinda Chang

adapt to a freshwater habitat. Prof. Belinda Chang's student (now Dr.) Alex Van Nynatten shed light on the resulting changes in fish vision by resurrecting ancestral sequences of the visual pigment rhodopsin in a paper from *Mol. Biol. Evol.* Van Nynatten was excited to find that rhodopsin from freshwater croakers absorbed light that was

red-shifted compared to their saltwater ancestors, in line with the idea that rhodopsin would evolve to better detect the red-shifted light in freshwater. Faster kinetics were also observed which would be advantageous in turbid freshwater environments by improving rhodopsin's ability to adjust vision between dark and light environments.

A synthetic biology circuit from the **Chang lab** may lead to IBD treatment. Dr. **Ben Scott** is fascinated by synthetic biology. As a student in Belinda Chang's lab, he set out to make a biosensor for extracellular ATP (eATP) in the gut since eATP can lead to irritable bowel disease. He developed a yeast-based sensor, and further adapted these yeast to degrade eATP when it was at high levels. In collaboration with scientists at Brigham & Women's Hospital, they showed in *Nature Medicine* that the synthetic yeast system could improve IBD symptoms in mice.

University of Toronto

Department of Molecular Genetics

Correspondents: Dr. Martina Steiner and Soha Usmani (with the assistance of Barbara Funnell)

As the COVID-19 pandemic carried over into 2021, while it continued to impact students, faculty and staff members, our department and university pushed forward and made valuable research and community contributions. Several of our faculty members either included COVID-19, or transitioned their research towards COVID-19, working on projects such as novel testing and treatment methods, isolating essential genes, or studying viral structure and interactions. Among these researchers are Molecular

Genetics PIs Drs. **Scott Gray-Owen**, **Anne-Claude Gingras**, **James Rini**, **Sachdev Sidhu**, **Aled Edwards**, **Jason Moffat**, **Jeff Wrana**, **Laurence Pelletier**, **Fritz Roth**, **Ben Blencowe**, **Mikko Taipale**, and **Igor Stagljär**.

The University of Toronto held online classes in the winter and summer of 2021 and hybrid in-person and online classes in Fall 2021. In-person activities occurred while maintaining strict safety standards with screening, and mask and vaccine mandates. UofT also launched its vaccine clinic for both COVID-19 and seasonal flu, facilitating the high immunization rates of our school.



Dr. Gray-Owen with Minister Champagne;
photo credit: Johnny Guatto

In November, the Department was proud to give a tour of our Combined Containment Level 3 (C-CL3) lab to the Canadian Minister of Innovation, Science and Industry, François-Philippe Champagne, during his campus visit. The Department also revamped and launched a new website at the end of the year, providing a more valuable and user-friendly experience for our current and prospective members and students.

Community updates:

The MoGen Department held its **6th Career Development Symposium** on May 31, 2021, virtually. The symposium featured 25 alumni from various career backgrounds



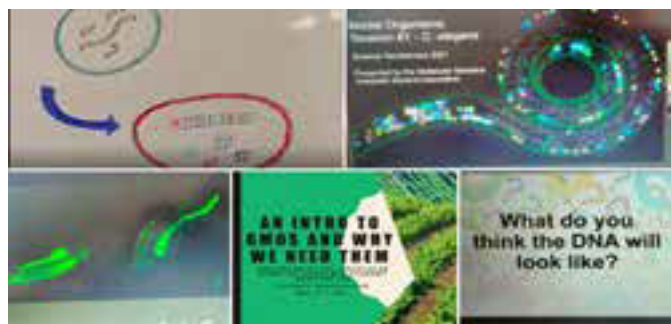
Mentors at the 2021 Molecular Genetics Career Development Symposium

such as medical writing, forensic science, biotech, science policy and more. The afternoon included three round-table discussions in which organizers allocated alumni to breakout rooms with small groups of trainees. These discussions were followed by two “focussed learning” sessions, presenting career skills to our attendees. The first was a moderated discussion: “Building skills during your graduate studies for non-academic careers”, featuring three of our alumni, Dr. Anna Georges (Corbin Therapeutics), Dr. James Havey (Life Molecular Imaging), and Dr. Gabe Musso (BioSymetrics). Dr. Teresa O’Meara from the University of Michigan presented the second session, focussing on seeking post-doctoral opportunities. The organizers were Dr. Barbara Funnell and a team of students, staff, and faculty: Iosifina Fotiadou, Sophie Karolczak, Umama Siddiqi, Chen, Magali Aguilera Uribe, Matt Rok, Alex Rigney, Zachary Coulson, Ryan Chieu, Kwame Diko and Dr. Martina Steiner.

The **Molecular Genetics Graduate Student Association** launched its Career Resources team, which will aid the graduate student community in informing them about career opportunities, identifying potential career routes, and developing the skills needed to pursue said paths. They host and organize monthly career seminars based on specific themes and invite guests who specialize in the subfield to speak and network with.

On May 8, 2021, MoGen welcomed hundreds of school-aged children across the GTA to our annual science presentations at **Science Rendezvous 2021**. This year’s event saw a shift towards an entirely virtual format, presenting creative booth design and format opportunities. MoGen ran a total of five booths. We hosted live demonstrations on animal models featuring mutant *C. elegans* and glow-in-the-dark zebrafish. Live demonstrations also featured a fruit-based DNA extraction, which included a handy printout protocol for attendees to try at home. Our pre-recorded sessions exhibited genetically modified organisms and their impact on human health, as well as a computational biology demonstration featuring sequence alignment and genetic relatedness.

The pre-recorded sessions can be viewed on the University of Toronto’s Science Rendezvous official YouTube channel, which also showcases pre-recorded videos from other departments and groups for this year’s event.



Science Rendezvous contributions by the Department of Molecular Genetics

The Department of Molecular Genetics also established several groups on the new Temerty Faculty of Medicine networking and social media website **Temerty Medicine Connect**. This includes pages for job and career postings and for post-doctoral fellows. The social network is specialized for students, alumni, staff, and faculty in the Department, allowing for a more focussed live feed and allows for easier networking and mentorship opportunities.



Gregory Costain

New faculty:

The Department welcomed **Dr. Gregory Costain**, a Scientist-Track Investigator in the Genetics & Genome Biology program at the SickKids Research Institute. The Costain lab specializes in rare variants in the human genome and genome sequencing to shed light on novel disease-causing genes and genotype-phenotype associations.



*Dr. Leah Cowen
(photo courtesy of NSERC)*

Faculty highlights and awards:

Dr. Scott Gray-Owen co-launched the Emerging and Pandemic Infections Consortium (EPIC) as part of UofT’s Institutional Strategy Initiatives portfolio. The initiative endeavours are to prevent future pandemics,

epidemics, and emerging infections from causing the same amount of devastation and shortcomings as COVID-19 has. This will be facilitated by the C-CL3 unit along with the CL2 facilities and UT COVID-19 BioBank. View the consortium's website for more information: <https://epic.utoronto.ca/>.

The University of Toronto appointed **Dr. Leah Cowen** as its Vice-President, Research and Innovation, and Strategic Initiatives. Her role includes recruiting the most qualified researchers and facilitating high-impact and interdisciplinary collaboration and partnerships. See the following article for more details: <https://www.utoronto.ca/news/leah-cowen-named-u-t-s-vice-president-research-and-innovation-and-strategic-initiatives>.

Dr. Rafael Montenegro-Burke was awarded the *Connaught New Researcher Award*, an interdisciplinary award that develops the careers and research profiles of recently hired UofT faculty members. He was one of the 53 faculty members and among the seven Temerty Faculty of Medicine winners of this competition.

Dr. Julie Claycomb received the *2020-2021 Faculty of Medicine Award for Mid-Career Excellence in Graduate Teaching and Mentorship*, distributed by the Temerty Faculty of Medicine to honour meaningful contributions to graduate education.

The Hospital for Sick Children appointed **Dr. Stephen Scherer** as its Chief of Research in July 2021. Dr. Scherer is also the director of SickKids' Centre for Applied Genomics and a senior scientist in its Genetics and Genome Biology program.

Dr. Kieran Campbell was awarded the *David Dime Family Catalyst Initiative – Catalyzing Innovative & Transformative Research Ideas Award*.

An Associate Faculty member in the Genetic Counselling program **Jillian Murphy** was awarded the *Cheryl T. Shuman, Interprofessional award* in the Division of Clinical and Metabolic Genetics at SickKids Hospital.

An Associate Faculty member in the Genetic Counselling program **Cheryl Cytrynbaum** won the *Association of Genetic Counsellor Program Directors Annual Outstanding Supervisor award*.

The federal-launched COVID-19 Immunity Task Force funded research from **Dr. Anne-Claude Gingras'** lab and incorporated the findings in their summary reports. The Gingras lab also joined the Coronavirus Variants Rapid Response Network (CoVaRR-Net), established at the end of March 2021, alongside the labs of **Drs. Jason Moffat, Jeff Wrana and James Rini**.

Dr. Gary Bader helped coordinate the Human Cell Atlas consortium meeting in August 2021 sponsored by Medicine by Design, of which he is a governing member. The HCA's initiative is mapping and comprehending all the cell types in the human body from development to old age.

Dr. Hannes Röst launched a mass spectrometry (MS) outreach and training program which aims to encourage diversity in computational MS, which deals with the programming and software development side, with support from the Chan Zuckerberg Initiative. This will be done by teaching a more inclusive group of researchers (with emphasis on underrepresented groups) on how to utilize the OpenMS software.

2021 Research Chairs:

Five faculty members from Molecular Genetics were awarded Canada Research Chairs in 2021:

Dr. Brenda Andrews - Tier 1 Canada Research Chair in Systems Genetics and Cell Biology

Dr. Benjamin Blencowe - Tier 1 Canada Research Chair in RNA Biology and Genomics

Dr. Daniel Schramek - Tier 2 Canada Research Chair in Functional Cancer Genomics

Dr. Mikko Taipale - Tier 2 Canada Research Chair in Functional Proteomics and Proteostasis

Dr. Ji-Young Youn - Tier 2 Canada Research Chair in Membrane-less Organelle Proteomics

Trainee awards:

Justin Belair-Hickley from Dr. Derek van der Kooy's lab was among the finalists for the *Eye on the Cure Awards* hosted by Fighting Blindness Canada for his research in stem cells and vision loss.

Five MoGen students - **Adrian Granda Farias, Shamira Tabrejee, Sara Pour, Steven Dupas, and Brandon Lieng** - were among the winners of the 2021 Cecil Yip Doctoral Research Award.

Dr. Marina Musa, a post-doctoral fellow from Dr. Andrew Fraser's lab, received the 2021 Charles H. Best Fellowship for post-doctoral research.

Jessica Knox from Dr. Peter Roy's lab and **Shubham Gupta** from Dr. Hannes Röst's lab were awarded 2021 Jennifer Dorrington Graduate Research Awards.

Mfonobong Udoh-Orok, who graduated from the Medical Genomics program in 2021, was the inaugural recipient of the MHSc McLaughlin Centre Valedictorian Award.

Departmental awards:

Jacqueline Watt - L.W. MacPherson Award (Dr. Jun Liu lab)

Sophie Karolczak - Roman Pakula Award (Dr. James Dowling lab)

Shamira Taberjee - Norman Bethune Award (Dr. Tim Hughes lab)

Jhenielle Campbell - Eric Hani Fellowship (Dr. William Navarre lab)

Vernon Monteiro - Dr. Louis Siminovitch Catalyst Award (Dr. Thomas Hurd lab)

Meaghan Leslie - McLaughlin Centre, Cheryl Shuman Award (Genetic Counselling program)

Lydia Vermeer - McLaughlin Centre, Merit Based Entrance Scholarship (Genetic Counselling program)

University of Toronto Mississauga

Department of Chemical and Physical Sciences

Correspondent: Voula Kanelis



Scott Prosser is the 2022 winner of the Biological and Medicinal Chemistry Lectureship Award

Scott Prosser: The Prosser group continues to focus on functional and mechanistic studies of GPCRs and dehalogenases. The success of the Prosser research program is evidenced by the fact that Scott was endowed as the new AstraZeneca Chair in Biotechnology ([https://www.utm.utoronto.ca/main-news/astrazeneca-](https://www.utm.utoronto.ca/main-news/astrazeneca-chair-biotechnology)

[chair-biotechnology](https://www.utm.utoronto.ca/main-news/astrazeneca-chair-biotechnology)) and is also the 2022 winner of the Biological and Medicinal Chemistry Lectureship Award (<https://www.cheminst.ca/awards/csc/bio-lectureship/>). Scott, along with colleague Prof. Josh Milstein (Physics at UTM) launched the INSPIRE Scholars Drug Discovery Program (<https://www.utm.utoronto.ca/imi-exec-ed/inspire-scholars-drug-discovery-program>), a 4-week intensive program that aims to introduce students to research in biophysical chemistry through in-person laboratories and workshops.

Jumi Shin: The Shin lab has been busy on two main prongs in their protein-design research: 1) improving their viral continuous evolution system with cytosine/adenine base editors to increase mutations, and 2) an exciting new protein motif only found in plant transcription factors called the HD-Zip. This is a fusion of a homeodomain that binds DNA and leucine zipper dimerization domain; no high-resolution structures exist. The Shin HD-Zip variants bind to 20-40 bp sites, which is useful to govern gene circuits in synthetic biology. The Shin group published papers in ACS Chem. Biol. and ACS Omega describing their continuous evolution of proteins with potential as cancer therapeutics.

Sarah Rauscher: 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.

Voula Kanelis: The Kanelis lab continues to study ABC transporters and K_{ATP} channels, and has also started to investigate the structural basis for metal transfer between different *E. coli* proteins. Voula Kanelis and Ph.D. student Sarah Bickers attended the 65th CSMB Meeting: Membrane Proteins in Health and Disease in Banff where they presented structural studies of a yeast ABC protein, Ycf1p. Ph.D. students Wayne Law and Sarah Quail presented their work on NikA ligand selectivity and on Ycf1p interactions, respectively, at the 2022 Canadian Chemistry Conference and Exhibition. Ph.D. students Agatha Tymczak and Jeffrey Youn are looking forward to presenting their data on intrinsically disordered regions in K_{ATP} channels at the Intrinsically Disordered Proteins Gordon Research Conference. The Kanelis lab was also well represented at the Chemical and Physical Sciences Award night, as Sarah Bickers received the Best Paper

Award from a graduate student for her 2021 PNAS paper on the Ycf1p cryo-EM structure. Sarah also a recipient of the prestigious Huguette J. Cohen Award. Congratulations Sarah!

Voula continues to co-direct the Amgen Biotechnology Experience (ABE) outreach program with her colleagues in the Department of Biology at UTM (Prof. Steven Chatfield) and in the ABE@UTM group (site co-ordinator and master lab technician Kristina Han). This year, the ABE@UTM group has supported both in-class ABE programming, as well as online ABE labs through LabXChange. The ABE@UTM team is looking forward to offering an in-person professional development program for high school teachers - the first since August 2019! The ABE@UTM team is also looking forward to expanding the program to the Ottawa area with partners in the Department of Biology at Carleton University.

Alana Ogata: The Ogata lab started in July 2021 with three new graduate students; Justin Van Houten, Advikaa Dosajh, and Jared King. Throughout the year the Ogata lab has received the NSERC Discovery grant, CFI-JELF, the Research Scholarly Activity Fund, and XSeed funding to support research. Advikaa and Justin both attended the CCCE 2022 conference, where Advikaa Dosajh won second place prize in the graduate Analytical Division Poster Symposium and Justin presented his first talk. Justin was also a lead volunteer for the UTM Indiciu program, where he mentored 3 undergraduate students to perform a literature review and present at the UTM competition. Justin and his team received first place and will move on to the national competition. We also celebrated Jared's newborn daughter and wish him well during his parental leave. The Ogata lab is happy to host four undergraduate students this summer; Shriya Gulati an NSERC USRA fellow, and Ruben Castillo Barberi,



CCCE conference attendees (left to right): Alana Ogata, Advikaa Dosajh, Justin Van Houten



McMillen group (left to right) Stan Wong, Cris Cruz, Zhe Tang, Yasmin Alhamdah, Dave McMillen, Saumya Mathur, Alex Duggan, Danny Huang, Matt Newman. (present in spirit: Louis Dacquay)

Christine Gaoiran, and Gurjap Bhullar as ROP students. To learn more about the Ogata lab, visit their website: <https://ogata-lab.squarespace.com/>

David McMillen: Congratulations to Cris Cruz, who completed her M.D./Ph.D. program (visiting the lab from the University of the Philippines) in August 2021, and to Zhe Tang, who graduated with his Ph.D. in February 2022! They are of course irreplaceable, but in unrelated news we will be welcoming new graduate students Danny Huang, Saumya Mathur, and Matt Newman, in the fall. The group continues to chug along, transitioning back to in-person group meetings and generally getting gradually back to normal.

Andrew Beharry: Andrew Beharry's research focusses on the development of small molecules for cancer diagnosis and treatment. For more information on the Beharry group, please see: <http://www.beharrylab.com>.

Patrick Gunning: Patrick Gunning and his group continue their research to develop drugs for fighting cancer and other diseases, create new drug screening platforms, and develop new chemosensors for cell biology. For more information on the Gunning group, please see: <https://www.gunninggroup.ca/home>.

University of Victoria

Department of Biochemistry and Microbiology

Correspondent: Perry Howard



Dr. Jennifer Cobb

New faculty:

The department welcomed its newest faculty member, **Dr. Jennifer Cobb**. Dr. Cobb completed her Ph.D. at the University of Tennessee. She is being recruited as a full Professor from the University of Calgary.

Her current areas of investigation focus on DSB repair pathway choice during cellular aging using genetic, molecular biological and biochemical approaches, and yeast as a model organism.

Research news:

Three researchers received funding support from the Canada Foundation for Innovation's John R. Evans Leaders Fund in the summer of 2021.

Dr. John Burke received support to develop a protein structural biology and molecular interactions facility.

Dr. Caroline Cameron received support to establish the infrastructure of a molecular health research centre for study of public health priority areas.

Dr. David Goodlett will upgrade a mass spectrometer at the UVic-Genome BC Proteomics Centre with the support he received, allowing detection and characterization of microbial signatures especially as they pertain to corresponding changes in the immune system.

Goodbyes:

The department experienced some major changes in 2021, including saying farewell to three long-time faculty members as they made the decision to retire. We wish them all the best.

Dr. Francis Nano, retired in July 2021 after 33 years with the department. Dr. Nano researched the engineering of microbial pathogens and synthetic biology.

Dr. Paul Romaniuk, retired in December 2021 after spending 38 years in the department. Dr. Romaniuk's research recently focussed on developing low-cost test systems to detect respiratory viruses and STIs for resource-poor countries.

Dr. Christopher Upton, retired in July 2021 after 28 years with the department. Dr. Upton specialized in viral bioinformatics and is a managing member of the Viral Bioinformatics Resource Center.

Renovations continue in the Petch building. The Cameron lab will be moving into their newly renovated lab in the next month.

University of Waterloo

Department of Biology

Correspondent: Bernie Duncker



Kirsten Muller

2021 got off to a terrific start for the Waterloo Department of Biology with **Dr. Kirsten Muller** beginning her tenure as Department Chair, after a string of highly successful administrative roles, including Associate Dean of Science for Graduate Studies, and Assistant Vice-President for Graduate Studies and Postdoctoral Affairs.

As we continued to navigate the pandemic and its effects, several of our faculty members were at the forefront of detection efforts, including **Dr. Mark Servos**, who was recognized with a Minister's Award of Excellence for his work in the surveillance of SARS-CoV-2 in wastewater (<https://uwaterloo.ca/daily-bulletin/2022-01-28#waterloo-people-awarded-minister-s-awards-of-excellence>), while **Drs. Trevor Charles** and **Jozef Nissimov** received significant internal funding to launch a campus project screening COVID using saliva (<https://uwaterloo.ca/waterloo-centre-microbial-research/news/wcmr-launches-astraw-project-covid-19-screening>).

There was an abundance of award and grant success



Mark Servos

Trevor Charles

Jozef Nissimov

pollution”); a CFI JELF award to **Dr. Dale Martin** (“Microscopy system for targeting S-palmitoylation in neurodegeneration”), while **Dr. Jozef Nissimov** was awarded the Norma J. Lang Fellowship from the Phycological Society of America for his work investigating viruses associated with harmful algal blooms in Canadian lakes. Finally, Distinguished Professor Emeritus **Dr. Bernie Glick** made it to Clarivate Analytics’ 2021 list of top 1% Highly Cited Researchers.



Laura Hug

among UW Biology faculty members in 2021, including Ontario Early Researcher Awards to **Dr. Laura Hug** (“Novelty and utility: identifying microbial populations transforming contaminants in municipal waste sites”) and **Dr. Barb Katzenback** (“Conservation of amphibian populations by using biological tools to

understand amphibian-virus-environment interactions and disease outcomes”).

Dr. Katzenback was also one of three inaugural winners of the Waterloo Excellence in Science Research Awards. Additional honours included an NFRF Exploration grant to **Dr. Trevor Charles**, in collaboration with Dr. Boxin Zhao (Chemical Engineering) (“Synergistic photocatalytic and biocatalytic degradation for controlling microplastic



Barb Katzenback

Dale Martin

Bernie Glick

CSMB-Sponsored Events 2021

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 2021.

Dalhousie University

Biochemistry and Molecular Biology Student Research Day

Correspondent: Jeffrey Simmons

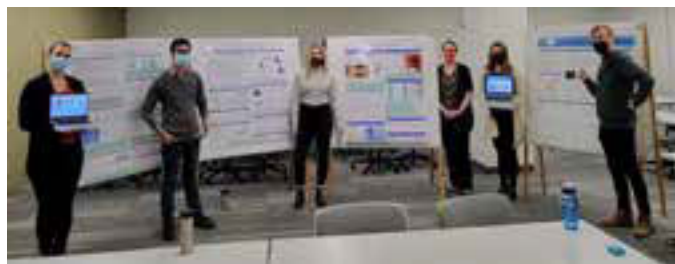
With support from the Canadian Society for Molecular Biosciences for presentation awards and event grab bags, the first hybrid, student-centred research day was held for students of the Department of Biochemistry & Molecular Biology at Dalhousie University, hosted and organized by Jeffrey Simmons and Sarah van der Ende. This Biochemistry and Molecular Biology Student Research Day, held on November 24th, 2021, contained a mix of virtual and in-person events to satisfy COVID-19 regulations at the time. Having a mix of virtual and in-person components as voted on by students provided the opportunity for in-person presentations within the university community, discussion of research difficult to obtain in a virtual setting, and incorporation of small

skill-building seminars voted on by student attendees. Most graduate students in the Halifax and Saint John campuses of Dalhousie's Department of Biochemistry & Molecular Biology participated in at least one of the events throughout the day.

The event started with the in-person poster session, where the 6 presenting students had the choice of presenting a physical poster or a virtual poster on their computers. This gave the opportunity for anyone to present without having to print a new poster for the event and provided more opportunities for students from Dalhousie's New Brunswick campus to get involved with the research of their colleagues on the Halifax campus.

This was followed by a short break and two virtual soft skill-building topics: *A Guide to Networking*, presented by Mabel Ho, the FGD Director of Professional Development and Student Engagement at Dalhousie University, and *Transitioning to Academia* presented by David Langelan, a former graduate student and current Professor in the Department of Biochemistry & Molecular Biology at Dalhousie University. This was followed by the virtual student platform presentations, where the 5 presenting students had 15-20 minutes to present their research with 5-10 minutes of questions. The last event of the day was the virtual Keynote Seminar presented by **Xavier Banquy**, Tier 2 Canada Research Chair in Bio-inspired Materials. His presentation “Bioinspired hairy materials: from biolubrication to nanomedicine” discussed his work on designing biomaterials for biomedical applications.

On behalf of the attendees of this event, we would like to thank the CSMB for their support, which allowed for an event with the first in-person session for students of our department since the start of the pandemic, sessions with skill development crucial for transitioning to a job after graduate studies, and the opportunity for students to give formal presentations to their peers, providing opportunities for potential collaboration.



In-person poster session at Dalhousie Biochemistry & Molecular Biology Student Research Day

McGill University

21st Annual Biomedical Graduate Conference (AMBGC)

Correspondent: Amelia Martínez Villarreal

In 2001 the Experimental Medicine Graduate Students' Society (EMGSS) of the McGill University launched the Annual McGill Biomedical Graduate Conference (AMBGC) in order to promote scientific exchange between McGill's biomedical departments. Over the past 20 years, the AMBGC has greatly broadened its reach, becoming one of the largest student research conferences of its kind in Canada, and an established fixture within Montreal's

biomedical research community.

This year's AMBGC organizing committee Chair was Amelia Martínez Villarreal, and the Organizing Committee members were Juan-Carlos Padilla, William Brothers, Noelia Azalde García, María Bigorra Mir, Michelle Chen and Neera Sriskandarajah.

The AMBGC is one of the largest student-run research symposia in Canada. It offers graduate and undergraduate students, engaged in biomedical research across Montreal, the opportunity to present and discuss their work in an encouraging environment. By promoting direct communication across diverse research backgrounds and universities, this symposium contributes to the advancement of biomedical research in Montreal.

For the second year in a row, the 21st AMBGC was held virtually through the platforms Whova and Zoom. Approximately 317 individuals registered on the Whova platform, including attendees, presenters, judges and sponsors. During the conference, we had both oral and poster presentations, and together they encompassed 109 presenters.

The conference themes were:

- Oncology
- Microbiology and Immunology
- Cellular and Molecular Biology
- Endocrinology & Metabolism
- Cardiovascular & Respiratory Systems
- Genetics and Gene Expression
- Epidemiology and Bioethics
- Clinical Therapeutics and Applications
- OMICS, Bioinformatics and Computational Biology

We had the honour to host our keynote speaker, Dr. **Robert A Weinberg**, Daniel K. Ludwig Professor for Cancer Research, M.I.T., and Director, Ludwig Center for Molecular Oncology and Founding Member of the Whitehead Institute.

Best known for his discoveries of the first human oncogene, RAS, and the first tumour suppressor gene, RB, Dr. Weinberg has, for decades, been at the forefront of oncology. His seminal publication *The Hallmarks of Cancer*, which he co-authored with Dr. Douglas Hanahan, has greatly influenced modern cancer research. He delivered an hour-long lecture, highlighting the most

recent research in his lab, and at the end of his lecture we had a Q&A session. Dr. Weinberg was really pleased with the Q&A, and a few students remained on the Zoom meeting to ask him additional questions.



French version of the event poster



English version of the event poster

Université de Sherbrooke

Journée Phare

Correspondante: Audrey Paillé

L'édition 2021 de la Journée Phare a été organisée par un comité formé de 10 étudiants de l'Université de Sherbrooke.

Présidentes : Maude Hamilton et Julie Douchin

Finances : Alyann Otrante et Olivier Dionne

Logistique et conseils : Vincent Roy et Elora Midavaine

Communication : Carla-Marie Jurkovic et Audrey Paillé

Promotion et site web : Julie Frion et Corentin Haidon

L'organisation de cet événement a également été supporté par le Pr. Louis Gendron et Véronique Laplante (représentante externe de l'UdeM).

La 13ème édition a pris place à l'Hôtel Chéribourg, Orford, QC, des 2 et 3 décembre 2021. Nous avons eu le plaisir de recevoir environ 180 personnes de diverses universités comme celles de Sherbrooke, Montréal ou Québec. La Journée Phare s'est déroulée sous un format hybride, de façon simultanée à l'Hôtel Chéribourg d'Orford ainsi que via la plateforme virtuelle Zoom.

Jeudi 2 décembre:

Le colloque a débuté le jeudi 2 décembre par une conférence présentée par la **Pre Geneviève Almouzni**, du **Centre de recherche de l'Institut Curie** à Paris. Véritable cheffe de file dans le domaine de l'épigénétique, ces recherches ont joué un rôle central dans la compréhension des mécanismes moléculaires impliqués dans l'assemblage de la chromatine. Ces travaux ont conduit à la publication de plus de 150 manuscrits dans des journaux de renom et ont grandement contribué à repousser les frontières des connaissances dans le domaine.

Plusieurs autres événements sont venus compléter la journée du 2 décembre. Parmi ceux-ci: une séance de présentation orale étudiante ainsi qu'une séance de présentation par affiche.

Nous avons également reçu une formation portant sur l'utilisation des médias sociaux afin de promouvoir la science auprès du grand public. Une table ronde au cours de laquelle plusieurs intervenants ont pu discuter de la situation de la communication scientifique au travers des différents types de médias.

Finalement, la journée du 2 décembre s'est conclue par notre traditionnel souper-conférence qui a été animé cette année par **M. Rémi Quirion, scientifique en chef du Québec**.



Membres du comité d'organisation



Geneviève Almouzni



Rémi Quirion



Présentations orales



Présentations par affiches



Présentations par affiches



Le souper-conférence



Table ronde sur la communication scientifique

Vendredi 3 décembre:

Les deuxièmes parties des séances de présentations étudiantes, à l'oral et par affiche, ont eu lieu lors de la journée du 3 décembre. Un atelier tenu par l'association des communicateurs scientifique du Québec intitulé *L'art de parler de science au grand public* a également été présenté.

Nous avons également eu la chance de compter sur la participation de notre deuxième conférencier, le **Pr. Vincent Martin** du département de Biologie de l'Université Concordia. Détenteur de la Chaire de recherche en ingénierie microbienne et biologie synthétique, le Pr. Martin s'intéresse principalement à la modification des

voies métaboliques des microorganismes en vue d'assurer la production de composés chimiques utiles et de grande valeur. Le Pr. Martin est également impliqué au sein de plusieurs entreprises biotechnologiques.



Vincent Martin

