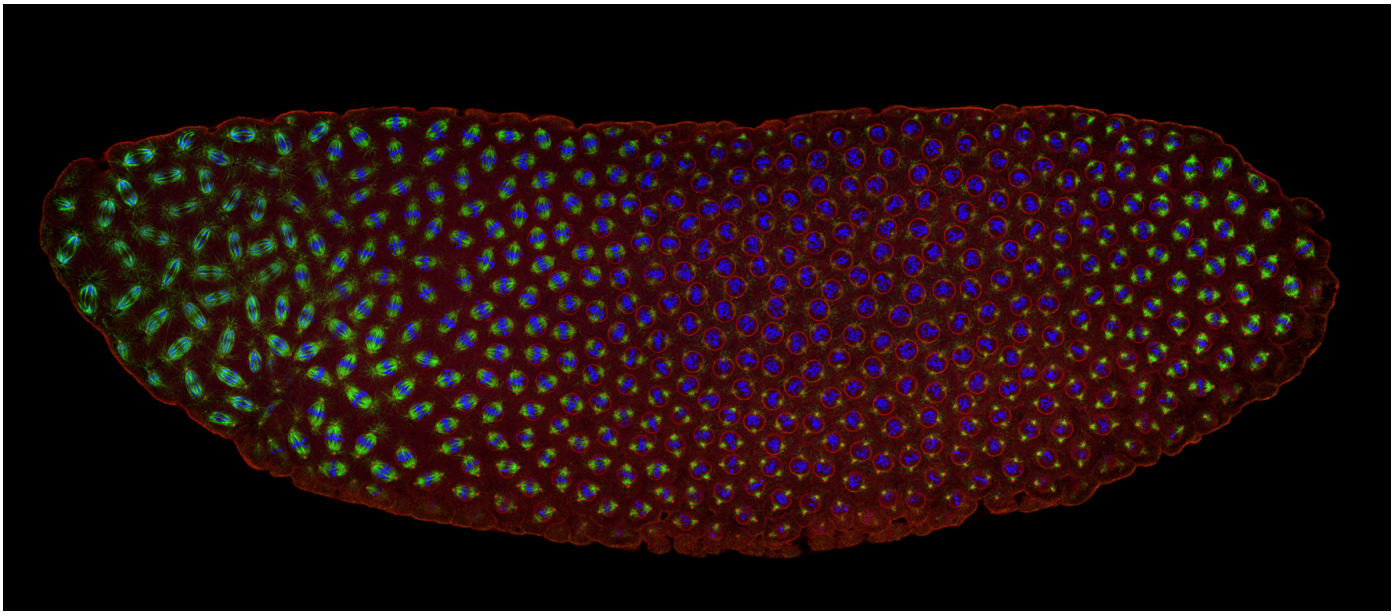
Bulletin



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

2015

www.csmb-scbm.ca

Bulletin

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

2015

www.csmb-scbm.ca

CSMB Board for 2015

From left to right: front row, Randal Johnston, Wafaa Antonious, Frances Sharom, Kristin Baetz, Jim Davie; second row, Jan Rainey, Anastassia Voronova, Arthur Hilliker; third row, Christian Baron, Andrew Simmonds, Tarik Möröy; back row, Justin Nodwell, Martin Bisaillon, Logan Donaldson.

President/Président
Dr. Kristin Baetz
University of Ottawa
Department of Biochemistry, Microbiology & Immunology
451 Smyth Road, Roger Guidon Hall
Ottawa ON K1H 8M5
Tel: (613) 562-5800 X8592
E-mail: kbaetz@uottawa.ca

Past-President/Président Précédent and Chair, Nominating Committee/Président, Comité de mise en candidature
Dr. Christian Baron
Université de Montréal
Département de biochimie
C.P. 6128, Succ. Centre-ville
Montréal, QC H3C 3J7
Tel: (514) 343-6372
E-mail: Christian.Baron@umontreal.ca

Vice-President/Vice-Président
Dr. Philip Hieter
University of British Columbia
Michael Smith Laboratories
2185 East Mall
Vancouver, BC V6T 1Z4
Tel: (604) 822-5115
Email: hieter@msl.ubc.ca

Treasurer/Trésorier
Dr. Arthur Hilliker
York University
Department of Biology
4700 Keele Street
Toronto ON M3J 1P3
Tel: (416) 817-9325
E-mail: hilliker@yorku.ca

The CSMB Board at its annual Fall meeting, held in Ottawa, December 2015.

Secretary/Secrétaire
Dr. Randal Johnston
University of Calgary
Department of Biochemistry and Molecular Biology
Faculty of Medicine
3330 Hospital Drive N.W.
Calgary AB T2N 4N1
Tel: (403) 220-8692
E-mail: RNJohnst@ucalgary.ca

Councillor/Conseiller
Dr. Martin Bisaillon
University of Sherbrooke
Département de biochimie
2500 Boul. de l'Université
Sherbrooke QC J1K 2R1
Tel: (819) 821-8000, X75287
E-mail: Martin.Bisaillon@USherbrooke.ca

Councillor/Conseiller
Dr. Jim Davie
University of Manitoba
Manitoba Institute of Cell Biology
675 McDermot Avenue
Winnipeg MB R3E 0V9
Tel: (204) 787-2391
E-mail: davie@umanitoba.ca

Councillor/Conseiller
Dr. Logan Donaldson
York University
Department of Biology
4700 Keele St.
323B Life Sciences Bldg
Toronto, ON M3J 1P3
Tel: (416) 257-2346
E-mail: logand@yorku.ca

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

Councillor/Conseiller
Dr. Justin Nodwell
University of Toronto
Department of Biochemistry
1 King's College Circle
Toronto, ON M5S 1A8
Tel: (416) 978-2696
E-mail: justin.nodwell@utoronto.ca

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

Councillor/Conseiller
Dr. Andrew Simmonds
University of Alberta
Department of Cell Biology
5-19 Medical Sciences Bldg
Edmonton AB T6G 2H7
Tel: (780) 492-1840
E-mail: andrew@ualberta.ca

Councillor/Conseiller
Trainee Representative/Représentante des stagiaires
Mr. Mustapha Lhor
Université Laval
Département de Ophtalmologie
Hôpital du Saint-Sacrement, CHU de Québec
1050 Chemin Sainte-Foy
Québec, QC G1S 4L8
Tel: (418) 682-7872
E-mail: mustapha.lhor.1@ulaval.ca

Councillor/Conseiller
Trainee Representative/Représentante des stagiaires
Dr. Anastassia Voronova
Hospital for Sick Children
PGCRL Building
686 Bay Street, Room 18.9400E Bay J
Toronto, ON M5G 0A4
Tel: (416) 813-7654
E-mail: anastassia.voronova@sickkids.ca

Bulletin Editor/Éditeur du Bulletin
Dr. Frances Sharom
University of Guelph
Department of Molecular and Cellular Biology
Science Complex Rm. 3446
Guelph, ON N1G 2W1
E-mail: fsharom@uoguelph.ca

CSMB President, Kristin Baetz

President's Report 2015

Dr. Kristin Baetz

2015 was truly a remarkable year for the CSBM and scientists across Canada. While I continue to work with the board to promote the society's mandate to advance and promote the molecular biosciences in Canada, my number one priority was to increase the advocacy efforts of the CSMB. Funding for fundamental science is at a critical cross-roads in Canada, and is the number one concern of our members. Through multiple initiatives, the CSMB promoted the importance of increased funding support of discovery research and worked to ensure that science was part of the national agenda during Election 2015. Moving forward, with the new Innovation Agenda we have an unprecedented opportunity to work together to build a Canada where science and research plays a critical role.

Increased trainee engagement:

During what have been challenging budgetary times for scientists in Canada, the CSMB believes it is extremely important to encourage our next generation of scientists. The addition of both postdoctoral fellow and graduate student board members has led to increased focus on trainee-driven activities. During 2015, the CSBM provided financial support to over 10 trainee-organized activities from coast to coast, including career days and scientific symposiums. To further engage with our trainees, the CSMB will be launching novel initiatives in 2016 including video challenges and trainee-specific workshops at all CSMB-sponsored meetings.

Scientific meetings:

To become more relevant to our members, we will strive to offer you affordable national and international conferences that will be of interest to larger numbers of our members. Not only will our CSMB conferences continue to be outstanding scientific meetings, but we will be offering trainee-specific workshops and open-forums to discuss federal science funding issues to aid in shaping CSMB recommendations and policy positions. The 2015 CSMB conference at Dalhousie University in Halifax on *"Lipids: The membrane and beyond"* was attended by over 200 delegates, the majority of which were trainees who had exceptional opportunities to present and network. In 2016, in collaboration with the International Union of Biochemistry and Molecular Biology (IUBMB) and the Pan-American Association for Biochemistry and Molecular Biology (PABMB) we will be hosting our 59th annual conference in Vancouver on "Signaling Pathways in Development, Disease and Aging". Bringing this conference to Canada has taken years of preparation, but our goal is for this landmark event to greatly increase the visibility of Canadian molecular biosciences at the international level. For Canada's Sesquicentennial year, the CSMB 60th annual conference called *"Celebrating Canadian Molecular Biosciences: from organelle to systems biology"* will take place in Ottawa May 17- 21 2017. Not only will this meeting strive to offer a diverse range of speakers, but we are planning many events to show-off Canada's outstanding researchers (that means YOU!) to politicians and the public. Come join the party in Ottawa in 2017.

Advocacy work:
2015 was remarkable year for the CSMB in which we continued to focus on advocating for increased funding for fundamental research. Due to the unprecedented efforts of many societies, individual scientists and the public, science became a part of the discussion during Election 2015. The Liberal Government has strongly indicated that Science will once again become a priority. Not only does Canada now have two Ministers with science portfolios, but remarkably Prime Minister Justin Trudeau has mandated that Minister of Science Kirsty Duncan "examine options to strengthen the recognition of and support for fundamental research to support new discoveries." As a resident of Ottawa and as the President of the CSMB, I take every opportunity whether at official meetings on Parliament Hill or bumping into Ministers, MPs or senior government officials at a grocery store, a restaurant or out walking the dog, to advocate for a robust and sustainable funding model for research in Canada.

Here I want to highlight what the CSMB has done on the advocacy front this past year, and I encourage you to check out our advocacy web pages to stay informed of our efforts https://www.csmb-scbm.ca/advocacy/Petition.aspx.

1. **Member letter writing campaigns.** Letters/emails to Members of Parliaments (MPs) remain an incredibly powerful tool to bring issues to the forefront for our parliamentarians, especially if received in large numbers. In 2015 the CSMB organized four letter writing campaigns: 1) Thank You Letters for Tri-Council Funding; 2) Call to Action: Request for increasing funding for research; and 3) Time to Demand Change at CIHR and 4) Letter Welcoming our new Government and outlining issues and mechanism to improve science funding. I can assure you these letters have been noticed by many levels within Government and the Tri-Council.

2. **Petition.** To help ensure that Science was part of the pre- and post-election discussions, the CSMB launched a petition to increase support for basic discovery research in Canada. With over 4,000 signatures, this campaign was noticed by mainstream media, the public and politicians.

3. **CSMB outreach to Parliamentarians.** The CSMB continues to take every opportunity to educate our government on the value of fundamental research for Canada. We continue to make submissions for Pre-Budget Consultations to the House of Commons and officially respond to the Federal Budget. We continue to advocate for budget increases for NSERC and CIHR, and that increases be directed to non-targeted open operating grant competitions, and for continued investment in research infrastructure. In 2015, CSMB Past-President Christian Baron and I met with both NDP and Liberal Science Critics to discuss the major challenges of our members. We have also directly welcomed all our new government MPs and, working with our lobbying partner Research Canada, we participate in events on Parliament Hill to get our message directly to MPs. Moving forward, we will take every opportunity to meet with our new government to keep pressure on them to indeed strengthen support for fundamental research.

4. **CSMB outreach to the NSERC and CIHR.** Both our Past-President and I have had many opportunities this year to talk directly one-on-one with Dr Mario Pinto and Dr Alain Beaudet, Presidents of NSERC and CIHR respectively, about the concerns of our members. Further at the CSMB December Board meeting in Ottawa, our guest was Dr Jane Aubin, Chief Scientific Officer of CIHR, and we had an open discussion of the issues surrounding CIHR reforms. As we move forward it is important to keep an open dialogue with the TriCouncils with the goal of improving the funding mechanisms in Canada.

5. **CSMB in the media.** It is essential that the public values and understands the importance of fundamental research to Canadian society. Hence as President I have actively working to get our message into the mainstream media, including commenting on articles in the Ottawa Citizen and the Globe and Mail and on the CBC Radio 1 program "Ontario Today". Further CSMB ran an ad in the Hill Times to ask Prime Minister Trudeau to work with us to get researchers back into their labs. Stay tuned for future initiatives.

6. **Working with other scientific societies.** The CSMB is just one of many volunteer-based academic science societies in Canada that are concerned about the sustainability of discovery research in Canada. Going forward it is essential that we work together to ensure we are all staying on message, coordinating our efforts, and helping each other out. For example this year Evidence for Democracy asked us to help increase survey participants from the biomedical sciences. Your response overwhelmed them and has had an impact. This year we also joined the Partnership Group for Science and Engineering (PAGSE) to add our voice to their agenda and we will be coordinating a "Bacon and Eggheads" session on Parliament Hill at which scientists present their work to, and meet with, MPs.

   Looking towards 2016 and the Liberal Government's bold Innovation Agenda, the CSMB wants to continue being a strong voice for fundamental research in Canada. Our primary goals will be to continue to advocate for increases in funding for non-targeted principal investigator-driven research programs such as NSERC's Discovery Grants and CIHR's Foundation and Project Grants; to continue to work towards building a rigorous peer-review process for all federal funding, and to work with Minister Duncan on her comprehensive review of all elements of federal support for fundamental science. We all need to work together to achieve our goal of building sustainable and robust funding mechanisms that are essential for breaking new ground in molecular biosciences research, and for Canada to truly become an innovative society.

   I hope this illustrates the dynamic efforts and activities of the CSMB and that they convince you to not only renew your membership but to motivate your colleagues to join us. We have a unique window of opportunity to improve the research environment in Canada, and this requires strengthening our political voice in Ottawa by raising our membership numbers.

   In conclusion, it is an honour to serve as President of the CSMB and I am looking forward to the exciting year ahead. Do not hesitate to reach out to myself or any other members of the board. We are here to work for you!

Incoming Members of the CSMB Executive Board

Logan Donaldson

Logan Donaldson, *Councillor*

Logan Donaldson is a Professor in the Department of Biology at York University. He received his Ph.D. in biochemistry from the University of British Columbia in 1996 (with Lawrence McIntosh) and trained as an MRC Postdoctoral Fellow at the National Institutes of Health (1996-1998, with Marius Clore and Angela Gronenborn) and later at the University of Toronto (1998-2000, with Lewis Kay). He joined the faculty at York University in 2000 and was promoted to Professor in 2010.

Dr. Donaldson has maintained a long standing interest in the structural biology (NMR and X-ray crystallography) of protein-protein and protein-nucleic acid complexes in gene regulation and cell signalling. Recently, his group has expanded its research efforts in the area of proteomics and aspects of enteropathogenic bacteriophage infection. Aside from his research, he is a strong advocate for teaching and experiential education in the life sciences, culminating in a three year long Academic Innovation Fund Award (2011-2014) to implement a first year learning community at York University. With the CSMB, Dr. Donaldson is excited to continue to work in this area with the trainees in the Teaching/outreach subcommittee.

Tarik Moroy

Tarik Möröy, *Councillor*

Since 2006, Dr. Tarik Möröy has been the President and Scientific Director of the Institut de recherches cliniques de Montréal (IRCM), as well as Director of the Hematopoiesis and Cancer research unit and Full IRCM Research Professor. Since 2007, he has held the Canada Research Chair (Tier 1) in Hematopoiesis and Immune Cell Differentiation which was renewed in 2014. He is also Full Research Professor at the Université de Montréal and adjunct professor at McGill University. Since his academic accreditation in 1991 in Germany, he has trained over 50 postdoctoral fellows and graduate students, directed several research networks and, until 2006, held several senior management positions in Germany.

As the IRCM's President and Scientific Director, he provides leadership for 35 principal investigators. He is responsible for strategic planning; researcher recruitment (14 new researchers were recruited since 2007); the institute's funding; university, hospital and government relations; training, public communications and education; operations of the IRCM clinic; and overseeing the budget of one of Canada's leading biomedical research institutions. Under his management, the IRCM vastly expanded its technical core facilities services and created a graduate program focused on translational research in order to bridge the gap between basic laboratory research and the needs of the clinical practice, thus accelerating the shift towards personalized medicine. These initiatives centred around the desire to "provide passionate researchers with the ideal conditions to experiment with their boldest ideas, test their theories and pave their own way for the benefit of us all."

Dr. Möröy has authored more than 280 publications, including 152 original articles and reviews in specialized journals, as well as over 120 contributions to scientific meetings. In 2014, he received a recognition award from the Leukemia and Lymphoma Society. In 2015, he was appointed "Honorary Guest Professor" by the Capital University in Beijing for outstanding achievements in immunology.

For more information, please visit https://www.ircm.qc.ca/IRCM/president/.

Justin Nodwell

Justin Nodwell, *Councillor*

Justin Nodwell obtained his Ph.D. in 1993 from the Department of Medical Genetics, University of Toronto (with Jack Greenblatt), where he worked on the recognition of anti-terminator RNA by transcription factors in E. coli. This was followed by a postdoctoral fellowship (from 1993-1998) with Richard Losick (Molecular and Cellular Biology, Harvard University), where he investigated the control of cell differentiation by cell-cell signalling in *Streptomyces coelicolor*.

Dr. Nodwell began his independent career at McMaster University in 1998, when he joined the faculty of the (now) Department of Biochemistry and Biomedical Sciences. He progressed through the ranks at McMaster, where he was a founding member of the DeGroote Institute for Infectious Diseases Research and a Professor of Biochemistry. In 2013, Dr. Nodwell moved to the University of Toronto, where he took up the position of Professor and Chair in the Department of Biochemistry. His research involves the use of genomics and chemistry to identify biologically active small molecules from environmental microbes. The central focus of this work is in antibiotic and antibiotic target discovery. Increasingly, his group is interested in molecules that act on eukaryotes as well, including fungal pathogens and metazoans such as the fruit fly and the nematode.

In his spare time, Dr. Nodwell enjoys playing the piano and chess.

Minutes of the 58th Annual General Meeting 2015

Halifax, Nova Scotia – 16 June 2015

1. Greetings from the President (Baron)

Baron called the meeting to order. Johnston stated that there are 18 attendees and he declared quorum to hold the annual general meeting of the society.

2. Approval of Quorum and Agenda

Motion: Johnston made a motion to approve the agenda, seconded by Hilliker, all in favour, agenda approved.

3. Approval of the Minutes of 57th Annual General Meeting in Banff, AB April 2014

Motion: Hilliker made a motion to approve the 57th AGM minutes. Seconded by Sharom, all in favour, minutes approved.

4. Business arising from the minutes (Johnston)

Johnston stated that most of the business arising from the minutes is included in the agenda and will be discussed.

a) Society transition to the new Not for Profit Act for corporations

Johnston confirmed that CSMB had transitioned and was fully compliant with the new Not for Profit Act, and Corporations Canada has provided the CSMB with a certificate of continuance.

5. Secretary's Report (Johnston)

a) Membership - attached

Johnston provided details of the CSMB membership. As of June 15, 2015 there are 471 renewed and new CSMB members. CSMB is one of the largest scientific societies in Canada. We are hosting an international meeting in Vancouver, and we will be using that meeting to increase our membership.

6. Treasurer's Report (Hilliker)

a) Presentation of the Accountant's Reviewed Financial Statement

Hilliker presented the financial statement. He stated that CSMB as of December 31, 2014 had $403,956 in investment funds.

Then he provided the details of the 2014 conference revenue and expenses: the 2014 conference had a net loss of $12,284 (compared to the 2013 conference which had a net loss of $36,189). The 2015 conference is expected to break even. The 2014 conference could be considered as break even if we do not count the cost of awards and board travel.

b) Acceptance of the Reviewed Financial Statement (2014)

Motion: Michael James made a motion to accept the reviewed financial statement as prepared by Ms. Andrea Poole. Kristin Baetz seconded the motion, all in favour, motion approved.

c) Approval of Signing Officers

Johnston and Hilliker are the signing officers on the CSMB RBC account.

Motion: Reinhart Reithmeier made a motion to approve the continuation of both signing officers. Simmonds seconded the motion, all in favour, motion approved.

7. Board Membership for 2015-2016 (Simmonds)

a) Councillors

Simmonds stated that the Society had issued a call for nomination for new councillors on the board. He listed the names of the 3 nominees that were eligible, (T. Moroy, L. Donaldson and J. Nodwell). He added that the board member from Eastern Canada will be finishing his term next year, so he encouraged other members from Eastern Canada to apply when the request for nominations is sent out next year.

Motion: Simmonds made a motion to approve the 3 nominations. Rainey seconded the motion, all in favour, motion approved.

b) Vice-President (Elect)

Simmonds added that Kristin Baetz will take over from Christian Baron as President on July 1st as approved last year, and Phil Hieter is recommended as the Incoming President at that time.

Motion: Simmonds made a motion to approve Kristin Baetz as President and Phil Hieter as Incoming President. Hilliker seconded the motion, all in favour, motion approved.

8. Meetings Reports

a) 2015: Halifax - Rainey
Membrane Lipids in Signalling and Regulation

Rainey stated that the meeting went well and should break even.

b) 2016: July 17-21, 2016, Vancouver - Johnston
Signalling Pathways in Development, Disease and Aging; in partnership with IUBMB & PABMB

Johnston stated that they were working with IUBMB and PABMB. ICS is an international conference organizing company that was hired to be the official conference organizer. The estimated breakeven is when the attendance reaches 1,000. The launching of the website will be in Brazil at the IUBMB conference.

c) 2017: May 16-20, 2017, Ottawa – Baetz
Celebrating Canadian Molecular Biosciences

Baetz stated that they were using this meeting to engage with politicians. She added that there will be two parallel sessions. She is the program chair for the System Biology sessions and the second session will be run by a group from Toronto. She added that she will invite MPs to attend. The estimated breakeven will be 300 attendees, and the meeting will be held in Ottawa at the Shaw Convention Centre.

d) 2018: July 14-19, 2018, Vancouver - Johnston
Genetic Horizons: Evolution, Development, Sustainability and Health; in partnership with the International Genetics Federation and the Genetics Society of America

The IGF conference is held every 5 years. Johnston stated that the 2018 Conference would be using the same Professional Conference organizer as the 2016 IUBMB Conference. Some IGF Board members will come to the 2016 IUBMB meeting to review progress.

These two meetings will be considered as the CSMB Annual Conferences for those years.

9. Other Business/Adjournment

Hilliker made a motion to adjourn, Johnston seconded the motion, all in favour, meeting adjourned.

List of Motions:

Motion: Johnston made a motion to approve the agenda. Seconded by Hilliker, all in favour, agenda approved.

Motion: Hilliker made a motion to approve the 57th AGM minutes. Seconded by Sharom, all in favour, minutes approved.

Motion: Michael James made a motion to accept the reviewed financial statement as prepared by Ms. Andrea Poole. Kristin Baetz seconded the motion, all in favour, motion approved.

Motion: Reinhart Reithmeier made a motion to approve the continuation of both signing officers. Simmonds seconded the motion, all in favour, motion approved.

Motion: Simmonds made a motion to approve the 3 nominations. Rainey seconded the motion, all in favour, motion approved.

Motion: Simmonds made a motion to approve Kristin Baetz as President and Phil Hieter as Incoming President. Hilliker seconded the motion, all in favour, motion approved.

Motion: Hilliker made a motion to adjourn, Johnston seconded the motion, all in favour, meeting adjourned.

Financial Statement
STATEMENT OF FINANCIAL POSITION

As at DECEMBER 31, 2015 (with unaudited comparative figures as at December 31 2014)
UNAUDITED

	2015	2014
ASSETS		
CURRENT		
Cash	$ 15,600	$ 6,142
Accounts receivable - CSMB	4,343	8,194
Prepaid expenses	15,557	8,080
	35,500	22,416
INVESTMENTS (note 4)	350,121	403,956
	$ 385,621	$ 426,372
LIABILITIES		
CURRENT		
Accounts payable and accrued liabilities	$ 15,617	$ 5,053
Deferred membership and subscription fees	2,476	3,091
	18,093	8,144
LONG TERM		
Deferred membership fees	3,778	4,049
UNRESTRICTED NET ASSETS	363,750	414,179
	$ 385,621	$ 426,372

STATEMENT OF OPERATIONS AND CHANGES IN ASSETS

As at DECEMBER 31, 2015 (with unaudited comparative figures as at December 31 2014)
UNAUDITED

	2015	2014
REVENUE		
Membership dues	$ 24,707	$ 24,653
Annual meeting	78,410	72,841
Other	727	415
	103,844	97,909
Investment income	8,823	10,073
	112,667	107,982
EXPENSES		
Annual meeting (note 5)	90,554	85,125
Secretariat	19,579	16,930
Website	10,543	2,280
Board meetings	10,102	14,500
Meeting sponsorship	6,500	6,000
Bulletin	5,300	4,549
Science advocacy	3,521	19
Bank and credit card fees	2,955	2,533
Office	2,570	1,067
Professional fees	2,300	2,300
Insurance	1,726	1,794
Dues and subscriptions	1,000	-
	156,650	137,097
NET (EXPENSES) FOR THE YEAR	$ (43,983)	$ (29,115)
Unrestricted net assets at beginning of year	$ 414,179	$ 418,250
Balance before items affecting net assets	370,196	389,135
Gains from sale of investments - realized (note 3)	38,263	13,518
Gains (losses) on investments - unrealized (note 3)	(44,709)	11,526
UNRESTRICTED NET ASSETS AT END OF YEAR	$ 363,750	$ 414,179

STATEMENT OF CASH FLOWS

As at DECEMBER 31, 2015 (with unaudited comparative figures as at December 31 2014)
UNAUDITED

	2015	2014
CASH PROVIDED BY (USED FOR)		
OPERATING ACTIVITIES		
Cash from operations		
Net (expenses) revenue for the year	$ (43,983)	$ (29,115)
Non-cash portion of investment income	(7,611)	(10,073)
	(51,594)	(39,188)
Net change in non-cash working capital balances		
Accounts receivable	3,851	4,524
Conference deposit	(7,477)	6,236
Accounts payable and accrued liabilities	10,564	(10,754)
Deferred membership and subscription fees	(886)	(710)
Deferred conference income	-	(5,357)
	(45,542)	(45,249)
INVESTING ACTIVITY		
Transfer of funds from investment account	55,000	40,436
INCREASE (DECREASE) IN CASH	9,458	(4,813)
Cash, beginning of year	6,142	10,955
CASH, END OF YEAR	$ 15,600	$ 6,142
CASH POSITION		
Cash	$ 15,600	$ 6,142

NOTES TO THE FINANCIAL STATEMENTS

DECEMBER 31, 2015
UNAUDITED

1. PURPOSE OF THE ORGANIZATION

The Canadian Society for Molecular Biosciences (CSMB) 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

These financial statements are the responsibility of management and have been prepared in accordance with Canadian accounting standards for not-for-profit organizations (ASNFPO) using the accounting policies summarized below.

(a) Revenue recognition

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

(b) Capital assets

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

(c) Use of estimates

The preparation of the 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, liabilities, revenue and expenses and disclosure of contingent assets and liabilities. These estimates are reviewed periodically and adjustments are made to net revenue as appropriate in the year they become known.

(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. FINANCIAL RISKS AND CONCENTRATION OF RISKS

The carrying values of cash, accounts receivable and accounts payable approximate their fair values due to the short-term nature of these assets and liabilities.

Marketable securities are comprised of bonds, money market investments and segregated mutual funds. These are initially recorded at fair value based on quoted market prices and are subsequently measured at fair value at each year end. Net gains and losses arising from changes in fair value are recognized in the Statement of Operations. For the year ended March 31, 2015, the net unrealized gain was $(44,709) (March 31, 2014 unrealized gain was $11,526).

Fair value approximates amounts at which financial instruments could be exchanged between willing parties, based on current markets for instruments of the same risk, principal and remaining maturities. Fair values are based on quoted market values.

Unless otherwise noted, it is management's opinion that the Society is not exposed to significant interest, currency or credit risks arising from these financial statements.

4. INVESTMENTS (at Market Value)

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

BMO Nesbitt Burns Canadian Account	**2015**	**2014**
Cash and short term investments	$ 14,068	$ 30,670
Fixed income	96,825	52,360
Common equity	97,238	249,247
	208,131	332,277
BMO Nesbitt Burns US Account (in $ Canadian)		
Cash and short term investments	832	1,012
Common equity	141,158	70,667
	141,990	71,679
	$ 350,121	$ 403,956

5. ANNUAL MEETING EXPENSES

	2015	**2014**
Exhibits and facility	$ 4,000	$ 7,635
Travel and expenses	25,308	54,345
Awards	15,408	15,130
Organizing and planning	3,989	6,100
Supplies and other	11,359	1,914
Reception and banquets	30,490	-
	90,554	85,124

Andrea Poole, C.A.
Licensed Public Accountant
48 Dunvegan Road Ottawa ON K1K 3G3
613-218-5931 accounting@pooleca.com

REVIEW ENGAGEMENT REPORT

To the Members of the Canadian Society for Molecular Biosciences

Report on the Financial Statements

I have reviewed the statement of financial position of the Canadian Society for Molecular Biosciences (CSMB) as at December 31, 2015 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.

My review was made in accordance with Canadian generally accepted standards for review engagements and accordingly consisted primarily of enquiry, analytical procedures and discussion related to information supplied to me by the company.

A review does not constitute an audit and consequently I do not express an audit opinion on these financial statements.

Based on my review, nothing has come to my attention that causes me to believe that these financial statements are not, in all material respects, in accordance with Canadian accounting standards for not-for-profit organizations.

Andrea Poole, CPA, CA
Licensed Public Accountant

Ottawa, Ontario June 30, 2016

Meeting Report: The 58th Annual Meeting of the CSMB, Lipids: The Membrane and Beyond

Barbara Karten[1] and Jan K. Rainey[1,2]
[1]Department of Biochemistry & Molecular Biology and [2]Department of Chemistry
Dalhousie University, Halifax, NS B3H 4R2 Canada
E-mails for correspondence: bkarten@dal.ca or jan.rainey@dal.ca

The 58th Annual Meeting of the CSMB was held June 14-17, 2015 in Halifax, Nova Scotia. All scientific sessions and meals were at Dalhousie University's Carleton Campus, with the exception of the banquet and student awards presentation, which took place at the newly renovated Canadian Museum of Immigration at Pier 21, overlooking historic Halifax harbour. The meeting attracted 116 attendees hailing from all Canadian provinces except Saskatchewan and Prince Edward Island, from U.S. states ranging from California to Florida to New York and several others in between, and from Austria, Germany, Italy, Switzerland, and the U.K. Our organizing committee was drawn from Dalhousie's Department of Biochemistry & Molecular Biology, Department of Microbiology & Immunology, and the Atlantic Research Centre in the Department of Pediatrics. Representation included six Halifax-based researchers and two researchers from the Dalhousie Medicine New Brunswick campus in Saint John, NB.

Over the course of an intense program underpinned by two keynote lectures, six topical scientific sessions allowed for presentations by 18 invited speakers and 17 speakers chosen from contributed abstracts, alongside 42 poster presentations. Three CSMB awards were also presented, with lectures from each of the awardees. Finally, a presentation by Sylvie Roy and Kayla Zavitske from NSERC gave attendees the chance to hear about and discuss the latest grant program details and statistics. Questions and discussion were vigorous throughout the meeting - engagement remained high, despite the intensive schedule! Comments by many attendees about the beauty of the Halifax region showed that the scientific program allowed sufficient flexibility before and after the meeting to enjoy our Maritime setting. A highlight of the meeting from many attendees' perspectives was certainly our banquet at Pier 21 organized by Dr. Roger McLeod (who also happens to be a trained sommelier). The banquet opened with a reception in the Canadian Museum of Immigration at Pier 21, where attendees could walk around the exhibition while sampling some fine Nova Scotian sparkling wine. A Nova Scotia-influenced buffet then followed, with seafood chowder, smoked salmon, lobster, mussels, oysters, halibut, and local chicken and lamb alongside a variety of cold and hot vegetable options - there seemed to be something for everyone, with many taking advantage of the lobster bibs!

Our scientific goal for the meeting was to encourage and foster interactions between researchers from disparate areas of lipids research. We also wanted to emphasize the fact that lipids function not only as components of membranes, but in a wide range of other contexts. Dalhousie's diverse lipid research community reflects the multifaceted lipid research across the country and helped us to assemble a stimulating and broad program.

Keynote lectures

Dr. Andrea Ballabio

The first keynote lecture, immediately following opening remarks by conference Co-Chair Dr. Jan Rainey, was given by Dr. Andrea Ballabio, founder and director of the Telethon Institute of Genetics and Medicine in Naples, Italy. Dr. Ballabio's work has been instrumental in extending our view of lysosomes beyond the traditional understanding as merely digestive organelles. The keynote lecture highlighted the role of lysosomes as central hubs that coordinate sensing, signalling and transcriptional mechanisms with environmental cues such as nutrient availability. Dr. Ballabio focused on the discovery of a lysosomal gene network under control of the transcription factor TFEB, which controls lysosomal biogenesis and various cellular clearance processes and is itself regulated by nutrients and lysosomal status, forming an intricate crosstalk between lysosomes and nucleus.

Dr. Lukas Tamm

Our second keynote lecture took place on Tuesday and was given by Dr. Lukas Tamm, the Harrison Distinguished Professor in Molecular Physiology and Biological Physics at the University of Virginia. Dr. Tamm is at the forefront of the field of membrane protein biophysics. Notable contributions include the introduction of planar supported bilayers as model membrane systems and solving of one of the first integral membrane protein structures by NMR spectroscopy. During his keynote lecture, Dr. Tamm described his group's pioneering studies to elucidate how synaptic vesicles exocytose and release neurotransmitters into the synaptic junction at timescales of milliseconds or less. Dr. Tamm presented beautiful TIRF microscopy experiments allowing comparison of the fusion effected by model systems and by purified natural vesicles. These results provide direct insight into the required fusion protein stoichiometry and mechanisms by which fusion is regulated.

CSMB Award Lectures

GE Healthcare New Investigator Award

This year, the recipient of the GE Healthcare New Investigator Award was Dr. Vincent Archambault from the Université de Montréal, for his fundamental work on cell cycle control by the Greatwall-PP2A axis. Dr. Archambault presented his recent work investigating the reciprocal spatiotemporal regulation of the kinase Greatwall (Gwl) and the protein phosphatase 2A, and the identification of PP2A substrates using genetic and proteomic approaches.

NRC Research Press Senior Investigator Award

The NRC Research Press Senior Investigator Award this year was presented to Dr. Michael James, FRS and Emeritus Distinguished University Professor from the Department of Biochemistry at the University of Alberta. Although Dr. James' many seminal contributions in structural biology were recognized with this Award, he very fittingly focused his talk on recent structural work from his group on a key enzyme involved in lysosomal storage diseases - α-L-iduronidase (IDUA). Very unusually, a post-translationally linked glycan is required for enzyme function - Dr. James' group showed structurally that this is through direct interaction with a glycan subunit in the mucopolysaccharide being degraded by IDUA.

Robert H. Haynes Young Scientist Award in Genetics

Dr. Luigi Bouchard from the Université de Sherbrooke, who received this year's Young Scientist Award in Genetics, brought an additional, fascinating aspect of lipid metabolism to the conference when he reported on his work on epigenetic programming and regulation of HDL metabolism. Over recent years, Dr. Bouchard's group has identified epigenetic polymorphisms associated with circulating lipoprotein levels, and discovered associations between DNA methylation of several lipoprotein metabolism genes with maternal metabolic status and gestational diabetes.

Focused Scientific Sessions

Cellular Lipid Transport

Following Dr. Ballabio's keynote lecture, the Sunday evening session, organized by conference Co-Chair Dr. Barbara Karten, focused on lipid transport. To start off, Dr. Fred Maxfield from Cornell University gave a clear overview of intracellular cholesterol transport pathways and spoke in more detail about their latest research on the cytosolic cholesterol transport protein StarD4. Employing a combination of sophisticated live-cell imaging approaches and *in vitro* assays, the Maxfield lab discovered a new regulatory mechanism for StarD4-mediated cholesterol transfer by phosphoinositides. In the second part of his talk, Dr. Maxfield presented recent studies using histone deacetylase inhibitors to treat Niemann-Pick Type C1 deficiencies. Dr. Greg Fairn from the University of Toronto presented his group's work using novel genetically-encoded fluorescent probes for cholesterol and phosphatidylserine to investigate how phosphatidylserine influences the transbilayer distribution of cholesterol. Dr. Barbara Karten from Dalhousie University described the work of her group on the role of Niemann-Pick Type C proteins in cholesterol trafficking to mitochondria, and the consequences of NPC1-deficiency for mitochondrial cholesterol levels and function.

A shorter, contributed presentation by Dr. Stacy Horner from Duke University demonstrated an intriguing link between lipid metabolism and virology. Her group's recent proteomics analyses of mitochondria-associated membranes (MAM) during RNA virus infection suggest a central role for MAM in the coordination of innate immune signaling through the assembly of signalling complexes around the host protein MAVS in MAM. In a second short presentation, postdoctoral fellow Dr. Cameron Scott from Dr. Jean Gruenberg's lab at the University of Geneva, Switzerland, demonstrated a role for Wnt3a in the regulation of cholesterol metabolism, lipid storage and endosome transport, whereby Wnt3a stimulates lipid droplet formation in a mechanism requiring LDL cholesterol endocytosis and functional endosomes.

Lipid Metabolism

The Monday morning session (sponsored by VWR) on lipid metabolism, organized by Dr. Aarnoud van der Spoel, started off with a presentation by Dr. Tobias Hartmann from Saarland University, Germany, who outlined the close interrelationship between membrane lipids and amyloid precursor protein (APP) cleavage. A strong influence of gangliosides and fatty acid chains on gamma-secretase cleavage of APP on one side, and regulation of several key enzymes of lipid metabolism by APP breakdown products on the other side, create potential feedback mechanisms that might serve to maintain physiological lipid levels in neuronal membranes. Dr. Jerry Chipuk, from the Icahn School of Medicine at Mount Sinai, whose lab has provided pivotal insight into the role of mitochondrial membrane composition in the control of the mitochondrial outer membrane permeabilization (MOMP) over the last years, presented new links between mitochondrial morphology and MOMP. Using GFP-tagged cytochrome c to monitor MOMP in live cells, the Chipuk lab showed that hyperfragmented mitochondria did not undergo MOMP, and confirmed these findings further using a novel size fractionation technique of isolated mitochondria. Dr. Russell Bishop from McMaster University spoke about the phospholipid palmitoyltransferase PagP in the outer membrane of Gram negative bacteria, which modulates membrane permeability and the bacterial host immune response. Recent findings from the Bishop lab show that certain PagP homologues can palmitoylate phosphatidylglycerol in addition to the commonly known acceptor lipid A, which may have effects on bacterial membrane permeability.

Three trainee presentations rounded out this session. Sabri Rial from Dr. Catherine Mounier's group at the Université du Québec à Montréal described the role of hexanoate on fatty acid synthesis and insulin sensitivity of HepG2 hepatocytes. A presentation by Louis Dacquay from the lab of Dr. Kristin Baetz at the University of Ottawa outlined two complementary yeast genetic screens to investigate the role of lysine acetylation of Oxysterol-Binding Protein homologue Osh4p. Both screens implicated the lysine acetyltransferases NuA4 and Rtt109 as inhibitors of Osh4p function. Graduate student Ryan Bradley from Dr. Robin Duncan's lab at the University of Waterloo presented a novel mouse model, in which the loss of the enzyme AGPAT4 leads to decreased total brain phosphatidylinositol levels and learning and memory defects, thus demonstrating an as yet unknown role for the enzyme AGPAT4 in brain phosphatidylinositol metabolism.

Lipid Droplets

Our Monday afternoon session, organized by Dr. Petra Kienesberger, was on Lipid Droplets. Dr. Rudi Zechner from the Medical University of Graz, Austria was due to open the session - air travel woes meant that he spoke later in the meeting. Dr. Zechner described his group's recent work on the role of adipose triglyceride lipase (ATGL) in lipid metabolism and insulin resistance. Because whole body deletion of ATGL causes severe cardiomyopathy and early lethality, the Zechner group generated a new mouse model of "healthy" ATGL-deficient mice by re-expressing ATGL specifically in cardiomyocytes. Mice lacking ATGL in all tissues but cardiomyocytes were protected from high-fat diet-induced obesity and had increased insulin sensitivity, associated with altered PPAR-gamma signaling and reduced food intake. Dr. Zechner suggested that pharmacological inhibition of ATGL may have beneficial effects in metabolic disorders if the cardiac phenotype can be avoided. Dr. Petra Kienesberger from Dalhousie Medicine New Brunswick detailed recent work from her group examining the role of the adipokine autotaxin in obesity-related metabolic disorders. Autotaxin secretion by adipocytes was related to adipocyte differentiation and insulin levels, while circulating autotaxin levels in human patients and mouse models positively correlated to measures of obesity and insulin resistance, suggesting a potential therapeutic or biomarker role for autotaxin. Dr. Robert Farese, Jr. from the Harvard School of Public Health rounded out the session with a very nice presentation about mechanisms of lipid droplet formation. Recent work from his group has demonstrated a bimodal population of droplet size as a function of early formation vs. an expansive growth stage in typical cells, and outlined the role of different DGAT enzymes in synthesizing the oil that is packed inside the droplets at each stage of growth.

The first contributed talk in this session was from PhD student Christopher Choy from Dr. Robert Botelho's group at Ryerson University, who showed a relationship between PtdIns(3,5)p2 signalling and transcription factor regulation, leading to lysosomal size modulation. Dr. Louis Lapierre from Brown University described studies in *C. elegans* and mice showing that vitellogenin and hepatic apolipoprotein B levels influence transcriptional regulation of aging-related autophagy with implications that increased lipoprotein levels impair induction of autophagy.

Membrane Fusion

Monday evening's session, organized by Dr. Roy Duncan, was focused on membrane fusion from both physiological and pathological standpoints. The session opened with Dr. Leonid Chernomordik from the National Institutes of Health, who discussed recent studies on cell fusion involved in development and in dengue virus and HIV infection, focusing on the distinction between players involved in the events leading up to fusion vs. those directly mediating fusion. Dr. Chernomordik's work clearly showed a strong dependence of the fusion process not only upon the fusion protein machinery but also on lipid composition. Dr. Jeffrey Lee from the University of Toronto presented elegant structural biology studies of viral envelope glycoproteins. His identification of structural features that are retained across multiple viruses is not only of fundamental interest but is also key to allow for rational design and development of new inhibitors. Finally, Dr. Roy Duncan from Dalhousie University described his group's characterization of the reovirus fusion-associated small transmembrane (FAST) proteins, which are the smallest identified membrane fusion proteins to date, and yet display a striking variety in their architecture. Ongoing structure-function studies in the Duncan lab are beginning to reveal a diverse set of structural features that work together in varying combinations to mediate fusion.

In the first contributed talk of the session, Dr. Christopher Brett of Concordia University described light and electron microscopy-based studies of native vacuolar lysosome fusion, showing interesting differences in the fusion pathway and resulting outcomes for native organelles vs. reconstituted proteoliposomes. Postdoctoral fellow Sebastian Fiedler from the group of Dr. Heiko Heerklotz at the University of Toronto discussed cyclic lipopeptides with potential application in crop-protection. Intriguing differences in lipid selectivity were apparent, allowing insight into the functional features that provide selectivity of antifungal vs. more broadly acting cyclic peptides.

Protein-Lipid Interactions

Tuesday morning began with a session on Protein-Lipid Interactions, organized by Dr. Roger McLeod, who also was the first scheduled speaker of the session but had given his talk earlier due to Dr. Zechner's travel delays. Dr. McLeod described his group's research to characterize the structure of apolipoprotein B100. To date, all structural data for apoB100 rely upon bioinformatics predictions and relatively low-resolution electron microscopy. These structural predictions are at odds with circular dichroism and nuclear magnetic resonance (NMR) spectroscopy studies from Dr. McLeod's group, implying that the structure of apoB100 may still have some interesting surprises. Dr. Mike Oda from the Children's Hospital Oakland Research Institute detailed work on another apolipoprotein, apoA-I. Using a beautiful series of electron paramagnetic resonance spectroscopy experiments, his group has derived models of apoA-I in both lipid-free and lipid-bound states. Dr. Oda demonstrated that these, in turn, provide a means to directly and accurately monitor effects of cardiovascular disease upon HDL function. The final invited speaker, Dr. Valerie Booth from the Memorial University of Newfoundland, showed the value of characterizing antimicrobial peptides and lung surfactant proteins in physiologically relevant settings. In the former case, nice NMR studies on lipid behaviour in intact bacteria as a function of antimicrobial peptide concentration help in rationalization of the fact that minimal inhibitory concentrations are much higher than would be implied from simple model systems. In the latter case, clear parallels were observed between studies of surfactant proteins in model systems vs. in real lung surfactant.

Ph.D. student Parthajit Mukherjee from Dr. Jeffrey Atkinson's group at Brock University contributed a talk about lipid-mediated binding and sterol extraction by oxysterol-binding proteins. Kyungsoo Shin, a Ph.D. candidate with Dr. Jan Rainey at Dalhousie University, used CD and NMR spectroscopy to propose the involvement of membrane binding and "catalysis" for proprotein processing in the apelinergic system. Finally, postdoctoral fellow Antreas Kalli from the group of Dr. Mark Sansom at the University of Oxford, presented results of large-scale molecular dynamics simulations on the protein Band 3, which are allowing evaluation and rationalization of preferential protein-lipid interactions and their involvement in protein-protein interaction.

Tuesday Afternoon Contributed Talks

Two very interesting contributed talks were sandwiched between Dr. Tamm's keynote lecture and Dr. James' Award lecture. Dr. Costin Antonescu from Ryerson University discussed work from his group examining the effects on fatty acyl chain substitutions in phosphoinositides and convincingly showed that PI function should be considered in light of not only the headgroup status but also the acyl chain composition. Following this, Dr. Gerhard Multhaup from McGill University presented studies using an octapeptide that interacts with Aβ42 and disrupts Aβ42-membrane binding, which in turn appears to modulate Aβ42 toxicity.

Advanced Techniques in Lipid Research

The final session of the conference, organized by Dr. Neale Ridgway, focused on methodological advances in lipid research. Dr. Steffany Bennett from the University of Ottawa spoke about the need to develop harmonized protocols for lipidomics analyses, and described recent work profiling phospholipid species in synaptic membranes to distinguish alterations in Alzheimer's Disease and mild cognitive dysfunction. Dr. Mary Kraft from the University of Illinois presented her group's pioneering work to analyze the spatial distribution of lipids in cell membranes by Nanoscale Secondary Ion Mass Spectrometry (NanoSIMS), with which her group can map lipid-specific stable isotope enrichment in cell membranes with a spatial resolution of approximately 100 nm. NanoSIMS images revealed an enrichment of 15N-labeled sphingolipids in cytoskeleton-dependent lateral domains, while cholesterol was distributed relatively evenly in the membrane. Dr. Rosemary Cornell from Simon Fraser University presented their work on elucidating the structure-function relationship of CTP-phosphocholine cytidylyltransferase (CCT). Using a powerful combination of structural analyses and molecular dynamics simulations, the Cornell group could identify a key role for a flexible linker region between the autoinhibitory motif and the catalytic site of CCT.

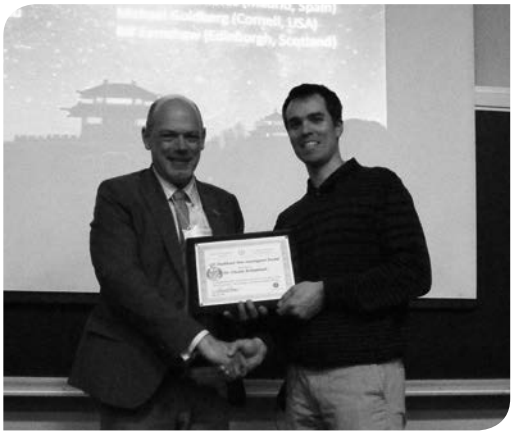
The three short presentations in this session highlighted additional innovative techniques in lipid research. Graduate student Philippe-Pierre Robichaud from Dr. Marc Surette's lab at the Université de Moncton spoke about the use of 19-alkyne arachidonic acid as a click chemistry probe for arachidonate-phospholipid metabolism. Dr. Svetlana Baoukina, a postdoctoral fellow in the group of Dr. Peter Tieleman at the University of Calgary, presented molecular dynamics simulations with the MARTINI coarse-grained force field, which model lipid bilayers on a 100 nm length and tens of microseconds time scale to study bilayer lipid mixing and phase behavior. Lastly, Dr. Gil Privé from the University of Toronto gave a short overview of the lipid complexing behaviour of saposins and highlighted the possibility that, in addition to their physiological activity in the breakdown of glycosphingolipids in lysosomes, these saposin picodiscs can serve as non-detergent lipid-solubilizing systems in lipidomics and protein-lipid interaction analyses.

Poster Sessions

Overall, 42 posters were presented over the course of two poster sessions on Monday and Tuesday afternoon. The presenters ranged from undergraduate researchers to principal investigators. Poster sessions were well attended and led to many animated discussions. The placement of the posters right outside the lecture theatre also made it easy to mingle during the poster sessions and facilitated frequent discussion outside of the scheduled poster sessions.

Thanks to the generous contributions of our sponsors, 7 poster awards were given to trainees presenting their research at the conference. In spite of this relatively large number of prizes to award, the judges found it difficult to pick the winners, due to the generally high quality of presentations. In the end, two awards to postdoctoral fellows sponsored by the CSMB and by Horiba Scientific went to Dr. Luc Boudreau from Marc Surette's group at the Université de Moncton and to Dr. Chungen Pan from Dr. Roy Duncan's group at Dalhousie University. Graduate student awards were sponsored by *Biochemistry and Cell Biology*, Sciex and Bruker, alongside two from the CSMB. Recipients were Erin McNally from Dr. Christopher Brett's lab at Concordia University, Antonietta Pietrangelo from Dr. Neale Ridgway's group at Dalhousie University, Sanchia Miller from Dr. Russell Bishop's group at McMaster University, Maria Davis from Dr. Shawn McLellan's lab at the University of New Brunswick, and Aditya Pandey from Dr. Jan Rainey's lab at Dalhousie University.

Scenes from the 58th Annual Meeting *Halifax, 2015*



Vincent Archambault (Université de Montréal) receives the GE Healthcare New Investigator Award from Christian Baron, outgoing President of the CSMB (2014-2015)

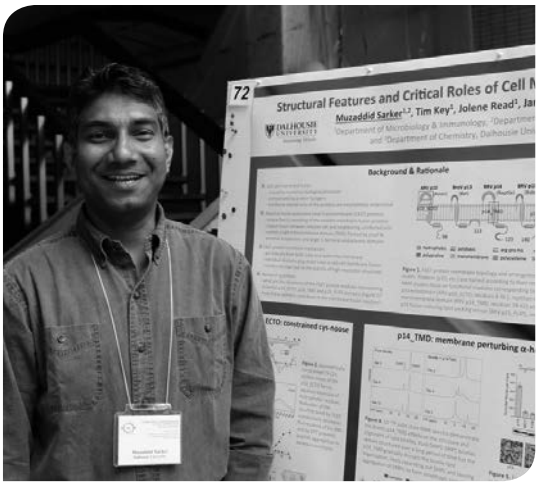
Michael James (University of Alberta) is presented with the NRC Research Press Senior Investigator Award by Randy Johnston, Secretary of the CSMB

Audience at one of the conference talks

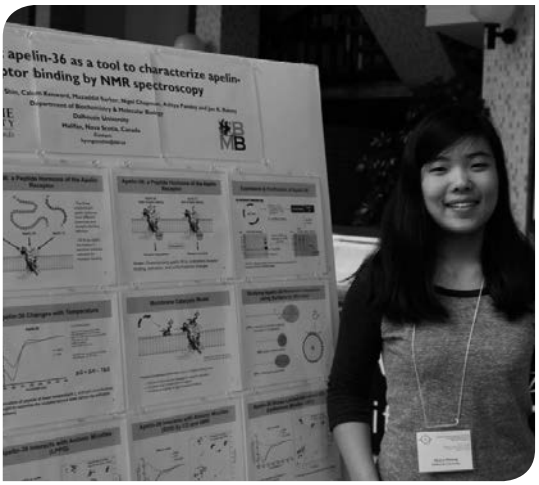
Attendees at the poster sessions

Attendees at the poster sessions

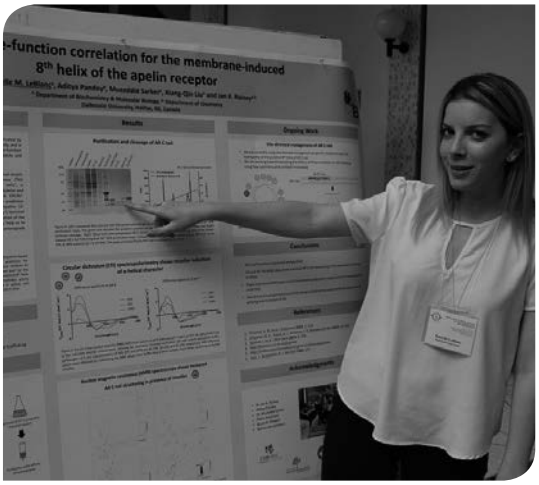
Lively discussion at the poster sessions



Poster presentation

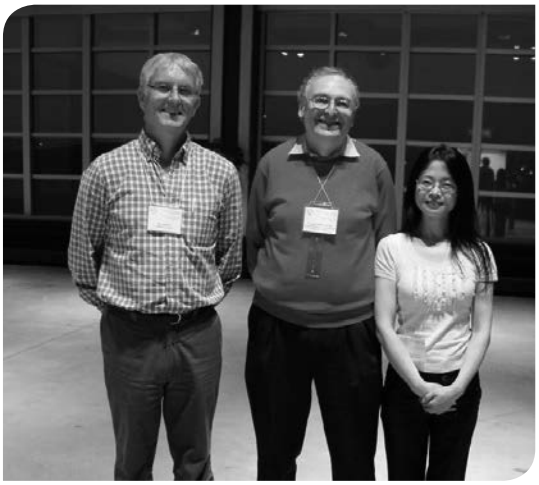


Poster presentation



Poster presentation

VWR exhibitor booth



The conference banquet was held at the Canadian Museum of Immigration at Pier 21

Conference co-Chairs Jan Rainey and Barbara Karten

Jan Rainey, conference co-Chair, receives an award from Jeff Turner of Tourism Halifax

Incoming CSMB President (2015-2016), Kristin Baetz, gives her address at the conference banquet

Mike James with the youngest conference attendee

Group enjoying the conference seafood banquet

Group enjoying the conference seafood banquet

Group enjoying the conference seafood banquet

Group enjoying the conference seafood banquet

Group enjoying the conference seafood banquet

Lipids: The Membrane and Beyond
CSMB 58th Annual Meeting
Halifax, Nova Scotia, June 14-17, 2015

Group photo of the CSMB Board members who attended the Halifax meeting

Poster and Travel Award Recipients

2015 CSMB Annual Scientific Meeting, Halifax, NS

POSTER PRIZES

AWARDEE	UNIVERSITY	SUPERVISOR
CSMB Post-doctoral Fellow Poster Award		
Dr. Luc Boudreau	University de Moncton, Moncton	Dr. Marc Surette
Horiba Scientific Post-doctoral Fellow Poster Award		
Dr. Chungen Pan	Dalhousie University, Halifax	Dr. Roy Duncan
CSMB Graduate Student Poster Awards		
Eric McNally	Concordia University, Montreal	Dr. Christopher Brett
Sanchia Miller	McMaster University, Hamilton	Dr. Russell Bishop
Bruker Graduate Student Poster Award		
Aditya Pandey	Dalhousie University, Halifax	Dr. Jan Rainey
Sciex Graduate Student Poster Award		
Maria Davis	University of New Brunswick, Fredericton	Dr. Shawn McLellan
Biochemistry & Cell Biology Graduate Student Poster Award		
Antonietta Pietrangelo	Dalhousie University, Halifax	Dr. Neale Ridgway

TRAVEL AWARDS

AWARDEE	UNIVERSITY	SUPERVISOR
CSMB Travel Awards		
Dr. Svetlana Baoukina	University of Calgary, Calgary	Dr. Peter Tieleman
Charneal Dixon	McMaster University, Hamilton	Dr. Russell Bishop
Maria Davis	University of New Brunswick, Fredericton	Dr. Shawn McLellan
New England Biolabs Travel Award		
Sabbir Shuvo	University of Manitoba, Winnipeg	Dr. Deborah Court
JPK Instruments Travel Award		
Parthajit Mukherjee	Brock University, St. Catharines	Dr. Jeffrey Atkinson
Zeiss Travel Award		
Erin McNally	Concordia University, Montreal	Dr. Christopher Brett
Cambridge Isotopes Travel Award		
Philippe-Pierre Robichaud	University de Moncton, Moncton	Dr. Marc Surette
BBA Biomembranes Travel Award		
Kenneth D'Souza	Dalhousie University, Halifax	Dr. Petra Kienesberger
Suraij Manrao Student Travel Fund		
Purvi Trivedi	Dalhousie University, Halifax	Dr. Thomas Pulinilkunnil
Qiagen Travel Award		
Andrew Cowie	Dalhousie University, Halifax	Drs. Petra Kienesberger & Thomas Pulinilkunnil

Poster award winners (from left to right); Dr. Barbara Karten (CSMB conference organizer), Antonietta Pietrangelo, Maria Davis, Dr. Luc Boudreau, Dr. Chungen Pan, Eric McNally, Aditya Pandey, Sanchia Miller, Dr. Jan Rainey (CSMB conference organizer)

Travel award winners (from left to right); Maria Davis, Sabbir Shuvo, Mustapha Lhor (CSMB Trainee Representative Councillor), Svetlana Baoukina, Charneal Dixon, Eric McNally, Parthajit Mukherjee, Philippe-Pierre Robichaud, Andrew Cowie, Kenneth D'Souza, Purvi Trivedi

2016 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.

Dr. Filip Van Petegem
Associate Professor, Department of Biochemistry and Molecular Biology, University of British Columbia

Dr. Filip Van Petegem obtained his Ph.D. in 2002 at Ghent University (Belgium), where he utilized X-ray crystallography to look at the adaptation of enzymes to extremely cold or hot temperatures. He then joined the lab of Daniel Minor (University of California, San Francisco) for postdoctoral studies. Using a fellowship from the American Heart Association, he investigated the structure and function of voltage-gated calcium channels (Ca_Vs), providing high-resolution insights into the regulation by calmodulin and the intracellular beta subunit.

Dr. Van Petegem joined UBC as an Assistant Professor in July 2007, and obtained tenure in 2012. The general theme of his lab is to understand ion channels in native and diseased states, and he has mostly focussed on two classes of channels. One is the ryanodine receptor (RyR), a 2.2 MDa protein located in the membrane of the sarcoplasmic reticulum and the endoplasmic reticulum. By comparing crystal structures of RyR domains in native and disease mutant forms, he was able to uncover mechanisms leading to stress-induced cardiac arrhythmias and malignant hyperthermia. A second theme includes the voltage-gated sodium channel, a membrane protein involved in depolarization of the plasma membrane in excitable tissues. Combining electrophysiology with X-ray crystallography, his lab has provided new insights into modulation of this channel by the extracellular beta subunit and by calmodulin. Dr. Van Petegem has received New Investigator Awards from the CIHR (2008) and the Michael Smith Foundation for Health Research (2008), as well as a UBC Faculty of Medicine Award for excellence in basic science (2013). He has previously served on the editorial board of the Journal of Biological Chemistry, and is currently an editorial board member at 'Channels'.

Canadian Science Publishing Senior Investigator Award

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

Dr. Gerry Wright
Professor, Department of Biochemistry and Biomedical Sciences, McMaster University; Director, Michael G. DeGroote Institute for Infectious Disease Research

Dr. Gerry Wright received his B.Sc. in Biochemistry (1986) at the University of Waterloo, where he worked on siderophore biosynthesis with Thammaiah Viswanatha and became interested in microbial natural products. He continued at Waterloo to complete his Ph.D. in Chemistry (1990) working in the area of antifungal drug medicinal chemistry under the supervisor of Dr. John Honek. He followed this up with 2 years of postdoctoral research at Harvard Medical School in Christopher Walsh's group in Boston where he worked on the molecular mechanism of resistance to the antibiotic vancomycin in Enterococci. He joined the Department of Biochemistry at McMaster in 1993, and was Chair from 2001-2007.

Gerry's research has focused on antibiotics their function, resistance, and biosynthesis. He was the first to articulate the concept of a pan-bacterial 'resistome' that encompasses the totality of antibiotic resistance elements in microbial communities, not just in human pathogens. The Wright lab has explored the resistome in terms of the origins and evolution of resistance - demonstrating that resistance is ancient and common in all bacteria. The lab is also focussed on understanding the molecular mechanisms of resistance, and its mobilization from benign organisms to disease-causing bacteria. This information is now informing new approaches to block resistance in many forms and rescue legacy antibiotics. The lab has also been deeply interested in the biosynthesis of antibiotics and other microbial natural products, and in applying synthetic biology and complimentary strategies to expand their chemical diversity to address the challenge of resistance.

With Eric Brown, Gerry helped to establish the first high throughput small molecule screening platform at McMaster. This unit has evolved into the Centre for Microbial Chemical Biology, a core laboratory that unites screening, medicinal and natural product chemistry, informatics, and analytical chemistry, along with microbiology and protein chemistry, and supports fundamental and translation research in infectious and other diseases. In 2007, Gerry was named the founding Director of the Michael DeGroote Institute for Infectious Disease Research (IIDR) at McMaster. The goals of the IIDR are to support cross-disciplinary research, linking the lab and the clinic. The IIDR includes members from four faculties and nine departments at McMaster and offers a unique training environment for over 200 graduate students, fellows, and technical staff.

Gerry was elected as Fellow to the Royal Society of Canada (2012), as Fellow of the American Academy of Microbiology (2013), and received the R.G.E Murray Award for Career Achievement from the Canadian Society of Microbiologists in 2013. He is Editor of *Annals of the New York Academy of Sciences - Antimicrobial Therapeutics Reviews*, an Associate Editor of *ACS Infectious Diseases*, and serves on the editorial boards of several other journals.

Arthur Wynne Gold Medal

The CSMB Arthur Wynne Gold Medal is presented by the Canadian Society for Molecular Biosciences (CSMB) to an individual who has made a major contribution to biochemistry, molecular and cell biology in Canada over their career. The recipient of this life-time achievement award has typically attained an international profile in research, has played a major role in the development and promotion of the discipline in Canada, and has a long-standing record of service to the academic community. 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.

Dr. Morag Park

Professor, Departments of Medicine, Oncology and Biochemistry, McGill University; Director Goodman Cancer Research Centre

Dr. Morag Park is a Professor in the Departments of Oncology and Biochemistry, James McGill Professor and holds the Diane and Sal Guerrera Chair in Cancer Genetics at McGill University. She is a Fellow of the Royal Society of Canada. Dr. Park received her B.Sc. in Molecular Biology with first class honours from the University of Glasgow in 1978, and a Ph.D. in viral carcinogenesis at the Medical Research Council Virology Institute in Scotland in 1983. She then moved to the National Cancer Institute/NIH in Washington DC as a Fogarty Fellow, under the supervision of Dr. Donald Blair, where she isolated and characterized the met oncogene. From 1985-1988, Dr. Park was a postdoctoral fellow at the National Cancer Institute/Frederick Cancer Research Facility, where she worked with Dr. George Vande Woude on isolation and characterization of the met receptor tyrosine kinase in normal and transformed cells. In 1988, she moved to Montreal, where she became Research Head of the Laboratory of Molecular Oncology at the Ludwig Institute for Cancer Research, and Adjunct Assistant Professor in the Department of Medicine at McGill University. She was the Director of the Molecular Oncology Group at the McGill University Hospital Centre (2006-8), Scientific Director of the Institute of Cancer Research for the CIHR (2008-13), co-chair of the Canadian Cancer Research Alliance (2008-2010) and is now Director of the Goodman Cancer Research Centre (2013-present). Dr. Park is a research leader in the field of receptor tyrosine kinases (RTK) and mechanisms of oncogenic activation of RTKs in human cancers. She has recently developed leadership in the breast cancer microenvironment, and is the elected chair of the Tumour Microenvironment Network of the American Association for Cancer Research (2015-2017). She is a recent recipient of a Canadian Cancer Research Alliance Award (2015) for Exceptional Leadership in Cancer Research. Dr. Park has more than 180 publications, with an internationally recognized research program on identifying and characterizing the role signal transduction pathways play during the development of human cancers.

Robert H. Haynes Young Scientist Award in Genetics

This award recognizes a notable paper, or series of related papers, based on original research in genetics or allied fields published by recipient in a refereed journal during the 15-year period immediately following the completion of a first degree.

Dr. Laurence Pelletier
Lunenfeld Tanenbaum Research Institute, Mount Sinai Hospital; Department of Molecular Genetics, University of Toronto

Laurence Pelletier is a Senior Investigator at the Lunenfeld Tanenbaum Research Institute in Mount Sinai Hospital and an Associate Professor in the Department of Molecular Genetics at the University of Toronto. Dr. Pelletier obtained his Ph.D. in 2002 from Yale University, where he studied the biogenesis of the Golgi apparatus under the supervision of Dr. Graham Warren. As an EMBO and HFSP postdoctoral fellow from 2002 to 2006, Dr. Pelletier moved to the Max Planck Institute for Molecular Genetics in Dresden, Germany, to study centrosome biogenesis in the laboratory of Dr. Tony Hyman. In 2007, Dr. Pelletier launched his group at the Lunenfeld Tanenbaum Research Institute, where he currently studies several facets of centrosome and cilia biogenesis and function. Using large scale functional proteomics, in combination with cutting-edge super-resolution imaging and biochemistry, the overreaching goal of his lab is to identify and study novel proteins and protein complexes required for these processes. His pioneering approaches have illuminated the role of these processes in development, and revealed how defects in the complex centrosome protein networks contribute to disease states.

Grant and Moens Award of Excellence in Genetics

This award recognizes the distinguishing contributions of a professional geneticist to genetic research and/or teaching, and to the fostering of excellence in genetics in Canada.

Dr. Esther Verheyen
Professor, Department of Molecular Biology and Biochemistry, Simon Fraser University

Dr. Esther Verheyen received her B.A. degree in 'Biology and Society' from Cornell University in 1988. In 1993 she obtained her Ph.D. from the Yale University School of Medicine in Genetics, studying profilin function in *Drosophila* with Dr. Lynn Cooley. She conducted postdoctoral research in the HHMI lab of Dr. Spyros Artavanis-Tsakonas, also at Yale, where she developed an interest in using genetic approaches to elucidating the control of signal transduction during development. Dr. Verheyen started her faculty position at Simon Fraser University in 1998, in which time she has developed and taught numerous Genetics courses, including Introductory Genetics, Developmental Genetics and Human Genetics. Dr. Verheyen has received the SFU Faculty of Science Excellence in Teaching Award. Her research program has focussed primarily on kinase regulation of evolutionarily conserved signaling pathways, notably Wnt/Wingless. Her research strives to integrate the power of genetic analysis with rigorous biochemical studies to address and test mechanistic hypotheses. Using both forward and reverse genetic approaches, Dr. Verheyen's group has identified mechanisms controlling growth, patterning and tissue proliferation. Verheyen lab trainees have been recognized through numerous student fellowships and awards, and take leading roles in publishing their research. Dr. Verheyen has served in several administrative roles, such as Associate Chair and Acting Chair of the MBB department. She has organized several national and international research conferences, and is an editor at PLoS ONE. Dr. Verheyen is very interested in fostering science outreach, and has given several public talks on genetics and stem cells, as well as written a book review for the Literary Review of Canada.

2015 GE Healthcare New Investigator Award

La voie Greatwall – PP2A nous mène vers une meilleure compréhension du cycle cellulaire

Vincent Archambault

Département de biochimie et médecine moléculaire, Institut de recherche en immunologie et en cancérologie, Université de Montréal

Abstract

La biologie cellulaire est fascinante. Le cycle de la division cellulaire eucaryote implique la coordination de plusieurs transformations intracellulaires complexes qui doivent mener à la production de deux cellules à partir d'une seule. La duplication des chromosomes et leur ségrégation en deux jeux identiques doivent se faire sans erreur, faute de quoi la stabilité génomique et la viabilité cellulaire sont compromises. Plusieurs enzymes participent à la régulation de la division cellulaire par des mécanismes qui sont fortement conservés entre les espèces. Mon laboratoire utilise une combinaison d'approches génétiques, moléculaires, biochimiques et microscopiques avec la mouche drosophile comme modèle pour mieux comprendre ces processus. Au cours des dernières années, mon équipe a contribué à mettre en lumière un nouveau mécanisme fondamental dans la régulation du cycle cellulaire. Cette contribution m'a valu l'honneur de recevoir le Prix Nouveau Scientifique GE Healthcare de la SCBM en 2015. C'est à ce titre qu'on m'a demandé de présenter un séminaire au congrès de la SCBM à Halifax en juin 2015. Mon séminaire intitulé *The Greatwall – PP2A pathway: Elevating us to a new understanding of cell cycle control*, a semblé réussir à intéresser les chercheurs présents au congrès, lesquels étaient pourtant surtout consacrés aux lipides et membranes, la thématique spécifique du congrès. Voici quelques grandes lignes de ma présentation.

On sait depuis une trentaine d'années que l'entrée en mitose est activée par la complexe cycline B-Cdk1 qui phosphoryle plusieurs substrats pour induire la condensation des chromosomes, le bris de l'enveloppe nucléaire, la formation d'un fuseau mitotique et d'autres transformations. Plusieurs autres kinases participent aussi à la régulation de la mitose. La complétion de la mitose requiert la protéolyse de la cycline B, ce qui a pour effet d'inactiver Cdk1 [1]. Il y a un consensus général dans le domaine quant à l'idée que plusieurs protéines doivent être déphosphorylées pour permettre la sortie de mitose, même si l'identité de telles protéines reste incertaine. De plus, plusieurs prenaient pour acquis que les phosphatases responsables de ces déphosphorylations, quelles qu'elles soient, ne devaient pas être assujetties à une régulation dans le cycle et pouvaient simplement rester toujours actives.

La découverte de Greatwall (Gwl) a ouvert la voie à une meilleure compréhension à cet égard. Des drosophiles

mutantes isolées par des cribles génétiques dans les labos de Michael Goldberg à l'Université Cornell et de David Glover à l'Université de Cambridge, ont permis d'identifier Gwl comme une nouvelle protéine kinase essentielle à la mitose et à la méiose [2,3]. C'est alors que j'étais postdoc à Cambridge que j'ai pu participer à cette découverte. Des études biochimiques subséquentes dans des extraits d'œufs de grenouille xénope par l'équipe du Professeur Goldberg ont rapidement montré que Gwl est activée par cycline B-Cdk1 et qu'elle est essentielle au maintien de la phase M dans ce système [4].

Mais quel était le rôle moléculaire de Gwl? Afin d'explorer cette question, j'ai lancé un crible pour identifier des gènes qui interagissent avec *gwl* dans le contexte du développement embryonnaire. Après fertilisation, le premier noyau zygotique initie 13 cycles mitotiques rapides et synchronisés dans un syncytium (Figure 1). Cette étape du développement dépend des contributions maternelles en protéines et ARN messagers, alors que très peu de transcription zygotique survient avant la cellularisation de chaque noyau du blastoderme au cycle 14. On cherchait des gènes dont la délétion d'un allèle rendrait stérile des femelles hétérozygotes pour un allèle dominant de *gwl (gwl^{Scant})* qui code pour une forme de la kinase toujours active. Les deux gènes identifiés qui interagissent le plus fortement avec *gwl^{Scant}* codent pour des sous-unités de la phosphatase PP2A-B55 : *microtubule star* (*mts*) pour la sous-unité catalytique et *twins* (*tws*) pour une sous-unité régulatrice de type B55. La majorité des œufs pondus par les mères doubles mutantes *gwl^{Scant} /+, tws^{-}/+* arrêtent leur développement en méiose ou dans les premiers cycles mitotiques [5]. Des travaux précédents avaient montré que PP2A-B55 joue un rôle essentiel à la sortie de mitose et peut déphosphoryler efficacement les substrats de Cdk1 [6]. Mais quel était le lien moléculaire entre Gwl et PP2A-B55?

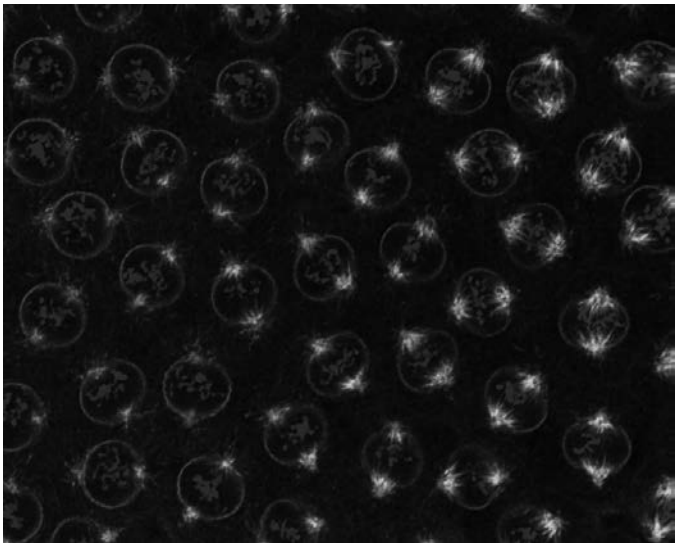


Figure 1. Divisions nucléaires par mitose dans un embryon syncytial de drosophile. *L'embryon a été fixé et analysé par immunofluorescence pour y révéler les microtubules en vert, l'enveloppe nucléaire et les centrosomes en rouge et l'ADN en bleu. L'image a été obtenue par microscopie confocale à balayage (crédit: Haytham Mehsen).*

La réponse à cette question est venue d'expériences biochimiques avec des extraits d'œufs de xénopes par l'équipe de Sir Tim Hunt en Angleterre et par celle de Thierry Lorca et Ana Castro en France. Ces études ont montré que le rôle de Gwl est d'inhiber PP2A-B55 à l'entrée de la mitose, de manière à permettre une pleine activation de cycline B-Cdk1 et une phosphorylation suffisante de ses substrats. Elles ont même permis de cerner le mécanisme de cette régulation. Gwl phosphoryle les protéines homologues Endosulfine et Arpp19 qui, une fois phosphorylées, deviennent de puissants inhibiteurs compétitifs spécifiques à PP2A-B55 [7,8,9]. Des travaux génétiques chez la mouche menés indépendamment dans mon laboratoire et dans celui de David Glover en Angleterre ont mené à des conclusions conformes à ce modèle et ont confirmé que le mécanisme est conservé et actif *in vivo* en mitose et en méiose [5,10]. Chez la drosophile, Gwl phosphoryle Endos qui inhibe PP2A-Tws.

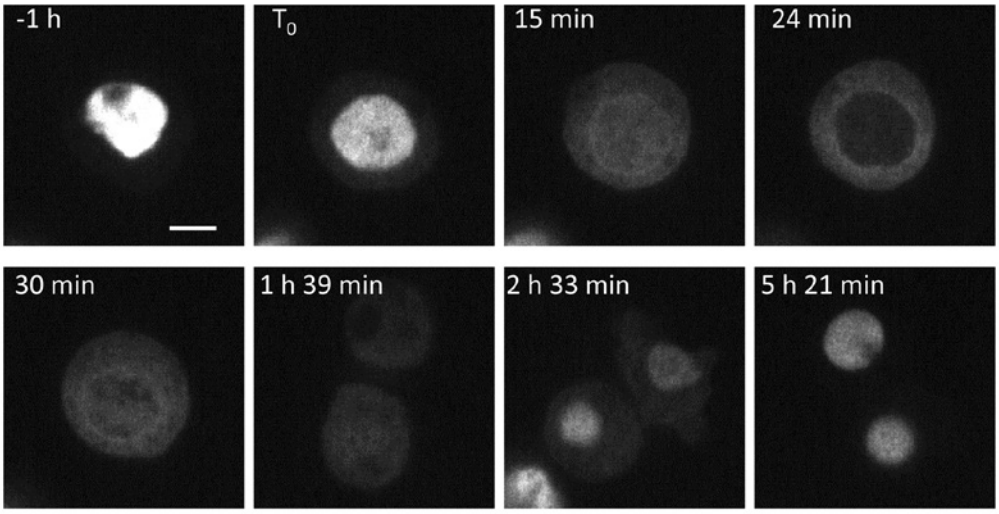


Figure 2. Changements de localisation de Gwl-GFP dans une cellule de drosophile en culture qui se divise. *La kinase Gwl est nucléaire en interphase (-1 h), commence à se relocaliser au cytoplasme à l'entré en mitose (T_0), devient cytoplasmique et exclue du noyau brièvement en prophase tardive (24 min), devient diffuse dans toute la cellule après le bris de l'enveloppe (30 min) et revient aux noyaux après la division (2 à 5 h). Échelle: 5 µm.*

Si la mouche avait été battue de vitesse par la grenouille dans la quête de ce mécanisme, elle n'avait pas encore épuisé ses atouts. Une compréhension complète du mécanisme cellulaire impliquant Gwl et PP2A-B55 ne pouvait être atteinte que par son étude dans le contexte de la cellule et de l'animal entier. L'organisation de la cellule fait en sorte que la dimension spatiale est cruciale dans le contrôle de la division cellulaire. Certaines enzymes changent de localisation pour mieux accéder aux structures cellulaires qu'elles régulent. De plus, les régulateurs se régulent entre eux et utilisent des changements de localisation entre différents compartiments ou structures qui leur permettent de se rencontrer ou non, selon la progression du cycle. Un exemple connu de l'importance de ce contrôle spatial est l'activation de cycline B-Cdk1, où son importation dans le noyau facilite son activation au moment de l'entrée en mitose [11]. On pense que cette activation de cycline B-Cdk1 au noyau est facilitée en partie par le fait que PP2A-B55, qui contribue à la garder inactive de plusieurs façons, est surtout cytoplasmique [12]. Une fois activée par Cdk1, Gwl doit mettre PP2A-B55 en échec. Mais où est donc Gwl?

Gwl a été reconnue dès son identification comme une protéine nucléaire en interphase [2]. Nous avons par la suite remarqué que Gwl se relocalise rapidement et brièvement au cytoplasme avant le bris de l'enveloppe nucléaire durant l'entrée en mitose (Figure 2). Nos études ont permis de comprendre les mécanismes qui contrôlent cette localisation [13,14]. Dès son identification, la kinase Gwl paraissait particulière parce ce que son domaine kinase contient un long segment de fonction alors inconnue immédiatement après sa boucle d'activation [2]. Nous avons trouvé deux signaux de localisation nucléaires (NLS) qui sont essentiels à l'enrichissement de Gwl au noyau. Cette région est phosphorylée à plusieurs sites par les kinases mitotiques Polo et Cdk1. Cette phosphorylation est essentielle à la relocalisation de Gwl au cytoplasme en prophase. Nous avons aussi identifié un signal d'exportation nucléaire (NES) qui permet à Gwl d'être exportée au cytoplasme. Des formes mutantes de Gwl qui ne peuvent plus se localiser au noyau ou se relocaliser au cytoplasme en prophase ne peuvent pas remplir les fonctions essentielles de Gwl en cellules ou *in vivo*. Des résultats similaires ont été obtenus peu après en cellules humaines [15].

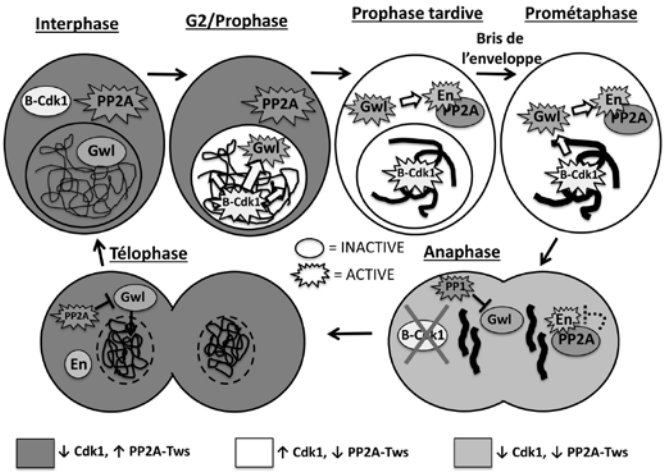


Figure 3. Modèle pour la coordination spatiotemporelle de Gwl, cycline B-Cdk1 et PP2A-B55. *En interphase, cycline B-Cdk1 est inactive et PP2A-B55 est active. Au moment de l'entrée en mitose (G2/prophase), cycline B-Cdk1 entre au noyau en s'activant et active Gwl en même temps qu'elle phosphoryle ses autres substrats nucléaires [11]. Peu de temps après, Gwl est relocalisée au cytoplasme [3], où elle phosphoryle Endos (En) qui inhibe alors PP2A-B55 avant le bris de l'enveloppe nucléaire et la maintient inhibée jusqu'à l'anaphase, qui marque le début de la sortie de mitose. À ce moment, cycline B est dégradée et Gwl est inactivée par la protéine phosphatase 1 (PP1) [22]. C'est PP2A-B55 qui déphosphoryle Endos et elle se libère ainsi de son inhibition [23]. À partir de la télophase, PP2A-B55 peut déphosphoryler ses substrats dont Gwl, permettant son retour aux noyaux [14].*

Mais pourquoi Gwl doit-elle ainsi changer de localisation durant le cycle cellulaire? Je propose un modèle (Figure 3). Puisque l'activation de Gwl requiert sa phosphorylation par cycline B-Cdk1, et puisque cycline B-Cdk1 devient active au noyau à l'entrée en mitose, la localisation nucléaire de Gwl facilite probablement son activation. La relocalisation de Gwl au cytoplasme pourrait permettre à Gwl d'aller inhiber efficacement PP2A-B55, qui est surtout cytoplasmique. Cela permettrait d'empêcher PP2A-B55 de déphosphoryler les substrats de cycline B-Cdk1, nucléaires comme cytoplasmiques, après le bris de l'enveloppe nucléaire. En l'absence de Gwl, on observe d'ailleurs que la mitose échoue, souvent avec des chromosomes éparpillés sur un fuseau mitotique difforme [2,3]. Cependant, face à ce modèle, un élément peut nous laisser dubitatifs. Le substrat de Gwl, Endos, est une petite protéine de 9 kDa qui devrait en principe diffuser librement à travers les pores nucléaires si rien d'autre ne la retient. Alors pourquoi Gwl aurait-elle besoin de sortir du noyau pour aller phosphoryler Endos? Nous prévoyons continuer à mettre à l'épreuve notre modèle, qui est presque assurément incomplet.

Une autre question importante est l'identification des substrats de PP2A-B55 qui doivent être absolument protégés contre son activité en début de mitose, et l'identification de ceux qui doivent être déphosphorylés en fin de mitose. Pour y arriver, nous utilisons présentement des approches génétiques et protéomiques. Nos expériences d'imagerie de la division cellulaire dans des embryons mutants ou après déplétion de Tws en cellules montrent que PP2A-Tws joue un rôle dans la reformation de l'enveloppe nucléaire. Nous tentons d'identifier les substrats directs de PP2A-Tws dans ce processus. Nous avons aussi récemment trouvé que le retour de Gwl au noyau après la mitose dépend de PP2A-Tws (Figure 3). Cette dépendance n'est pas simplement le résultat d'un retard de la formation de l'enveloppe nucléaire puisque nous avons identifié un site de phosphorylation par cycline B-Cdk1 sur Gwl, près des NLS, qui est en partie responsable de cette régulation [14].

Ces découvertes récentes offrent de nouvelles perspectives sur la régulation du cycle cellulaire chez les eucaryotes. Elles ont mis en lumière un nouveau mécanisme fondamental et conservé qui fait intervenir un jeu de régulation réciproque entre Gwl, PP2A-B55 et Cdk1 dans le cycle de division, preuve qu'il reste encore des morceaux importants du casse-tête à découvrir. Il ne fait maintenant plus aucun doute que la régulation des

phosphatases est cruciale pour le fonctionnement du cycle cellulaire, et je mets au défi quiconque de venir me dire maintenant que les phosphatases sont ennuyantes! Nos résultats illustrent de plus belle l'importance de la coordination spatiale dans les mécanismes de régulation du cycle cellulaire. Cette dimension reste encore peu explorée.

Une meilleure compréhension de la régulation et des fonctions du module Gwl-PP2A pourrait ouvrir des portes au développement de thérapies contre les cancers. PP2A est déréglée dans plusieurs cancers et on a récemment commencé à trouver des implications de Gwl dans ces maladies [16,17,18,19]. De plus, bloquer spécifiquement la sortie de mitose est considéré comme une nouvelle avenue thérapeutique potentielle et prometteuse [20,21]. Toutefois, je ne promets rien quant à de futurs développements thérapeutiques qui pourraient être dérivés de nos découvertes. La recherche fondamentale est imprévisible et il n'y a jamais de garantie qu'un quelconque projet mène à un développement utile. Mais il n'en demeure pas moins que, dans l'histoire moderne, la plupart, sinon toutes les grandes avancées technologiques, incluant en médecine, se sont basées sur les découvertes de la recherche fondamentale. Que nous soyons fascinés par la division cellulaire, par les lipides, les membranes ou par tout autre sujet en sciences de la vie, nos recherches sont un investissement intelligent et pertinent pour l'amélioration de la condition humaine à long terme. La Société canadienne des biosciences moléculaires fait un travail remarquable pour nous unir et faire valoir l'importance de nos contributions.

Remerciements. Les recherches de mon laboratoire discutées ici ont été supportées par les Instituts de recherche en santé du Canada, la Fondation canadienne pour l'innovation et le Fonds de recherche du Québec - Santé.

RÉFÉRENCES

1. Morgan DO (2007) The Cell Cycle: Principles of Control. London: New Science Press. 297 p.
2. Yu J, Fleming SL, Williams B, Williams EV, Li Z, et al. (2004) Greatwall kinase: a nuclear protein required for proper chromosome condensation and mitotic progression in Drosophila. J Cell Biol 164: 487-492.
3. Archambault V, Zhao X, White-Cooper H, Carpenter AT, Glover DM (2007) Mutations in Drosophila Greatwall/Scant Reveal Its Roles in Mitosis and Meiosis and Interdependence with Polo Kinase. PLoS Genet 3: e200.
4. Yu J, Zhao Y, Li Z, Galas S, Goldberg ML (2006) Greatwall kinase participates in the Cdc2 autoregulatory loop in Xenopus egg extracts. Mol Cell 22: 83-91.
5. Wang P, Pinson X, Archambault V (2011) PP2A-twins is antagonized by greatwall and collaborates with polo for cell cycle progression and centrosome attachment to nuclei in drosophila embryos. PLoS Genet 7: e1002227.
6. Mochida S, Ikeo S, Gannon J, Hunt T (2009) Regulated activity of PP2A-B55 delta is crucial for controlling entry into and exit from mitosis in Xenopus egg extracts. Embo J 28: 2777-2785.
7. Vigneron S, Brioudes E, Burgess A, Labbe JC, Lorca T, et al. (2009) Greatwall maintains mitosis through regulation of PP2A. Embo J 28: 2786-2793.
8. Mochida S, Maslen SL, Skehel M, Hunt T (2010) Greatwall phosphorylates an inhibitor of protein phosphatase 2A that is essential for mitosis. Science 330: 1670-1673.
9. Gharbi-Ayachi A, Labbe JC, Burgess A, Vigneron S, Strub JM, et al. The substrate of Greatwall kinase, Arpp19, controls mitosis by inhibiting protein phosphatase 2A. Science 330: 1673-1677.
10. Rangone H, Wegel E, Gatt MK, Yeung E, Flowers A, et al. (2011) Suppression of scant identifies Endos as a substrate of greatwall kinase and a negative regulator of protein phosphatase 2A in mitosis. PLoS Genet 7: e1002225.
11. Gavet O, Pines J (2010) Activation of cyclin B1-Cdk1 synchronizes events in the nucleus and the cytoplasm at mitosis. J Cell Biol 189: 247-259.
12. Santos SD, Wollman R, Meyer T, Ferrell JE, Jr. (2012) Spatial positive feedback at the onset of mitosis. Cell 149: 1500-1513.
13. Wang P, Galan, J.A., Normandin, K., Bonneil, E., Hickson, G.R., Roux, P.P., Thibault, P., Archambault, V. (2013) Cell cycle regulation of Greatwall kinase nuclear localization facilitates mitotic progression. The Journal of Cell Biology 202: 277-293.
14. Wang P, Larouche M, Normandin K, Kachaner D, Mehsen H, et al. (2016) Spatial regulation of greatwall by Cdk1 and PP2A-Tws in the cell cycle. Cell Cycle 15: 528-539.

15. Alvarez-Fernandez M, Sanchez-Martinez R, Sanz-Castillo B, Gan PP, Sanz-Flores M, et al. (2013) Greatwall is essential to prevent mitotic collapse after nuclear envelope breakdown in mammals. Proc Natl Acad Sci U S A 110: 17374-17379.
16. Perrotti D, Neviani P (2013) Protein phosphatase 2A: a target for anticancer therapy. Lancet Oncol 14: e229-238.
17. Wang L, Luong VQ, Giannini PJ, Peng A (2014) Mastl kinase, a promising therapeutic target, promotes cancer recurrence. Oncotarget 5: 11479-11489.
18. Vera J, Lartigue L, Vigneron S, Gadea G, Gire V, et al. (2015) Greatwall promotes cell transformation by hyperactivating AKT in human malignancies. Elife 4.
19. Seshacharyulu P, Pandey P, Datta K, Batra SK (2013) Phosphatase: PP2A structural importance, regulation and its aberrant expression in cancer. Cancer Lett 335: 9-18.
20. Manchado E, Guillamot M, Malumbres M (2012) Killing cells by targeting mitosis. Cell Death Differ 19: 369-377.
21. Huang HC, Shi J, Orth JD, Mitchison TJ (2009) Evidence that mitotic exit is a better cancer therapeutic target than spindle assembly. Cancer Cell 16: 347-358.
22. Heim A, Konietzny A, Mayer TU (2015) Protein phosphatase 1 is essential for Greatwall inactivation at mitotic exit. EMBO Rep 16: 1501-1510.
23. Williams BC, Filter JJ, Blake-Hodek KA, Wadzinski BE, Fuda NJ, et al. (2014) Greatwall-phosphorylated Endosulfine is both an inhibitor and a substrate of PP2A-B55 heterotrimers. Elife 3: e01695.

2015 NRC Research Press Senior Investigator Award

The structure of α-L-iduronidase and its role in mucopolysaccharidosis-I: part of my lifetime in the realm of structural biology

Michael James, FRS, FRSC
Distinguished University Professor Emeritus, Department of Biochemistry, University of Alberta

I am greatly honoured to have been the 2015 recipient of the NRC Research Press Senior Investigator Award. I am truly indebted to Joe Casey (Departments of Physiology and Biochemistry) and to Mark Glover (Department of Biochemistry) at the University of Alberta for taking the time to put together my nomination for this Award. It was a great pleasure to attend the CSMB meeting in Halifax. I had never visited the Atlantic Provinces of Canada before and the time that I spent in Halifax only urges me to return, and to see more of these historic and picturesque provinces of Canada.

It turns out that 2016 is an historic year for me; it is 50 years since I graduated with my doctorate from Oxford. I studied in the laboratory of Professor Dorothy Crowfoot Hodgkin, OM, FRS, where I worked on the structures of peptide-derived antibiotics such as micrococcin P and ampicillin. On my return to Canada with a highly valued NRC post-doctoral fellowship in the Chemistry Department at the University of Alberta, I worked with Dave Hall who had recently come to Edmonton from Auckland, New Zealand. Dave had been hired to start the X-ray crystallography lab and it was my job to assist in this endeavor, along with three graduate students and another post-doctoral fellow, Michael Elder. In addition to working on monosaccharides with Ray Lemieux in the Chemistry Department, I managed to solve and refine the structure of ampicillin trihydrate from data that I had collected from a new four-circle diffractometer made by the Hilger Watts Co. of the U.K. This small molecule structure was published in *Nature* of all places! Things have certainly changed in structural biology.

In the fall of 1967, I was approached by Cyril Kay and Larry Smillie of the Department of Biochemistry, University of Alberta. We had a nice lunch at the Faculty Club and they asked me to apply for a job in Biochemistry. I was blown away by this, because my good friend from my days in Honours Chemistry at the University of Manitoba, Bill Bridger, had already been hired that July. All I had to do was to be successful in an application for a Scholarship from the Medical Research Council of Canada. Needless to say, I was successful and I joined the Department of Biochemistry, University of Alberta in July, 1968.

Dave Hall, the New Zealander, found Edmonton too cold (actually it was his wife) and he went back to Auckland to a Chair in Chemistry. So my first two graduate students were Graheme Williams, a New Zealander and Bill Cruse, a native from Winnipeg. They had been left behind when Dave returned to Auckland. We started working on the structures of small molecules in collaborations with the medicinal chemists, Ed Knauss and Len Wiebe from the Faculty of Pharmacy at the University of Alberta. I also continued working on structures of monosaccharides in collaboration with Ray Lemieux. Gradually we built up the lab with equipment (a Picker diffractometer that was top of the line at that time) and with people; two postdoctoral fellows joined me to work on protein structures. They were Michael Joynson and Louis Delbaere. Both had spent

time in Oxford in David Phillips' lab and were very keen to work on some of the proteases that had been isolated in Larry Smillie's lab and that were being actively sequenced in the early 1970's. Our first serine peptidases were from bacteria, *Streptomyces griseus* Protease B (SGPB) and the α-lytic protease from *Lysobacter enzymogenes*. Larry had completed the amino-acid sequencing of both of these enzymes with Lubo Jurasek, Peter Johnson and Mark Olsen. The sequences were both very similar to the pancreatic serine proteases, leaving a major question about the evolution of these molecules. Did mammals and bacteria have a common ancestral origin? Indeed, it turned out that bovine α-chymotrypsin and SGPB had similar three-dimensional folds, therefore strongly implicating a common ancestral origin for this family of molecules. Our first two papers on protein structure were published in the *Canadian Journal of Biochemistry*[1] and in *Nature.*[2]

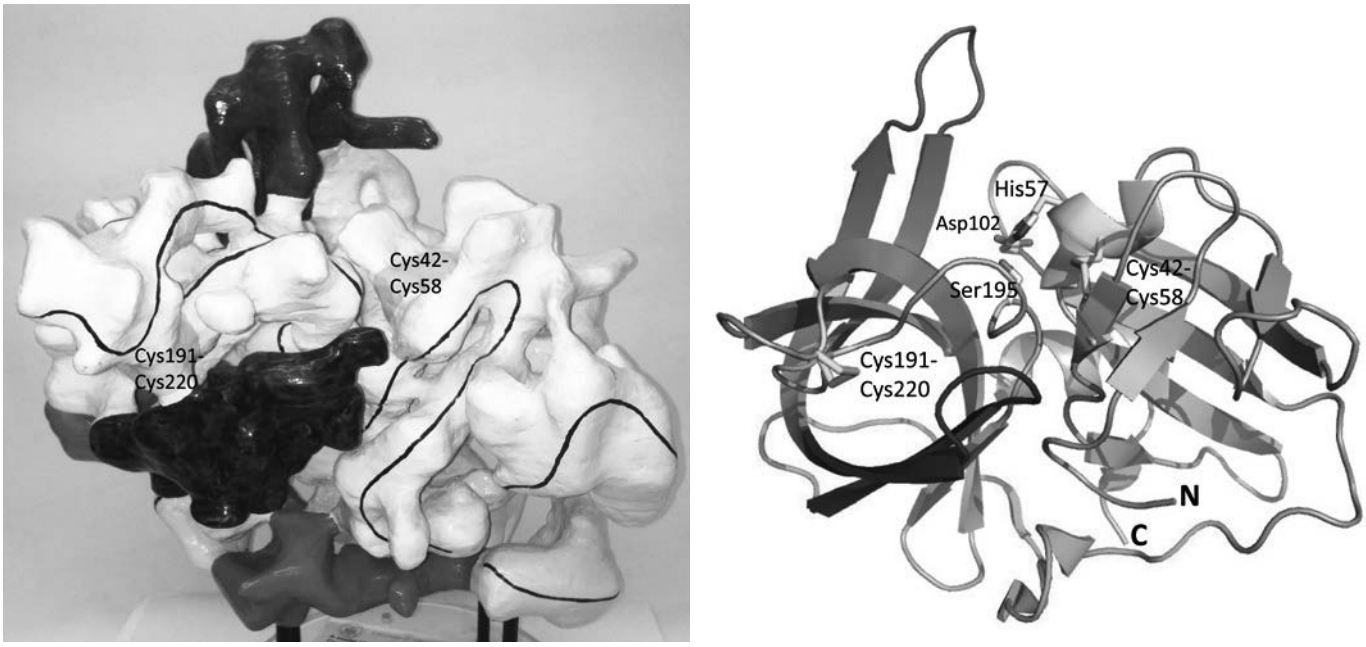


Figure 1. Two views of the bacterial peptidase SGPB.
(a) A photograph of a balsa wood model of SGPB constructed from the electron density map computed at 2.8 Å resolution.[1,2] The path of the polypeptide chain is traced on the model by a thin black line. The two disulfide bridges in the molecule are labelled, as is the amino terminus (N). The regions in a darker shade on the model highlight those regions of SGPB that have different conformations to the homologous regions in α-chymotrypsin. The dark shaded region at the top of the model corresponds to the "methionine" loop and the central shaded region corresponds to the activation loop in α-chymotrypsin.
(b) PyMol representation of the polypeptide chain in SGPB. This view of the molecule corresponds approximately to the view of the balsa wood model in (a). Arrows represent strands in β-sheets. The N-domain (a β-barrel) is on the right of the figure and the C-domain (also a β-barrel) is on the left. The two disulfide bridges are labelled (Cys42-Cys58 and Cys191-Cys220). The active site triad, Ser195, His57 and Asp102, are labelled and drawn in a stick representation. The N-terminus (Ile16) is labelled "N" and the C-terminus (Tyr242) is labelled "C". SGPB has 185 residues as distinct from the 241 residues present in α-chymotrypsin. The coordinates for SGPB in (b) were determined by T.-W. Lee[3] and are in the protein data bank with PDB accession code 2GKV.

β-Hexosaminidase B structure and mechanism

In the early 1990's, Don Mahuran from the Sick Children's Hospital in Toronto and I met at a meeting in Toronto. Don was studying β-hexosaminidases and their roles in lysosomal storage diseases. I was very excited to join his work on these interesting enzymes that play a major role in Tay-Sachs and Sandhoff diseases. It is the many genetic defects in the enzymes β-hexosaminidase A and B that give rise to the build-up of the ganglioside G_{M2} in neuronal cells and the debilitating diseases with which they are associated. Lora Swensen and Bret Church were able to crystallize a hexagonal crystal modification of human β-hexosaminidase B (β-Hex B) purified from human placenta in 1992.[4] A long delay because of the loss of activity of the affinity column that Don was using for the purification of β-Hex B kept the structure of this enzyme from us until the early years of the new millennium.[5] Brian Mark, a talented graduate student who is presently a Professor at the University of Manitoba, and Maia Cherney were able to reproduce the crystals of β-Hex B originally grown in 1992. The crystals were taken to the synchrotron radiation facility of the Advanced Photon Source (APS) in Chicago, IL. The data were collected at the BioCars beamline (14-BM-C). The structure was solved by Brian[5] using the method of multiple isomorphous replacement. The native structure of β-Hex B was refined to a working R-factor of 0.201 (R_{free}=0.231) at 2.4 Å resolution. The asymmetric unit of the crystallographic space group contained 2 protein subunits. By suitably selecting pairs of molecules from among the subunits in the asymmetric unit of the space group, it became apparent which pair formed the biological homodimer (Figure 2).

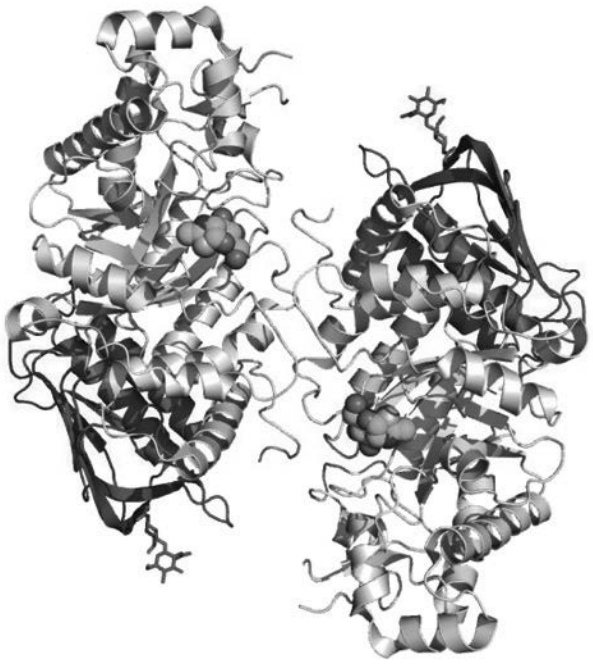


Figure 2. The dimer of human β-Hex B with the bound inhibitor N-acetylglucosamine-thiazoline (NAG-thiazoline).[5]

In this view the catalytic domains of each subunit are grey and the ~150 N-terminal residues of each subunit (in a darker grey) form a six-stranded anti-parallel β-sheet that buries 2 parallel α-helices against the residues of the larger catalytic domains II (the triose phosphate isomerase or TIM-barrels). The 2 subunits of the biological dimer are related by a crystallographic 2-fold axis that is perpendicular to the page in this figure, and is located centrally between the two subunits. The NAG-thiazoline (rendered in dark grey spheres) is bound to the catalytic domain of β-Hex B at the C-termini of the 8 central β-strands of the TIM-barrel. The detailed H-bonding interactions that the residues in the active site of β-Hex B make with NAG-thiazoline are shown in Figure 3.

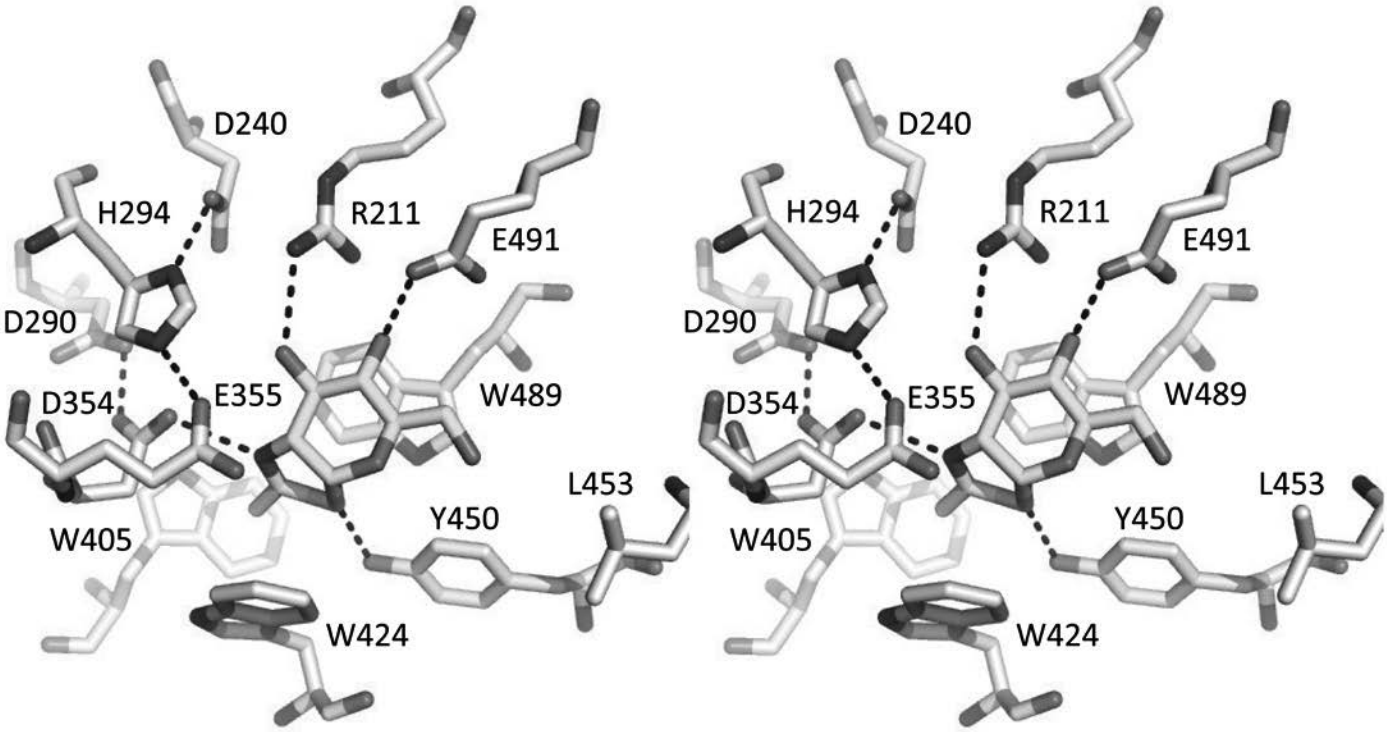


Figure 3. A cross-eyed stereo view of residues in the active site of human β-Hex B with bound reaction intermediate analogue NAG-thiazoline.[5]

The general acid/base on the catalytic pathway is Glu355. It is positioned appropriately to donate a proton to the glycosidic oxygen of the substrate. The carboxyl group of Glu355 is bonded to His294 that in turn is H-bonded to Asp240. The carboxyl group of Asp354 forms an H-bonded ion pair with the positively-charged nitrogen atom of the 5-membered thiazoline ring of the reaction intermediate analogue. The pyranose ring adopts a $^{4}C_{1}$ chair conformation. Tyr450 forms an H-bond from the phenolic oxygen to the sulfur atom of the thiazoline ring.

The biological dimer has a buried interface between monomers of ~2700 Å^2 surface area. The active site and the substrate-binding site of each monomer have a contributing residue (Tyr456) that is part of the polypeptide chain from the other monomer of the dimer (not shown in Figure 3). It is thought that the interactions involving Tyr456 and Tyr547 of the partnering subunit with residues Glu491 and Tyr492 of the main subunit selectively stabilize the binding of galacto-configuration sugars at the active site.

Combining the structural data from human β-Hex B[5] and from *S. plicatus* β-hexosaminidase[6] each having bound reaction intermediate analogues such as N-acetylglucosamine-thiazoline (NAG-thiazoline) and GalNAc-isofagamine, with the structural data from chitobiase[7] from *Serratia marcescens* having the bound substrate chitobiose, it has been possible to assemble a reaction pathway for the family 20 glycoside hydrolases. The active site of the *S. marcescens* chitobiase with the bound chitobiose (Figure 4) clearly shows that the N-acetyl group on the 2'-carbon is adopting an orientation ~120° rotated from the usual conformation of an N-acetyl group at this site.

This places the carbonyl oxygen atom directly "under" the C1' anomeric carbon atom and the whole N-acetyl group is "fixed" in position by W639 and by H-bonds from Y669OH and to D539 (from the N-H group of the thiazoline ring). This position for the carbonyl oxygen atom clearly suggests that it is the nucleophile in the reaction, and that the protonated carboxyl group of E540 is the general acid that protonates the glycosidic oxygen between the two sugar residues of the chitobiose substrate.[7] The sugar pucker of the N-acetyl glucosamine in the –1 position (the non-reducing position) clearly adopts the ^{1,4}B

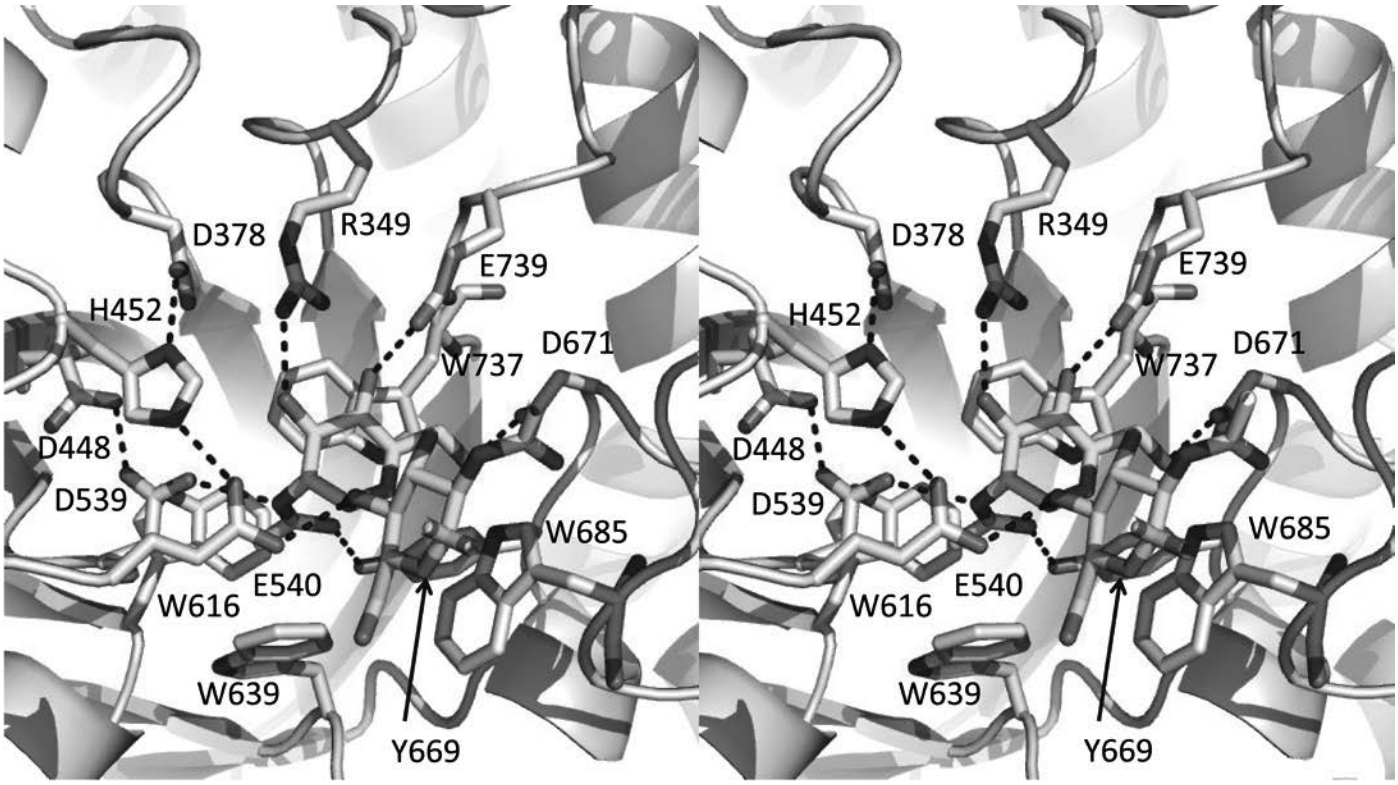


Figure 4. A cross-eyed stereo view of the residues forming the active site of the catalytic domain of the family 20 chitobiase from *Serratia marcescens*.[7]

The chitobiose substrate (dark sticks) is fortuitously bound, directly giving an image of the Michaelis complex and the interactions (H-bonding and van der Waals) with the residues of the enzyme. The general acid/base is the carboxyl group of Glu540. It forms an H-bond with the glycosidic oxygen atom of chitobiose and the other carboxyl oxygen is H-bonded to His452 that in turn is H-bonded to Asp378. Asp539 receives an H-bond from the N-H of the acetamide group on C2' thereby assisting in the stabilization of the conformation that places the carbonyl-oxygen atom of N-acetylglucosamine in the appropriate position for nucleophilic attack on the anomeric C1' carbon to form the oxazolinium ion reaction intermediate (see Figure 5). The phenolic OH of Tyr669 donates an H-bond to assist in the development of the nucleophilic character of the carbonyl oxygen.

conformation as shown in Figures 4 and 5 representing the Michaelis complex on the reaction pathway of the family 20 glycoside hydrolases. The next step in the reaction pathway is represented by the structure of the analogue of the oxazolinium ion intermediate, NAG-thiazolidine (Figure 3). This sulfur analogue is stable and it could be soaked into the crystals of human β-Hex B.[5] The resulting structure shows that the sugar adopts a $^4C_1$ conformation with the sulfur atom covalently bonded to the anomeric C1' carbon atom. Tyrosine Y450 of β-Hex B donates an H-bond to the sulfur atom and the positively charged nitrogen atom of the thiazolidine ring forms an H-bond with the carboxylate of Asp354. The side chain of W424 lies approximately parallel to the plane of the thiazoline ring in an analogous fashion as the plane of W639 in chitobiase lies roughly parallel to the plane of the N-acetyl group of the –1 sugar of chitobiose.

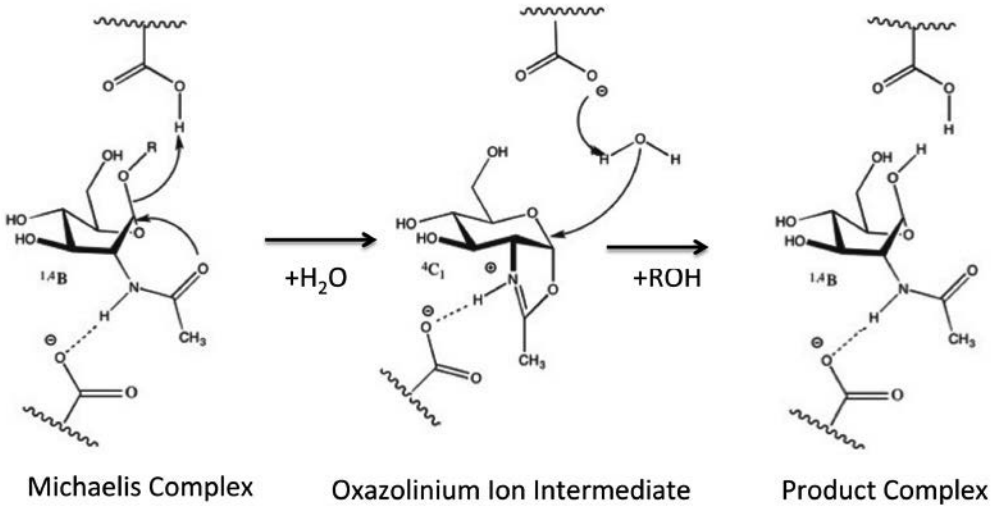


Figure 5. The reaction pathway of the family 20 glycoside hydrolases (substrate-assisted catalysis[5,6,7]).
In the majority of glycoside hydrolases that cleave oligosaccharides via configuration-retaining mechanisms, the nucleophiles are residues on the enzyme and thus have glycosyl-enzyme covalent intermediates. The structures of the enzymes chitobiase and β-Hex B show conclusively that this family catalyzes the hydrolysis in a substrate-assisted manner. The nucleophilic atom is the carbonyl-oxygen atom of the N-acetyl group on the 2' carbon of the sugar residing in the -1 binding site on the enzyme. There is a general acid/base residue (in these cases a glutamic acid residue) suitably positioned to protonate the glycosidic oxygen atom of the substrate. The carboxylate of this same glutamic acid residue also acts as the general base to generate the strongly nucleophilic OH^- hydroxide to attack the anomeric C1' atom and result in the product. The pyranose ring has a $^{1,4}B$ boat conformation in the Michaelis complex and a $^4C_1$ chair conformation in the oxazolinium ion intermediate.

The second step of the reaction is a water molecule replacing the 4'-OH of the leaving group sugar of chitobiose and the generation of the strong nucleophilic OH^- by the removal of the proton by the general base function of Glu355. It is interesting to note that in both chitobiase[7] and in the β-hexosaminidases[5] the general acid/base is a glutamic acid (Glu540 and Glu355, respectively). The carboxyl groups in each of these residues are H-bonded to a histidine and then to an aspartate (H452 and D378 in chitobiase and H294 and D240 in human β-Hex B).

α-L-iduronidase structure and mechanism

The mucopolysaccharidoses are a group of eleven lysosomal storage diseases (LSDs) characterized by genetic defects in enzymes that are involved with the breakdown and turnover of glycosaminoglycans.[8] Mucopolysaccharidosis type I (MPS-I) (also known as Hurler, Hurler-Scheie or Scheie syndromes depending upon the severity of the disease in the affected individual) is the loss of, or decrease in, activity of the enzyme α-L-iduronidase (IDUA). IDUA removes single α-L-iduronyl residues from the non-reducing ends of the glycosaminoglycans, dermatan sulfate and heparan sulfate. It is the build-up of these unprocessed substrates that results in skeletal, cardiac and neurological disorders of various severities. MPS-I of medium severity (Hurler-Scheie) is presently treated by enzyme replacement therapy (ERT). Unfortunately ERT is extremely costly, approaching $500,000 per patient per year. As a result, alternative treatments such as the development of pharmacological chaperones are being sought for many of the LSDs. It is of paramount importance to have available the crystal structure of the wild-type enzyme, and if possible the mutant forms that cause the disease, in order to develop such pharmacological chaperones. Our research is geared to determining these structures and to defining the catalytic pathway taken by IDUA by determining the structures of the Michaelis complex, the reaction pathway intermediates and the product complexes.[9]

Early attempts by others to crystallize IDUA resulted in spherulites. We reasoned that part of the problem could lie in the heterogeneous glycosylation at the six known sites on IDUA. Allison Kermode at Simon Fraser University and members of her laboratory had developed an expression system for human IDUA in seeds of a complex glycan line from *Arabidopsis thaliana*. The so-expressed human IDUA was purified to homogeneity using ConA-Sepharose and anti-IDUA affinity chromatography. The high yield allowed us to crystallize the human IDUA produced by *Arabidopsis* in three different crystalline lattices. The one that was ultimately used to solve the structure was a rhombohedral-shaped crystal of space group R3.[9] These crystals diffracted to 2.1 Å resolution.

Haiying Bie and Jiang Yin solved the structure of rhombohedral IDUA using single wavelength anomalous diffraction (SAD) from a crystal of IDUA that had been co-crystallized with ethyl mercuric phosphate (EMP) at 5 mM concentration.[9] The native structure was refined to an R_{work} of 0.198 and an R_{free} of 0.214. Crystals soaked in solutions containing 20 mM concentrations of 2-deoxy-2-fluoro-iduronyl acid fluoride (2F-IdoAF) and 5-fluoro-iduronyl acid fluoride (5F-IdoAF) resulted in structures for the Michaelis complex (5F-IdoAF) and for the covalent glycosyl-enzyme intermediate (2F-IdoAF). Ethan Goddard-Borger synthesized these inhibitors in the lab of Steve Withers at the University of British Columbia, Chemistry Department.

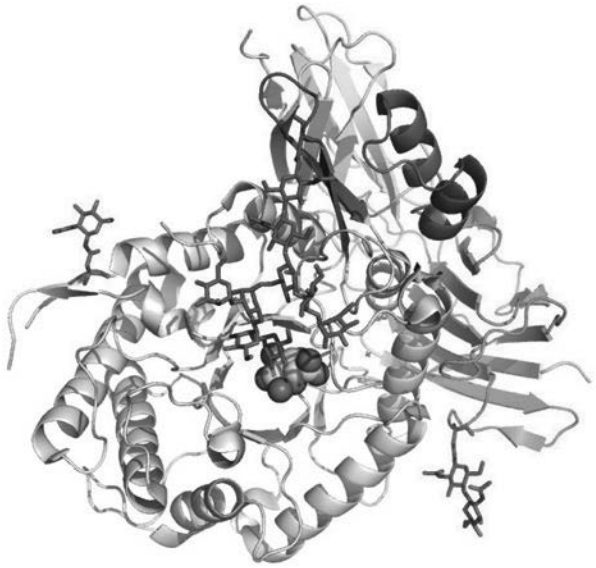


Figure 6. Human IDUA[9] expressed in the plant, *Arabidopsis thaliana*.
The enzyme consists of 653 amino acids that are folded into three major domains. The largest domain (I) is the catalytic (β/α)$_8$, TIM barrel that harbours the nucleophilic Glu299 and the general acid/base Glu182. It is represented in light grey. Domain II is a β-sandwich and is located on the right side (from this viewpoint) of domain I. It is represented in dark grey. The third and final domain III is made up from the C-terminal ~100 amino acids. It is located above the catalytic domain I in this view and the residues adopt a type III fibronectin fold. There are two unusual insertions, one in the regular folding of the catalytic domain (a β-hairpin comprising β12 and β13) and the other an antiparallel pair of α-helices (α15 and α16) that is in the β-sandwich domain. Of the three N-linked glycans seen in the electron density map the largest (a high mannose glycan) is located on Asn372 in the β-hairpin insertion. One limb of this high mannose glycan reaches into the active site and is intimately involved in the catalytic events carried out by IDUA.[9,10] The final feature represented in this figure is the bound IdoA represented by spheres and located centrally in the active site of the catalytic domain I. The N-linked glycan on Asn372 can be seen forming H-bonds to IdoA in the product complex.

The molecular structure of IDUA consists of three prominent domains.[9] Domain I is the catalytic domain comprising residues from Arg48 to Ala394 (Figure 6). Domain II is a β-sandwich consisting of the N-terminus of IDUA and a single β-strand (residues His30 to Leu43) as well as the remaining residues of the domain, from Glu398 to Ala542. The third domain (Thr552 to Glu640) resembles the fold of a type III fibronectin domain. The last 11 residues of the enzyme (Val643 to Pro653) are disordered and therefore not visible in the electron density map. The catalytic domain is a $(\beta\alpha)_8$ barrel resembling that of triose phosphate isomerase (TIM barrel). The general acid/base Glu182 and the nucleophilic carboxylate Glu299 are contained in this domain.

There are three N-linked glycans in our structure of IDUA: one each at Asn110, Asn372 and Asn415 (Figure 6). Asn110 has a single N-acetylglucosamine (GlcNAc) residue that is visible in the electron density and Asn415 has two GlcNAc residues covalently bonded. The most highly defined N-glycan is the high mannose glycan consisting of 2 GlcNAc residues bonded to Asn372 and seven mannose residues. From all of the structures that were determined in this study, the most well-defined N-glycan is the one present on Asn372 in the three structures that had IdoA analogues bound in the active site of molecule B of the structure. In that structure one of the terminal mannose residues forms an H-bonded interaction with the 3' OHs on the 2F-IdoA (Figure 7) and on the 5F-IdoAF substrate analogues. This suggested that the N-glycan might be involved in substrate binding and its presence could have an effect on the catalytic hydrolysis of the natural GAG substrates.

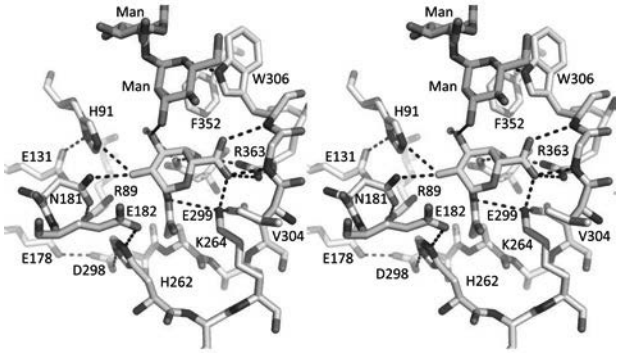


Figure 7. A cross-eyed stereo representation of the residues forming the active site of IDUA with the bound, covalently-linked glycosyl-enzyme intermediate analogue of 2F-IdoA.

The pyranose ring adopts a $^{2,5}B$ boat conformation; one of the oxygen atoms of the carboxyl group of Glu299 is covalently bonded to the anomeric carbon atom C1'. The carboxylate on C5' receives four H-bonds one each from Gly305NH, Trp306NH, Arg363 and Lys264. In this analogue of the glycosyl-enzyme intermediate, the OH on C3' of mannose 7 makes an H-bond to the OH on C3' of 2F-IdoA. Also, in a manner similar to the H-bonding interactions of the general acid/base of the β-Hex B, Glu355 (Figure 3 and 4), the carboxyl group of Glu182 (the general acid/base of IDUA makes an H-bonded interaction with His262 that in turn is H-bonded to the carboxylate of Asp298.

The structures of IDUA bound with 5F-IdoAF, 2F-IdoA and IdoA are in the protein data bank under the PDB accession codes 4KGJ, 4KH2 and 4OBR, respectively. These three structures provide insight into the catalytic pathway of the enzyme, which is a member of the glycoside hydrolase family 39. The Michaelis complex is represented by 5F-IdoAF bound in the IDUA active site. In this, and the substrate analogues we studied, the 5' COO^- group is the recipient of 4 H-bonds and two electrostatic interactions from the enzyme, namely from the ammonium group of Lys264 and from the guanidinium group of Arg363. The pyranose ring of the 5F-IdoAF adopts a skew boat ^2S_O conformation that presents the anomeric carbon (C1' of the pyranose ring) in an ideal position to receive the nucleophilic attack by the carboxylate of Glu299. In the Michaelis complex the fluorine atom on the anomeric carbon is the recipient of an H-bond from the general acid/base carboxyl group of Glu182. This is a perfect set up for protonation of the glycosidic oxygen in a substrate (Figures 7 and 8).

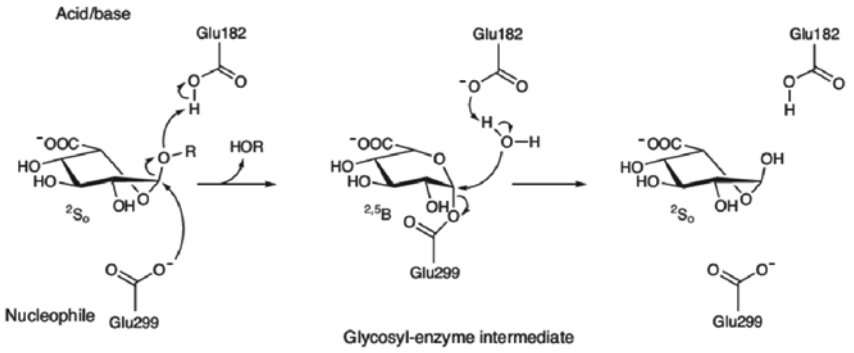


Figure 8. A representation of the catalytic pathway of IDUA derived from the crystal structures of fluoro-analogues of IdoA.

The Michaelis complex is represented by the structure of 5F-IdoF; the glycosyl enzyme intermediate is represented by the crystal structure of the covalently bonded carboxyl group of Glu299 to the C1' anomeric carbon atom of 2F-IdoA. The product complex is represented by the co-crystal of human IDUA with IdoA. The pyranose ring in both the Michaelis complex and the product complex adopts a skew $^{2}S_{O}$ conformation, whereas the conformation of the pyranose ring in the glycosyl-enzyme intermediate is a $^{2,5}B$ boat conformation. In the left panel of this figure, the general acid of Glu182 is shown protonating the glycosidic oxygen of the substrate, thereby facilitating the nucleophilic attack of the carboxylate of Glu299 on the anomeric carbon of the substrate to form the glycosyl-enzyme intermediate shown in the central panel. The nucleophilic OH^{-} is generated from a water molecule by the general base function of Glu182. The OH^{-} attack on the anomeric C1' atom displaces the carboxyl group of Glu299 to produce the product IdoA in the right hand panel.

The proton transfer from Glu182 to the glycosidic oxygen of the substrate, coupled with the nucleophilic attack of the carboxylate of Glu299 on the anomeric carbon of the non-reducing sugar, results in the glycosyl-enzyme intermediate (Figures 7 and 8). The 2F-IdoA bound to IDUA (PDB accession code 4KH2) clearly shows a covalent bond from the carboxyl group of Glu299 to the anomeric C1' of the substrate analogue. The pyranose ring in this glycosyl-enzyme intermediate adopts a $^{2,5}B$ boat conformation, and there is a water molecule in a suitable position for the attack by the -OH on the anomeric carbon atom to produce the product IdoA which also has a $^{2}S_{O}$ conformation for the pyranosyl-iduronic acid ring (PDB accession code 4OBR).

The terminal mannose 7 of the glycan on Asn372 makes several polar and H-bonded interactions with atoms on the various IdoA analogues and with IdoA that are suggestive of a role for the glycan in catalysis and substrate binding. Our group was not the only one to have made this observation.[1]. We treated the plant-produced IDUA with carbohydrate binding module (CBM) peptide N-glycosidase F and found that the enzymatic activity of this deglycosylated IDUA was ~10% of that of the fully glycosylated IDUA.[9] The K_{M} and V_{max} values of the deglycosylated IDUA were ~3× and ~0.5× those of untreated IDUA. This shows clearly that N-glycosylation of at least Asn372 is critical for full IDUA catalytic activity. Our group is continuing this study by mutation of the N-glycan sequon at position 372 and following the resulting protein by a determination of the kinetic consequences for a thorough assessment. Our initial work is on the fairly common mutation of P533R.[9]

Acknowledgements

I am extremely fortunate to have been a member of the Department of Biochemistry at the University of Alberta for such a long time. All of my colleagues over the years have not only had the patience to teach me about their areas of expertise, but have also been great friends that I have valued immensely. Unfortunately, some of them have passed away: Bill Bridger, Larry Smillie, Richard Morgan, Doug Scraba and John Colter; but others are still close, in particular Cyril Kay, Joel Weiner and Brian Sykes. My greatest pleasure has been the opportunity to have guided and mentored so many talented students and post-doctoral fellows over the years. I could not cover all of the projects that we have done, so I have had to be selective. I chose the lysosomal storage diseases story because I think that our studies of the β-hexosaminidases A and B and of α-L-iduronidase have a real chance of being helpful in the treatments of the associated genetic diseases. I have valued the collegiality of Don Mahuran, Mike Tropak, Steve Withers and Allison Kermode and the members of their labs who did the work that I have described. Brian Mark, Maia Cherney, Jiang Yin and Haiying Bie deserve special credit for the work that they did in solving the structures of β-Hex A and B and IDUA. I am deeply indebted to Barb Thom for her typing of this paper and many others for me. Of course none of this research would have been possible without the financial support of the Canadian Institutes for Health Research, the Orphan Diseases Network, the University of Pennsylvania, the Alberta Heritage Foundation for Medical Research and the University of Alberta.

References

1. Codding, P.W., L.T.J. Delbaere, K. Hayakawa, W.L.B. Hutcheon, M.N.G. James & L. Jurasek. *Can. J. Biochem.* **52**: 208-220 (1974).
2. Delbaere, L.T.J., W.L.B. Hutcheon, M.N.G. James & W.E. Theissen. *Nature* **257**: 758-763 (1975).
3. Lee, T.-W., M.A. Qasim Jr., M. Laskowski & M.N.G. James. *J. Mol. Biol.* **367**: 527-546 (2007).
4. Church, W.B., L. Swenson, M.N.G. James & D. Mahuran. *J. Mol. Biol.* **227**: 577-580 (1992).
5. Mark, B.L., D.J. Mahuran, M.M. Cherney, D. Zhao, S. Knapp & M.N.G. James. *J. Mol. Biol.* **327**: 1093-1109 (2003).
6. Mark, B.L., D.J. Vocadlo, S. Knapp, B.L. Triggs-Raine, S.G. Withers & M.N. James. *J. Biol. Chem.* **276**: 10330-10337 (2001).
7. Tews, I., A. Perrakis, A. Oppenheim, Z. Dauter, K.S. Wilson & C.E. Vorgias. *Nature Struct. Biol.* **3**: 638-648 (1996).
8. Clarke, L.A. *Expert Rev. Mol. Med.* **10**: e1 (2008).
9. Bie, H., J. Yin, X. He, A.R. Kermode, E.D. Goddard-Borger, S.G. Withers & M.N. James. *Nat. Chem. Biol.* **9**: 739-745 (2013).
10. Maita, N., I. Tsukimura, S. Saito, K. Ohno, H. Taniguchi & H. Sakuraba. *Proc. Natl. Acad. Sci. U.S.A.* **110**: 14628-14633 (2013).

2015 Robert H. Haynes Young Scientist Award in Genetics

Increasing evidence supporting epigenetic programming and regulation of HDL-cholesterol metabolism

Luigi Bouchard
Department of Biochemistry, Université de Sherbrooke

Abstract

Atherosclerosis is the primary cause of cardiovascular disease (CVD). Its development is a long process that sometimes begins in early childhood with possible fetal origins. High-density lipoproteins (HDL) are involved in reverse cholesterol transport and have antioxidant, anti-inflammatory and antithrombotic effects, which all contribute to their well-known cardioprotective properties. However, recent clinical trials aiming to improve the CVD risk profile by increasing HDL-cholesterol (HDL-C) levels have been unsuccessful, clearly underlying the need to better understand HDL-C metabolism and its cardioprotective properties. Indeed, circulating HDL-C levels are strongly influenced by genetic determinants. However, this influence is only partially explained by traditional genetic changes. This situation has led our group to suggest that epigenetics could be involved in programming and regulating HDL-C metabolism. Epigenetics refers to the regulation of DNA transcription that is independent of changes to the DNA sequence. DNA methylation occurring at position 5' of the cytosine pyrimidine ring is the most stable and best understood epigenetic mark. DNA methylation is partially inherited but is also dynamic. More recently, new aspects of the structural complexity of HDL have been revealed with the discovery that HDL carries microRNAs with functional capabilities. MicroRNAs are small RNA molecules that bind to specific messenger RNA (mRNA) to regulate gene expression and protein synthesis. They are implicated in the regulation of central metabolic pathways and considered by many as an epigenetic mechanism. Both DNA methylation and microRNA variations have profound phenotypic effects. This short review will present recent evidence supporting epigenetic programming and regulation of HDL-cholesterol metabolism and perspectives on the high potential of microRNAs.

Introduction

Cardiovascular disease (CVD) is the main cause of death worldwide.[1] It affects endothelial and smooth muscle cells of large arteries and is characterized by a chronic, low-grade inflammation. High-density lipoprotein cholesterol (HDL-C) has been recognized in numerous large prospective studies as a strong and independent inverse cardiovascular risk marker.[2-4] Indeed, each 0.1 mmol/L-decrease in circulating HDL-C is associated with an 8% to 12% increase in the risk of a cardiovascular event.[2-4] In support, subjects with hyperalphalipoproteinemia presenting large HDL particles and elevated HDL-C levels are also protected from cardiovascular events.[5-7] HDL-associated cardioprotection is believed to be dependent on its role in reverse cholesterol transport[8] and its numerous other properties.[9] These have recently been characterized[10] and include anti-oxidative, anti-inflammatory, antithrombotic and anti-apoptotic effects as well as nitric-oxide and insulin-secretory properties. Accordingly, improving HDL concentrations and its associated cardioprotective functionality could provide substantial additional health benefits over those already obtained with low-density lipoprotein (LDL)-C-lowering drugs. These observations highlight the need to better understand the mechanisms regulating HDL metabolism and cardioprotective functions.

Among them, genetic variations have already been widely studied and are implicated in the regulation of HDL contents and properties. However, although the heritability of HDL-C levels is high (~65%), only a few gene variants have been associated with plasma levels of HDL-C, suggesting that other molecular mechanisms including epigenetic changes might be involved. Epigenetics refers to the regulation of DNA transcription without changing the DNA sequence.[11] The epigenetic regulation of cellular functions is a normal and essential process in cell development and differentiation. Epigenetic marks are thus mitotically-stable and enduring, producing long-term changes in gene expression, but they are also dynamic and influenced by metabolic and environmental factors.[12] Epigenetic marks are also partially inherited.[13]

Embryonic and fetal stages are critical windows for epigenetic programming. These early stages of development are characterized by intense cellular differentiation, growth, DNA synthesis and high DNA methyltransferase activity. Accumulating evidence suggest that effects of epigenetic reprogramming during the fetal development may have long lasting effects,[14-17] with profound phenotypic effects.[18] Indeed, epigenetic marks are subject to reprogramming throughout life by both stochastic and environmental stimuli, but more determinedly by factors influencing the *in utero* environment.[19] All these provide supportive evidence for a role of epigenetic changes in the developmental origin of health and disease (DOHaD) hypothesis.[20]

HDL metabolism regulation through *LPL* DNA methylation programming

Most of our studies so far have focussed on the impacts of maternal metabolic dysregulation (mainly gestational diabetes[21-23] but also dyslipidemia) on the newborn DNA methylation profile or methylome (Figure 1). DNA methylation occurring at position 5' of the cytosine (mC) pyrimidine ring is the more stable and best understood epigenetic mark.[11] Cytosine methylation is observed at CpG dinucleotides, which are often clustered in DNA element called CpG islands (CpGi). CpGi are located within the regulatory regions of about 50-60% of transcribed genes.[11,24] Promoter cytosine methylation is usually associated with the transcriptional silencing of the target genes,[25,26] essentially by inhibiting the binding of transcription factors.[27] More recently, DNA methylation outside of CpGi (i.e. within low CpG density regions) has emerged as being associated with active regulatory loci, suggesting that these regions should also be investigated.[28]

Among our studies, those on lipoprotein lipase (LPL) have suggested epigenetic programming and regulation of HDL metabolism. LPL is located at the cell surface and hydrolyses triglycerides (TG) from TG-rich lipoprotein to support cellular energy needs. Therefore, LPL contributes to decrease the plasma TG content and recycles the main constitutive lipoprotein of the HDL, the apolipoprotein A1 (ApoA1). LPL thus contributes to the generation of nascent HDL particles, which is the first step of reverse cholesterol transport. In placenta, LPL acts as one of the initial steps in the transplacental transfer of free-fatty acids (FFA), a source of energy for the developing fetus. Indeed, we have showed that placental *LPL* DNA methylation levels are decreased in response to exposure to maternal hyperglycemia and high levels of HDL-C, suggesting that the maternal metabolic profile impacts the newborn's epigenome (placental cells are of embryonic origin).[29] We have also reported that lower *LPL* DNA methylation is associated

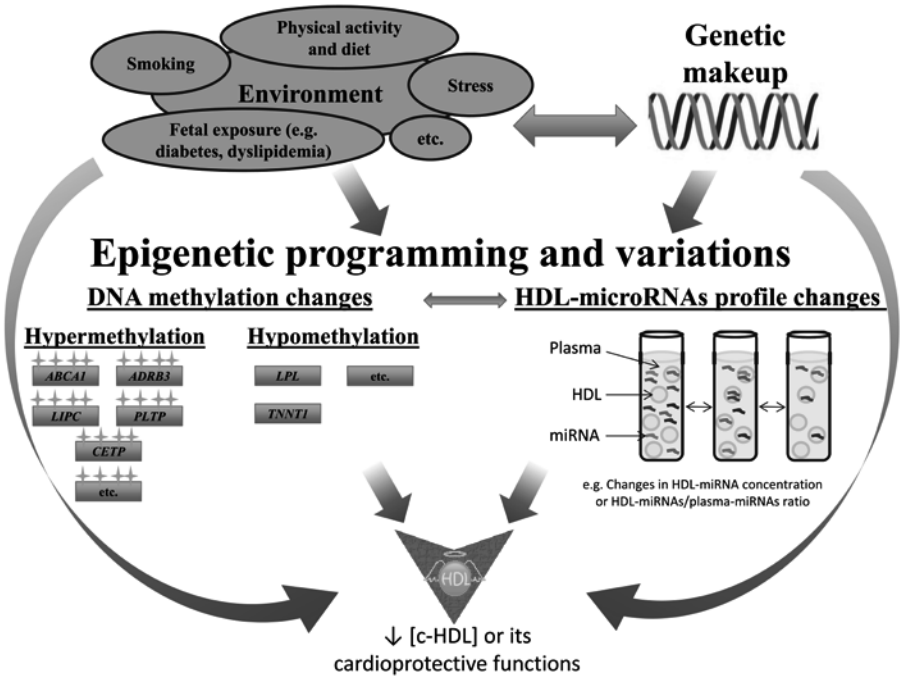


Figure 1: Interaction between environment, genetic makeup and epigenetic modifications on HDL composition and cardioprotective functions.

with higher *LPL* gene transcription,[29,30] suggesting that these *LPL* epivariations are functional. Interestingly, we also reported that lower placental *LPL* DNA methylation levels were associated with higher HDL-C levels and lower total cholesterol to HDL-C ratio in cord blood. Both are biomarkers associated with cardiovascular protection.[29] This suggested that maternal hyperglycemia and high circulating HDL-C levels might be associated with an improved LPL activity in the placenta and corresponding disruption of materno-fetal lipid transfer. Finally, we have validated and confirmed the associations between *LPL* DNA methylation, *LPL* mRNA levels and HDL-C in patients with familial hypercholesterolemia (FH; blood) or severe obesity (blood and visceral adipose tissue).[30]

Using both prospective birth cohorts and cross-sectional studies, our studies have so far contributed to demonstrate that DNA methylation changes are associated with low HDL-C levels among other obesity, diabetes and CVD risk factors. The science and technology are now available to assess whether epigenetic marks programmed early in fetal development and in the perinatal period are predictive of obesity, diabetes and CVD later in life (some markers are informative as early as 2 years of age) and whether they will remain stable (or not) over time. These goals will be best achieved in humans using large longitudinal birth cohorts.[31] Indeed, the follow-up of our birth cohorts in early childhood (3 and 5 years old) is ongoing. Showing that epigenetic programming of cellular functions in response to early maternal metabolic insults is involved in the DOHaD is thus the next step we are looking forward to achieve.

Paradigm shifting in HDL research and the microRNA "revolution"

Along with understanding the molecular determinants of HDL-C metabolism, achieving cardiovascular benefits by raising HDL-C concentrations through drug therapies has proven to be challenging (Table 1).[32,33] The cholesteryl ester transfer protein (CETP) is a key HDL-metabolism enzyme that triggers the hetero-exchange of TG and cholesteryl esters between TG-rich lipoproteins and HDLs.[34] Despite great expectations, CETP inhibitors have so far failed to demonstrate cardiovascular benefits despite massive 30-140% increases in plasma HDL-C levels.[32,35] This example and others[33,36] have highlighted the striking discrepancy between HDL-C concentrations and HDL functions.

Also, the role of HDL-C in lowering CVD risk has been assessed using Mendelian randomization. Neither of the studies published so far provided supportive evidence

Drug	Activity	Impacts on HDL-C levels	Impacts on cardiovascular risk	Studies (n)
Niacin	↓ ApoA1 catabolism ↓ TG, LDL-C	↑ 15%-40%	Unclear	HPS2-THRIVE trial (n=25,673) AIM-HIGH trial (n=3,414)
Fibrates	↑ ApoA1 and ApoA2 synthesis ↓ TG (PPARα activation)	↑ 5%-20%	10% to 13% decrease of serious cardiovascular and coronary events respectively, but no impact on stroke	Meta-analysis (18 trials, n=45,058)
CETP inhibitor	↓ Cholesteryl Ester Transfer Protein (CETP) inhibitor ↓ LDL-C	↑ 30%-140%	• None for dalcetrapib or torcetrapib • Two other phase III ongoing clinical assays (anacetrapib and evacetrapib)	ILLUMINATE trial (n=15,067) Dal-OUTCOMES trial (n=15,871) DEFINE trial (n=30,000, ongoing) ACCELERATE trial (n=11,000, ongoing)
RVX-208	↑ ApoA1 synthesis	↑ 3.2-8.3%	Unclear – ASSURE and SUSTAIN studies still ongoing	ASSERT trial (n=299, 12 weeks)
HDL-mimetic (CER-001)	↑ Number of pre-β HDL	↑ ~117% (1 to 5 hours post-infusion)	None	CHI-SQUARE trial (n=507)

HPS2-THRIVE trial: HPS2-THRIVE Collaborative Group. *Eur Heart J*. 2013; 34:1279-1291; **AIM-HIGH trial:** AIM-HIGH Investigators. *N Engl J Med*. 2011; 365:2255-2267; **Fibrates meta-analysis:** Jun *et al*., *Lancet*. 2010; 375:1875-1884; **ILLUMINATE trial:** Barter *et al*., *N Engl J Med*. 2007; 357:2109-2122; **Dal-OUTCOMES trial:** Schwartz *et al*., N Engl J Med. 2012; 367:2089-2099; **ASSERT trial:** Nicholls *et al*., J Am Coll Cardiol. 2011; 57:1111-1119; **CHI-SQUARE trial:** Tardif *et al*., Eur Heart J. 2014; 35:3277–3286.

regarding the clinical relevance of increasing HDL-C in high-CVD-risk patients.[36,37] Accordingly, the authors have concluded that raising plasma HDL-C alone might not be protective from myocardial infarction (MI). The results remain nevertheless controversial as only a small number of genes have been investigated and the results on the association between *CETP* variants and MI were not fully considered as weakened by an association with LDL-C. Mendelian randomization studies nevertheless suggested that a high HDL-C concentration is at best only one of the factors involved in HDL-associated cardioprotection and that increasing HDL-C levels alone might not be sufficient to lower the CVD risk. Accordingly, the paradigm of HDL research is shifting towards understanding and improving its many cardioprotective properties with the expectation that these will further lower the CVD risk.

Another breakthrough in the field was made in 2011 when Vickers *et al.* reported that HDL particles carry specific microRNAs with functional capabilities and deliver them to target cells.[38] microRNAs are small single-stranded RNAs that bind to their target messenger RNA (mRNA) to regulate gene expression and protein synthesis.[39] The regulation of gene expression through microRNA pathways is a recognized mechanism that has been linked to the control of normal cellular processes such as cell differentiation, development and adaptation to environment.[39-44] A deregulation in microRNA concentrations has also been observed in human diseases such as cancer, diabetes, dyslipidemia and CVD.[45-48] microRNAs thus provide a molecular mechanism with large regulatory impacts.[49]

Among the few studies conducted so far, Vickers *et al.* found that miR-223 was the most abundant microRNA in HDLs (4th in non-FH subjects) and the most overexpressed in FH (3,780-fold, p=0.02; as compared to non-FH subjects).[38] It is also one of the most abundant

microRNAs in mouse HDL and its concentration increased when *Apoe*$^{-/-}$ and *Ldlr*$^{-/-}$ mice were subjected to a high fat diet.[38] Since that first publication, additional supportive evidence for the role of miR-223 in cholesterol metabolism and inflammation has been provided by the same group.[50,51]

Although their analyses focussed on a limited subset of microRNAs (n=9) already associated with vascular function and inflammation processes, Wagner *et al*.[52] have provided supportive evidence for most of the findings of Vickers *et al.*. However, Wagner *et al*. reported that only 8% of the miR-223 in circulation was indeed transported by the HDL particles, suggesting that its role in cholesterol metabolism and inflammation might not be tightly related to its binding with HDLs as first assumed.

Using quantitative real-time PCR (qRT-PCR), we have tested the presence in HDL of 126 microRNAs known to be associated with diabetes and CVD, or described in human plasma. Ninety-nine of them were detected (ct<35), including miR-223.[53] Interestingly, the variation in HDL miR-223 levels after consumption of a diet rich in *trans* fatty acids for four weeks was negatively correlated with changes in HDL-C and ApoA1 concentrations.[54] These were pilot studies whose results support either a role as biomarker for HDL-carried microRNAs, or their involvement in regulating the cardioprotective properties of HDL particles. These studies also support the need for larger studies.

To follow up, and in collaboration with Dr. Kendall van Keuren-Jensen, we have recently developed a next-generation microRNA-sequencing method applied to our microRNAs extracted from purified HDL particles. Only one pilot analysis has been conducted so far, but this large-scale approach allowed us to identify hundreds more microRNAs carried by HDL, with some likely more specific to HDL than miR-223 (unpublished results). If confirmed, these HDL-specific microRNAs should provide the best targets to study their roles in HDL functionality regulation.

Research on HDL-microRNAs is just beginning but they have huge potential to unravel the biology behind HDL's cardioprotective functions and show tremendous therapeutic promises.[55,56] Indeed, microRNAs transported by HDL particles may well be part of the solution to further improve CVD prevention and treatment, but more research is needed in this emerging field.

Perspectives

The epigenetics of complex traits such as obesity, diabetes and CVDs will help us understand mechanisms, genes and pathways behind the development of these diseases. Such studies may add a layer of complexity to the "traditional" genetic regulation of gene transcription, but this complexity is precisely the most exciting challenge to address.

Acknowledgement

I am sincerely thankful to the study participants, Céline Bélanger, Chicoutimi Hospital, for her thoughtful revision of the manuscript and to Véronique Desgagné (M.Sc.), Andrée-Anne Houde (Ph.D.), Simon-Pierre Guay (Ph.D.) and Stephanie-May Ruchat (Ph.D.), my graduate students and postdoctoral fellow (S.-M. R.) who have completed most of the laboratory work done on DNA methylation and microRNAs. This research has also benefited from the insights and contribution of many colleagues whose cooperation is deeply appreciated. Among these, I express my special appreciation to Diane Brisson, Daniel Gaudet, Jean-Patrice Baillargeon, Renée Guérin and Marie-France Hivert for their lasting and meaningful collaboration.

References

1. Alwan A, Armstrong T, Bettcher D, Branca F, Chisholm D, Ezzati M, *et al*. Burden: mortality, morbidity and risk factors. Global status report on noncommunicable diseases. 2010: World Health Organization, 2011:9-31.
2. Assmann G, Schulte H, von Eckardstein A, Huang Y. High-density lipoprotein cholesterol as a predictor of coronary heart disease risk. The PROCAM experience and pathophysiological implications for reverse cholesterol transport. Atherosclerosis 1996; 124 Suppl: S11-20.
3. Gordon T, Castelli WP, Hjortland MC, Kannel WB, Dawber TR. High density lipoprotein as a protective factor against coronary heart disease. The Framingham Study. The Amer J Med 1977; 62:707-714.
4. Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F, *et al*. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. Lancet 2004; 364:937-952.

5. Boekholdt SM, Sacks FM, Jukema JW, Shepherd J, Freeman DJ, McMahon AD, *et al*. Cholesteryl ester transfer protein TaqIB variant, high-density lipoprotein cholesterol levels, cardiovascular risk, and efficacy of pravastatin treatment: individual patient meta-analysis of 13,677 subjects. Circulation 2005; 111:278-287.
6. Curb JD, Abbott RD, Rodriguez BL, Masaki K, Chen R, Sharp DS, *et al*. A prospective study of HDL-C and cholesteryl ester transfer protein gene mutations and the risk of coronary heart disease in the elderly. J Lipid Res 2004; 45:948-953.
7. Ridker PM, Pare G, Parker AN, Zee RY, Miletich JP, Chasman DI. Polymorphism in the CETP gene region, HDL cholesterol, and risk of future myocardial infarction: Genomewide analysis among 18 245 initially healthy women from the Women's Genome Health Study. Circ Cardiovasc Genetics 2009; 2:26-33.
8. Rader DJ, Alexander ET, Weibel GL, Billheimer J, Rothblat GH. The role of reverse cholesterol transport in animals and humans and relationship to atherosclerosis. J Lipid Res 2009; 50 Suppl:S189-194.
9. Scanu AM, Edelstein C. HDL: bridging past and present with a look at the future. FASEB J 2008; 22:4044-4054.
10. Asztalos BF, Tani M, Schaefer EJ. Metabolic and functional relevance of HDL subspecies. Curr Opin Lipidol 2011; 22:176-185.
11. Bird A. DNA methylation patterns and epigenetic memory. Genes Dev 2002; 16:6-21.
12. Kangaspeska S, Stride B, Metivier R, Polycarpou-Schwarz M, Ibberson D, Carmouche RP, *et al*. Transient cyclical methylation of promoter DNA. Nature 2008; 452:112-115.
13. Bell JT, Tsai PC, Yang TP, Pidsley R, Nisbet J, Glass D, *et al*. Epigenome-wide scans identify differentially methylated regions for age and age-related phenotypes in a healthy ageing population. PLoS Genetics 2012; 8:e1002629.
14. Heijmans BT, Tobi EW, Stein AD, Putter H, Blauw GJ, Susser ES, *et al*. Persistent epigenetic differences associated with prenatal exposure to famine in humans. Proc Natl Acad Sci USA 2008; 105:17046-17049.
15. Talens RP, Boomsma DI, Tobi EW, Kremer D, Jukema JW, Willemsen G, *et al*. Variation, patterns, and temporal stability of DNA methylation: considerations for epigenetic epidemiology. FASEB J 2010; 24:3135-3144.
16. Tobi EW, Lumey LH, Talens RP, Kremer D, Putter H, Stein AD, *et al*. DNA methylation differences after exposure to prenatal famine are common and timing- and sex-specific. Hum Mol Genet 2009; 18:4046-4053.
17. Tobi EW, Goeman JJ, Monajemi R, Gu H, Putter H, Zhang Y, *et al*. DNA methylation signatures link prenatal famine exposure to growth and metabolism. Nature Commun 2014; 5:5592.
18. Ling C, Del Guerra S, Lupi R, Ronn T, Granhall C, Luthman H, *et al*. Epigenetic regulation of PPARGC1A in human type 2 diabetic islets and effect on insulin secretion. Diabetologia 2008; 51:615-622.
19. Jaenisch R, Bird A. Epigenetic regulation of gene expression: how the genome integrates intrinsic and environmental signals. Nat Genet 2003; 33 Suppl:245-254.
20. Gluckman PD, Hanson MA, Cooper C, Thornburg KL. Effect of in utero and early-life conditions on adult health and disease. N Engl J Med 2008; 359:61-73.
21. Bouchard L, Hivert MF, Guay SP, St-Pierre J, Perron P, Brisson D. Placental adiponectin gene DNA methylation levels are associated with mothers' blood glucose concentration. Diabetes 2012; 61:1272-1280.
22. Bouchard L, Thibault S, Guay SP, Santure M, Monpetit A, St-Pierre J, *et al*. Leptin gene epigenetic adaptation to impaired glucose metabolism during pregnancy. Diabetes Care 2010; 33:2436-2441.
23. Ruchat SM, Houde AA, Voisin G, St-Pierre J, Perron P, Baillargeon JP, *et al*. Gestational diabetes mellitus epigenetically affects genes predominantly involved in metabolic diseases. Epigenetics 2013; 8:935-943.
24. Bird AP. CpG-rich islands and the function of DNA methylation. Nature 1986; 321:209-213.
25. Jones L, Hamilton AJ, Voinnet O, Thomas CL, Maule AJ, Baulcombe DC. RNA-DNA interactions and DNA methylation in post-transcriptional gene silencing. Plant Cell 1999; 11:2291-2301.

26. Klose RJ, Bird AP. Genomic DNA methylation: the mark and its mediators. Trends Biochem Sci 2006; 31:89-97.
27. Rakyan VK, Down TA, Balding DJ, Beck S. Epigenome-wide association studies for common human diseases. Nat Rev Genetics 2011; 12:529-541.
28. Stadler MB, Murr R, Burger L, Ivanek R, Lienert F, Scholer A, *et al*. DNA-binding factors shape the mouse methylome at distal regulatory regions. Nature 2011; 480:490-495.
29. Houde AA, St-Pierre J, Hivert MF, Baillargeon JP, Perron P, Gaudet D, *et al*. Placental lipoprotein lipase DNA methylation levels are associated with gestational diabetes mellitus and maternal and cord blood lipid profiles. J Dev Orig Health Dis 2014; 5:132-141.
30. Guay SP, Brisson D, Lamarche B, Marceau P, Vohl MC, Gaudet D, *et al*. DNA methylation variations at CETP and LPL gene promoter loci: new molecular biomarkers associated with blood lipid profile variability. Atherosclerosis 2013; 228:413-420.
31. Bouchard L. Epigenetics and fetal metabolic programming: a call for integrated research on larger cohorts. Diabetes 2013; 62:1026-1028.
32. Barter PJ, Caulfield M, Eriksson M, Grundy SM, Kastelein JJ, Komajda M, *et al*. Effects of torcetrapib in patients at high risk for coronary events. N Engl J Med 2007; 357:2109-2122.
33. Briel M, Ferreira-Gonzalez I, You JJ, Karanicolas PJ, Akl EA, Wu P, *et al*. Association between change in high density lipoprotein cholesterol and cardiovascular disease morbidity and mortality: systematic review and meta-regression analysis. BMJ 2009; 338:b92.
34. Tall AR. Plasma cholesteryl ester transfer protein. J Lipid Res 1993; 34:1255-1274.
35. Schwartz GG, Olsson AG, Abt M, Ballantyne CM, Barter PJ, Brumm J, *et al*. Effects of dalcetrapib in patients with a recent acute coronary syndrome. N Engl J Med 2012; 367:2089-2099.
36. Voight BF, Peloso GM, Orho-Melander M, Frikke-Schmidt R, Barbalic M, Jensen MK, *et al*. Plasma HDL cholesterol and risk of myocardial infarction: a Mendelian randomisation study. Lancet 2012; 380:572-580.
37. Haase CL, Tybjaerg-Hansen A, Qayyum AA, Schou J, Nordestgaard BG, Frikke-Schmidt R. LCAT, HDL cholesterol and ischemic cardiovascular disease: a Mendelian randomization study of HDL cholesterol in 54,500 individuals. J Clin Endocrinol Metab 2012; 97:E248-256.
38. Vickers KC, Palmisano BT, Shoucri BM, Shamburek RD, Remaley AT. MicroRNAs are transported in plasma and delivered to recipient cells by high-density lipoproteins. Nature Cell Biol 2011; 13:423-433.
39. Sayed D, Abdellatif M. MicroRNAs in development and disease. Physiol Reviews 2011; 91:827-887.
40. Cremisi F. MicroRNAs and cell fate in cortical and retinal development. Frontiers Cell Neurosci 2013; 7:141.
41. Luo W, Nie Q, Zhang X. MicroRNAs involved in skeletal muscle differentiation. J Genet Genomics 2013; 40:107-116.
42. Malizia AP, Wang DZ. MicroRNAs in cardiomyocyte development. Wiley Interdisc Rev Systems Biol Med 2011; 3:183-190.
43. Turner ML, Schnorfeil FM, Brocker T. MicroRNAs regulate dendritic cell differentiation and function. J Immunol 2011; 187:3911-3917.
44. Vidigal JA, Ventura A. Embryonic stem cell miRNAs and their roles in development and disease. Seminars Cancer Biol 2012; 22:428-436.
45. Comprehensive molecular portraits of human breast tumours. Nature 2012; 490:61-70.
46. Rayner KJ, Esau CC, Hussain FN, McDaniel AL, Marshall SM, van Gils JM, *et al*. Inhibition of miR-33a/b in non-human primates raises plasma HDL and lowers VLDL triglycerides. Nature 2011; 478:404-407.
47. Trajkovski M, Hausser J, Soutschek J, Bhat B, Akin A, Zavolan M, *et al*. MicroRNAs 103 and 107 regulate insulin sensitivity. Nature 2011; 474:649-653.
48. Zampetaki A, Willeit P, Tilling L, Drozdov I, Prokopi M, Renard JM, *et al*. Prospective study on circulating microRNAs and risk of myocardial infarction. J Amer Coll Cardiol 2012; 60:290-299.
49. Bartel DP. MicroRNAs: target recognition and regulatory functions. Cell 2009; 136:215-233.
50. Tabet F, Vickers KC, Cuesta Torres LF, Wiese CB, Shoucri BM, Lambert G, *et al*. HDL-transferred microRNA-223 regulates ICAM-1 expression in endothelial cells. Nature Commun 2014; 5:3292.

51. Vickers KC, Landstreet SR, Levin MG, Shoucri BM, Toth CL, Taylor RC, *et al*. MicroRNA-223 coordinates cholesterol homeostasis. Proc Natl Acad Sci USA 2014; 111:14518-14523.
52. Wagner J, Riwanto M, Besler C, Knau A, Fichtlscherer S, Roxe T, *et al*. Characterization of levels and cellular transfer of circulating lipoprotein-bound microRNAs. Arterioscler Thromb Vasc Biol 2013; 33:1392-1400.
53. Desgagné V, Guay SP, Guérin R, Corbin F, Patrick C, Lamarche B, *et al*. Consumption of dietary trans fat affects the HDLs' microRNA profile in healthy men. Epigenomics and Common Diseases Conference. University Arms Hotel, Cambridge, UK, 2014.
54. Desgagné V, Guay SP, Guérin R, Corbin F, Lamarche B, Bouchard L. Variations in HDL miR-223 levels after consumption of dietary trans fat are associated with changes in blood lipid and inflammatory markers in healthy men. Keystone Symposia: Epigenetic Programming and Inheritance (D2). Boston, MA, 2013.
55. Fernandez-Hernando C, Suarez Y, Rayner KJ, Moore KJ. MicroRNAs in lipid metabolism. Curr Opin Lipidol 2011; 22:86-92.
56. Liu X, Suo R, Xiong SL, Zhang QH, Yi GH. HDL drug carriers for targeted therapy. Clin Chim Acta 2013; 415:94-100.

News from Member Departments

Dalhousie University

Department of Biochemistry & Molecular Biology
Correspondent: Stephen L. Bearne

The 2015-16 academic year started off with the CSMB 58th Annual Conference in Halifax (June 14–17, 2015), which was co-chaired by **Jan Rainey** and **Barbara Karten**. Other organizing committee members included **Roger McLeod**, **Neale Ridgway**, **Aarnoud van der Spoel**, **Petra Kienesberger**, and **Thomas Pulinikunnil**.

We are pleased to note that **David Langelaan** will be joining the Department in July 2016 as an Assistant Professor. David will use his expertise in structural biology, biophysical methods, and cell-based functional and genetic assays to study proteins involved in cell development and function, disease states, and biotechnological applications. **John Archibald** was awarded a University Research Professorship in recognition of his world-renowned research on molecular evolution, eukaryotic diversity, and comparative genomics, as well as his outreach activities. He has utilized the photosynthetic cryptophyte and chlorachinophyte algae as model systems for furthering our basic understanding of eukaryotic genome evolution. For the 2016-2017 academic year, **Roger McLeod** will be Acting Associate Dean of Research within the Faculty of Medicine.

John Archibald

During the past year, the Department has continued to celebrate the success of our students, postdoctoral fellows, and research associates. **Laura Eme**, a postdoctoral fellow in **Andrew Roger's** laboratory, received the 2015 *Schnare-Spencer Prize*, which was established by **Mike Gray** in honour of two long-time research associates in his lab. **Sarah Aboushawareb**, a graduate student with **Stephen Bearne**, received the 2015 *Doug Hogue Award* for persistence and dedication to research and **Courtney Stairs**, a graduate student from **Andrew Roger's** lab, received the departmental *Patrick Prize* for outstanding research by a recent Ph.D. graduate.

2015 Schnare-Spencer Prize; Dr. Michael Gray (left) and award recipient Laura Eme (right)

Saki Sultana, a graduate student with **Aarnoud van der Spoel**, received the Beth Gourley Conference Award established by **Catherine Lazier** and her husband John Lazier.

2015 Patrick Prize; from left to right, Dr. Stephen Bearne, award recipient Courtney Stairs, and Dr. Andrew Roger

2015 Beth Gourley Conference Award; Dr. Catherine Lazier (left) and award recipient Saki Sultana (right)

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.

Hospital for Sick Children Research Institute, Toronto

Correspondents: Julie Brill and Charles Deber

New Chief of Research:

Michael Salter

Dr. Michael Salter has been named Chief of Research at The Hospital for Sick Children Research Institute. Dr. Salter is a Senior Scientist in the Program in Neurosciences & Mental Health, and a Professor of Physiology at the University of Toronto. Dr. Salter received an M.D. degree from the University of Western Ontario in 1982 and went on to obtain a Ph.D. in Physiology from McGill in 1987. After post-doctoral training at Toronto Western and at Mount. Sinai hospitals, he joined the Research Institute of SickKids in 1990. From 1999 to 2009, Dr. Salter was the founding Director of the University of Toronto Centre for the Study of Pain. His main research focus is on synaptic physiology, in particular in relation to pain, and he has done groundbreaking work that has led to new paradigms about neuroplasticity and about how synaptic transmission in the central nervous system is regulated by biochemical processes within neurons and by glial-neuronal interactions. His work has regularly appeared in elite journals including *Nature*, *Science*, and *Cell*. He has received numerous awards including the John Charles Polyani Prize in Physiology or Medicine, and the Distinguished Career Investigator Award of the Canadian Pain Society. Dr. Salter is a Fellow of the Royal Society of Canada.

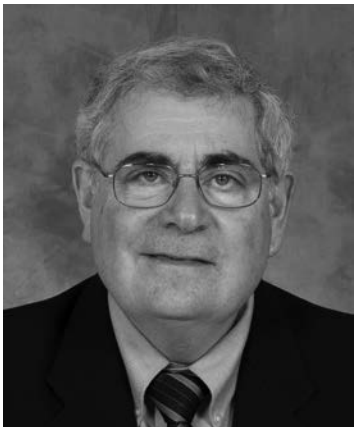
Molecular Structure & Function Program

Awards:

Dr. Khosrow Adeli, Senior Associate Scientist in Molecular Structure & Function, and Division Head of Clinical Biochemistry at SickKids, has been leading a national initiative to establish a comprehensive database of healthy pediatric reference values for biochemical markers of pediatric disease. The CALIPER project (Canadian Laboratory Initiative in Pediatric Reference Intervals) has recruited over 8000 healthy children and adolescents and established a comprehensive database for over 100 biochemical markers to improve diagnosis and monitoring disease in pediatrics (www.caliperdatabase.ca). In 2015, Dr. Adeli was awarded three national and international awards in recognition of these major accomplishments including: the 2015 *Canadian Society of Clinical Chemists (CSCC) Award for Innovation in Laboratory Medicine* (awarded at the CSCC annual meeting in Montreal); the 2015 *Ontario Society of Clinical Chemists (OSCC) Lifetime Achievement Award* (awarded at the OSCC annual meeting in Hamilton; and the 2015 *American Association for Clinical Chemistry (AACC) Award for Outstanding Contributions to Pediatric-Maternal-Fetal Division* (awarded at the AACC annual meeting in Atlanta).

Khosrow Adeli

Dr. Charles Deber, a Senior Scientist in the Program in Molecular Structure & Function, and a Professor in the Department of Biochemistry at the University of Toronto, has been selected to present the "2016 Murray Goodman Lecture" at the University of California, San Diego, in La Jolla, CA. The endowed lectureship, which is awarded annually to a leader in the field of peptide and protein biochemistry, was created in 2005 in the memory of Dr. Murray Goodman, who was a renowned scientist in this field at UCSD. Previous winners have included protein biochemists Harold Scheraga, William DeGrado, and Lila Gierasch. Dr. Deber's lecture deals with his research on the hierarchy of forces that characterize the interactions of peptides and proteins with membranes, and how these forces produce membrane protein structure and function. Dr. Deber is a fellow of the Royal Society of Canada.



Charles Deber

Christine Bear

Dr. Christine Bear, Senior Scientist in Molecular Structure and Function at the SickKids Research Institute and Professor in the Department of Biochemistry at the University of Toronto, in collaboration with Dr. Felix Ratjen and Dr. Janet Rossant at SickKids, has obtained a 7.5 million dollar award, "The SickKids-CF Canada Program for Individualized Cystic Fibrosis Therapy", from Cystic Fibrosis Canada and the SickKids Foundation over a 5-year time frame. Through this partnership, the program will fund the efforts of several PIs, and provide synergy grants and training programs for the CF research community. The team will be creating a "first of class" biobank containing primary and pluripotent stem cell lines from 100 CF patients, linked to whole genome sequencing, gene expression, and clinical data. The overall goal is to provide the international community with predictive tools enabling personalized medicine.

New Canada Research Chair:

Dr. Julie Forman-Kay (Senior Scientist, The Hospital for Sick Children; Professor, Department of Biochemistry, University of Toronto) was awarded a Tier I Canada Research Chair in Intrinsically Disordered Proteins. Dr. Forman-Kay is currently Program Head in Molecular Structure and Function (MSF) at the SickKids Research Institute. Dr. Forman-Kay is a leading expert in the structural and functional analysis of molecular pathways, particularly by NMR spectroscopy, with internationally-recognized contributions to our understanding of intrinsically-disordered proteins.

Julie Forman-Kay

Cell Biology Program

Awards and Honours:

James Rutka

Dr. James T. Rutka (Senior Scientist and Co-Director of the Arthur and Sonia Labatt Brain Tumour Research Centre, The Hospital for Sick Children; Professor and Chair, Division of Surgery, University of Toronto) was named Officer of the Order of Canada. He was also co-recipient of the Robert L. Noble Prize, Canadian Cancer Society, and received the Margolese National Brain Disorders Prize from The University of British Columbia. Dr. Rutka's research investigates the molecular mechanisms of brain tumour formation and migration, with a particular focus on astrocytomas, medulloblastomas and malignant gliomas.

Lisa Robinson

Dr. Lisa Robinson (Senior Scientist, The Hospital for Sick Children; Professor, Department of Pediatrics and Chief Diversity Officer, Faculty of Medicine, University of Toronto) was elected President of the Canadian Association of Paediatric Nephrologists. She also received the 2015 President's Award, Winner in the Empowering People, Commitment to Compassion and Innovating to Drive Impact categories, from The Hospital for Sick Children. Her research employs genetic and pharmacologic approaches to address mechanisms controlling leukocyte migration into sites of inflammation at both the cellular and whole organism levels.

Nicola Jones

Dr. Nicola Jones (Senior Scientist, The Hospital for Sick Children; Professor, Departments of Paediatrics and Physiology at University of Toronto) is President-Elect of the Canadian Association of Gastroenterology. Dr. Jones is also Principal Investigator of the Canadian Child Health Clinician Scientist Program. Her research centres on cellular and molecular mechanisms by which infection and inflammation contribute to gastroenteric diseases such as *Helicobacter pylori* infection, inflammatory bowel disease, and inflammation-mediated cancers.

Amira Klip

Dr. Amira Klip (Senior Scientist, The Hospital for Sick Children; Professor, Departments of Biochemistry, Paediatrics and Physiology, University of Toronto) received the Walter B. Cannon Memorial Award from the American Physiological Society. In addition, she received an honorary doctorate from the University of Copenhagen at a ceremony attended by the Queen of Denmark. Dr. Klip is a Canada Research Chair, CIHR Distinguished Scientist, and Fellow of the Royal Society of Canada. Her research explores mechanisms of insulin action and resistance, glucose transport, intracellular trafficking, signal transduction, diabetes and inflammation.

Julie Brill

Dr. Julie Brill (Senior Scientist, The Hospital for Sick Children; Professor, Department of Molecular Genetics, and Director, Collaborative Program in Developmental Biology, University of Toronto) was elected a 2015 Fellow of American Association for the Advancement of Science (AAAS). Dr. Brill's lab studies *in vivo* roles and regulation of phosphoinositide signaling in cell morphogenesis. Her research addresses fundamental cellular mechanisms involved in cytokinesis, gametogenesis, organelle biogenesis, cytoskeletal organization, and membrane trafficking during animal development.

Annie Huang

Dr. Annie Huang (Senior Scientist, The Hospital for Sick Children; Associate Professor, Departments of Paediatrics, Lab Medicine and Pathobiology, University of Toronto) received the Traynor Lectureship and Award from the Pediatric Brain Tumor Foundation. She also received the Mid-Career Physician Research Award from The Hospital for Sick Children. Dr. Huang is a neuro-oncologist whose research focusses on understanding the pathogenesis of malignant embryonal brain tumours.

Aleixo Muise

Dr. Aleixo Muise (Senior Scientist and Co-Director, Inflammatory Bowel Disease Centre, The Hospital for Sick Children; Associate Professor, Institute of Medical Science and Department of Biochemistry, University of Toronto) received the American Gastroenterological Association - Gastronenterology Research Group (AGA-GRG) Young Investigator Award in Basic Science. His research aims to understand the pathogenesis of severe intestinal disease in young children.

Developmental and Stem Cell Biology Program

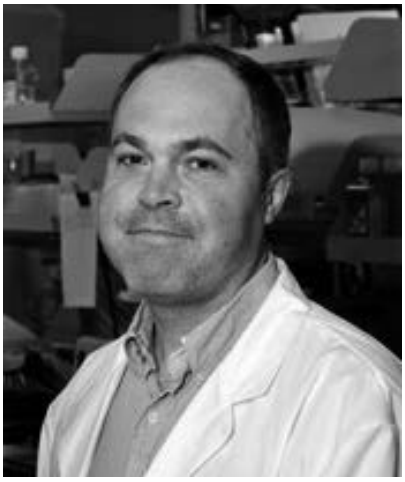
Awards:

Janet Rossant

Dr. Janet Rossant (Senior Scientist, and Chief of Research Emeritus, The Hospital for Sick Children; University Professor, Departments of Molecular Genetics and Obstetrics and Gynaecology, University of Toronto) has been appointed Companion of the Order of Canada, the highest level of the Order, which recognizes national pre-eminence or international service or achievement. Dr. Rossant is being honoured for advancing the global understanding of embryo development and stem cell biology, and for her leadership in health science. She was also awarded the 2015 Canada Gairdner Wightman Award for her outstanding scientific contributions to developmental biology, and for her exceptional international leadership in stem cell biology and policy-making.

Sean Egan

Dr. Sean Egan (Senior Scientist, The Hospital for Sick Children; Professor, Department of Molecular Genetics, University of Toronto) has been awarded the 2015 Breast Cancer Research Program Breakthrough Award from the U.S. Department of Defense through its Congressionally Directed Medical Research Programs. Dr. Egan's research employs animal models to study development of the mammary gland and lung, as well as transformation and metastasis in these tissues.



Michael Taylor

Dr. Michael Taylor (Senior Scientist, The Hospital for Sick Children; Associate Professor, Departments of Surgery and Lab Medicine and Pathobiology, University of Toronto) is the recipient of the 2015 Canadian Cancer Society William E. Rawls Prize. The Rawls Prize is given to a researcher whose is judged to have made outstanding contributions to research that advance cancer control. Dr. Taylor's research focusses on identification and characterization of mutations that lead to formation of paediatric medulloblastomas and ependymomas.

Genetics and Genome Biology Program

Awards:

Steve Scherer

Dr. Steve Scherer (Senior Scientist and Director, The Centre for Applied Genomics, The Hospital for Sick Children; Professor, Department of Molecular Genetics, and Director, McLaughlin Centre, University of Toronto) was named a Thomson Reuter 2015 Highly Cited Researcher, 2015 World's Most Influential Scientific Minds. He also received the Autism Ontario Gerry Bloomfield Professional Award for outstanding contributions to the field of Autism Spectrum Disorders, and the South Asian Autism Awareness Radiant Night, Excellence in Research Award. Dr. Scherer's pioneering research contributions include discovery of copy number variation as a highly abundant form of human genetic variation.

Uri Tabori

Dr. Uri Tabori (Senior Scientist, The Hospital for Sick Children; Associate Professor, Departments of Paediatrics and Institute of Medical Science, University of Toronto) received the Bernard and Francine Dorval Prize of the Canadian Cancer Society. His work explores the mechanisms that control tumour progression and resistance to therapy, with a particular focus on brain tumour immortality and recurrence, including studies on the roles of telomere maintenance, p53 mutations, and replicative senescence in the predisposition to cancer.

Berge Minassian

Dr. Berge Minassian (Senior Scientist, The Hospital for Sick Children; Professor, Department of Paediatrics, and Michael Bahen Chair, Epilepsy Research, University of Toronto) received the Muscular Dystrophy Canada "George Karpati" Award. Dr. Minassian's lab studies the pathogenesis of Lafora Disease, as well as Rett and Angelman and other syndromes related to childhood neurological diseases and epilepsy.

Elise Heon

Dr. Elise Heon (Senior Associate Scientist and Mira Godard Chair in Vision Research, The Hospital for Sick Children; Professor, Department of Ophthalmology and Vision Science, University of Toronto) was awarded the Franceschetti Medal by the International Society of Genetic Eye Disease and Retinoblastoma (ISGEDR). Dr. Heon's research focusses on the genetics involved in inherited eye disorders, including glaucoma, cataracts, and retinal dystrophies.

New faculty members:

Eric Campos

Dr. Eric Campos (Scientist, The Hospital for Sick Children: Assistant Professor, Department of Molecular Genetics, University of Toronto) received his Ph.D. from the University of British Columbia and was a Post-doctoral Fellow with Dr. Danny Reinberg, HHMI, at New York University School of Medicine. His laboratory studies mechanisms of chromatin biology, epigenetic inheritance and spatiotemporal regulation of histones in cell division and human disease.

Neal Sondheimer

Dr. Neal Sondheimer (Associate Scientist, The Hospital for Sick Children: Assistant Professor, Department of Paediatrics, University of Toronto) did his M.D./Ph.D. with Dr. Susan Lindquist at the Whitehead Institute, MIT; and his clinical training in Paediatrics, Genetics and Clinical Biochemistry at Children's Hospital of Philadelphia. His research focusses on the regulation of mitochondrial gene expression and the role of mitochondrial mutations in human disease.

McMaster University

Department of Biochemistry and Biomedical Sciences

Correspondent: Alba Guarné

New undergraduate program:

We will forever associate 2015 with the launch of our newly minted Biomedical Discovery and Commercialization program. The program unites our passion for discovery research and the desire to understand its role in commerce (http://www.chch.com/biomedical-business/). Early adopters started in January 2015 and our first full level III cohort began in September 2015. To commemorate its official start, an inaugural symposium was held on 25 November 2015, with Paul Petrelli (Biogen Inc.) as the keynote speaker and Chris Delvecchio (Shift Health Consulting), Patricia Hrynyk (AstraZeneca) and Geordie Stewart (Innovation Factory) as career speakers. With the two cohorts raving about their experience, the program is rapidly gaining momentum.

Early adopters of the BDC program pictured with Nancy McKenzie (Program Manager); Eric Brown (Program Director); and Felicia Vulcu (Assistant Professor) on the front row.

Research news:

On the research front, the Department continued to be a flurry of activity. The teams led by **Mick Bhatia** and **Karun Singh** discovered a new method to transform peripheral blood cells to neural progenitors (Cell Reports); **Greg Steinberg**'s laboratory found a link between high levels of circulating serotonin and obesity (Nature Medicine); the teams of **Yingfu Li** and collaborator **Bruno Salena** developed a rapid litmus paper test capable of identifying the presence of pathogenic bacteria in stool samples (Angew. Chem.); **Jonathan Schertzer**'s group showed that faulty sensing of bacterial cell wall fragments contributes

to inflammation and insulin resistance in obesity (EMBO Mol. Med.); **Alba Guarné** and her team published back-to-back papers describing the replication-dependent target selection mechanism of Tn7 and the weak interaction between the replication sliding clamp and a repair factor (Nucleic Acids Research); **Mike Surette**'s group showed that fecal transplants may also benefit ulcerative colitis patients (Gastroenterology).

Research funding:
Our researchers also continued to be successful at capturing research funding. As part of the government's response to the threat of antimicrobial resistance, a multidisciplinary team led by **Nathan Magarvey** received a $1.5 million grant from the Ministry of Health. **Eric Brown** received a CIHR Foundation Grant that will support his program on survival strategies of bacteria, while **John Hassell**, **Matthew Miller** and **Dino Trigatti** were awarded CIHR open transition operating grants. **Cecile Fradin**, **Yingfu Li, Karen Mossman, Allison Holloway** and **Marie Elliot** renewed their NSERC Discovery grants. **Marie Elliot** also received an NSERC Accelerator Award. **John Schertzer** was awarded an Early Researcher Award from the Ministry of Research and Innovation of Ontario.

Faculty awards:
The calibre of our Faculty members was recognized through prestigious international awards: **Deborah Sloboda** received the Nick Hales Award from the Developmental Origins of Health and Disease Society, joint member **Greg Steinberg** and associate member **Marie Elliot** received McMaster University Scholar Prizes recognizing mid-career faculty members who have distinguished themselves as international scholars, and **Matthew Miller** received the Bhagirath Singh Early Career Award in Infection and Immunity. Matthew has also become an active spokesperson for the importance of flu vaccination and the development of a universal flu vaccine.


Lesley MacNeil

Faculty recruitment:
Our ongoing recruiting efforts in the area of systems biology have brought **Dr. Lesley MacNeil** back to McMaster University. Lesley started her research career at McMaster where she completed her M.Sc. with **John Hassell**. She then moved to University of Toronto where she obtained her Ph.D. from the Department of Molecular Genetics and continued her training at the University of Massachusetts. Lesley's research uses the model organism *C. elegans* and systems biology approaches to understand how diet metabolism and signal transduction pathways regulate development and induction of disease. Welcome Lesley!

Graduate student news:
Our graduate program remained a flagship program at McMaster University and our graduate students continued to prove that they are at the driver's seat of the science engine. In 2015, we welcomed 22 new trainees, adding to the 300% increase in our Ph.D. program over the last 10 years. Competitive external and internal scholarships and prizes supported 46% of our students. **David Bakhshinyan** (Sheila Singh lab) was awarded the Thomas Neilson Scholarship presented annually to the student with most potential at the time of the transfer exam. **Robert Gale** (Brown lab), **Brian Tuinema** (Coombes lab) and **Stephen Boulton** (Melacini lab) received the departmental publication impact awards for their work developing new tools to probe cell wall biosynthesis (Gale), to map allosteric networks using NMR chemical shift covariance analysis (Boulton), and describing how Salmonella survives in neutrophils to promote infection (Tuinema). **Robert Gale** (Brown lab) and **Brandyn Henriksbo** (Schertzer lab) received the Karl Freeman Award for the best Ph.D. presentations in our graduate seminar series, and **Margarita Rashev** (Guarné lab) and


2015 Karl Freeman Awardees: from left to right, Robert Gale (Ph.D. 1st place); Dr. Karl Freeman (Professor Emeritus); Margarita Rashev (M.Sc. 1st place) and Brandyn Henriksbo (Ph.D. 2nd place)

2015 Michael Kamin Hart Memorial Scholarships: Andrew King (far left) and Netusha Thevaranjan (third from right) pictured with their supervisors, Gerry Wright (far right) and Dawn Bowdish (second from right), as well as, Justin Nodwell (former IIDR member and Michael Hart M.Sc. supervisor) and Michael's family

Rachel Gysbers (Li lab) received it in the M.Sc. category. **Kali Iyer** (undergraduate) **Netusha Thevaranjan** (M.Sc. student in the Bowdish lab) and **Andrew King** (Ph.D. student in the Wright lab) received the 2015 Michael Kamin Hart Memorial Scholarships, which are awarded to trainees who demonstrate academic excellence, leadership and the same enthusiasm for science that Michael had. These scholarships were presented at the IIDR trainee day and Michael's family was in attendance to congratulate the awardees.

In an effort to expose trainees to all aspects of research, we launched The Catalyst, a departmental journal designed to showcase ongoing undergraduate research. **Felicia Vulcu** spearheaded the project with graduate students participating as editors and reviewers.

Members of the Li lab, dressed as a roller coaster, posing for the Halloween costume contest judges

As in previous years, the Biochemistry and Biomedical Sciences Graduate Association (BBSGA) helped us maintain a balanced - yet competitive - life style. We had a well-attended Biochemistry Picnic in June where we held once again the Biochemistry Olympics (this year under pouring rain!) and the welcome barbecue in September where we welcomed both Biochemistry and BDC students into the Department. At the Halloween celebrations, the **Surette**, **Brown** and **Li** laboratories won the top prizes of the pumpkin-carving contest. The **Li** lab (dressed as a roller coaster) also won the group costume contest followed by the **Miller** (pirates...arrghhhh) and **Wright** (Disney princesses) laboratories. The **Li** laboratory maintained his reign during the Christmas celebrations with a clear win at the Gingerbread House Building Contest.

Members of the Miller lab, dressed as a pirates, posing for the Halloween costume contest judges

Members of the Wright lab, posing as Disney princesses, posing for the Halloween costume contest judges

Princess Margaret Cancer Centre, Toronto

Correspondent: Linda Penn

Research Highlights:

The editors of Nature Medicine publish a list of the most notable achievements in biomedical research. This year, two studies were featured that were published by PMCC researchers **Drs. Daniel De Carvalho** and **Senthil Muthuswamy**. These studies were also featured on the Canadian Cancer Society's list of Top 10 Research Impact Stories of 2015. The latter also included **Dr. John Dick**, another highly regarded PMCC Research Scientist.

Daniel De Carvalho

In a paper published in Cell, PMCC Scientist **Daniel De Carvalho** identified a new anti-cancer mechanism by analyzing how the cancer therapeutic, known as decitabine, is able to target colorectal cancer stem cells. His findings revealed that decitabine causes the cancer cells to behave like they are infected with viruses. As a consequence of this, the cells are targeted and cleared by the immune system.

Senthil Muthuswamy

PMCC Senior Scientist **Senthil Muthuswamy's** study was published in Nature Medicine and detailed a method to create three-dimensional "mini-tumours" called organoids. These organoids, which originate from human pancreatic cancer cells, are being used to test new therapeutics for pancreatic cancer.

John Dick

By using a new cell sorting method, PMCC Senior Scientist **John Dick** was able to provide a revised model for blood production that challenges current views on how blood is produced. The findings, published in Science, will help scientists gain more insight on how different blood disorders develop.

Igor Jurisica

Igor Jurisica (PMCC Senior Scientist) was included on a select list of highly cited researchers (http://highlycited.com/) for 2015. The list, compiled by Thomson Reuters, acknowledges 3,125 researchers from around the world who have published the top 1% most cited papers in their subject field and year of publication. Citations serve as a measure of how foundational and influential a scientist's published research is within their field. This year's list identified 90 Canadians.

Awards and Honours:

Leonardo Salmena

A new Tier 2 Canada Research Chair was announced for **Dr. Leonardo Salmena** in the area of Signal Transduction and Gene Regulation in Cancer.

Benjamin Haibe-Kains

Dr. Benjamin Haibe-Kains received an Early Researcher Award from the Ontario Ministry of Research and Innovation. The program supports promising, recently appointed Ontario researchers by helping them to build their research teams of trainees and technical staff. Dr. Haibe-Kains also received a CIHR New Investigator Award.

Rama Khokha

PMCC Cancer Centre Senior Scientist **Dr. Rama Khokha** was a co-recipient of the Canadian Cancer Society's prestigious Robert L. Noble prize along with University of Toronto researcher Dr. James Rutka. The award recognizes Dr. Khokha's research contributions to our understanding of various aspects of cancer biology, particularly the hormonal regulation of mammary stem cells, and developing a new method for discovery of bone cancer driver genes.

Simon Fraser University

Department of Molecular Biology and Biochemistry

Correspondent: Christopher Beh

On the occasion of Simon Fraser University's 50th anniversary, this year's report details a number of significant changes to our SFU MBB Department. We also continue our outreach to engage our large number of student graduates and postdoc alumni. To our MBB Department alumni, we welcome the opportunity to hear from you about the direction your careers have taken, so please contact us at mbbalumni@sfu.ca.

Department highlights

Last year, **Dr. Lynn Quarmby** resigned her position as Department Chair to focus on her electoral bid to represent Burnaby North-Seymour in Parliament. While the next Chair was being chosen, **Dr. Esther Verheyen** ably took the reins and served as interim Chair. We thank them both for their guidance, hard work, and service to our Department.

Dr. Ryan Morin, Terry Fox New Investigator Award recipient

Congratulations to students and faculty for another year of exemplary achievements, only a few of which can be highlighted here. MBB Department Assistant Professor **Dr. Ryan Morin** and MBB adjunct professor **Dr. Martin Hirst** received *Terry Fox New Investigator Awards*, recognizing their work in the diagnosis and treatment of leukemia and lymphoma. Given that Terry Fox was an SFU student, the awards are particularly cherished. As part of a newly awarded *Genome Canada Large-Scale Applied Research Project*, **Dr. Willie Davidson** co-leads an effort to revive declining populations of wild Coho salmon. In this project, Dr. Davidson will apply his expertise in salmonid genomics to improve how Pacific salmon stocks are managed. SFU will be a partner in Glyconet (Canadian Glycomics Network), which involves several SFU researchers including MBB and Chemistry professor **Dr. David Vocado** (Tier 1 Canada Research Chair), and associate MBB faculty **Drs. Andrew Bennet** and **Margo**

Moore. Together they will collaborate in a large effort to apply glycomics to carbohydrate-related health and translational research.

Student awards and other news

Dr. Irina Kovalyova, MBB lecturer and author of acclaimed novella "Specimen"

Apart from her valued work as an MBB Department lecturer, **Dr. Irina Kovalyova** is also an accomplished sci-fi author. During the past year she published "*Specimen*," in which she applied her scientific background to tell eight highly inventive sci-fi tales. As reviewed by Macleans Magazine, it was described as a "technical marvel." We congratulate **Dr. Vilaiwan Fernandes** on receiving the *Dean of Graduate Studies Convocation Medal* as recognition of her achievements on obtaining her Ph.D. in Dr. Verheyen's lab. Ph.D. student **Kwangjin Park** received a *Vanier Canada Graduate scholarship* for his doctoral research on ciliary function in **Dr. Michel Leroux's** lab. Before coming to SFU, Mr. Park had distinguished himself for meritorious service by the U.S. Army and was awarded an *Army Commendation Medal*. We also congratulate **Devon Kollmyer** who, for the second straight year, was selected to the *Great Northwest Athletic Conference (GNAC) All-Academic Women's Soccer team*. As a top undergraduate in our Department, Ms. Kollmyer showed that academic achievement can be combined with athletic excellence. Another MBB undergraduate athlete, **Cameron Proceviat**, received the *SFU Terry Fox Award for Inspiration* and earned *US Track & Field & Cross Country Coaches Association All-Academic honours* for both his GNAC wins, as middle distance runner, and his academic excellence. True to SFU's motto of "engaging the world," **Dr. Mark Brockman** and his graduate student **Gursev Anmole** helped mentor **Nicole Ticea**, a Vancouver high school student, who won one of the top prizes at the *2015 Intel International Science and Engineering Fair*. Her invention will help provide a portable device for HIV detection. Our Department takes great pride in all the honours awarded to our faculty, staff, and students, and we revel in the prospects for the next 50 years.

Sunnybrook Research Institute

Biological Sciences Platform

Correspondent: David Andrews

Our scientists in the Biological Sciences Platform at Sunnybrook Research Institute (SRI) are striving to understand how biological systems function in healthy and disease states. Among our research areas are tumour biology, protein-protein interactions, immune system development, and neurodegeneration and regeneration.

Dan Dumont

Sunnybrook Research Institute lost one of its pioneering scientists and close friends in 2015. **Dr. Dan Dumont** was a senior scientist at SRI and a professor in medical biophysics at the University of Toronto. He held a Tier 1 Canada Research Chair in Angiogenic and Lymphangiogenic Signalling, an honour stemming from his identification of the Tie2 gene and his contributions toward a better understanding of angiogenesis and cell signalling. His passing was mourned by friends and colleagues at SRI, U of T and abroad, on whom he had an indelible impact.

New appointments:

In 2015, we welcomed **Dr. Robert Screaton** to SRI as a Senior Scientist. His research is focused on understanding the mechanisms underlying beta cell proliferation and mitochondrial maintenance. He is using high-throughput functional screens to identify novel genes and signalling pathways that contribute to both processes. Dr. Screaton is also an Associate Professor in the Department of Biochemistry at the University of Toronto. He was recently awarded a John R. Evans Leaders Fund grant from the Canada Foundation for Innovation, and an operating grant from the Canadian Institutes of Health Research (CIHR).

We were also pleased to welcome **Dr. Helen Mackay**,

who joined SRI as a Scientist. Dr. Mackay is also the head of the Division of Medical Oncology and Haematology at Sunnybrook's Odette Cancer Centre, and an Associate Professor in the Faculty of Medicine at the University of Toronto. Her research activity involves investigating the Hedgehog pathway in cervix cancer as a means of overcoming resistance to chemoradiation, and leading clinical trials, including a Phase II/III trial of intraperitoneal (IP) cisplatin combined with intravenous paclitaxel in patients with epithelial ovarian cancer optimally debulked at their initial surgery performed following neoadjuvant IV chemotherapy.

Other news:

David Andrews

Dr. David Andrews, Director of Biological Sciences at SRI, was awarded a Tier 1 Canada Research Chair in Membrane Biogenesis. His research uses high-content screening to study protein-protein interactions, membrane protein assembly and apoptosis. Dr. Andrews also received a Foundation Scheme live pilot grant from CIHR to study the assembly of apoptotic and protein complexes on subcellular membranes.

Dr. James Carlyle was awarded a CIHR operating grant to study the molecular mechanisms of natural killer and innate lymphoid cell development and function. **Dr. Juan Carlos Zúñiga-Pflücker** received a Discovery grant from the Natural Science and Engineering Research Council of Canada (NSERC) to further his work on T cell development. **Dr. Stanley Liu** received an Early Researcher Award from the Ontario Ministry of Research and Innovation to study the role of microRNAs as mediators of aggression and therapy resistance in prostate cancer.

Jonathan Rast

In June 2015, **Dr. Jonathan Rast** and his postdoctoral fellow **Dr. Katherine Buckley** organized the sixth annual North American Comparative Immunology Workshop held at the University of Toronto. The workshop started six years ago as the brainchild of Dr. Rast and University of Waterloo professor Dr. Brian Dixon, and has grown to over 70 attendees this year.

Trent University

Department of Biology

Correspondent: Carolyn Kapron

Sarah West

The Biology Department welcomed a new member, **Dr. Sarah West**, who is jointly appointed to Biology and the Trent Fleming School of Nursing. Dr. West comes to us from SickKids Hospital, where she completed her post-doctoral fellowship in Physiology and Experimental Medicine. She is currently an Adjunct Scientist at SickKids Hospital. Dr. West will provide support to the new Kinesiology degree pathway at Trent. Her research program will focus on examining exercise and bone health in various populations, including in those with chronic disease, specifically: 1) characterizing bone health and its association with exercise in those with chronic disease; 2) evaluating the effectiveness of exercise interventions on multiple outcomes (bone quantity, bone microarchitecture, fracture risk, muscle function, physical function, metabolic health, and quality of life) in adults/children with chronic disease or in special populations; and 3) examining bone and muscle health throughout the lifespan, and developing preventative and lifestyle

Ingrid Brenner

management exercise based interventions for aging adults with and without chronic disease.

The Bachelor of Health Science in Kinesiology is now under way. This degree program, offered in collaboration with the University of Ontario Institute of Technology (UOIT), allows students to complete their first two years of study on Trent's Peterborough campus, after which they complete their courses at UOIT in Oshawa. Jointly administered by Biology and the Trent Fleming School of Nursing, the program is coordinated by **Dr. Ingrid Brenner**, who is cross-appointed to the two units. Dr. Brenner's research examines the impact of exercise (acute and chronic) and environmental stress on immune function and molecular physiology. She is also interested in examining the role of exercise in health promotion in cardiovascular disease (peripheral artery disease and stroke).

This year, the Department also received approval for a new Bachelor of Biomedical Science degree. This program, which will start accepting students for the Fall of 2016, prepares students for future careers or studies in health-related fields. While providing foundation courses and allowing students to explore a variety of areas related to human health, the program also gives students hands-on experience in a capstone Internship course in a health-related setting. The new degree grew out of the Specialization in Health Sciences that has been offered to Biology majors since the 2000-2001 academic year.

Université de Montréal

Department of Biochemistry and Molecular Medicine

Correspondent: Luc DesGroseillers

Since June 2015, **Luc DesGroseillers** was appointed as the new director of the Department of Biochemistry and Molecular Medicine. The former director **Christian Baron** has been appointed as the new Vice-Dean Research and Development.

26 members of the Department, including four professors, participated in the **Movember** fundraising effort as team "Biochimistes à la moustache" and raised $3,495 for research on male health issues. This was our third participation in this initiative. Fundraising has also been a focus of other departmental activities aimed at providing support for new recruits and for other priorities.

The Department of Biochemistry and Molecular Medicine will participate in the "Pint of Science" Festival from May 23 to 25. The Pint of Science festival aims to deliver interesting, fun, relevant talks on the latest science research in an accessible format to the public – all in a local pub!

Appointments and promotions:

John Pascal

In 2015, we were delighted to welcome new recruits. **John Pascal**, a structural biologist interested in DNA repair processes, was recruited from Thomas Jefferson University in Philadelphia. He joined the Department as Associate Professor in September 2015. The Department also recruited as assistant professors two young researchers in the field of bio-informatics in September 2015. **Adrian Serohijos**, a computational and theoretical biologist, did post-doctoral training at Harvard University in Eugene Shakhnovich's group. In particular, he will synthesize molecular biophysics and evolutionary biology to address

Adrian Serohijos

the problem of antibiotic resistance and develop novel methodologies in molecular phylogenetics. **Sebastian Pechmann** is developing an outstanding and innovative research program to decipher how cells keep their proteins in shape. By taking a highly interdisciplinary approach of developing and applying computational, evolutionary and experimental approaches, this research program may enable novel therapeutic interventions for diseases linked to protein misfolding. The Department was equally involved in the recruitment of **Elitza Tocheva** as an Assistant Professor in the Faculty of Dentistry in September 2015. Dr. Tocheva had a stunning success as postdoctoral researcher, pioneering novel approaches for structural analyses of bacteria by cryo-tomography in Grant Jensen's laboratory at Caltech. She greatly strengthens the field of molecular imaging at our institution. **Michel Bouvier** was appointed as Chief executive officer at the Institut de Recherche en Immunologie et Cancer (IRIC), a research institute on the Université de Montréal main campus. He was also appointed Deputy Vice-rector Research, Creation and Innovation. In his new role, he will further advance the development of research and innovation at the Université de Montréal. **Vincent Archambault, Eric Lecuyer** and **Daniel Zenklusen** were promoted to Associate Professor status. Unfortunately, **Muriel Aubry** retired after 22 years as professor in the Department. She also acted as director of the department (2006-2008).

Sebastian Pechmann

Elitza Tocheva

Research highlights:

The research of **John Pascal** made the cover of Molecular Cell in December 2015. Two articles from Dr. Pascal and his team were published in this volume: "Structural basis of detection and signaling of DNA single-strand breaks by human PARP-1" and "PARP-1 activation requires local unfolding of an autoinhibitory domain".

The Journal of Biological Chemistry highlighted the importance of the work of Salima Daou, Ph.D. student in the Biochemistry and Molecular Medicine programs. Her Ph.D. studies focused on characterizing the role and mechanism of action of the deubiquitinase and tumor suppressor BAP1 in the control of cell proliferation.

Awards and Distinctions:

Michel Bouvier has renewed his Tier 1 Canada Research Chair in Signal Transduction and Molecular Pharmacology for his studies on G protein-coupled receptors (GPCRs), a family of proteins that play key roles in controlling diverse biological processes. **Elitza Tocheva** received a Tier 2 Canada Research Chair in Microbial Ultrastructure. She explores the internal structural organization of bacteria in relation to their fundamental cellular processes.

Université Laval

Department of Molecular Biology, Medical Biochemistry and Pathology

Correspondent: Jean-Yves Masson (Director)

Our department, which celebrated its 70th anniversary last year, comprises 40 professors working on medical biochemistry and pathology, mostly on basic research and molecular and cellular biology. **Josée N. Lavoie** was named Professor Emeritus 2016 of our department. This was the result of many years of involvement as the Director of our Molecular and Cellular Biology program at Laval. **Darren Richard** was named Director of the Biomedical Sciences Baccalaureate. Darren is also very appreciated by the students and he will do outstanding work.

Amélie Fradet-Turcotte

Our department welcomed **Amélie Fradet-Turcotte** as an Assistant Professor in September 2015. She obtained a B.Sc. degree in Biochemistry from University of Sherbrooke, and carried out her Ph.D. in Biochemistry at the University of Montréal under the supervision of Dr. Jacques Archambault at the Institut de Recherches Clinique de Montréal (IRCM). Amélie completed her post-doctoral training at the Lunenfeld-Tanenbaum Research Institute in Toronto, in the laboratory of Dr. Daniel Durocher. Amélie is working on virology and the DNA damage response. The main interest of her laboratory is to understand how these pathways are challenged during viral infections. They use a combination of molecular biology, biochemistry and cellular biology to determine how the infection impacts the genomic integrity of the infected cell, and to tackle the mechanisms used by the human papillomavirus (HPV) to usurp the DNA damage machinery in order to promote the viral life cycle.

Nicolas Bisson was awarded a Canada Research Chair in Cancer Proteomics, and **Jean-Yves Masson** was the recipient of a FRQS Research Chair in Genome Stability.

It should be noted that the well-known pathologist **Bernard Têtu** retired in 2015.

University of Alberta

Department of Biochemistry

Correspondent: Joe Casey

The NSERC CREATE International Research Training Group in Membrane Biology, based in the Department of Biochemistry, continues to play an important role in the department. Principal investigators and their trainees participated in the annual joint meeting with their German counterparts in the program, at Bad Dürkheim Germany in September. The meeting was coincident with the world's largest wine festival, leading to interesting evening discussions (see photo).

In 2015, graduate students **Jonathan Githaka** (**Nicolas Touret** lab), **Sampath Loganathan** (**Joe Casey** lab), **Katie Badior** (**Joe Casey** Lab), **Aruna Augustine** (**Larry Fliegel** Lab), and **Sally Wu** (**Joel Weiner** Lab) each visited German partner labs for about three months to carry out collaborative research projects.

Drs Emmanuelle Cordat (Physiology), Larry Fliegel, Todd Alexander (Pediatrics/Physiology) and Joe Casey (Biochemistry) hoist 500 ml glasses of wine at the Bad Dürkheim, Germany wine festival during the IRTG in Membrane Biology Joint meeting in September 2015

Appointments:

Michael Overduin joined the department as Campus Alberta Innovates Program (CAIP) Chair of Protein Mis-folding Diseases. Michael completed his B.Sc. and Ph.D. at Wilfred Laurier University and Rockefeller University, respectively. He held faculty positions at University of Colorado, Denver and University of Birmingham, where he led the Henry Wellcome Building for Biomolecular Nuclear Magnetic Resonance Spectroscopy. Michael is now Executive Director of the National High Field Nuclear Magnetic Resonance Centre at the University of Alberta.

Grand opening of the laboratory of Michael Overduin (left) with Vice President Research, Lorne Babiuk (centre)

Marita Hobman joined the department as Assistant Chair, Administration in July. She did her Ph.D. in Virology at the University of Goteborg, and post-doctoral research at the University of British Columbia, University of California San Diego and the University of Alberta. She has an M.B.A. from the University of Alberta and spent ten years managing intellectual property and business development at a biomedical company in the cancer field. She joined the Department from the University of Alberta Research Services Office managed Partnered Projects.

Marek Michalak was seconded part-time to a position as Alberta Innovates Health Solutions (AIHS) Provincial Lead - Discovery Research & Innovation. In this role Marek is working to find ways in which AIHS (which replaced the Alberta Heritage Foundation for Medical Research) can best assist basic scientists.

Ph.D. graduates:
It was a terrific year for the department's graduate program, with eight Ph.D. graduates: **Xia Gao** (**Dennis Vance**), **Curtis Hodge** (**Mark Glover**), Sampath Loganathan (Joe Casey), Sandra Pineda Sanabria (Brian Sykes), **Daniel Prins** (**Marek Michalak**), and **Ganesh Venkatraman** (**David Brindley)**. **Yanfei Zhang** and **Justin Fedor** graduated as **Joel Weiner**'s last graduate students. In addition M.D./Ph.D. student **Matt Benesch** (**David Brindley**) received his Ph.D.

Awards:
Two biochemistry Ph.D. students were awarded Vanier Canada Scholarships, **Darpan Malhotra** (**Joe Casey** lab) and **Ayat Omar** (**Andrew Macmillan** lab).

Vanier Award Winner, Darpan Malhotra

Vanier Award Winner, Ayat Omar

University of Alberta

Department of Physiology
Correspondent: Emmanuelle Cordat

Robin Clugston

Lots happening in the Department of Physiology at the University of Alberta! On March 1, 2016, our department will welcome **Dr. Robin Derek Clugston** as a new Assistant Professor.

Dr. Clugston first became interested in pursuing a career in academic research during his undergraduate degree in human anatomy and embryology at the University of Glasgow in Scotland. Following completion of his undergraduate degree, Dr. Clugston joined the University of Alberta to pursue a Ph.D. in neuroscience, under the supervision of Dr. John Greer. While this basic research project was focused on the neuromuscular development of the mammalian diaphragm, the research also addressed the pathogenesis and etiology of the birth defect congenital diaphragmatic hernia, giving it a clinical perspective. This project greatly contributed to

the body of knowledge concerning the embryogenesis of congenital diaphragmatic hernia, and one of the themes of this research was the importance of vitamin A signalling in the development of the diaphragm. It was this aspect of his research that ignited an intense interest in vitamin A homeostasis, and led Dr. Clugston to undertake postdoctoral training with Dr. William S. Blaner, an internationally recognized leader in the field of vitamin A and lipid biology, at Columbia University in New York City. Dr. Clugston's postdoctoral research focused on the effect that chronic alcohol consumption has on how the liver utilizes vitamin A, and the significance of this interaction in the initiation and progression of alcoholic liver disease. This research was deemed significant enough to merit Dr. Clugston being awarded a prestigious Pathway to Independence (K99/R00) career development award from the National Institutes of Health in 2014.

Dr. Clugston will establish a laboratory at the University of Alberta dedicated to better understanding the physiological role of vitamin A in human health and disease. This research will include continuing efforts to determine the role of abnormal vitamin A utilization in the pathogenesis of alcoholic and non-alcoholic diseases of the liver, as well as other important aspects of vitamin A biology. In addition to establishing a successful research program, Dr. Clugston hopes to pay back to the community by contributing to the same excellent training environment that he benefited from earlier in his career.

On September 14, 2015, our Department lost one of our long-time Physiology professors, **Dr. Edward Karpinski**. Dr. Karpinski joined the Department as a demonstrator in Physiology in 1965, and was appointed to full professor of Physiology in 2004. After his "retirement" in 2007 as a Professor Emeritus, he continued to teach, administer teaching programs and conduct research until his sudden death in September last year. "Dr. K.", as he was known in our Department, published more than 90 research papers in his research career and was a fabulous mentor, "always very concerned about the well-being of students", said his colleague and friend Dr. Loren Kline. His legacy can be remembered here http://www.med.ualberta.ca/news/2015/september/mr-physiology-legacy-remembered

University of British Columbia

Department of Biochemistry and Molecular Biology
Correspondent: Roger Brownsey

All change at the top at UBC

Change has come at all levels of UBC in the past year and not without effects on the Department. I will not dwell on the challenges that UBC has faced with the precipitous departure of President Arvind Gupta, less than a year into his term. That issue has been much discussed in the press and private circles and the ripple effects still propagate. Interim (and former) President Martha Piper has steered a remarkable holding operation while the search for a new President has been carried out. At the time of writing, hopes are high that a successful outcome is imminent.

Change has also taken place, although in an entirely natural progression, as former Dean of Medicine, Gavin Stewart, completed the maximum two full terms in the summer of 2015. The new Dean of Medicine, Dermot Kelleher, arrived in August and has understandably been taking stock of all aspects of a large, complex and province-wide faculty. A new strategic planning exercise for the Faculty of Medicine was started in October and at this time we anxiously await the outcomes of that deliberation. Organization and alignment of departments and other administrative units are among our particular areas of anticipation.

Within the department, change is also in the offing as **Roger Brownsey** decided to step down as Department Head and retire. Roger says: "My family and I arrived in Vancouver from England back on December 1983, and the journey since then has been absorbing to say the least. I remain truly indebted to Dave Severson (formerly of the University of Calgary) who I came to know as a result of his sabbatical in Bristol, where I also subsequently trained as a postdoctoral fellow. Dave had some wonderful advice and many valuable insights for me when I was considering the option at UBC. Thanks, Dave! In the span since 2004 I have spent much time serving as Department Head or the interim version. Despite the challenges that any other Head will appreciate, that latter period of my time at UBC has been nonetheless compelling. Although mandatory retirement is a thing of the past, I have decided that an already-retired spouse (happy wife, happy life), four

rambunctious grandsons (growing up way too fast) and a minor dent to my lifelong belief in immortality, mean that now is a good time. Considering the fiscal situation of all departments in the Faculty of Medicine right now, freeing up a salary for much-needed recruitment will also hopefully have a strategic pay-off." At this time, with strategic planning and all else considered, there is as yet no clear indication from the Dean on the next steps for the department. In the meantime, **Leonard Foster** has agreed to serve as Associate Head and to come up to speed on issues and policies during the remaining months of overlap with Roger before he retires.

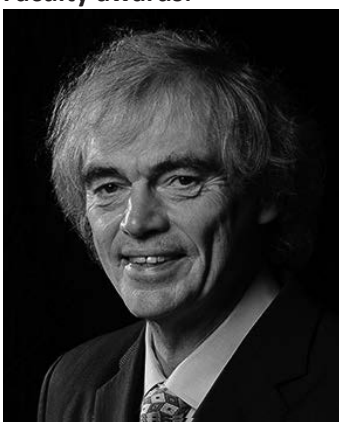
Faculty highlights:

Despite all of the institutional changes and the continuing fiscal challenges, members of the Department have had another stellar year when looking at their collective activity.

The roll-out of the new CIHR funding schemes certainly caused much apprehension all round, but three of our colleagues were successful in the inaugural competition for Foundation Grants - **Natalie Strynadka**, **Shoukat Dedhar** and **Calvin Yip**. Since then much effort and nervous energy has been expended in trying to fathom and prepare for the first CIHR Project Grant competition. A great deal of sleep has been lost in that tortuous process and many fingers remain crossed.

If there is anything of a silver lining to the dark clouds around traditional funding, it may be that scientists are nothing if not smart and alert to other possibilities. It's too early to say for sure but there are a number of promising signs that at least some of the shortfall in traditional support might be generated by alternate means. For example, **Pieter Cullis'** passion for the Personalized (Precision) Medicine Initiative appears to be attracting interest as far afield as mainland China, with a big new collaborative agreement about to be announced at the time of writing. Plans are also afoot to attract spin-off research into the Life Sciences Centre, in an effort to generate rental incomes coupled with the potential for new collaborative university-industry funding. Others have struck up new collaborative projects to tackle rare diseases through the national network, successfully exploited options through NIH to a greater extent and generated either commercial or philanthropic support for their research. Times are changing.

Faculty awards:



Pieter Cullis

The continuing research successes have resulted in a number of notable personal awards.

Pieter Cullis was the recipient of the LifeSciences B.C. Milton Wong award for Leadership. This award recognizes an individual outside the life sciences and biotechnology industry in British Columbia who has demonstrated a significant contribution to the development of the sector. The award highlights the accomplishments of a person who has impacted and strengthened relationships with external supporters favouring the sector. Pieter is a Professor in the Department, the Director of the Life Sciences Institute and the NanoMedicine Research Group and Chair of the Personalized Medicine Initiative.

Joerg Gsponer

Joerg Gsponer won the 2015 Distinguished Achievement Award for Overall Excellence (early career PI) from the Faculty of Medicine. This is a Faculty-wide annual competition to recognize overall performance and impact of young investigators in teaching, research and service. Joerg joined he Department in 2009, has since established a strong international recognition for his work using computational techniques to dissect protein structure and structural flexibility, has developed a very strong teaching record and contributed not only to the activities of the Department but also to the Centre for High Throughput Biology and the graduate program in Genome Sciences and Technology.

Shoukat Dedhar

Shoukat Dedhar won the Distinguished Medical Research Lectureship in basic science for 2015. This Faculty of Medicine Award is for sustained outstanding and impactful research. Many colleagues in the CSMB will likely know Shoukat personally and we feel extremely fortunate to have recruited him back from Toronto in the early 90's. Shoukat has established himself as a leader in the field of cancer biology, notably with his discovery of integrin-linked kinase and the associated cellular signaling pathways. His latest ventures into the roles of carbonic anhydrase isoforms are no less exciting.

Natalie Strynadka was elected as a Fellow of the Royal Society of London. Membership of this august group needs little explanation and is a fitting tribute to the huge impact Natalie and her group are having on the critical field of bacterial pathogenesis, and particularly in developing strategies to combat the scourge of drug resistance. The sustained and impressive level of achievement of Natalie and her team brings tremendous pride to the department and the university.

Natalie Strynadka

Changes in the ranks:

Following the retirement in the previous year of **George Mackie**, we were sorry to see the retirement and departure of one of our most long-serving colleagues in the past year - **Grant Mauk**. The Department and the Centre for Blood Research will both have a big hole to fill with Grant's departure, although we are still hoping to sustain some of the impressive assembly of equipment that Grant helped to develop for a range of spectroscopic and other techniques. His long-time research associate, Federico Rosell, is still working to develop a sustainable business plan for the infrastructure. Grant and his wife Marcia, another long-time member and research associate in the Department, have settled into their new life in Santa Fe and are evidently wonderful hosts. As Grant points out with his typical dry humor, the room rates can't be beat. He is still publishing and attending meetings.

On the topic of long service, it's worth a shout out to **Ivan Sadowski** for reaching the quarter-century club at UBC while **Bob and Laurie Molday** have hit the almost unbelievable mark of 40 years with UBC and the department. It's fascinating to consider the scientific advances that have taken place since 1975 - a time that predated our detailed knowledge of the genome, of the complexity of cellular signalling pathways, site-directed mutagenesis and PCR, of epigenetics, proteomics and a host of other areas of investigation.

New faculty appointments:

Hugh Kim

While losing some faculty members, were are delighted to welcome two new associate members to the department: **Hugh Kim**, an Assistant Professor with a primary appointment in the Faculty of Dentistry, and **Harry Brumer**, a Professor in the Department of Chemistry. As well, we are happy to welcome a new affiliate member, **Stephanie Willerth**, a Professor and Canada Research Chair located at the University of Victoria. Harry Brumers' research on carbohydrate enzymology has a particular focus on enzymes that synthesize, re-arrange or break glycosidic bonds. This work, together with studies of carbohydrate

Harry Brumer

Stephanie Willerth

oxidases, is being applied to study plant wall biogenesis, biomass recycling and the breakdown of dietary fibre by the gut microbiome. The focus of research by Stephanie Willerth is on the bioengineering of neural cells, with the goal of providing insights into potential therapy for neurodegenerative diseases. Hugh Kim is interested in the role of platelet signaling in inflammatory diseases, with special emphasis on the relevance in gum disease.

Postdoctoral fellows and Research Associates:
Our 70+ postdoctoral fellows and research associates play vital roles in providing continuity of training of younger researchers, the maintenance and oversight of core equipment and unspoken hours of quiet mentorship. To recognize our postdoctoral fellows we have established an annual prize, awarded in memory of a former trainee, Michael Page. This prize was won in 2015 by **Solmaz Sobhanifar**, working in Natalie Strynadka's laboratory. In keeping with the tradition of this unique award, Solmaz gave both a research seminar and artistic presentation - her title was "The "BIO" in science and flamenco". Evidently, Solmaz' dance accomplishments are just as impressive as her research! Michael Page had earned his Ph.D. working with Ross MacGillivray and he went on to a junior faculty position, but died suddenly in 2013 at the age of only 36. Ross and Mike's family established the Michael John Page Postdoctoral Fellow Award to "recognize a Postdoctoral Fellow who reflects Dr. Pages' academic excellence and his passion for life". Julien Bergeron (2013) and Michael Yuchi (2014) were the first two recipients and the award is funded jointly by the Page family, the Department and the Centre for Blood Research.

Postdoctoral fellows present their work at the regular Department poster sessions and at annual retreats. In addition, we have established an annual series of research talks to enable senior fellows to present their work with the option of a "mock interview day" to meet one-on-one with a number of faculty members to discuss their future plans. The series of talks this year were given by the following postdoctoral fellows:
Gesa Volkers (Natalie Strynadka lab) "Molecular insights into the polysialylation of human cell surfaces – structure of ST8 sialyltransferase"
Patrick Chan (Thibault Mayor lab) "Proteomic profiling of the [PSI+]yeast prion strain by quantitative mass spectrometry"
Soumya De (Lawrence McIntosh lab) " Critical role of inhibitory helix stability in the autoinhibition of DNA-binding by the ETV6 transcription factor"
Michael Yuchi (Filip van Petegem lab) "Crystal structures of novel Ryanodine Receptor domains reveal binding determinants for FKBP-12"
Madhavan Chalet (Bob Molday lab) "C-terminal domain of lipid flippase, ATP8A2"
Julien Bergeron (Natalie Strynadka lab) "Secretion of the third kind: architecture and assembly of the type III secretion system"
Guillaume Lamour (Joerg Gsponer lab) "Material properties of prion nanofibrils"

Graduate student activities and successes:
The following students graduated in 2015:
Brianne Burkinshaw (Ph.D., supervised by Natalie Strynadka): "Structural and functional characterization of the type III secretion system components"
Genevieve Desjardins (Ph.D., supervised by Lawrence McIntosh): "The effect of YY1 and small molecules on HIV-1 expression"
Matthew Solomonson (Ph.D., supervised by Natalie Strynadka): "Structure, proteolysis and evolution of secreted tuberculosis virulence factors"
Anthony Khong (Ph.D., supervised by Eric Jan): "Characterization of cricket paralysis virus-host interaction and viral protein synthesis"
Bjorn Bean (Ph.D., supervised by Elizabeth Conibear): "Insights into cargo adaptor function through the study of novel interactors"
Maria de Lourdes Vallejo Espi (Ph.D., supervised by Shoukat Dedhar): "Characterization of the mechanisms by which carbonic anhydrase IX facilitates tumour growth and metastasis"
Dustin King (Ph.D., supervised by Natalie Strynadka): "Protecting our beta-lactam antibiotic assets: structural investigation of beta-lactamases"

Patrizio Panelli (M.Sc., supervised by Thibault Mayor): "Characterization of the potential role of myosin IIa in parkin translocation during mitophagy"
Aleeza Tam (M.Sc., supervised by Bob Molday): **"**Characterization of hippocalcin-like protein 1 (HPCAL1) a neuronal calcium sensor protein in the retina"

The winners of the top graduate student awards for 2015 were:

Brianne Burkinshaw

SH Zbarsky Scholarship, for the top graduate student presentation in the graduate seminar series, was awarded to **Jay Kulkarni** (Pieter Cullis lab)
Marianne Huyer Memorial Prize, for the top graduating Ph.D. thesis, was awarded to **Brianne Burkinshaw** (Natalie Strynadka lab)

A special commendation is in order for the executive of the Graduate Student Association for all their hard work in running the regular departmental research poster sessions, a welcome reception for new graduate students and postdocs and for helping to judge the 3MT thesis competition. They also organized a pub-crawl, but the evidence was not recorded. The key players in this hard-working group were **Alyssa Kirlin** (President), **Fabian Garces** (Vice-President), **Kathleen Kolehmainen** (Secretary), **Stafanie Novakowski** and **Olivia Wong** (Social Coordinators), **Mina Ordobadi** and **Michael Carlson** (Academic Coordinators) and John Young (Communications). If the above activities were not enough, Michael Carlson had the added energy to organize a second year of special workshops, given by students and postdocs to full-house audiences of trainees:
Nic Scott: "Matrix analysis using Perseus"
Bernd Gardill: "DNA manipulation software"
Christian Lizak: "Figure making and structure analysis"
Michael Yuchi : "Chimera protein structure suite"
Jordan Shimell: "Image manipulation with Image J"
Pankaj Panwar: "Referencing software"
Ray Socha: "Building evolutionary trees"

Undergraduate and graduate teaching programs:
Having completed a major overhaul of our undergraduate programs quite recently, significant attention is now being directed to review of the graduate program. This program review is being led by the graduate program committee - Eric Jan, Lawrence McIntosh, Nobu Tokuriki and Doris Metcalf. In prospect are a set of new course modules, including a focus on common general as well as specific skills - in part stimulated by the success of the workshops the students have themselves designed. Attempts will also be made to integrate our activities in the broader context of the Life Sciences Institute and the parallel programs offered in Cell, Neuroscience and Microbiology & Immunology.

The undergraduate program continues to evolve, with attention to new options to exploit expertise in emerging areas including computational and structural biology, regulatory RNAs, nano-medicines, "omics" and others. A new collaborative joint degree program in Forensic Biochemistry, developed in collaboration with colleagues at the BC Institute of Technology has also been developed and should be implemented within the next year. The joint specialization will provide a focussed and compact program enabling students to gain core scientific competencies in the field of biochemistry while achieving the requirements of the Forensic Science Education Programs Accreditation Commission (FEPAC). Our instructors **Warren Williams**, **Scott Covey** and **Jason Read** have all been heavily involved in this venture. Initial discussions with the Faculty of Applied Science have also been started to consider opportunities under the umbrella of "Bioengineering", although this will require substantial development based on our 3-4 year effort with BCIT.

Planning is now pretty well completed for the overhaul and expansion of the UBC Biosciences Building to accommodate teaching laboratories, offices and other resources for undergraduate education. This major building project is still on track to come on stream in the summer of 2018 and will be the new home for our third-year and fourth-year undergraduate teaching labs. Our two lab instructors, Scott Covey and Jason Read, have taken the lead in the extensive planning, which began more than five years ago.

The M.D. undergraduate program continues to evolve, with the first year of the latest new curriculum beginning in August 2015. The new format for all four years will come on-stream in the subsequent years. The new curriculum has led to changes in overall organization and sequence of topics, specific lecture assignments and tutor roles. The M.D. students will also have the option of engaging in basic science research projects in the new elective "Flexible Learning" (FLEX) course. Looking ahead, a new and interesting challenge will come with the proposed abolition of science as a pre-requisite for entry into the M.D. program. The extent to which this will impact demand for our B.Sc. programs and/or the need for basic science within the two foundational years of the M.D. program remains to be determined.

Other highlights during 2015:

The Biochemical Discussion Group hosts a number of local and invited talks through the year, the highlight being the Annual Michael Smith Lecture, jointly supported by the Michael Smith laboratories. For the 11th annual seminar in this series we were especially fortunate to attract David Julius (Professor of Physiology, UCSF School of Medicine), his talk entitled: "Natural products as probes of the pain pathway: from physiology to atomic structure". David gave a wonderful and engaging talk describing his breakthrough studies on the TRP family of proteins. The talk was all the more remarkable for the way in which David captured the entire packed audience by starting from scratch and developing the complexity while keeping the audience on board. The lecture was surely a model of superb teaching as well as a remarkable demonstration of outstanding science.

The effort to establish a cryo-TEM facility at UBC to enable studies of the structures of macromolecules by single-particle imaging began more than 10 years ago. Space was engineered to accommodate high resolution TEM when the Life Sciences Centre was built in 2004 and Calvin Yip was recruited to bring additional specific expertise in 2011. The leadership group reached the final stages of negotiations to purchase a top-flight system at the very end of 2015. The final steps were successfully navigated early in January 2016 and the purchase of a Titan Krios TEM was finalized; the system should be delivered for installation in the latter half of 2016. The outcome of this initiative has illustrated how such a goal can be achieved when many units pull together, even when the fiscal picture is not encouraging. The initiative really took off in earnest early in 2015 with the success of a CFI application by a group of ten PIs led by **Natalie Strynadka** and including **Bob Molday**, **Calvin Yip** and other PIs from UBC, UVic and SFU. Although valued at more than $4M, this CFI grant alone was well short of the amount needed to purchase the latest generation of TEM that had emerged during the time between submission of the CFI application and the news of the grant award. Another huge boost came with infusion of $1.2M by the UBC VPRI and a major in-kind provision by the manufacturer (FEI). Still, a major gap remained to be filled and this is where the broad local community stepped up with contributions from the Faculties of Science, Medicine and Pharmaceutical Sciences, as well as a private philanthropic donation and funds from the Michael Smith Laboratories, Vancouver Fraser and Providence Health Research Institutes, the Vancouver Prostate Centre, BC Cancer Research Centre and the Terry Fox Foundation. Clearly, with many contributions, there are high hopes for big demand once the system is established.

University of Calgary

Department of Biochemistry and Molecular Biology, Cumming School of Medicine

Correspondent: Jonathan Lytton

Marco Gallo

The 2015 calendar year was a busy one in the Department of Biochemistry and Molecular Biology (BMB), at the Cumming School of Medicine, University of Calgary. Our graduate program continues to grow, and we recently held a very successful recruitment drive. New faculty recruitment is actively ongoing in the areas of bioinformatics, genomics and cancer/tumour biology. **Marco Gallo** joined the Department in the fall, jointly appointed in Physiology and Pharmacology. Other joint and adjunct appointments were made during the year to **Pinaki Bose, Aru Narendran**, **Tao Dong**, **Marek Michalak**, and **Sam Yeaman**. Both the University and our School continue to be strong advocates for basic science, and we expect to see many new recruitment possibilities in the coming year.

Aaron Goodarzi

Our Department members have been highly successful this year at CIHR, NSERC and disease-based granting councils despite tough competitions. Several members of the Department were also singled out for prestigious awards this year, including **Jay Cross**, who was selected as a **Fellow of the Royal Society of Canada**; **Aaron Goodarzi,** who was chosen for Avenue Magazine's **Top 40 Calgarians Under 40**; and **Christian Jacob** who, together with the LINDSAY project team, won the Alberta **ASTech Award** of "Innovation in Information and Communications Technology" for their medical educational software.

Our School's flagship Bachelor in Health Sciences undergraduate science program awarded **Mayi Arcellana-Panlilio** the **BHSc Teaching Award** for her passionate and encouraging approach to teaching MDSC351 (honours Cell & Molecular Biology), and **Paul Mains** received the **BHSc Research Mentor Award** for his exceptional commitment and support as a research supervisor and mentor. The Department also recognized **Savraj Grewal** (Associate Professor Award), **Mike Walsh** (Schultz Award for General Excellence), **William Brook** (Hans van de Sande Leadership & Service Award), **Mark Bieda** (Education Award), **Tobias Wiesenfahrt** (Postdoctoral Research Award), and **Amrita S Chandhoke** (Gordon Dixon Award for PhD candidates) for their excellent achievements and contributions.

BMB at the University of Calgary continues to recruit both new students and faculty. Please visit our website at www.ucalgary.ca/bmb/ for more information about these and other matters of our Department.

University of Calgary

Department of Biological Sciences, Faculty of Science

Correspondent: Vanina Zaremberg

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

During this year several colleagues were devoted to service in our Department. **Elmar Prenner** assumed the role of Associate Department Head for Research and Planning. Elmar has been instrumental in the opening of the Biological Sciences Cellular and Molecular Core Facility, which is available to all laboratories in the Biological Sciences Department. This facility comes with state of the art instruments including an automated high-throughput fluorescence microscope. Thanks to Elmar for his tireless dedication and efficiency in this role. **Raymond J. Turner** has served as Associate Department Head for the Graduate Program for the last three years. We thank Ray as he has been extremely dedicated, organizing workshops, new courses, reviewing policies and opening communication lines where students could voice their concerns. **Greg Moorhead** has agreed to replace Ray in 2016.

Sergei Noskov and **Marie Fraser** continued in their roles of chairs of the Biochemistry cluster and Biochemistry program respectively. Sergei and Marie led the group in the development of a five year vision plan focused

AIHS Translational Health Chair, Ian Lewis

on "quantitative biology", with impact in both future teaching and research initiatives. In this regard, **Ian Lewis** has joined our department as an AIHS Translational Health Chair. Ian recently completed renovations on a CFI-funded mass spectrometry facility (thanks also to Elmar Prenner) and is busy getting his metabolomics program underway. His AIHS funding supports research related to metabolic adaptation in hospital-acquired pathogens, and he recently earned an NSERC discovery grant which he will use to investigate the role that metabolic selection has played in shaping human evolution.

New mass spectrometry facility

Faculty research and other news:
Fundamental and applied research has been thriving during this year in our cluster. Many of our members have been involved in the development of multidisciplinary projects, commercialization initiatives and in the organization of workshops, conferences and seminars.

As a network investigator of the newly established Canadian Glycomics Network (GlycoNet), **Ken Ng** is leading a project to develop novel antibody-based therapeutics for *Clostridium difficile* infections. The multidisciplinary project includes contributions from three groups in Human Health Therapeutics at the National Research Council, as well as three other network investigators at the University of Calgary and University of Alberta.

The Centre for Molecular Simulation, directed by **Peter Tieleman**, organized several well-attended activities, including outstanding seminars by visiting speakers and a software development workshop. The **Tieleman** group develops computer models to study lipids and membrane proteins, at both atomistic detail and at a slightly coarser level of detail, in the now widely-used MARTINI force field for biomolecular simulation. Working towards high-throughput computational screening of interactions between lipids and membrane proteins, they continue to work on new tools for membrane protein simulations and applications to ABC transporters and other membrane proteins.

Sergei Noskov's group welcomed several new lab members this year, and continued research in the areas of ion channel biophysics, molecular modelling of protein-ligand complexes and mechanisms of transport across natural and artificial nanopores. In collaboration with the Salahub (Calgary), Cui (Wisconsin) and Roux (Chicago) labs, their group facilitated the development of theoretical models and related simulation techniques for studies of selective ion binding to ion channels and membrane transporters, with a particular emphasis on the development of novel polarizable force-fields for simulations of metalloproteins. A new research direction in computational toxicology, started in 2012-2015 with the support of a CIHR operating grant and Heart and Stroke Foundation Grant-In-Aid funding, led to the creation of a protein-to-cell-to-tissue virtual model for drug-induced cardiac arrhythmias. The predictive platform developed in collaboration with the Clancy (U.C. Davis) and Duff (Calgary) labs appeared recently in back-to-back publications by the Biophysical Journal and Journal of Physiology (London).

Since 2014, **Peter Facchini** has been successfully commercializing his academic research outputs through a spin-off company. Recent highlights include the filing of six patent applications, the licensing of three patents, and the establishment of key industry contracts to develop the technology. His laboratory currently includes four senior research associates, two postdoctoral fellows, and a doctoral candidate.

Elmar Prenner continued teaching in the Nanoscience minor and Biochemistry programs. His basic science research focuses on lipid-metal interactions, lipid-based anticancer drugs and nanoparticle-based drug delivery and tear film architecture. His applied research deals with the design of fluorescence instruments and bioanalytical assays. Elmar recently joined the editorial board of *BBA Biomembranes*. **Dae-Kyun Ro** co-chaired the "Biosynthesis of Natural Products" session with Ikuro

Abe (University of Tokyo) and Brad Moore (UC San Diego) at Honolulu in 2015 Pacifichem Conference. He also served as an organizing committee member for the 10th Canadian Plant Genomics Workshop (CPGW) in Victoria. **Hans Vogel** continues in his role as Executive Editor for *BBA Biomembranes*. Moreover, last year he accepted an invitation to join the Editorial Board of *J. Biol. Chem*. **Vanina Zaremberg** received a "Great Supervisor Award" from the Faculty of Graduate Studies and also joined the *JBC* editorial board for a five year term.

On the teaching side **Rob Edwards** has participated in a C-Lab (Classroom Learn Assess Build) project this year which continues as on-going teaching development. He introduced an authentic science component as part of our third-year biochemistry course, where students learn laboratory techniques for purifying and characterizing proteins. Students work in teams on experimental projects, which model in a simplified way those done by pharmaceutical companies in a drug-screening program. Rather than focussing solely on learning lab techniques, Rob wants his students to have the opportunity to ask a scientific question, design and carry out experiments to answer that question, and then interpret and report the results. This initiative will also be the basis for a workshop in the up-coming 2016 University of Calgary Conference on Postsecondary Learning and Teaching to be held May 10-11 at the Taylor Institute and the MacEwan Conference Centre at the University of Calgary.

Elke Lohmeier-Vogel continues to teach full time in Biochemistry and introductory Biology courses, as well as maintaining on-going research collaborations with the Department of Applied Microbiology at the University of Lund (Sweden) with Drs. Peter Radstrom and Ed van Niel. She co-supervises a Ph.D. student, Christer Larson (*Lactobacillus reuteri* probiotic metabolism) with her collaborators.

Isabelle Barrette-Ng, a senior instructor in the department, was awarded a Teaching Scholars Award from the Taylor Institute for Teaching and Learning, and a grant from the Quality Money Program of the University of Calgary Graduate Students Association to develop and lead a new teaching development program for graduate students in the Faculty of Science. Isabelle is also completing a study on the effects of flipped learning on the acquisition of scientific inquiry skills in a large enrollment biochemistry class, with support from a University of Calgary Scholarship of Teaching and Learning grant.

Several of our graduate students and post-docs have been recognized with distinctions/awards for their excellent research achievements. Special highlights of the year from the Noskov group were post-doctoral awards from Alberta Innovates Health Solution and Eyes High Program to Drs. **Van Ngo** and **Hristina Zhekova**. In addition, the following graduate students have received awards and recognitions: **Sean Booth** (Turner), **Sibapriya Chaudhuri** (Moorhead), **Thuy Dang** (Facchini), **Mathew Frankel** (Turner), **Suriakarthiga Ganesan** (Zaremberg), **Natalie Gugala** (Turner), **Anne-Marie Labandera** (Moorhead), **Mark Mahadeo** (Prenner, also recipient of a teaching award), **Isha Nasa** (Moorhead), **Matthew Patterson** (Prenner), **Rajnigandha Pushpker** (Turner), **Mohsen Ramezanpour** (Tieleman), **Brittney Shabits** (Zaremberg) and **Yibo Wang** (Noskov).

University of Guelph

Department of Molecular and Cellular Biology
Correspondent: Frances Sharom

New faculty members:

Malcolm Campbell

The new Vice President Research has joined MCB as a faculty member. **Malcolm Campbell**, a University of Guelph alumnus, was appointed as its new Vice-President Research for a five-year term, effective June 1 2015. Dr. Campbell came to Guelph from the University of Toronto, where he has been a professor since 2004, as well as serving as Vice-Principal Research for University of Toronto Scarborough (UTSC), a position he held since 2009. Dr. Campbell's research focuses on genome biology. As Vice-Principal Research, he helped build and strengthen the research platform at UTSC during a period of development. Dr. Campbell earned both his bachelor's degree in genetics and his Ph.D. in biochemistry from the University of Guelph. He conducted research in France and the United States before holding a tenured faculty position at the University of Oxford from 1996 to 2004.

Retirements:

Roz Stevenson

The department celebrated the retirement of two long-term members in 2015. **Roselynn (Roz) Stevenson** retired in September 2015, after over 38 years at the University of Guelph, first in the Department of Microbiology, which merged with the newly-formed department of Molecular and Cellular Biology in 2004. Roz was a stalwart member of the Microbiology teaching program, and received many other honours during her career. She was nominated for a YMCA-YWCA Guelph Woman of Distinction in Public Service, and received several teaching awards, including an Award of Excellence in Teaching, from the College of Biological Science, a Distinguished Professor Award from the University of Guelph, and a Faculty Association teaching award for the College of Biological Science. Her research program focussed on understanding fish diseases that occur in freshwater systems. Her laboratory carries out surveillance testing for bacterial and viral pathogens of fish, and research on diagnostic methods and pathogen diversity. Recent work focussed on *Yersinia ruckeri* and the bacterial gill disease bacterium, *Flavobacterium branchiophilum*, and molecular tools for detection and differentiation of fish pathogens. Roz gave the convocation address in June 2015, where she offered some thoughts on things that microbes can teach us about life.

Gan Bag

Jnanankur (Gan) Bag retired in December 2015 after 30 years at Guelph. Gan moved here from Memorial University of Newfoundland, and started off as an Associate Professor in the Molecular Biology and Genetics department, which also merged with the newly-formed Department of Molecular and Cellular Biology in 2004. He taught several undergraduate courses in the area of Molecular Biology and Genetics, and served on the Senate, the University Tenure and Promotion Appeals Committee, and the University of Guelph Faculty Association. Gan's research focussed on characterization of the molecular machinery involved in mRNA trafficking from the nucleus to the cytoplasm in mammalian cells, and the role of poly(A)-binding proteins in mRNA translation.

New research facilities:

A new spinning disk confocal microscope was recently acquired by **Cezar Khursigara** and colleagues **Joseph Lam** and **Chris Whitfield**. The new system, housed inside the Guelph Advanced Analysis Centre, is based on a camera capable of capturing biological processes as they occur in real time. It's differentiated from older microscopes by its speed; the new system utilizes a spinning disk that can capture images at speeds of up to 100 frames per second. It also takes 3D images, allowing researchers to look at different cell layers. The microscope will be in live 3D cell imaging for health, environmental and food applications. One of the principal applications of the new system is in Dr. Khursigara's cystic fibrosis research, where he is studying how biofilms in the lungs form and react to environmental and chemical changes. Acquiring the microscope took some creativity. A CFI John Evans Leadership Fund and Ontario Ministry of Innovation Infrastructure Grant supported the spinning disk and the computer hardware and software needed to produce and render the images. Khursigara, Lam and Whitfield recycled parts from older microscopes to form the base of the new system. The device will be available for both University of Guelph researchers and external users. You can watch the video at https://www.youtube.com/watch?v=ByrJtvpSNFs

Cezar Khursigara and his research team were also excited to receive CFI funding for the purchase of a scanning electron microscope, furthering their antimicrobial research. The microscope will be used to study chronic infections caused by multidrug resistant bacterial biofilms, to help develop new antimicrobial therapies for chronic infections.

Research news:

Cardiovascular researcher **John Dawson**, a member of the Centre for Cardiovascular Investigations (CCVI) at the University of Guelph, received 1 of 10 "CP Has Heart" 2015 Cardiovascular Research awards, presented by the Heart and Stroke Foundation and Canadian

"CP has Heart" Cardiovascular Award recipients; John Dawson is second from the left.

Pacific. Dr. Dawson looks at the relationships between actin and cardiac disease. The University of Guelph launched the CCVI to develop innovative ways to fight cardiovascular disease. The new centre involves eight lead cardiovascular scientists and clinicians, as well as dozens of collaborators, graduate and undergraduate students from across the University and beyond. It is one of a few centres worldwide looking at cardiovascular disease all the way from single molecules to clinical applications. Headed by heart researcher Dr. Tami Martino of the Department of Biomedical Sciences, the centre is dedicated to discovering novel ways to diagnose heart disease, advance treatment therapies and train the next generation of scientists.

A research partnership between **Tariq Akhtar** and PlantForm Corporation has been awarded an Engage Grant from NSERC. The funding will be used to investigate the targeted manipulation of dolichol biosynthesis to enhance the efficacy of plant-produced antibodies. Dolichol serves as a membrane scaffold for the process of N-glycosylation, the most critical determinant of monoclonal antibody efficiency, whereby a membrane-anchored oligosaccharide is transferred en bloc to the protein antibody soon after it is synthesized. The goal is to further advance the capabilities of PlantForm's *vivo*XPRESS™ production platform to advance plant technology for biopharmaceutical production.

Cezar Khursigara also obtained an NSERC Engage Grant to foster an industrial collaboration with EastGate Biotech, which develops improved novel formulations and alternative dosage forms of existing biologically active molecules. The grant was approved for the development and evaluation of new nano delivery vehicles for natural antimicrobial products with improved efficacy. The Khursigara research team will study the antimicrobial activity of the company's natural antibacterial products products.

The Canadian Glycomics Network (a new $26.3-million effort involving 64 researchers from 22 academic institutions nationwide) will involve four faculty members from our department; **Chris Whitfield**, **Joe Lam**, **Matt Kimber** and **Anthony Clarke**, along with Chemistry professors France-Isabelle Auzanneau and Mario Monteiro. Their research is leading to the development of new drugs and vaccines for diseases, such as influenza, genetic disorders and diabetes. GlycoNet aims to boost Canada's international leadership in glycomics by promoting research and training, and by generating new research and commercial products.

Despite the challenging funding environment at the national level, several faculty successfully obtained NSERC Discovery grants, including **Chris Whitfield**, **Joseph Yankulov**, **Jim Uniacke**, **Cezar Khursigara**, and **Jaideep Mathur**. **Jim Uniacke** and **Emma Allen-Vercoe** were the recipients of Canadian Cancer Society Innovation Grants. **Emma Allen Vercoe** was also a co-PI on a National Institutes of Health R01 grant with Erika Claud, at the University of Chicago. The Kidney Foundation of Canada awarded a grant to **Nina Jones**.

Chris Whitfield successfully renewed his Tier 1 Canada Research Chair in Microbial Cell Biology for a third 7-year term, and **Jim Uniacke** received an Ontario Early Researcher Award.

MCB faculty were big winners in the "Gryphon's LAAIR: Leading to Accelerated Adoption of Innovative Research" competition. Five of our members applied for LAAIR funding and two of them went in front of the LAAIR judges to pitch their ideas. All five were successful in obtaining funding to commercialize their products. Well-done MCB!

George van der Merwe: Creating a competitive advantage for Ontario craft beer through the use of novel regional yeast strains.

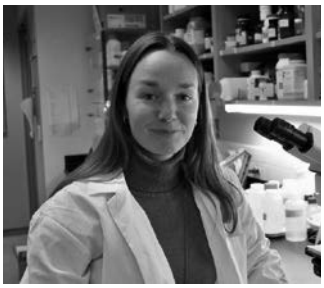
Lucy Muthuria: Developing a pathogen-specific multi-epitope peptide for diagnosis of subclinical Johne's disease.

Rod Merrill: Control of Paenibacillus larvae, the causative agent of American Foulbrood in honeybees.

Steffen Graether: Novel use of natural protein formulations for frost protection in sensitive high-value crops.

Emma Allen-Vercoe: Enhancing porcine health and production value using microbiome therapeutics.

Graduate student and post-doctoral fellow news:
Ph.D. students **Alison Berezuk** (Khursigara lab) and **Véronique Taylor** (Lam lab) were winners of the prestigious Donald Robert Phillips Scholarship, which recognizes outstanding research achievements. Both winners presented a public seminar to the department.



Amber Park

Cystic Fibrosis Canada has named **Dr. Amber Park** (Khursigara lab) as the 2015-2016 Cystic Fibrosis Canada Kin Fellow, making her the top-ranked post-doctoral researcher in the field. Amber studies the process of biofilm formation by the opportunistic pathogen *Pseudomonas aeruginosa*. Her project uses a multidisciplinary approach combining molecular microbiology, microscopy and proteomics to examine how environmental factors, host determinants and strain-related differences affect biofilm formation, which contributes to pathogenesis, persistence and drug resistance.

Ashley Brott (Clarke lab) won the Arthur Richards Memorial Scholarship, and **Wesley Ehrefellner** (Ryan lab) and **Kaitlyn Oliphant** (Allen-Vercoe lab) were awarded Vitamin Scholarships. **Michal Pyc** (Mullen lab) received the Roche Molecular Biochemicals Award of Excellence for the student who has presented the best graduate seminar during the academic year. **Samantha Watt** (Mullen lab) won a CBS Graduate Scholarship in Plant Science.

Poster prizes were awarded to **Karen Gonzalez** (Wood lab) at the Regina Meeting of the Canadian Society of Microbiologists, and **Chelsea Coumoundouros** (Wood lab) at the Waterloo Meeting of the Biophysical Society of Canada.

Véronique Taylor (Lam lab) won a Cedarlane CSM Graduate Student Presentation Award at the 2015 Annual Meeting of the Canadian Society of Microbiology held in Regina.

Overall, graduate students in MCB were supported by NSERC graduate scholarships (11 students), Ontario Graduate Scholarships (16 students), Ontario Trillium scholarships (2 students), and Queen Elizabeth II Graduate Scholarships (7 students).

University of Lethbridge

Department of Chemistry and Biochemistry, Department of Biological Sciences
Correspondent: Ute Kothe

Dr. Dmytro Yevtushenko, the new Research Chair in Potato Science at the University of Lethbridge

Dr. Dmytro Yevtushenko joined the Department of Biological Sciences at the University of Lethbridge in January 2016 as an Associate Professor, Research Chair in Potato Science. His appointment is a result of joint efforts of the University of Lethbridge and Alberta's potato industry to establish a world class research program in potato science with focus on the interests of potato industry locally, nationally and internationally. Originally from Ukraine, Dmytro earned his Ph.D. in Cell Biology at the Institute of Cell Biology and Genetic Engineering in Kiev, Ukraine. Throughout his career, he has been involved in numerous research projects on genetic improvement of potato and other plant species, both in academia and industry. He did his postdoctoral studies at the University of Guelph in Ontario and the University of Victoria in British Columbia. Before coming to the University of Lethbridge, Dmytro spent over five years in very competitive industry environment, leading the innovative research programs on highly efficient plant production systems. He held the positions of Director of Research and Development at Provitro Biosciences plant biotechnology company in Washington State, USA, and Head of MJ Bioscience, R&D Division of Highmark Marketing nutraceutical company in British Columbia, Canada. At the University of Lethbridge, Dmytro will establish a vigorous research program to address the fundamental questions of potato biology, such as plant development and growth, stress tolerance, plant-pathogen interactions, and then translate this scientific knowledge into agricultural practice to improve the crop yield and sustainability of Alberta's potato industry. Additionally, he will teach Advances in Agricultural Biotechnology course, and develop a new Plant Breeding and Genetics course.

Recognized as a pioneering researcher at the forefront of plant genome stability and the burgeoning field of epigenetics, **Dr. Igor Kovalchuk** has been named the 2015 winner of the University of Lethbridge's Speaker Research Award. Since coming to the University of Lethbridge's Department of Biological Sciences in 2001, Kovalchuk has gained the reputation as a world leader in epigenetics, which studies how individual genes are expressed by environmental factors. Specifically, he is investigating how plants evolve rapidly to handle various stressors such as temperature extremes, viruses, bacteria and toxic or nutritionally deficient soil. His goal is to understand how plants are capable of acclimating, adapting and passing those acquired traits on to their progeny. His work has developed various molecular techniques that can be used to create stronger and hardier plants that are able to resist a constantly changing environment to satisfy the demands of the agricultural biotechnology industry. He has also developed novel plant biomonitors that are used by more than 40 labs in more than 20 countries. Kovalchuk's expertise has also been recognized commercially, leading to a strategic alliance that may shape the future of the pharmaceutical production of codeine in Canada. His patented technologies, including cutting-edge methods for bioengineering poppy plants, make it possible to produce transgenic plants with high levels of codeine. A driving force behind the establishment of the Alberta Epigenetics Network, the first epigenetic network in Canada, Kovalchuk's lab has created valuable collaborative opportunities with research institutions, government agencies and multinational companies alike.

In 2015, the University of Lethbridge received $1.5 million in funding from the Government of Canada through Western Economic Diversification to enable the creation of a supervised maker-space in synthetic biology called **SynBridge**, the first of its kind in Canada. The Synbridge maker space initiative will enhance research capabilities, boost services available for industry partners, increase training capacity for Highly Qualified Personnel, and enable students to explore commercial applications of their research ideas. Federal funding will go towards the purchase of state of the art equipment to support the on campus maker space. This space will enable students at the University to move their research ideas to the proof of principle stage, while also providing western Canadian businesses in the life sciences sectors with enhanced access to the services and expertise they need to commercialize their technologies.

The University of Lethbridge's Alberta RNA Research and Training Institute (ARRTI) was proud to partner with the Canada Gairdner Foundation in bringing 2015 Canada Gairdner Foundation International Award winner **Dr. Lynne Maquat** to southern Alberta for a series of public speaker events in October 2015. Maquat, whose work has furthered our understanding of the molecular basis of human disease, conducted a trio of speaker events, including a presentation to students at Lethbridge Collegiate Institute, a featured session for the Women's Scholar Speaker Series and as the keynote lecturer for the Symposium "New Horizons in RNA Research". Maquat is the director of the Center for RNA Biology: From Genome to Therapeutics, Professor of Biochemistry and Biophysics at the University of Rochester School of Medicine and Dentistry, and a J. Lowell Orbison Endowed Chair. She earned the 2015 Canada Gairdner Foundation International Award for the discovery of the mechanism that destroys mutant messenger RNAs in human cells, called nonsense-mediated mRNA decay, which is critically important in both normal and disease states.

In 2015, **Dr. Ute Kothe** received an Alberta Innovates Tier 2 Strategic Chair in Transcriptomics of RNA Modification. The Chair is funded with $1 million over five years. The AITF Chair will significantly strengthen RNA research in Alberta by establishing a leading centre of transcriptomic research at the University of Lethbridge.

University of Manitoba

Department of Biochemistry and Medical Genetics

Correspondent: Louise Simard

The Faculty of Health Sciences, College of Medicine has extended **Dr. Louise Simard**'s appointment as Head of the Department of Biochemistry and Medical Genetics (BMG) to the end of September 2018. In this time, she expects to continue to promote cutting edge and transdisciplinary research in key areas of strength, foster curriculum renewal of the BMG graduate program so as to solidify the disciplines of Medical Biochemistry, Genetics and Computational Biology, and strengthen the department's role in undergraduate education.

Research Manitoba, formerly the Manitoba Health Research Council, initiated a new "Collaborative Research Team/Cluster Development Program" to promote the establishment and sustainability of transdisciplinary

health research. The first recipients were announced in April 2015 and BMG faculty members were among the leaders.

Spencer Gibson

Dr. Spencer Gibson, Head of Cell Biology, Research Institute in Oncology and Hematology and Professor in BMG, is the Lead Scientist for "An Innovative Cancer Research Model: Integrated Multidisciplinary CLL Research Cluster" which brings together a team of basic and clinician scientists. By establishing the CLL cluster, the team will be using a multifaceted approach to better understand the biology of chronic lymphocytic leukemia (CLL) with the aim to provide the best and up-to-date treatment and management for patients. Better communication with the medical community will ensure that appropriate patients are referred for monitoring and treatment while cost-benefit analysis studies will define the optimum use of health resources. The results of this program will lead to improved outcomes and quality of life for CLL patients and will provide a model for the development of other cancer research clusters in Manitoba.

Jim Davie

Dr. James (Jim) Davie is a member of the "Developmental Origins of Chronic Disease in Children Network (DEVOTION)" cluster led by Dr. Jonathan (Jon) McGavock, a Scientist in the Children's Hospital Research Institute of Manitoba (CHRIM). Dr. Davie, Professor in BMG, CHRIM Scientist and Director of the Manitoba Epigenetic Network, will drive the initiative to identify epigenetic signatures of gene expression profiles that contribute to early life programming of chronic risk in youth with type 2 diabetes, diabetes-related cardiac and renal disease, congenital diaphragmatic hernia, obesity, asthma and allergy. Each cluster will receive $2.5 million in Research Manitoba funding over a five year period.

Adding to his successes, **Dr. Jim Davie** was inducted as a Fellow into two of this country's most esteemed associations of scholars and scientists, namely the Royal Society of Canada and the Canadian Academy of Health Sciences; these are considered the highest honours for the Canadian health sciences community. Dr. Davie is a Tier 1 CRC in Chromatin Dynamics and his research, reported in over 200 original articles in peer reviewed journals, has significantly impacted the fields of cellular and molecular biology, as well as chromatin and epigenetic control of gene expression.

Leigh Murphy

Dr. Leigh Murphy became a "Distinguished Professor" in the University of Manitoba, a title that is conferred on academic members who have demonstrated outstanding distinction in research, scholarship, creative endeavours, professional service and teaching.

Barbara Triggs-Raine

Dr. Barbara Triggs-Raine was appointed Scientific Director of the Central Animal Core Facility in the Faculty of Health Sciences. As part of her mandate, her team will be developing a state-of-the-art core animal facility to ensure that researchers in the Faculty of Health Sciences have optimal support for their cutting-edge research programs.

The year ended with the official inauguration of the "Klaus Wrogemann Seminar Room". **Dr. Klaus Wrogemann,** Professor Emeritus, retired on June 30th, 2011. The renaming of our seminar room was in recognition of Dr. Wrogemann's significant contributions to our University, Faculty and Department as a biochemist, molecular biologist and geneticist with a national and international reputation. Throughout his career, Dr. Wrogemann maintained a thriving research program designed to uncover the molecular basis of genetic diseases, especially muscular dystrophies, cardiomyopathies,

androgen resistance syndromes and genetic diseases in inbred populations. The fruits of his labour have appeared in well over 100 publications that have been cited over 4300 times.

Finally, congratulations go out to **Dr. Jim Davie** (Co-Applicant) for the CIHR-Genome Canada grant to create the Canadian Epigenetics, Environment and Health Research Consortium Network, **Dr. Leigh Murphy** for her CIHR grant to pursue her studies on the involvement of kinases in estrogen signalling in normal and malignant human breast epithelial cells, **Dr. Spencer Gibson**, **Dr. Pingzhao Hu** and **Dr. Trevor Pemberton** in recognition of being recipients of five year NSERC operating grants, **Dr. Gibson** for grants from the Leukemia and Lymphoma Society of Canada, **Dr. Hao Ding, Dr. Geoffrey (Geoff) Hicks** and **Dr. Jim Davie** for each being awarded Cancer Research Society grants to study unique aspects of cancer, and **Dr. Pingzhao Hu** for his Canadian Breast Cancer Foundation grant to study how to improve breast cancer survival and drug response prediction based on a mutated gene network approach.

BMG has recognized Cancer, Computational Biology, Epigenetics, Genetic Basis of Development and Disease, Regenerative Medicine and Scholarship of Education as key areas of research. In 2015, primary BMG Faculty members contributed to well over 57 publications which appeared in peer-reviewed journals or book chapters. Among these were articles in Autophagy (Chen et al.), Disease Models and Mechanisms (Kaur et al.), Genetics (Guppy et al.), International Journal of Cancer (Ali et al., Kenwar et al.), Leukemia (Dielschneider et al.) and Oncotarget (Johnson et al., Liang et al., and Sajesh et al.), reflective of our significant strength in cancer research. Furthermore, our Faculty struck important national and international collaborations that led to important publications; examples are articles that appeared in Cancer Research (Wright et al.), Genetics in Medicine (Uddin et al.), the Journal of Proteome Research (Yan et al., Fenyö et al, Omenn et al, and Simon et al.), Molecular Oncology (Vollan et al.), Nature Genetics (de Angelis et al.) and the PNAS USA (Creanza et al.). On the Genetic Basis of Development and Disease front, some of our publications appeared in Biochimica Biophysica Acta (Armistead et al.), Experimental Neurology (Liyange et al.), Molecular Therapy (Walia et al.) and Plos Pathogens (Fu et al.).

Our success depends on the quality of our trainees and the completion of thesis work is the aspiration of all graduate students. In 2015, BMG students **Naderah Altaleb** (Dr. Barbara Triggs-Raine), **Fahmida Jahan** (Dr. Jeffrey Wigle), **Niaz Mahmood** (Dr. Jiuyong Xie), **Nivedita Seshadri** (Dr. Hao Ding), **Terry Tran** (Drs. Michelle Liu and Louise Simard) and **Ramya Vinith** (Dr. Barbara Triggs-Raine) completed their M.Sc. degrees, while **Peter McQueen** (Dr. John Wilkins) obtained his Ph.D. degree.

The 2015 national student awards included a Breast Cancer Society Hope Scholarship award to **Nicole Wilkinson** (Drs. Kirk McManus and Michael Mowat), the Nancie J. Mauro Graduate Scholarship in Oncology Research to **Laura Thompson** (Dr. Kirk McManus) and the Terry Fox Research Institute Star Studentship awards to **Erin McAndrew** and **Lucille Jeusset** (Dr. Kirk McManus), **Veronica Lau** (Dr. Jim Davie) and **Anna Blankstein** (Dr. Spencer Gibson). Finally, our graduate students were the recipients of a number of local, national and international awards and we are proud to mention some of these. **Brent Guppy** (Dr. Kirk McManus), **Eric Bouchard** (Drs. Versha Banerji and Spencer Gibson), **Erin McAndrew** (Dr. Kirk McManus), **Laura Thompson** (Dr. Kirk McManus) were each Canadian Cancer Research Conference Award Winners. **Angela Anhalt** (Drs. Michelle Liu and Louise Simard) was this year's recipient of the University of Manitoba President's Graduate Scholarship in Human Genetics and the BMG Phyllis J. McAlpine Graduate Fellowship. **Laura Thompson** and **Erin McAndrew** (Dr. Kirk McManus) received the BMG Human Genetic Endowment Fund Graduate Student Award and the BMG Phyllis J. McAlpine Graduate Fellowship, respectively. Finally, **Vichitra Batuwita** (Dr. Mojgan Rastegar) was the recipient of the Mindel Rady Olenick Fellowship in Human Genetics.

University of Ottawa

Department of Biochemistry, Microbiology and Immunology

Correspondent: Kristin Baetz

The Department of Biochemistry, Microbiology and Immunology (BMI) is a research-intensive department with more than 100 faculty members conducting research in modern biomedical and life sciences. Our mandate is to conduct leading basic and translational research while our approach is to integrate this research

with our educational programs to provide unique training opportunities for our undergraduate students, graduate students and post-doctoral fellows. While the department is physically located at the Faculty of Medicine in Roger Guindon Hall, members are located across the Ottawa region and, in particular, within our affiliated teaching hospitals, research institutes and government agencies. Committed to diversity in research, the core members of the Department of Biochemistry, Microbiology and Immunology engage in multi-disciplinary research in the areas of systems biology, cell, developmental and cancer biology, infection and immunity, metabolism, and structural biology.

The department is home to two University of Ottawa Research Centres and Institutes: the Ottawa Institute of Systems Biology and the Ottawa Institute of Computational Biology and Bioinformatics. In addition a new research group called "GRIP" (Group for Research in Inflammation and Pathogenesis) is growing.

Like all departments at uOttawa, BMI is undergoing an unprecedented expansion in its professorial ranks. We are pleased to introduce two of its newest members:

Marceline Côté

Dr. Marceline Côté joined the University of Ottawa in October 2014 as an Assistant Professor in the Department of Biochemistry, Microbiology, and Immunology, and as a Canada Research Chair in Molecular Virology and Antiviral Therapeutics. She received her Ph.D. in Microbiology and Immunology from McGill University and was a postdoctoral fellow at Brigham and Women's Hospital, Harvard Medical School, where she studied Ebola virus entry using small-molecule inhibitors of infection which led to the discovery of the Ebola virus receptor.

The overarching goal of the Côté laboratory is to improve our understanding of host-pathogen interactions during infection by emerging viruses, towards the development of novel host- and/or viral-oriented antiviral therapeutics. In the laboratory, her group combines virological, chemical biology, and genetic approaches to reveal the complex interactions between emerging viruses and their host, and to identify host proteins critical for viral infection that can be targeted for antiviral development. They are particularly interested in acquiring a detailed understanding of the entry pathways of filoviruses, arenaviruses, and coronaviruses.

Morgan Fullerton

Dr. Morgan Fullerton completed his Ph.D. in at the University of Guelph in 2009 under the supervision of Marica Bakovic. Interested in the molecular regulation of phospholipid metabolism, his work uncovered a link between phospholipids and obesity. He then joined the lab of Greg Steinberg at McMaster University for a postdoctoral fellowship. As a CIHR Fellow and a Banting Postdoctoral Fellow, his research focused on various aspects of immune cell lipid metabolism and links to whole body insulin sensitivity. In July 2014, he joined the Department of Biochemistry, Microbiology and Immunology at the University of Ottawa as an Assistant Professor. Using knockout and knock-in mouse models of key metabolic and nutrient regulators, his lab continues to focus on immunometabolism. Projects currently ongoing involve studies that aim to understand the metabolic regulatory networks in innate immune cells and hepatocytes that govern responses and progression to metabolic diseases, such as atherosclerosis, fatty liver disease and type 2 diabetes. He was awarded a CIHR New Investigator award in 2015.

University of Ottawa

Department of Cellular and Molecular Medicine

Correspondent: David Lohnes

Cellular and Molecular Medicine (CMM) is a large and active department in the Faculty of Medicine, home to 36 regular faculty members, with over 100 cross appointees and adjunct members. Our members conduct basic research in the biomedical sciences, including neuromuscular disease, neurodegenerative disorders, cancer, regenerative medicine, kidney disease, stroke recovery, congenital defects, and other areas of relevance to human health. Our mission also includes support for

undergraduate education in areas such as physiology, anatomy, reproductive biology and pharmacology and the undergraduate medical education curriculum. In addition, CMM offers M.Sc. and Ph.D degrees through the Cellular and Molecular Medicine and Neuroscience Graduate Programs, with over 200 students currently registered. The Department delivers a wide range of graduate courses in support of this training, and both of the graduate programs host seminar programs featuring prominent local, national and international guest speakers.

New faculty members:

Dylan Burger

CMM is undergoing significant and invigorating change with an aggressive recruitment effort which has brought some outstanding young and senior talent to the Department, highlighted below.

Dr. Dylan Burger has joined the department as an Assistant Professor. Dr. Burger's research examines mechanisms involved in the pathogenesis of diabetic vascular and kidney disease, with emphasis on the role of microparticles in these processes. Microparticles are small (0.1-1.0 µm) fragments of membrane that are shed from cells under conditions of stress or injury. Previous research from Dr. Burger and others has shown that microparticles may serve as biomarkers of underlying disease and that, once shed, microparticles exert deleterious biological effects on target cells.

New Assistant Professor, **Dr. Baptiste Lacoste** has demonstrated expertise in mechanisms of cerebrovascular network formation, function and remodelling in various health and disease contexts. The Lacoste lab investigates how cerebrovascular networks form properly after birth, what mechanisms underlie their plasticity, how their integrity is altered in neurological conditions, and how targeting cerebrovascular remodelling may offer innovative therapeutic options throughout life. Studying neuro-vascular interactions is essential to gain a better understanding of brain and mind health. Indeed, the brain is highly dependent on a steady supply of blood,

Baptiste Lacoste

which carries oxygen and nutrients, and therefore this noble organ is particularly vulnerable to inherited and acquired cerebrovascular failures. Ultimately, identifying key cellular and molecular mediators of cerebrovascular plasticity will lead to important findings about structural and functional determinants of vascular health, an essential pre-requisite for the development of transformative strategies for neuroprotection.

Michael Downey

Dr. Michael Downey has joined the department as an Assistant Professor. Dr. Downey has a strong background in high-throughput genetics and proteomics, as well as in exploiting model systems to shed light on evolutionarily conserved pathways required for cell homeostasis. His research program focusses on the intersection of the emerging field of non-histone protein acetylation and the regulation of cellular stress responses. While acetylation machineries have long been known to acetylate histone tails at gene promoters, more recent work has demonstrated that these proteins also impact diverse biological pathways, in all kingdoms of life, through the modulation of non-histone targets. These non-histone targets are potential critical regulators of human disease states that can be exploited for improved diagnoses and novel treatments.

Wenbin Liang

The research of new Assistant Professor **Dr. Wenbin Liang** is directed towards mechanistic studies of dysregulation of ion channels (channelopathies) in heart disease. Elucidation of the cellular and molecular bases of cardiac channelopathies would allow the development of novel, targeted therapies for cardiac arrhythmias, a condition affecting over one million Canadians. Dr. Liang's group uses human cardiomyocytes (isolated from patient biopsy samples; or derived from iPSCs generated with patient cells), CRISPR/Cas9 (for genome engineering and disease modeling), and patch-clamp and optical mapping (for studies of cellular and tissue electrical activities). Dr. Liang is currently investigating the role of Wnt signaling in sodium channelopathies and arrhythogenesis.

Ryan Russell

The lab of new Assistant Professor **Dr. Ryan Russell** aims to discover the mechanisms underlying autophagy regulation in normal and pathological tissues. Autophagy is an essential process that promotes cellular homeostasis and survival under stress conditions. At basal levels, autophagy is responsible for the clearance of damaged organelles and unfolded/aggregated proteins. Under times of acute stress, autophagy is activated particularly in response to depletion of cellular energy and nutrients as well as in response to DNA damage and hypoxia (low oxygen). Dysregulation of autophagy has been observed in several diseases including; cancer, Crohn's disease and neurodegeneration. One major limitation in the study of autophagy in disease is the lack of knowledge regarding the regulatory and signalling mechanisms responsible for the autophagy regulation in normal versus disease contexts. Recent work from Dr. Russell has shown novel regulatory mechanisms between nutrient sensitive kinases mTORC1, ULK1, and AMPK and the autophagy machinery. Future endeavours include expanding our knowledge of the regulatory mechanisms of mammalian autophagy and determining the clinical significance of recently identified pathways.

Derrick Gibbings

Dr. Derrick Gibbings has joined the department as an Assistant Professor. Dr. Gibbing's research is directed towards understanding how the complex cytoplasm controls RNA and the consequences of this for biology, evolution and disease. His group presently works on two themes: autophagy and exosomes. The first explores autophagy as a novel mechanism of RNA degradation. Dysregulation of autophagic degradation causes cancer and neurodegenerative disease in mice and likely many humans. Notably, prior research on autophagy overwhelmingly focussed on proteins and organelles degraded by autophagy as the cause of these diseases, while neglecting RNA. His research uses cutting-edge cell and systems biology to unveil how dysregulation of RNA degradation by autophagy contributes to diseases including many cancers, ALS and Parkinson's disease. Exosomes communicate RNA and other molecules in paracrine and systemic manners to control tumor metastasis and the spread of prion-like misfolded proteins in neurodegenerative diseases. Intriguingly, the contents of exosomes are highly selective. Dr. Gibbings is studying the mechanisms underlying selective packaging of RNA and proteins into exosomes, and applying this knowledge to uncover new mechanisms in neurodegeneration, clinical diagnostic tests and a flexible drug delivery platform for siRNA therapeutics.

Steve Ferguson

Dr. Steve Ferguson, a new full Professor in the department, investigates G protein-coupled receptors (GPCRs), which represent the largest class of membrane receptors and the targets of more than 50% of the drugs that used to treat disease. Dr. Ferguson's research program focusses on understanding how the activity of these receptors can be regulated under both normal physiological and pathophysiological

conditions. Consequently, he is trying to understand how proteins that contribute to desensitization and trafficking of GPCRs might represent novel targets for drug treatment. His laboratory utilizes a combination of molecular pharmacological and cell biological techniques to examine the role of a wide variety of other receptor interacting proteins in the signalling, endocytosis and intracellular trafficking of GPCRs. Their efforts are focussed on: 1) the role of metabotropic glutamate receptor signaling in Alzheimer's, Huntington's and Parkinson's diseases, 2) the regulation of serotonin receptor activity by corticotrophin releasing factor receptors in as a consequence of stress and the effect this has on anxiety and depression, and 3) the role of G protein-receptor kinases (GRKs) in hypertension and kidney disease. These studies are performed in heterologous cell cultures, primary neurons and in GRK2 transgenic, metabotropic glutamate receptor knockout, Alzheimer's mouse models and mutant huntingtin knock-in mouse models.

University of Toronto

Department of Biochemistry

Correspondent: David Williams

Faculty news:

As with other departments across the country, we have been coping with the uncertainties of reduced success rates in CIHR funding, navigating the Foundation and Project Grant schemes as well as the new peer review system. Nevertheless, we have been weathering the uncertain climate reasonably well. This is due in part to the proactive work of **Trevor Moraes** who has been leading departmental efforts to stay on top of what alternative funding is available - especially those alternatives that are easy to overlook - and to optimize our performance in the first CIHR Project Grant scheme. The consensus among applicants in the department is that the Project Proposal is too short and does not give sufficient space to justify or explain 5 years of funding. Despite the funding challenges, **Chair Justin Nodwell** has managed to keep the department in an expansion mode with several cross appointments made and, more importantly, searches carried out for new tenure stream faculty.

In other news, **Trevor Moraes** and **Alex Ensminger** are co-chairing the 66th Annual Conference of the Canadian Society of Microbiologists at the University of Toronto Medical Sciences Building and Hart House, with over 500 registrants from around the world. The conference boasts a broad range of topic areas including Structural Biology, applied and Environmental Microbiology, Infection and Immunity, and Molecular Genetics and Cellular Microbiology. The 15+ invited speakers include two keynote seminars on Cryo-EM and Tomography by Grant Jensen (Cal Tech) and Infectious Disease and Immunology by Arturo Casadeval (John's Hopkins).

Sian Patterson

Sian Patterson, Assistant Professor Teaching Stream, was the recipient of the 2015 Excellence in Undergraduate Life Sciences Teaching Award by the Faculty of Medicine. This award recognizes sustained excellence in teaching, coordination and the development of undergraduate lectures and seminar courses in the Faculty of Medicine. The testimonials from students describe an exceptional capacity to engage students and foster enthusiasm for learning. They commented on her mastery of the subject and ability to effectively communicate the topic while encouraging their interest in Biochemistry.

Nana Lee and **Reinhart Reithmeier's** Graduate Professional Development (GPD) Program continues to be extremely popular among our graduate students. Initiated in the Biochemistry Department in 2012 as a pilot course in preparing trainees to be market-ready, Nana spearheaded its implementation in the Department of Immunology in 2014, and has instructed over 150 PhDs, MScs, and postdoctoral fellows. Although most students are still in training, the GPD program has helped transition 26 graduates into their desired careers in industry, or pursuing academic postdoctoral fellowships. The GPD program consists of a quarter-credit graduate level course involving 12 hours of class time and customized individual development plan consultations. Highlights include networking with various career professionals, industry-style deliverables, students pitching own company ideas,

strategic communications in marketing oneself, written and oral communications of research summaries to the general public, implementing informational interviews, mentorship, exemplary cover letters and resumes, networking, interview skills, creating one's own career path, and a reflection on Lee and Reithmeier's guidebook "*Success In and After Graduate School*." The GPD program has been featured in Science Careers (2013), the National Post (2015), University Affairs (2015), the Varsity, U of T Magazine (2015) and was highlighted as a transformative initiative in a major report on PhD skills by the Conference Board of Canada (2015).

Nana Lee and Reinhart Reithmeier

Nana will be presenting her work to hundreds of other GPD leaders throughout North America at the Graduate Career Consortium National Meeting at Berkeley, CA in June of 2016. **Reinhart** is now Special Advisor to the Dean of Graduate Studies for Graduate Professional Skills and Engagement and is implementing GPD initiatives throughout the University of Toronto. One recent launch is the 10,000 PhDs Project, which plans to obtain robust career outcome data of U of T PhDs graduated in the last decade, in order to engage alumni in GPD activities as mentors and in experiential learning opportunities.

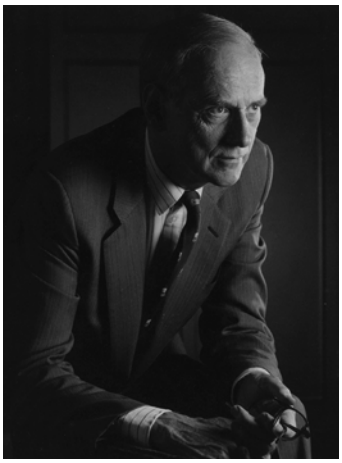
Amira Klip was awarded an Honorary Doctoral degree from the University of Copenhagen last November, and just received the Walter B. Cannon Award of the American Physiological Society. **Reinhart Reithmeier** won the Faculty of Medicine Graduate Faculty Teaching Award for Sustained Excellence in Graduate Teaching and Mentorship. He was also elected for a 3-year term to the Academic Board that is "responsible for matters affecting the teaching, learning and research functions of the University, the establishment of University objectives and priorities, the development of long-term and short-term plans and effective use of resources in the course of these pursuits." **Sergio Grinstein** presented the Keynote lecture at a recent Gordon Research Conference on Phagocytes. He was honoured for his many contributions to our understanding of phagocytosis, the process by which immune cells engulf and kill bacteria.

Christine Bear, along with co-PIs Felix Ratjen, Janet Rossant, Peter Ray, Lisa Strug, Tanja Gonska and Theo Moraes, have created a platform enabling personalized therapy development for Cystic Fibrosis. The platform is comprised of the 100 cell line project with primary tissue, iPS cells, WGS and RNAseq linked to clinical data from 100 CF patients. They have received fundraising approval by CF Canada and the SickKids Foundation and expect to recruit within the next month. The platform also enables the profiling of drug responses using patient-specific tissues (airway, pancreatic, and bile duct) derived from iPS cells. They will compare the efficacy of newly discovered correctors and potentiators relative to existing ORKAMBI combination therapy so that each patient is treated with the drug which is best for them. Their goal is to develop and provide in vitro drug testing platforms that are predictive of clinical outcome for ΔF508 patients and for CF patients with very rare mutations. WGS will be used to generate genetic signatures predictive of drug response and to understand the molecular mechanisms dictating pharmacological rescue of the basic defect. The Program will provide training modules and 6 synergy grants/annum. These resources will be accessible to the global CF research community.

Walid Houry, along with colleagues in the Chemistry and Physics Departments, has established the BiophysTO lunchtime seminar series. The intent is to promote scientific interactions and potential collaborations among the Toronto biophysics community with the focus on the quantitative characterization of biological molecules, processes, and systems. This is a pan-Departmental event with the talks being broadcast both downtown and at the U. of T. Mississauga campus: https://www.physics.utoronto.ca/research/biological-physics/BiophysTO

Congratulations to **Sergio Grinstein, Amira Klip, Frank Sicheri and David Andrews** who were awarded Foundation Grants from the Canadian Institutes for Health Research, and to **Alex Palazzo** who successfully renewed his NSERC grant and was awarded a Discovery

Accelerator Supplement. We were also delighted to learn that **Joel Watts** was awarded a CIHR New Investigator Award.



George Connell

The Department was saddened by the news of the passing of **Professor George Connell.** George spent most of his academic career at the University of Toronto, starting with his undergraduate and graduate degrees, and continuing as a faculty member in the Department of Biochemistry. He was an outstanding researcher and teacher, and a skilled administrator who went on to serve as Chair of the Department of Biochemistry, Associate Dean of Medicine, and Vice-President of Research and Planning. Recognized for his talent and accomplishments, he was appointed President of the University of Western Ontario in 1977, a position he held until returning to the University of Toronto as President in 1984. A Fellow of the Royal Society of Canada, he was appointed an Officer of the Order of Canada in 1987. Even as a senior administrator, the Biochemistry Department remained close to his heart. He requested that funds raised at the end of his term as President be directed to the Department. These funds have supported our George Connell Lecture series that has featured outstanding speakers from around the world. For some touching tributes to George from Emeritus Professors **David Tinker** and **Robert Murray** please visit: http://biochemistry.utoronto.ca/2015/03/in-memoriam-professor-george-connell

Research highlights:

The Forman-Kay lab provides new insights into how intrinsically disordered proteins mediate phospho-regulation. (Nature 2015, 519:106)

In its non-phosphorylated state, 4E-BP2 binds eIF4E with a helical binding element to suppress cap-dependent translation initiation. Phosphorylation at T37 and T46 induces folding of residues P18–R62 into a four-stranded β-domain that sequesters the eIF4E-binding element into a partly buried β-strand and the additional phosphorylation sites stabilize this fold. This mechanism for phospho-regulation of the 4E-BP:eIF4E interaction exemplifies a previously unreported mode of biological regulation mediated by intrinsically disordered proteins.

Rubinstein lab captures the highest-resolution structures ever determined for a V-ATPase (Nature 2015, 521:241) V-ATPases are proton pumps that control the pH in many compartments within cells. However, the mechanism by which V-ATPases pump protons remains mysterious. The Rubinstein Lab has employed state-of-the-art electron microscopy techniques with novel computational algorithms and a new type of electron-detecting camera to image this macromolecular machine in different states. In this way one can see how it moves in order to couple the use of ATP to proton pumping. The understanding of V-ATPase structure and function will allow for understanding the various processes the V-ATPase controls and enable design of drugs that influence its activity.

PhD student Attila Balint discovers signaling role for Slx4 (EMBO J. 2015, 35:793)

Slx4 is a nuclease scaffold protein that is mutated in Fanconi Anemia patients. In his study, Attila and colleagues in **Grant Brown's lab** defined the pathway that assembles Slx4 protein complexes onto chromatin when DNA replication is blocked by DNA damaging drugs. Surprisingly, Slx4 complexes promote checkpoint signaling to allow cells to resist and repair DNA damage. Attila's study provides the first view of signaling complexes at damaged DNA replication forks.

Rotin Lab discovers mechanism of leucine uptake into lysosomes and stimulation of mTORC1 activation (Nature Communications 2015, 6: 7250) mTORC1 is a master regulator of energy metabolism, protein synthesis, cell and animal growth. Influx of essential amino acids such as Leu into cells is mediated by the LAT1-4F2hc transporter and results in the recruitment of the mTORC1 complex to the lysosomal membrane. Intracellular Leu then enters the lysosome to activate the lysosomal membrane protein H^+-ATPase from inside the lysosome (inside-out mechanism), leading to activation of mTORC1. The critical step of how Leu enters the lysosomes was unknown. **Ruth Milkereit** and **Avinash Persaud** from the Rotin lab identified the lysosomal protein LAPTM4b as a binding partner for the Leu Transporter, LAT1-4F2hc. They then showed that LAPTM4b recruits LAT1-4F2hc to

the lysosome, leading to uptake of Leu into this organelle and stimulation of mTORC1 activation via the H^+-ATPase. **Highest resolution structure of the mitochondrial ATP synthase published by the Rubinstein Lab** (eLife 2015, 4:e10180) Mitochondria are the 'powerhouses' of cells, and ATP synthase is the macromolecular machine that makes the cell's supply of ATP. Using new cryo-EM methods the team demonstrated inherent flexibility in this essential enzyme. By combining their cryo-EM map with bioinformatic methods they were able to build the first atomic model of one of the key components of the ATP synthase. This structure will help explain how ATP synthesis is achieved in mitochondria.

Design and structures of new HIV-1 clade C trimers that increase the arsenal of Env immunogens (PNAS 2015, 112:11947) **Jean-Philippe Julien** and collaborators at the Scripps Research Institute report two HIV-1 envelope glycoproteins (Env) of clade C sequences that are faithful antigenic and structural mimics of the native trimer in its pre-fusion conformation. HIV-1 clade C is responsible for over 50% of all new infections worldwide, predominantly in sub-Saharan Africa – the epicenter of the AIDS pandemic. These stable clade C trimers contribute additional diversity to the pool of native-like Env immunogens as key components of strategies to induce neutralizing antibodies to HIV-1 by vaccination.

Ernst lab contributes DEER spectroscopy to Nature paper on rhodopsin-arrestin complex structure (Nature 2015, 523:561) The GPCR-arrestin complex crystal structure was solved using data collected at the Stanford LCLS X-ray free electron laser. **Ned van Eps and Lydia Caro** from Oliver Ernst's lab used pulsed electron paramagnetic resonance spectroscopy to validate the rhodopsin–arrestin complex assembly.

Reinhart Reithmeier and post-doc Xiaoyun Bai call for systemic research on solute carriers (Cell 2015, 162:478) The SLC human family of over 400 genes plays an essential role in ion and pH homeostasis, nutrient uptake and waste removal. Mutations in these genes are linked to a plethora of human diseases and SLCs are potential drug targets. Yet, SLCs are one of the most understudied human gene families. The article calls for a systematic attack on SLCs to elucidate their structures, functions and involvement in metabolic networks and human disease. This understanding will allow translational research to place SLCs in the sights of the pharmaceutical industry.

Moraes, Pomès, and Gray-Owen labs determine the structure of the bacterial zinc transporter (Nature Communications 2015, 6:7996) The conserved outer-membrane zinc transporter ZnuD is utilized by bacteria to overcome nutritional restriction imposed by the host organism during infection. In this paper it is shown that ZnuD is required for efficient systemic infections by the causative agent of bacterial meningitis, *Neisseria meningitidis.* Combined X-ray crystallography and molecular dynamics simulations were used to gain insight into the mechanism of zinc recognition and transport across the bacterial outer membrane.

Structure and functions of the bacterial sugar-phosphate transporter (PLoS Pathogens 2015, 11:31005107) Undergraduate student **Brandon Sit** together with other members of the **Moraes Lab** used X-ray crystallography and additional biochemical and functional approaches to illustrate that AfuABC binds and transports sugar-phosphates such as glucose-6-phosphate across the Gram negative bacterial membrane. In collaboration with the Vallance lab (at UBC) they went on to show that AfuABC is required by enteric pathogens to effectively transmit and re-establish infection, suggesting that the transport of sugar-phosphates is an important part of bacterial pathogenesis.

New advances in phagocytosis by the Grinstein Lab (Nature Communications 2015, 6:8623) Phagocytosis is the mechanism responsible for the clearance of pathogens, dead cells and macromolecular debris. The formation of the phagosome and its internalization requires tightly coordinated, localized actin assembly and disassembly. While mechanisms of actin assembly to drive advancing pseudopodia are well studied, the mechanism of actin disassembly was unknown. Screening a library of RhoGAP fluorescent fusion proteins, the Grinstein lab found 3 RhoGAPs that were recruited to large phagocytic cups in a phosphoinositide 3-kinase-dependent manner and were required for the completion of phagocytosis. The loss of any one of these RhoGAPs arrested phagocytosis at a stage where the actin-mesh is thick, indicating a non-redundant function of these GAPs.

Faculty appointments:
The Department was pleased to welcome four new Faculty members in 2015.

Alex Ensminger

Dr. Alex Ensminger joined the Department with a primary appointment as Assistant Professor. He is interested in the evolution of microbial pathogens and the mechanisms by which these organisms persist in our environment and make us sick. He focuses his attention primarily on *Legionella pneumophila*, a remarkable bacterial pathogen that maintains the microbial world's largest known arsenal of translocated effectors (with over 300 identified to date). Unlocking the secrets of this arsenal holds immense promise to provide novel insight into fundamental eukaryotic pathways, human health, and disease. After completing his PhD from MIT in 2006, Alex began postdoctoral work with Ralph Isberg Tufts University School of Medicine/HHMI). During this time, he established the laboratory's expertise in Illumina next-generation sequencing technologies. He also developed a powerful experimental evolution approach to uncover new genetic determinants of host range and bacterial virulence.

Robert Screaton

Dr. Robert Screaton, a Senior Scientist at the Sunnybrook Research Institute, joined our Department with a primary appointment as Associate Professor. Rob received his undergraduate and graduate training at McGill University and pursued post-doctoral studies at the Burnham Institute and the Salk Institute in San Diego, California. From 2005-2015 he was a Senior Scientist at the Children's Hospital of Eastern Ontario Research Institute and an Associate Professor in Pediatrics at the University of Ottawa, where he held the Canada Research Chair In Apoptotic Signaling, Tier II. Rob's research focuses on finding cures for Type 1 and Type 2 diabetes. A central effort is to better understand how the pancreatic beta cell converts feeding cues into signals leading to insulin synthesis and secretion. He uses high-throughput functional genomic imaging screens to identify novel players involved in cell signaling pathways that control human pancreatic beta cell proliferation. In addition, he is interested in the function and quality control of mitochondria, critical subcellular organelles essential for cell function and survival.

Mathieu Lemaire

Dr. Mathieu Lemaire, a Scientist-Track Investigator at the Hospital for Sick Children and Assistant Professor in the Department of Paediatrics, was cross-appointed to the Department as an Assistant Professor. Mathieu finished his medical training at McGill University in 2004 and then moved to Toronto to learn Paediatrics at The Hospital for Sick Children. After completing his fellowship in Paediatric Nephrology in Toronto, he went to Yale University to pursue a PhD in Investigative Medicine under the guidance of Dr Richard P. Lifton, with a focus on the genetics of rare paediatric kidney diseases. The overarching goal of his lab is to do translational research related to paediatric kidney diseases using various "omics" tools as a starting point. For example, he uses whole-genome or whole-exome sequencing to identify novel disease-causing genes. These studies are then followed by careful functional dissection of candidate genes using cutting-edge microscopic, genome editing, cell biology and biochemical methods. He also uses high-throughput screening to discover novel compounds that modulate the function of target genes. Recently his group identified the first non-complement gene that causes a recessive form of atypical hemolytic-uremic syndrome (aHUS), diacylglycerol kinase epsilon. They are also working on delineating the function of yet another disease-causing gene that defines a novel pathophysiologic path to aHUS. Other projects are focused on the biology specific to pediatric renal transplantation.

Aleixo Muise

Dr. Aleixo Muise, a Scientist in the Program in Cell Biology at the Hospital for Sick Children and Associate Professor in the Dept of Pediatrics, was cross-appointed to the our Department as an Associate Professor. Aleixo completed a PhD in Biochemistry at Dalhousie University, his M.D. at the University of Toronto and his Paediatric residency at The Hospital for Sick Children. He also did a Subspecialty Fellowship in the Division of Gastroenterology, Hepatology and Nutrition and completed postdoctoral training in the laboratory of Dr. Daniela Rotin. Aleixo's clinical work and laboratory research is focused on understanding the genetic susceptibility and function of identified genes in pathogenesis of Very Early Onset Inflammatory Bowel disease (VEOIBD). He has created the largest repositories of DNA from well phenotyped VEOIBD patients by establishing a clinic at SickKids to ascertain, treat, and follow infants and young children with VEOIBD, and by founding the SickKids-based interNational Early Onset Paediatric IBD Cohort Study (NEOPICS).

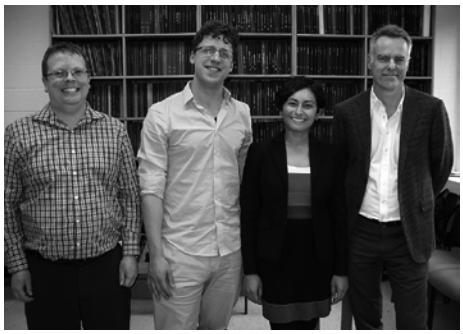
Departmental events:
Research Day

A terrific turnout for the 2015 Research Day

More than 200 attendees and 80 posters contributed to another highly successful Research Day. Held on May 21st in the Medical Sciences Bldg. auditorium with posters in the Stone Lobby, we also enjoyed a BBQ lunch

Jean-Bernard Caron with Theo Hofmann and Chair, Justin Nodwell

on the "patio" in between. As always, the calibre of science was extremely high, featuring research talks from trainees and our newest faculty members, as well as excellent poster presentations. We also enjoyed our annual **Theo Hofmann Lecture** (this year by Dr. **Jean-Bernard Caron**, Curator of Invertebrate Palaeontology, Royal Ontario Museum and Professor, U. of Toronto) who spoke about the fascinating fossil discoveries in the Burgess Shale deposit and similar locations within B.C. With good food, great science, perfect sunny weather and the chance to catch up with colleagues, Research Day was clearly a highlight of the year. For some additional photos of the event, please go to: http://biochemistry.utoronto.ca/2015/05/research-day-2015/



Host Joel Watts (left) with Eric Minikel and Sonia Vallabh

Joel Watts hosted a truly remarkable **seminar by Eric Minikel and Sonia Vallabh** who related their personal journey with prion disease. Several years ago, Sonia got the devastating news that she carries the same mutation in the prion protein gene that led to her mother's premature death from fatal familial insomnia. Prior to this, Sonia's husband Eric had graduated from MIT and worked in transportation planning and Sonia had completed Harvard Law School. They described how they decided to put these promising careers behind them and re-invent themselves in the areas of bioinformatics and neuroscience, with current positions as PhD students at the Harvard Broad Institute in the lab of Stuart Schreiber. They are highly proactive in the search for novel therapies for prion disease and

have already completed a study of human mutations in the prion gene. They discovered that several mutations previously thought to be disease-associated are in fact benign - great news for those carrying these mutations! For more on this remarkable couple see: http://news.harvard.edu/gazette/story/2016/03/strength-in-love-hope-in-science

Golf Day

More than 30 biochemists came out for a fun afternoon at our Annual Golf Day

July 14th saw the Biochemistry Department gathering once again for our exciting Annual Golf Day. Held at the Flemingdon 9-hole Golf Course in Midtown Toronto the threat of rain didn't deter our intrepid golfers. Eight teams composed of beginners and experienced players enjoyed a "best ball" format that ensured that all golfers were able to contribute to their team's effort. And it was a squeaker with the Pathological Lab Mates pulling out a 2-under par, just nudging ahead of the ERAdicals, Molecular Structure and Fun and Mitochondriacs-Fission who had a 3-way tie for second place at 1 under. More pics at: http://biochemistry.utoronto.ca/2015/07/2105-biochemistry-golf-day

Mutants win big at the Biochemistry-Immunology Baseball Challenge

The 2015 Biochemistry Mutants

The Immunology "Immunodominators" and Biochemistry "Mutants" have squared off over a fall exhibition game for as long as anyone can remember. And for the past few years, the Immunodominators have feasted on the keen but outmatched Mutants. This year was a whole new ball game as we moved off campus for an evening event at Riverdale Park. What a great decision that was! Not only were we playing on a field with cages and benches, the field was illuminated! The game was hard fought, but the Mutants showed what they were really made of. It was neck and neck for the first four innings, then the Mutants pulled ahead in the 5th with a lead that left the hapless Immunodominators bewildered. A final score of 21-12 gave the Mutants bragging rights for the year and the confidence to face the Immunodominators next year!

Graduate student news:
Benjamin Schachter Memorial Lecture

from left: Benjamin Schachter's daughter Bonnie Druxerman and his son Daniel Schachter, Cory Mulvihill, Bonnie's husband Peter Druxerman and Chair Justin Nodwell

A highlight in the academic year, the Benjamin Schachter Memorial Lecture provides our students with insights and advice on diverse career choices and is named in honour of former graduate student Benjamin Schachter, who conducted research in the Department from 1934-1939. This year, the Biochemistry Graduate Students Union invited **Dr. Cory Mulvihill** to present the Benjamin Schachter Memorial Lecture. Currently, he's the Chief of Staff of the Office of the Hon. Reza Moridi, Minister of Research & Innovation and the Minister of Training, Colleges & Universities for the province of Ontario. Dr. Mulvihill gave an insightful account of his journey into politics, starting from a background in research. He also highlighted the attributes and aspects required for a successful career following graduate education.

Annual poster competition:
The centerpiece of the Department's Annual Research Day is its trainee poster competition. As usual, the quality was high and the decisions tough but, in the end, the following students were chosen as poster winners:

PhD category:
Scott McAuley (Nodwell Lab) "*Inhibitors of Streptomyces development induce a small cell phenotype in Bacillus subtilis"*
Olesia Ivantsiv (Davidson Lab) "*Bacteriophage-encoded*

tail fibre assembly proteins - putative receptor binding proteins with a role in tail fibre formation"

Kamran Rizzolo (Houry Lab) "*Functional cooperativity among ATP-dependent proteases and molecular chaperones"*

Simon Wisnovsky (Kelley Lab) "*Exploring mitochondrial DNA repair pathways using chemical biology"*

Winners of the PhD Poster Awards

MSc category:

Martin Daniel-Ivad (Nodwell lab) *"Chemical control of secondary metabolism in Streptomyces to discover novel antibiotics"*

Frozan Safi (Rotin Lab) "*Drosophila Nedd4-long reduces amphiphysin levels in muscles and leads to impaired T-tubule formation"*

Zev Ripstein (Rubinstein lab) "*CryoEM analysis of the VAT complex"*

Winners of the MSc Poster Awards

Postdoc category:

Jason Koo (Howell Lab) "*Mapping the topology of the Pseudomonas aeruginosa Type IV pili outer membrane secretin, PilQ, by electron microscopy"*

Graduate awards:

Heidary presents his Paper of the Year (2014) Award talk

Beckman Coulter - Molecular Devices Paper of the Year Award

This year's winner of the Paper of the Year was **Arash E. Heidary** (Attisano lab) for his paper entitled:

Arhgef7 promotes activation of the Hippo pathway core kinase Lats.

Heidary Arash E., Song, K.M., Song, S., Shiban, A. and Attisano, L.

EMBO J. (2014) 33(24):2997-3011.

April Pawluk delivers her Centennial Award talk

Centennial Award

Created in memory of alumna **Sela Cheifetz**, this award was presented to **April Pawluk** (Davidson lab) who received the honour as our top PhD student beyond year 3.

Dustin Little receives the Outstanding Thesis award from Chair Justin Nodwell

Outstanding PhD thesis award

This award went to **Dustin Little** (Howell lab) for his thesis entitled *"Modification and translocation of the biofilm exopolysaccharide poly-b(1,6)-N-acetyl-D-glucosamine."* The award is based on having a well written and scholarly thesis that provides important contributions to new knowledge and outstanding performance at the oral defense.

David Scott Prize

The annual prize for outstanding all-round graduate student was awarded to **Tomas Gverzdys** (Nodwell lab). Award winners are selected on the basis of research and teaching excellence and outstanding contributions to the Department and to fellow students.

Chair Justin Nodwell presents the Scott Award to Tomas Gverzdys

The Outstanding Teaching Assistant award was presented to **Graeme Sargent** for his exceptional performance as a TA in our BCH377H lab course.

Undergrad coordinator Roula Andreopoulos with outstanding TA Graeme Sargent

More graduate news:
Scott McAuley, a grad student in the Nodwell lab, and business partner Leo Mui, were featured in the recent issue of U of T Magazine. The two grad students formed the company Lunanos and are developing a reusable disinfectant indicator sticker for use on rolling hospital equipment as a tool for infection control. Prototypes will shortly be tested in hospitals in Toronto and the Philippines.

Graeme Sargent was one of 15 students selected for the University-wide finals of the Three-Minute Thesis competition. The Three-Minute Thesis concept (originally developed at the University of Queensland) is simple, but daunting. Participants have three minutes, and a single, static slide, to explain years of research. All participants are PhD Candidates who are nearing completion.

Undergraduate news:
Congratulations to **Sympascho Young** on winning one of three Graduate and Life Sciences Education Undergraduate Student Leadership Awards. The award recognizes academically high achieving students involved in mentoring, student unions, student life and university governance. For the nomination submission, Sympascho wrote an inspiring Leadership Philosophy and Activity statement detailing his journey to effective leadership.

Congratulations also to **Michael Ly** and **Ashrut Narula** for exceptional achievement at the top of their classes in our 3rd and 4th year laboratory courses, respectively.

Sympascho Young (left), Michael Ly and Ashrut Narula (right) receive their awards from Undergraduate Coordinator Roula Andreopoulos

University of Toronto

Department of Cell and Systems Biology
Correspondent: Tony Harris

July 1, 2016 will mark the 10-year anniversary of the Department of Cell and Systems Biology. We are a major contributor to research and teaching at the University of Toronto. Groups in the Department combine high-throughput, cell imaging, physiological and bioinformatics methods to understand cellular and physiological processes in both model (*Arabidopsis*, *Drosophila*, mouse, zebrafish, *Xenopus*) and non-model organisms. The Department's major strengths include its groups studying plant molecular biology, its labs focussed on animal cell biology and tissue morphogenesis, and its groups studying neurophysiology. The department is also home to the Centre for the Analysis of Genome Evolution and Function, a CFI-funded centre for genomics and proteomics research, in addition to a state-of-the-art CFI-funded microscopy centre.

In the last year, Dr. **Vince Tropepe** became the Chair of Cell and Systems Biology. Also, Drs. **Nick Provart** and **John Peever** were promoted to Full Professor.

One of our research highlights from the last year came from the lab of **Peter McCourt**. His work was highlighted by Peter Boisseau of the UofT Arts and Science News:
"McCourt's work on the noxious weed could tackle

hunger and help save lives in places such as Africa, where *Striga* infests two-thirds of the arable land and is considered the single largest impediment to reducing poverty on that continent. The pinkish-lavender plant is an "obligate parasite" that feeds off other plants, sucking nutrients from their host while the *Striga* flourishes and produces new seeds. Each *Striga* produces thousands of dust-size seeds, which can lie dormant in the soil for decades, waiting for a host, which the *Striga* seed senses is nearby by detecting hormones the host exudes, called strigolactones, at astoundingly minute levels of one part per trillion. [The McCourt lab] cloned 11 receptor genes from *Striga hermonthica* and spliced them one by one into a model plant called *Arabidopsis* - considered the "fruit fly" for basic plant research because of its rapid life cycle and other characteristics that make it easy to use for experiments. In the process, they identified a receptor called HTL7 that made *Arabidopsis* as sensitive to strigolactones as *Striga*. Their work appeared in the October 2015 issue of the journal *Science,* published by the American Association for the Advancement of Science."

Other recent publications included:

A temporally controlled inhibitory drive coordinates twitch movements during REM sleep.
Brooks PL, Peever J.
Curr Biol. 2016 Mar 29. pii: S0960-9822(16)30189-30190.

A Par-1-Par-3-centrosome cell polarity pathway and its tuning for isotropic cell adhesion.
Jiang T, McKinley RF, McGill MA, Angers S, Harris TJ.
Curr. Biol. 2015 25:2701-2708.

Evolutionary transformation of rod photoreceptors in the all-cone retina of a diurnal garter snake.
Schott RK, Müller J, Yang CG, Bhattacharyya N, Chan N, Xu M, Morrow JM, Ghenu AH, Loew ER, Tropepe V, Chang BS.
Proc Natl Acad Sci USA. 2016 113:356-361. Epub 2015 Dec 29.

50 years of Arabidopsis research: highlights and future directions
Provart NJ, Alonso J, Assmann SM, Bergmann D, Brady SM, Brkljacic J, Browse J, Chapple C, Colot V, Cutler S, Dangl J, Ehrhardt D, Friesner JD, Frommer WB, Grotewold E, Meyerowitz E, Nemhauser J, Nordborg M, Pikaard C, Shanklin J, Somerville C, Stitt M, Torii KU, Waese J, Wagner D, McCourt P.
New Phytol. 2016 209:921-44. Epub 2015 Oct 14.

Decreases in mitochondrial reactive oxygen species initiate GABA(A) receptor-mediated electrical suppression in anoxia-tolerant turtle neurons.
Hogg DW, Pamenter ME, Dukoff DJ, Buck LT.
J Physiol. 2015 593:2311-2326. Epub 2015 Apr 13.

Decreased transcription factor binding levels nearby primate pseudogenes suggest regulatory degeneration.
Douglas GM, Wilson MD, Moses AM.
Mol Biol Evol. 2016 Feb 16. pii: msw030.

University of Toronto

Department of Molecular Genetics

Correspondents: Leah E. Cowen and Julie M. Claycomb

This has been an eventful year for the Department of Molecular Genetics! Whereas in 1969 the Department had 10 faculty members housed solely in the newly constructed Medical Sciences Building (MSB), it now comprises over ten times as many faculty members, half on campus in the MSB and the Donnelly Centre, and half in hospital-based research institutes including the Peter Gilgan Centre for Research and Learning, the Lunefeld-Tanenbaum Research Institute, and the Ontario Institute for Cancer Research. This growth reflects the success of the Department in establishing and maintaining key partnerships both on and off campus. We hope that you will enjoy our research highlights and coverage of exciting faculty and student achievements and initiatives.

Faculty highlights and awards:

Dr. Janet Rossant received the 2015 Canada Gairdner Wightman Award, was appointed a Companion of the Order of Canada, and was awarded the 2016 Henry G. Friesen International Prize in Health Research. The Gairdner Wightman Award is one of the most prestigious biomedical research awards in Canada, and recognizes Dr. Rossant for her extensive scientific contributions to developmental biology, her international leadership in stem cell biology and policy-making, and for her pivotal role in advancing research programs for children's health. His Excellency the Right Honourable David Johnson, Governor General of Canada, made the announcement

Janet Rossant

on July 1st, 2015 regarding the appointment as a Companion of the Order of Canada in recognition of Rossant's achievements that have advanced the global understanding of embryo development and stem cell biology, and her national and international leadership in health science. The Friesen Prize recognizes Dr. Rossant's exemplary vision and innovation in developmental and stem cell biology. Dr. Rossant will also assume a new role as the President and Scientific Director of the Gairdner Foundation as of May 1, 2016.

Monica Justice

Dr. Monica Justice was appointed a Tier 1 Canada Research Chair in Mammalian Molecular Genetics. As head of the Genetics & Genome Biology program at SickKids, Dr. Justice's research aims to ameliorate disease states in humans by merging mouse modelling with clinical genetics. **Dr. Julie Lefebvre** was awarded a Canada Research Chair (Tier 2) in Developmental Neural Circuitry. Dr. Lefebvre's research focuses on understanding how nerve cells in the brain are organized into circuits that enable functions such as sight, motor skills and language. **Dr. Daniel Schramek** was appointed a Tier 2 Canada Research Chair. Dr. Schramek's vision is to leverage functional genomics to make major advances in treating human cancers in a personalized and highly specific manner by analyzing the exact molecular underpinnings of why a tumour develops. **Dr. Helen McNeill** was awarded a Tier 1 Canada Research Chair. Dr. McNeill's research is focused on how cells become organized into tissues, and how growth is controlled during development.

Julie Lefebvre

Daniel Schramek

Helen McNeill

Igor Stagljar

Dr. Igor Stagljar was named 2015 Inventor of the Year. Dr. Stagljar was recognized for his invention of Mammalian Membrane Two-Hybrid (MaMTH), which tracks membrane proteins as they interact with other proteins to either maintain or contribute to health. These proteins are associated with more than 500 diseases. This technology provides a new tool to examine membrane proteins in their natural environment of the human cell. It is sensitive enough to detect minor changes upon the introduction of drugs and thus should prove useful in the development of therapeutics, especially for cancer and neurological diseases.

Julie Brill

Dr. Julie Brill was named Fellow of the American Association for the Advancement of Science. Election as an AAAS Fellow is an honor bestowed upon AAAS members by their peers. Dr. Brill is being recognized for her discovery of in vivo roles and regulation of phosphatidylinositol phosphates in cell morphogenesis during animal development.

Anne Claude Gingras

Dr. Anne Claude Gingras and **Dr. Daniel Durocher** were named Fellows of the Royal Society of Canada. The fellowship of the Royal Society of Canada comprises distinguished individuals from all branches of learning who have made remarkable contributions in the arts, the humanities and the sciences, as well as in Canadian public life.

Daniel Durocher

Dr. Gingras is recognized for her cutting edge research in systems biology that has advanced the frontiers of understanding how protein interactions affect disease. Dr. Durocher is recognized for his pioneering work in sensing and signalling DNA damage repair. **Dr. Brenda Andrews** was appointed as a Companion of the Order of Canada**.** Dr. Andrews received the highest level of the Order of Canada for her globally significant research in systems biology and for developing and nurturing prominent scientific communities in molecular genetics. **Dr. John Dick** was inducted to the American Association of Cancer Research Academy. The Academy recognizes "scientists whose major scientific contributions have propelled significant innovation and progress against cancer."

Brenda Andrews

John Dick

Ronald Cohn

Dr. Ronald Cohn has been appointed to the position of Chief of Paediatrics at The Hospital for Sick Children and Chair of Paediatrics at The University of Toronto. Dr. Cohn was recruited to the Hospital for Sick Children in 2012 to be the Chief of the Division of Clinical and Metabolic Genetics, Co-Director of the Centre for Genetic Medicine and Senior Scientist. He also became the Inaugural Women's Auxiliary Chair in Clinical and Metabolic Genetics in April of 2013, and is an Associate Professor in the Departments of Paediatrics and Molecular Genetics at the University of Toronto. He is the recipient of numerous awards including the David M. Kamsler Award for outstanding compassionate and expert care of pediatric patients, 2004; First Annual Harvard-Partners Center for Genetics and Genomics Award in Medical, 2006; and, the NIH Young Innovator Award, 2008.

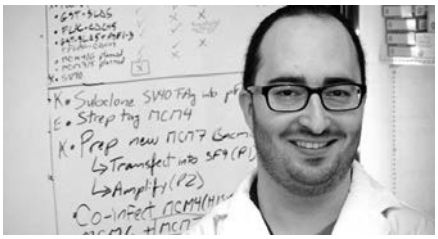
Welcome to new faculty:

Dr. Daniel Schramek was appointed to the Department of Molecular Genetics as an Assistant Professor on July 1, 2015, and is located in the Lunenfeld-Tanenbaum Research Institute node. He trained in Europe, Australia and the U.S., receiving a B.A. and an M.Sc. in Molecular Biology, a Ph.D. in Genetics and an Executive M.Sc. in Technology Management. For the last four years, he was a postdoctoral fellow and Emerald Foundation Young Investigator at the Rockefeller University (NY). His research focuses on leveraging functional genomics to make major advances in treating human cancers in a personalized and highly specific manner by identifying and characterizing why a tumour develops.

Xi Huang

Dr. Xi Huang was appointed to the Department of Molecular Genetics as an Assistant Professor on July 1, 2015, and is located in the SickKids Research Institute node where he is part of the Developmental & Stem Cell Biology program. He trained in China and the U.S., receiving a B.Sc. in Biology and a Ph.D. in Cell and Developmental Biology. Most recently, he was a Damon Runyon Postdoctoral Fellow at University of California, San Francisco/Howard Hughes Medical Institute. His research investigates the function of ion channels in brain development and cancer, using multi-disciplinary approaches including those in *Drosophila* genetics, mouse genetics, xenograft modeling, cell biology, and electrophysiology. His lab strives to define the mechanisms that ion channels utilize to regulate neural development and tumorigenesis.

Dr. Eric Campos was appointed to the Department of Molecular Genetics as an Assistant Professor on September 1, 2015, and is located in the SickKids Research Institute node where he is part of the Genetics & Genome Biology program. He trained in Canada and the U.S., receiving a B.Sc. and a



Eric Campos

Ph.D. in Experimental Medicine. He was a postdoctoral fellow at the Howard Hughes Medical Institute, New York University School of Medicine. His laboratory focuses on the mechanisms of epigenetic inheritance: self-perpetuating changes on chromatin that influence gene expression independently of DNA sequence. His team aims to understand the spatiotemporal regulation of epigenetic factors that cells utilize to maintain a transcriptional 'memory' through cell division. Emphasis is not only placed on the biochemical characterization of histones, histone chaperones and the protein complexes that help perpetuate epigenetic information under normal circumstances, but also on how the process goes awry in a number of childhood cancers.

Philip Awadalla

Dr. Philip Awadalla was appointed to the Department of Molecular Genetics as a Professor on September 1, 2015, and is located in the OICR node. He is a Senior Investigator at the Ontario Institute for Cancer Research, Professor of Population and Medical Genomics at the University of Toronto, and is a Principal Investigator of the Canadian Partnership for Tomorrow Project and biobank. He is also the Director of the Genome Canada, Canadian Data Integration Centre. Dr. Awadalla was trained at the University of Edinburgh, and his team focuses on the development of next-generation genomics approaches, model-based tools and population-based approaches to study mutation rates, genome biology, and cancer. His team's research also focuses on systems and population genomics approaches to capture signals in population-based samples or families as well as tools to capture rare or de novo variants, potentially critical to disease phenotypes. Dr. Awadalla's main research interests include identifying genetic determinants of blood disorders and cancers; and genomic epidemiology of age related disorders in population cohorts.

Student and trainee highlights:

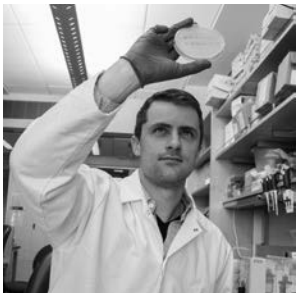
Graduate student **Wen Zhang** (Moran Lab) was awarded a "Women in Cancer Research Scholar Award" for her presentation at the American Association for Cancer Research Annual Meeting. Post-docs **Dr. Teresa O'Meara** (Cowen Lab) won young investigator awards for her presentations at the 2015 Fungal Genetics Conference at Asilomar and the FASEB meeting on Molecular Pathogenesis: Mechanisms of Infectious Disease. Post-doc **Dr. Michelle Leach** (Cowen Lab) wins a young investigator award for her presentation at the 2015 Fungal Genetics Conference at Asilomar. Graduate student **Tanvi Shekhar-Guturja** (Cowen Lab) won an Outstanding Young Investigator Award for Elevator talk and Poster Presentation at the 6th FEBS Advanced Lecture Course on Human Fungal Pathogens in La Colle sure Loup, France. Graduate student **Elizabeth Polvi** (Cowen Lab) wins the David W. Malloch Award for Best Graduate Student Presentation at the 31st Annual Great Lakes Mycology Meeting. **Jinglin (Lucy) Xie** from Dr. Leah Cowen's lab won an American Society of Microbiology Poster Presentation Award at the 2016 ASM Conference on *Candida* and Candidiasis.

Genetics Society of America Trainee-Organizes Symposia grant:

Ph.D. candidates **Amanda Veri** and **Samantha Yammine** have secured funding from the Genetics Society of America to help fund the Department of Molecular Genetics' monthly Career Development and Skills Workshop Series. Veri and Yammine are the tireless co-organizers of this series, which provide students with opportunities to network, develop skills and explore career options.

The following graduate students received departmental awards in 2015:

Gabriela Krivdova (Dick lab): Norman Bethune Award
Amanda Veri (Cowen lab): L. W. Macpherson Award
Daira Wojtal (Cohn lab): Eric Hani Fellowship
Megha Chandrashekhar (Moffat lab): Jennifer Dorrington Graduate Research Award
Mathieu Quesnel-Vallières (Blencowe and Cordes labs**):** Jennifer Dorrington Graduate Research Award



Joseph Bondy-Denomy

Joseph Bondy-Denomy (Davidson lab): 6th annual Barbara Vivash Award for the most outstanding Ph.D. thesis in the Department, entitled "CRISPR meets its match: Bacteriophages inactivate CRISPR function." Joe discovered a new class of proteins that he named "anti-CRISPRs", which allows bacteriophages to turn off the bacterial CRISPR/Cas

defense system. This opened up a whole new mechanism in how phages interact with bacteria. His groundbreaking discovery culminated in two first-author publications in Nature. His award ceremony lecture was extremely well attended, and the room was filled with old graduate school friends, all the professors that he interacted with over the years, lab mates, his wife and a proud mentor.

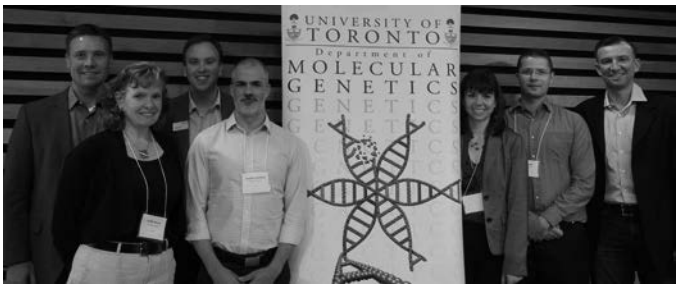
Senjuti Saha from Dr. Alan Davidson's lab was one of the top three finalists in the University of Toronto 3-minute thesis (3MT) Competition, with Nathan Schachter from the Sean Egan's lab and Lucy Xie from Leah Cowen's lab also finalists in this intense competition.

3-Minute thesis finalists

Department and community events:

Career Development Alumni Symposium

Exploring Careers. Building Community. Celebrating Excellence. These were the goals set forth for MoGen's inaugural Career Development Alumni Symposium and not only were they met, but all expectations were exceeded. The event took place on June 4th at the beautiful Bram and Bluma Appel of the Toronto Reference Library. Co-organized by Dr. Leah Cowen and Dr. Julie Claycomb, the symposium aimed to connect current trainees with MoGen's extraordinary alumni to further career mentorship within our own community. If you were unable to attend the Symposium this year, do not worry! Plans are already under way for the next Symposium, to be held June 10th, 2016!



MoGen Career Development Alumni Symposium Panelists

Collaborative Program in Developmental Biology (CPDB) 20th Anniversary Symposium. The Collaborative Program in Developmental Biology (CPDB) celebrated its 20th anniversary this year. Originally established in 1995, the program's mandate was to facilitate cross-disciplinary collaborations between different departments at the University of Toronto and to promote and foster research in the field of developmental biology. Currently, the program spans six departments, including Molecular Genetics, and comprises of over 40 professors and nearly 60 graduate students. To celebrate this milestone, CPDB held a symposium on April 9-10, 2015 at the PGCRL Auditorium with invited speakers including outstanding past graduates of the program who are now successfully running their own labs in Canada, the US and Europe. True to its purpose of connecting different research disciplines, the talks spanned all areas of developmental biology, from stem cell therapies to chromosome segregation, cilia biology, retinal development and much more.

University of Toronto Microbiology and Infectious Disease Research Days 2015. More than 220 faculty and trainees participated in this year's annual 'University of Toronto Microbiology and Infectious Disease Research Days', which were held on June 15-16, 2015. This is the only event each year that brings together infectious disease-focused clinicians, clinical scientists and basic researchers from across campus and all University-affiliated teaching hospitals, with the intent of highlighting research progress and sharing ideas. 75 abstracts were submitted by our trainees, from which 12 were selected for oral presentations during Monday's "Trainee Day". On Tuesday, a morning of seminars from our invited speakers was followed by lunch and a vibrant poster session. This year's event was hosted by Professors Scott Gray-Owen (Department of Molecular Genetics) and Rupert Kaul (Department of Medicine), with our Trainee Day being organized by Mogen graduate students Anna Sintsova and Epshita Islam.

Summer Student Poster Session. Every year, MoGen provides a 12-week summer research program for undergraduate students to gain hands-on laboratory experience. This program culminates with a poster session in which the students present a summary of their work. This year, the poster session was held on August 6 in the MSB Stone Lobby. The turn-out and quality of research presented was the best yet! The Stone Lobby was packed full of students and faculty and you had to squeeze your way through from poster to poster. Lively scientific discussion could be heard all around.

Summer BBQ. The annual MoGen Summer BBQ took place on August 13th at the front lawn of the CIE. The GSA, led by vice-president Samantha Yammine, really stepped up their game this year. Armed with a trunk full of goodies from Costco, they provided not only hotdogs and burgers, but also freeze pops (these were a hit with both students and faculty alike), and watermelon. Special considerations were also made to include veggie, vegan and halal options. Everyone lounged picnic-style on the green grass, enjoying the beautiful day and good company. It was truly picturesque, with frisbees flying overhead and students jumping rope. After everyone's stomachs were filled with food, the fun and games continued with a pub night at The Madison. It was a perfect way to celebrate the end of summer.

MoGen summer BBQ

Student vs. Faculty Softball Game. On August 27th, the second student versus faculty softball game was held at King's College circle. The weather could not have been more perfect and everyone was in high spirits, especially amongst the 10 professors that represented the faculty team. The competition was fierce and the faculty team really tried to hold their ground, however, youth and vitality won out in the end. No one suffered any serious injuries though, which is commendable! At the end, even though the professors suffered a crushing dignified defeat, everyone was all smiles and laughter, showing that even through difficult hardships and trials, professors and students always end up playing on the same side.

MoGen Retreat. The 2015 Molecular Genetics Retreat was once again held at Geneva Park YMCA, on September 23-25th. Attendance broke all records this year with 44 PIs, 94 graduate students, 14 post-docs/staff, 60 rotation students and 9 undergraduate MoGen specialists. The retreat was led this year by Michael Wilson and Jim Rini whose dedication and hard work made sure everything ran without a hitch. The new cohort of first year students and faculty members headed up to Geneva Park on the first day for the inaugural dinner and Power-Hour. Implemented 5 years ago, the Power Hour tests the PI's skills in condensing their research into only 2 minutes with one slide. Always entertaining, and we won't go into embarrassing detail, but let us just say not all the PIs escaped unscathed. The first year students were thoroughly amused and it acts as a great ice breaker. The rest of the department joined the next day.

Halloween Pub Night. On October 29th, the students and faculty of MoGen ditched their lab coats for ghostly face paint, cut up sheets, papier maché and other knick-knacks to celebrate Halloween! Held at the Marquis of Granby, the night was full of drinks, excitement, and karaoke (scientists are also surprisingly good singers)! As always, awards were given out for best costumes. The competition was intense. Everyone really showcased their creativity and humour. Alas, there could only be one individual and one group winner. This year, the winning costumes demonstrated that, even during Halloween,

2015 MoGen Halloween pub night

making fun of science always comes out first. The Best Individual Costume prize went to Boris Dyakov, who dressed up as a "western blot", which was a merge of a cowboy and the protein assay (haha, get it?). The Best Group Costume was awarded to the Cowen lab whose members each dressed up as their favourite piece of lab equipment, including a Bunsen burner, pipette, sterilization loop, centrifuge and more! If you missed the event, but are interested in checking out all the costumes, just head on over the GSA Facebook Page. If you did not win this year, have no fear. It's never too early to start brainstorming your costume idea for next year!

2015 Gairdner Awards Symposium:
This year, the Gairdner Foundation hosted three distinct symposia on October 28-30th entitled: "Global Preparedness for Pandemics: Lessons from Ebola", the "2015 Canada Gairdner Awardees Lecture - Minds that Matter", and "RNA and New Genetic". Held at the Macleod Auditorium, an amazing panel of the world's leading experts gathered to share their life's research accomplishments. Importantly, two Molecular Genetics faculty members were featured in this year's Gairdner Awards Symposium. **Dr. Janet Rossant**, former SickKids Chief of Research, was awarded with the 2015 Canada Gairdner Wightman Laureate Award, one of the most prestigious research awards in Canada. This award is only given to one Canadian scientist a year who has demonstrated outstanding leadership in the biomedical sciences. During the Minds that Matter Symposia, Dr. Rossant gave a truly inspirational talk about how her whole career began because of her love of the blastocyst and the process of how it develops to a fully functional embryo. Dr. Rossant was officially presented the Gairdner Award later that night at the dinner banquet. The last day of the Symposium was devoted to recent groundbreaking discoveries in the field of non-coding RNA and their importance in the regulation of various biological processes in the cell. One of the invited speakers was none other than MoGen's very own **Dr. Benjamin Blencowe**, who discussed his work on alternative splicing regulation, specifically in the identification of microexon splicing, which can have dramatic impact on the regulation of neurological development.

Movember Bake Sale and Trivia Night. Organized by the GSA, the Movember Trivia Night this year took place on November 25th at the Duke of York. This event celebrated the culmination of a month of raising awareness for prostate cancer and allowed participants to showcase their cultivated "staches". This year, the award for Best Moustache goes to **Kenneth Grisé**, who affectionately refers to it as his "bristly lipholstery". The GSA also held a Movember bake sale and raised an amazing $200, which was donated directly to the MoGen Movember team. Thank you to all the volunteer bakers that took the time to make hundreds of cupcakes, cookies, brownies and other decadent treats. Along with the Movember festivities, Trivia Night also encouraged students and PIs to exercise their brains at non-science-related facts. Hosted once again by Trivia Master Luke Pettigrews, teams battled it out and at the end of the night, there was a three-way tie between The Argonautes, Deez Nuts and Jet Fuel Can't Melt Steel Beams. In true graduate student fashion, the tie-breaker was decided by a drink-off. Proving that first year students should not be underestimated, team The Argonautes, consisting of Heather Gibling, Drew Mellow, Ryan Smith, Benjamin Piette, Tim Low, Amanda Charlesworth, Ellen Langille, Ashrut Narula and Karen Chiang, came out as the winner! Look out for the next Trivia Night in the Spring of 2016 for rematches!

University of Toronto Mississauga

Department of Chemical and Physical Sciences
Correspondent: Scott Prosser

Andrew Beharry demonstrating his fantastic pipetting skills

We would like to welcome our newest hire, **Dr. Andrew Beharry**, to UTM. Andrew is formally appointed to the Department of Chemistry at the University of Toronto, but he will be joining a nucleus of researchers at UTM interested in Biochemistry and Medicinal Chemistry. Riding a very successful stint as a postdoctoral scientist at Stanford University, under Eric Kool, Andrew will be focusing on the development of small molecule probes that serve as imaging agents or light activated therapeutics in cell and small animal cancer models. Photodynamic therapy is an age-old technique for the treatment of certain cancers. Andrew's novel organic approaches will hopefully reinvigorate this field through new species that can be

used in many different tissue types and can generate a robust signal for imaging while providing a cancer-killing "right hook", through reactive oxygen. This theme of fluorescent technologies is also part of Andrew's repertoire of research into drug resistance. Key drug resistance pathways involve a host of enzymes whose actions can be monitored *in vivo* by fluorescent assays. More information can be found on his website, http://www.beharrylab.com/.

Andrew will be a welcome addition to the Medicinal Chemistry Group, led by **Patrick Gunning** at UTM. Patrick's group is focused on a host of cancers, through the development of novel inhibitors to ubiquitination enzymes and Signal Transducers and Activators of Transcription (STAT proteins). If you don't have money to ride a roller coaster, see Pat's website instead: http://www.gunninggroup.ca/

Voula Kanelis is doing great things with ABC transporters and phage proteins and structural biology studies by NMR https://sites.google.com/site/kanelislaboratory/. Two of her students (Clarissa Sooklal and Elvin De Araujo) recently graduated with an M.Sc. and Ph.D., and we wanted to send a big shout out to them and recognize them for their research efforts. Congratulations also to Elvin and Claudia Alvarez for their recent poster awards at the Gordon Research Conference in Italy and the ABC meeting in Austria.

Jumi Shin is also taking aim at cancer biology with a host of biophysical methods. She is particularly interested in protein design and manipulating DNA binding. Details of her work can be found at http://www.utm.utoronto.ca/~shinjumi/People/People.html

Our resident physical biochemist, **Scott Prosser** https://www.utm.utoronto.ca/cps/faculty-staff/prosser-r-scott is teaming up with Patrick on some new drug delivery and drug screening projects that will use both ^{19}F NMR and MRI imaging. For some strange reason, Scott has a love affair with all things related to fluorine chemistry. Much of his recent work has been focused on the inner workings of GPCRs by ^{19}F NMR. Building upon their published work in 2015 in Cell (161(5), 1101-1111, co-authored with Nobel laureate Brian Kobilka), their most recent work on the adenosine receptor was just published in Nature http://www.nature.com/nature/journal/vaop/ncurrent/full/nature17668.html

Scott Prosser and post-doctoral fellow Libin Ye playing with their magnets

Everyone is looking forward to pushing the boundaries of biochemistry and structural biology and we welcome new students in the chemical, biochemical and medicinal fields.

University of Victoria

Department of Biochemistry and Microbiology

Correspondent: Perry Howard

Dr. Robert Burke completed his third term as Chair of the department, which spanned February 2007 through June 2015. During this time, Robert brought the department through an Academic Program Review. He successfully recruited two new faculty members, Chris Nelson and John Burke. He organized and was master of ceremonies at our first IdeaFest event, a University-wide community outreach celebration. Robert was instrumental in expanding experiential learning opportunities for our students, both in the teaching labs and in research. He established our non-credit Research Experience courses in the department which allow students to gain experience in our research labs at no cost. Robert oversaw massive overalls of research of research and teaching space. He also fulfilled his vision of developing a welcoming common area for our undergraduate students to gather and study.

Dr. Perry Howard accepted the position of Chair of the department in July 2015. He hit the ground running, bringing the department through the first ever round of 'Enhanced Planning Tools', a preliminary report to put us in good standing for our upcoming Academic

Scott Scholz

Program Review in 2017. This was barely complete when Perry led us in faculty recruitment for a molecular microbiologist/ immunologist, currently in progress.

This has been quite a year for **Scott Scholz**, a valued staff member who joined our department in 1984. Scott replaced Albert Labossiere as manager of the Biotech Support Centre in mid-2015, and is the recipient of the 2016 President's Distinguished Service Award for Service Excellence. This is well-deserved recognition for Scott, whose resourcefulness, dedication, integrity and friendly attitude provide inspiration to us all.

Faculty news:

Dr. John Burke, who joined our Department in the Fall of 2013, is the recipient of a CIHR New Investigator's Award - $300,000 over 5 years. John also received CFI funding for a HDX Mass Spectrometer, which was installed late summer 2015.

Dr. Caroline Cameron is President Elect of the International Society for Sexually Transmitted Diseases Research, and will be the Chair of the 23rd biennial meeting in 2019. The society crosses disciplines to provide an avenue of communication between researchers studying STDs.

Dr. Al Boraston (principal applicant) and co-applicants Stephen Evans and Marty Boulanger received CFI and BCkDF funding for a new crystallography suite which was installed early in 2016. The new X-ray diffraction infrastructure enables the collection of X-ray diffraction data on single crystals of biological macromolecules with the goal of determining their three-dimensional structures. This is a cutting-edge instrument that allows extremely rapid collection of diffraction data from single crystals at cryo-temperatures.

Alisdair Boraston

Dr. Monica Palcic was appointed as Adjunct Professor in February 2015. Monica was previously a Professor of Enzymology at the Carlsberg Laboratory in Copenhagen, and prior to that she was a Professor of Chemistry at the University of Alberta. Monica is a valuable addition to the department, teaching graduate courses and attending all departmental seminars.

Graduate and undergraduate student news:

Michelle Parker

Dr. Michelle Parker (née Tonkin) was awarded the 2015 Canadian Association for Graduate Studies Distinguished Dissertation Award in Engineering, Medical Science and Natural Sciences for her doctoral work, entitled "Molecular Strategies for Active Host Cell Invasion by Apicomplexan Parasites". She also received the Governor General's Gold Medal at the 2015 Spring Convocation. Michelle has accepted one of two positions in the Postdoctoral Training Program in Clinical Chemistry at the University of Toronto.

Heather Derocher, a 4th year microbiology undergraduate student, was the recipient of a Jamie Cassels Undergraduate Research Award in 2015/2016. Heather also won first prize at the Faculty of Science 2016 HonoursFest, a Science-wide competition of undergraduate honour students' research. Her poster was entitled "Making a murder: Mounting a potent anti-tumor immune response". Derocher's research focuses on characterizing how the immune response differs across the four molecular subtypes of endometrial cancer, comparing immunohistochemical data to clinical data from 450 patients. She hopes the results will influence the development of immunotherapies for the treatment of endometrial cancer.

University of Waterloo

Department of Biology

Correspondent: Bernie Duncker

2015 was a great year for the Department of Biology. After more months of construction and disruption than anyone cares to remember, our new Science Teaching Complex was finally completed. This five storey, 120,000-square-foot building includes state of the art teaching labs, five 150-seat lecture halls, a 425 seat amphitheatre (the largest on campus), and plenty of social space, including an exposed glass atrium. One of its first visitors was Prime Minister Justin Trudeau, who toured our new Biology teaching labs and met with members of several of our Velocity Science student start-up companies, including Medella Health, Vitameter and Acorn Cryotech.

Prime Minister Justin Trudeau meets with students from Acorn Cryotech

Dr. Laura Hug

Another highlight of the past year was the arrival of new faculty member, **Dr. Laura Hug**, who joined us after completing postdoctoral studies at U.C. Berkeley. She is investigating the diversity and function of microbial communities in contaminated sites. She recently received a lot of attention for her revised "tree of life", published in *Nature Microbiology*.

Dr. Christine Dupont was one of several expert speakers at a well-attended Public Lecture on the Zika virus, which was followed by a very animated Q&A session. **Dr. Trevor Charles** was honoured with the Ontario Genomics Institute SPARK award for his innovative work in the area of bioplastics, while Ph.D. candidate Laura Sauder from Josh Neufeld's lab won the University-wide award for exceptional teaching by a student. Finally, for the third consecutive year, our International Genetically Engineered Machine (iGEM) Team won a gold medal, as well as Best Poster and Best Software Tool, at the finals in Boston.

University of Western Ontario

Department of Biochemistry

Correspondents: Lynn Weir and David Litchfield

The Department of Biochemistry at the University of Western Ontario is one of the seven basic medical science departments within the Schulich School of Medicine & Dentistry. The Department of Biochemistry currently comprises 21 full-time faculty members with 28 additional cross-appointed or jointly appointed faculty members from other Departments within the Schulich School of Medicine & Dentistry or the Faculty of Science. Several of our faculty members are scientists within Western's affiliated research institutes, including the Robarts Research Institute, the London Regional Cancer Program, the Children's Health Research Institute, and the Lawson Health Research Institute. Our faculty members are engaged in a broad spectrum of research and educational activities. A central theme of research in our program is focused on the molecular origins of disease with particular emphasis in the areas of cancer, chronic diseases of aging, and developmental disorders. Synthetic biology is also emerging as a theme within our research and educational programs.

Recent recruits:

Patrick O'Donoghue, a new faculty member, was recruited for a joint appointment in the Departments of Biochemistry and Chemistry in 2013 and holds a Canada Research Chair in Chemical Biology. He obtained his B.Sc. (Biophysics) and Ph.D. (Chemistry) from the University of Illinois at Urbana-Champaign, followed by post-doctoral training at the University of Illinois with Carl Woese and at Yale University in Dieter Soll's lab. Pat's research focusses

Patrick O'Donoghue

on establishing systems for making proteins that contain atypical amino acids at specific sites. One example includes the tailored addition of post-translational modifications (PTMs) to proteins, thus allowing delineation of PTM function in normal cells and diseased states, such as cancer and neurodegeneration.

Ilka Heinemann

Ilka Heinemann joined the Department of Biochemistry in 2013 as a new faculty member. She completed her undergraduate Diploma, Masters, and PhD in Microbiology at the Technical University of Braunschweig in Germany. Her post-doctoral training took place at the same university, as well as at Yale University with Dieter Soll. Ilka's lab examines the underlying mechanisms in RNA regulation within cells and the contribution of polymerases to such regulation. Specific research interests encompass directionality in polymerases and RNA polyuridylation in normal and cancer cells.

Murray Junop

Murray Junop moved from McMaster University to the Department of Biochemistry at Western (one of his alma maters) in 2014. He earned his B.Sc. (Applied Chemistry and Biology) from Ryerson University and his Ph.D. (Biochemistry) from the University of Western Ontario. He completed post-doctoral training at NIH with Wei Yang and was then hired as a new faculty member at McMaster University, where he worked for many years. Murray's research targets the repair mechanisms of DNA damage in bacteria, yeast, and humans. His insight into the macromolecular structures formed between DNA and its repair enzymes contributes to the design of inhibitors of repair that could be useful as chemotherapeutics.

Core facilities: The London Regional Proteomics Centre http://www.uwo.ca//biochem/lrpc/LRPC.html

An award from the Canada Foundation for Innovation in 1998 for a project led by **Gary Shaw** and Stan Dunn enabled the establishment of the London Regional Proteomics Centre (LRPC). Since that time, additional funding, including awards from the Canada Foundation for Innovation, the Ontario Research Fund and Genome Canada, has enabled expansion of the scope of the LRPC. At the present time, the LRCP continues to operate under Stan Dunn's leadership and comprises 6 facilities that house complementary infrastructure: Biomolecular Interactions and Conformations Facility (**Stan Dunn**, Facility Director), Biological Mass Spectrometry Laboratory (**Gilles Lajoie**, Director), Biomolecular NMR Facility (**Gary Shaw**, Facility Director), Functional Proteomics Facility (**David Litchfield**, Facility Director), Macromolecular Crystallography Facility (**Brian Shilton**, Director) and MALDI Mass Spectrometry Facility (**Ken Yeung**, Director). Collectively, these facilities have promoted productive collaborations - locally and globally - and have engaged over 100 research labs that are documented users of these facilities.

Noteworthy awards:

Stan Dunn was the recipient of a Distinguished University Professorship to recognize "sustained excellence as a complete scholar over a substantial career at Western". **David Edgell**, **Greg Gloor** and **Graeme Hunter** have been recognized with Faculty Scholar Awards for their scholarly achievements in research and education. **Fred Possmayer** (2015) and **Geoff Pickering** (2016) are the recipients of the Distinguished Alumni Awards from the Schulich School of Medicine & Dentistry. Fred received the award for his discovery of surfactant that has revolutionized the treatment of premature infants both in Canada and internationally. This discovery was also recognized in a recent compilation by the Council of Ontario Universities as one of the top 5 game-changing research discoveries to emerge from an Ontario University. Geoff has been recognized for his success as a Clinician Scientist and discoveries related to vascular disease. In addition to **Pat O'Donoghue**, **Gary Shaw** and **Shawn Li** are also current Canada Research Chair holders. Gary holds the Canada Research Chair in

Structural Biology to support the efforts of his laboratory to elucidate the structural basis for defects in proteins that are involved in neurodegenerative disorders. Shawn is the Canada Research Chair in Functional Genomics and Cellular Proteomics. The main focus of Shawn's lab is to elucidate the molecular and epigenetic basis of cancer leading to the development of protein and peptide-based diagnostics and therapeutics.

Celebration to recognize the contributions of Drs. Ted Lo and Bill Sanwal:

Chris Brandl organized a celebratory dinner last fall at Bellamere Winery in London to honour the contributions of two former Chairs of the Department of Biochemistry, **Theodore (Ted) Lo** and **Bishnu (Bill) Sanwal**. The event attracted ~90 people, including past faculty, staff and graduates of the department, former trainees of Bill and Ted, and current departmental members. To honour Bill and Ted's legacy, the department's Graduate Endowment Fund was re-named to the Bishnu (Bill) Sanwal and Theodore (Ted) Lo Graduate Endowment Fund. This fund enhances the recruitment and training of graduate students, provides seed funds for new research involving trainees, and promotes dissemination of research outputs.

Ted Lo and Bill Sanwal

York University

Department of Biology

Correspondent: Logan Donaldson

Over the past year, an effort has been made by our department to bring science to the community in the form of public lectures. Two such events that well attended were "*Neuroscience: How Your Brain Lives, Works, and Dies"* and "*The Science of Science Fiction*".

Peter Backx (CRC Tier 1) was a notable new faculty appointment to the Department of Biology in the area of muscle health and research.

With the new Markham satellite campus scheduled to open in three years, there is considerable excitement as the date draws closer to finalize new degrees in biotechnology and the biomedical sciences. Furthermore, incoming 2016 students will have the opportunity to participate in a new team-taught integrated science program.

CSMB-Sponsored Events

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.

Requests for graduate event support should be directed to the CSMB Secretary.

Canadian Association of Neuroscience Meeting

University of British Columbia

Correspondent: Kathryn Post

The Canadian Association for Neuroscience (CAN) Annual Meeting is our community's most important event that brings together 800-1000 neuroscientists and trainees from across Canada. This year's meeting was held in Vancouver. The highlights of this meeting were keynote talks by Drs. Melvyn Goodale, Mayank Mehta, Karel Svoboda, Clay Reid, and Kristen Scott, as well as CIHR Brain Star Awards for outstanding trainees, including Martin Munz from McGill University, Ying Chen from York University, and Robert P. Bonin from the Institut Universitaire en Santé Mentale de Québec.

While this is a major international meeting, providing educational, presentation and network opportunities for trainees is a major goal and responsibility of the Program Committee. To this end, we held workshops on *Alternative Careers outside Academia*, a panel session on *How to Succeed in Academic Research*, poster presentations, networking sessions with principal investigators, and networking with peers at a Student Social. CSMB's generous contribution was directed towards the Student Social, which is considered a highlight of the meeting by our trainees, since it allows free exchange of ideas between peers and the formation of supportive and lasting community networks that bridge universities and provinces.

The Student Social was held on May 25th from 7:30-9:30 pm at Mahoney's & Sons Restaurant, and the CSMB contribution aided in the cost of food. The Social was very successful with approximately 140 trainee attendees who stayed for the entire event. Our queries to trainees on the value of different aspects of the 2015 CAN Annual Meeting consistently results in statements that the Student Social was one of the most valued.

Cell Biology Invited Speaker and Research Day 2015

Department of Cell Biology, University of Alberta

Correspondents: Lael Barlow (current President of the Cell Biology Student's Association) and Azra Lari (former President of the Cell Biology Student's Association)

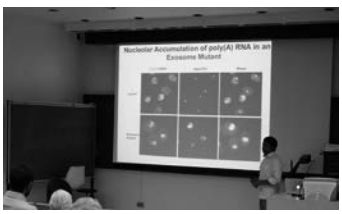
The Cell Biology Student's Association hosted distinguished guest Dr. Heidi McBride from the Department of Neurology and Neurosurgery at McGill University. The first day of our event began with a very exciting and well-received keynote lecture given by Dr. McBride, titled "Mitochondrial Derived Vesicles and Parkinson's Disease." We were also able to highlight our own research through selected student talks and a competitive poster session. These sessions were well attended by members within and outside our own department. We also hosted a pizza lunch for graduate students who asked Dr. McBride many questions about her research, academic career, and opinions about science in general. These activities were followed by a "Meet the Speaker" evening reception for students and faculty to mingle with Dr. McBride.

The second day was our "Careers in Science" discussion led by a panel of invited guest speakers, all of whom have a background in science. This year our speakers were Dr. Rasha Maal-Bared who is currently a senior microbiologist at EPCOR Water Services, Mr. Richard Stadlwieser who is Acting Executive Director, Technology Partnerships and Investments, Innovation and Advanced Education for the Government of Alberta, and Dr. Jonathan Parrish who is a Faculty Services Officer/Associate Teaching Professor Department of Biochemistry, University of Alberta. This diverse panel gave the Cell Biology Graduate students a chance to engage with successful individuals who have established careers outside traditional academic research.

Keynote Lecture by Dr. Heidi McBride

Cell Biology Graduate Students with Dr. McBride at "Meet the Speaker" evening reception

This event created an environment of learning, discussion, networking, and sharing of knowledge and skills. This is imperative for students to experience in order to be successful in their graduate studies and future careers paths, regardless of where those paths take them. Research Day was also beneficial to the many guests from outside our department from the Faculty of Medicine & Dentistry, as well as the Department of Biological Sciences, and promoted an environment for collaborative discussion within our own University.




Student talks and poster presentations

Graduate Student Symposium 2015

College of Biological Sciences, University of Guelph

Correspondent: Lily Nasanovsky

The College of Biological Sciences Graduate Student Symposium is a student-run event that aims to encourage scientific communication between students, research fellows and professors within the three departments of Molecular and Cellular Biology, Integrative Biology and Human Health and Nutritional Sciences. We had approximately 200 registrants consisting of graduate students, post doctoral fellows, lab technicians, lab coordinators and professors.

The event featured a keynote address by Dr. Kevin Kain (University of Toronto), Canada Research Chair in Molecular Parasitology. He spoke on characterizing host-parasite interactions responsible for major global infectious disease threats, such as malaria and HIV. The symposium showcased graduate student research across

Keynote lecture by Dr. Kevin Kain

Wine and cheese social event

Student talks and posters

the college with 48 student oral presentations and 42 student posters. The day also featured an afternoon wine and cheese social.

Graduate Student Careers in Biology Day 2015

College of Biological Science (CBS) University of Guelph

Correspondent: Molly Udaskin

The goal of this event was to expose and familiarize graduate students in College of Biological Sciences (CBS) to the various career paths and opportunities in industry and government. The event was organized and run by the graduate students of CBS, in conjunction with the Associate Dean of Research from CBS, to aid their colleagues in their career development.

Keynote speaker Jamie Doran, CEO and Director of Client Services, Innovation Guelph

The event was held in the Science Complex Atrium and had over 250 graduate students, postdoctoral fellows and faculty from CBS attending the various portions of the day. There were over 20 alumni speakers and professionals networking and providing advice to attendees. The day began with three interactive, conversational sessions by highlighting different sectors. We also had two specific sessions focused on entrepreneurship in science. During the lunch period, Jamie Doran (CEO and Director of Client Services, Innovation Guelph) gave a keynote presentation, outlining trends in technology and the advancement of science.

Trainees listening to one of the career talks

The presentation was followed by another set of small discussion sessions. The day concluded with a career fair and networking social. By combining the lunch and keynote presentation, more attendees were present and able to appreciate the talk. As in previous years, the event was well received, with over 90% of attendees saying it was useful to their career development and planning.

Vins et Fromages 2015
Institut de recherches cliniques de Montréal (IRCM)

Correspondent: Maeva Luxey

Participants enjoying the wine and cheese event

The IRCM Wine and Cheese event took place on Thursday, March 26th 2015. It was a great success story, with outstanding participation from the internal community which included researchers, clinicians, as well as members of the IRCM Foundation. Canadian and international graduate students who are affiliated with the different programs of Biochemistry, Cellular Biology, Molecular Biology and Experimental Medicine from University of Montréal and McGill University also attended.

The atrium of the IRCM was transformed to accommodate 300 people or more. This was used for the wine and cheese tasting, and to make it a suitable place for scientific gatherings and networking opportunities.
The event was organized by the Wine and Cheese Committee of the IRCM Student Association, composed of Marine Barbelanne, Julie Bergalet, Tiphaine Dolique, Lorelei Durand, Claudia Gentile, Maëva Luxey, Alexandre Mayran, Audrey Pelletier and Marine Roux.

La Journée Scientifique des Étudiants du Centre de Recherche sur le Cancer de Québec et l'Axe Oncologie du CHU de Québec 2015

Correspondent: Claire Dziengelewski

La 19ème édition de la Journée Scientifique des Étudiants (JSE) du Centre de Recherche sur le Cancer de Québec et l'Axe Oncologie du CHU de Québec s'est déroulée les 19 et 20 août 2015 au Centre de Recherche sur le Cancer de l'Université Laval. Organisée par les étudiants du Centre de Recherche, cette journée a rassemblé environ 120 participants provenant des diverses équipes de recherche en cancérologie fondamentale et clinique, en radio-oncologie ainsi qu'en néphrologie. Plus de 90 stagiaires de premier cycle, étudiants diplômés, professionnels de recherche et stagiaires post-doctoraux ont profité de l'occasion pour présenter leurs travaux de recherche par

Discussions at the poster session

un exposé oral ou sous forme d'affiche. Les meilleures présentations ont été récompensées par l'octroi de plus de $8500 en bourses de congrès et de $1800 en prix.

Chaque année, les étudiants invitent pour l'évènement un ou plusieurs chercheurs de renommée internationale qui présentent leurs travaux. Pour la 19ème édition, nous avons eu le plaisir d'accueillir les Dr. Fred Saad du Centre Hospitalier de l'Université de Montréal et Dr. Guy Sauveageau, également de l'Université de Montréal. Ils ont présenté leurs travaux de recherche portant sur les marqueurs moléculaires pronostiques du cancer de la prostate, et sur les fondements moléculaires de l'auto-régénération des cellules souches, respectivement. Ces deux conférences de très grande qualité ont été appréciées à la fois par les étudiants des différents axes de recherche, mais également par les chercheurs. La disponibilité et la facilité d'approche des conférenciers ont aussi été soulignées par les étudiants.

James Lepock Memorial Student Symposium 2015

Department of Medical Biophysics, University of Toronto

Correspondent: Deborah Ng

The goal of the James Lepock Memorial Symposium is to offer a forum for graduate students in the Department of Medical Biophysics to come together and discuss the latest technology and research in our varied affiliated institutes, including the Princess Margaret Cancer Centre, the Ontario Institute of Cancer Research, SickKids Hospital, Sunnybrook Health Sciences Centre, the Lunenfeld-Tanenbaum Research Institute, and the Donnelly Centre. The JLM Symposium is organized by students in the Medical Biophysics Graduate Student Association.

Symposium participants listening to one of the talks

Student posters

The event took place in the Medical Sciences Building at the University of Toronto, and consisted of two keynote talks, two poster sessions, and oral presentations by M.Sc. and Ph.D. students. Approximately 150 graduate students, post-docs, research technicians and faculty participated.

This year, our event featured keynote talks by Dr. Stuart Foster, Senior Scientist at the Sunnybrook Research Institute, and Dr. Andras Nagy, Senior Investigator at the Lunenfeld-Tanenbaum Research Institute.

Ottawa-Carleton Institute of Biology 12th Annual Symposium 2015

Correspondent: Marc Beal

Each spring, the OCIB Symposium brings together students from both Carleton University and the University of Ottawa to engage in exciting discussions related to current developments in biology with leaders in the field. The OCIB Symposium has become an integral part of the biology community at both universities and is an important opportunity to showcase the high calibre research being performed there.

This year's theme, "OCIB: The Next Generation", was two-fold. Under this theme, we highlighted novel methods and technologies, and also focussed on up-and-coming researchers and graduate students as the next generation of innovators. This symposium included

sessions on genetics, disease and therapy, and ecology, as well as a new technologies and methods workshop, a careers session, a pub talk, and a student poster session. The organizing group consisted of Ph.D. students from both Carleton University (Francina Webster, Marc Beal) and the University of Ottawa (Alexandra Long, Julie Cox).

The 2015 OCIB symposium was held at Carleton University in the Azrieli Theatre, and the poster session was showcased in the Galleria of the University Centre. The symposium included 157 registrants consisting of undergraduate students, graduate students, postdoctoral fellows, faculty, and staff. There were 12 invited speakers, 11 student oral presentations, 34 two-minute presentations by students, and 38 poster presentations. Furthermore, as the various talks and sessions were open, additional faculty and students participated at the event.

Student posters

We had an exciting lineup of 12 speakers for this year's symposium. The topics ranged from rare genetic diseases, to endangered species, to intellectual property law and how to write a great manuscript, and were of broad interest to biology students and faculty. We had speakers from across the province to present a variety of exciting topics, including Dr. Dawn Bowdish from McMaster University, Dr. Sarah Sawyer from the Children's Hospital of Eastern Ontario, and Dr. Joseph Nocera from Trent University. Students benefited from participating in the "Saved by the Bell" speed round, where each poster presenter gave a two minute talk about their research. Also, this year we had two special sessions, the New Technologies session and the Careers session, where students learned about innovative research and skills to advance their career, respectively.

Keynote speaker Dr. Dawn Bowdish

Keynote speaker Dr. Sarah Sawyer

Simon Fraser University

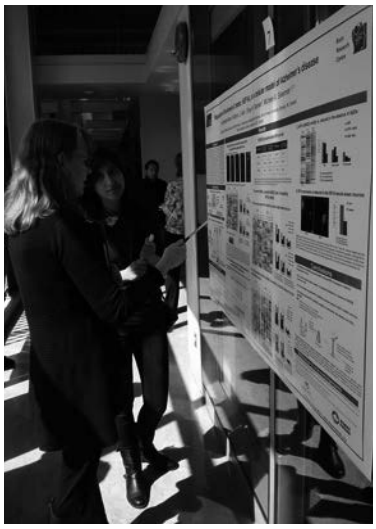
Molecular Biology and Biochemistry Graduate Colloquium 2015

Correspondent: Kaylee Magee

The Department of Molecular Biology and Biochemistry (MBB) at Simon Fraser University holds an annual MBB Colloquium; the students in the MBB Graduate Caucus organize the event, from booking the venues to chairing the talk sessions, to preparing the food. The overall goal of the Colloquium was to highlight recent student research in the department. The event took place at the IRMACS (Interdisciplinary Research in the Mathematical and Computational Science) Centre at Simon Fraser University.

We had talks and poster presentations on many different topics throughout the day, all of which stemmed from

Keynote presentation by Dr. Naomi Fast



A student discusses her poster with a faculty judge

research conducted by MBB undergrads, grad students, and post-docs. Approximately 100 people attended the event, while 25 students presented posters and 20 students gave talks. Our keynote speaker, Dr. Naomi Fast of the University of British Columbia, gave a talk entitled "Genome reduction: What can nature's smallest genomes teach us about cellular processes?" We also had faculty judges for the student talks and posters and were able to give out over $800 in prizes to student participants.

A student receives a presentation award from the Graduate Caucus President at the Colloquium dinner

Software Carpentry Scientific Computer Programming Workshop

Simon Fraser University

Correspondence: Tiffany Timbers

On April 30 - May 1 2015, several post-docs and graduate students in the Department of Molecular Biology & Biochemistry at Simon Fraser University organized and ran a Software Carpentry computer programming workshop for SFU science faculty, post-docs and graduate students. Software Carpentry (http://software-carpentry.org/) is a not-for-profit organization whose mandate to teach scientists computer programming skills to analyze their data more efficiently. The organization is gaining ground and has significant experience; its volunteer instructors have trained over 10,000 scientists at their workshops worldwide.

We held two parallel workshops, with a combined number of 77 participants. In the workshop, learners were taught practical computer programming, data science and open science skills that researchers can use to facilitate their research. The workshop covers the Unix Shell, a programming language (Python or R), and version control (using Git and Github).

This workshop inspired the creation of a peer-facilitated learning group, called the Scientific Programming study group, to help support the learning of graduate students and post-docs who want to continue to increase their scientific programming skills, as well as to build a solid community so that we can have more collaboration in this aspect in our department and beyond at SFU. We now have been running this group on a weekly basis for one year. Most study sessions consist of an hour-long tutorial, where one member of our community (grad student or post-doc) demonstrates a tool, package or some other useful computer skill. Other times we host co-working sessions, where we all bring our own work to the session and give/get help to/from each other. We have a website to advertise our events: http://sciprog.ca/

University of Ottawa, Faculty of Medicine Post-doctoral Association

7th Annual Post-doctoral Research Day 2015

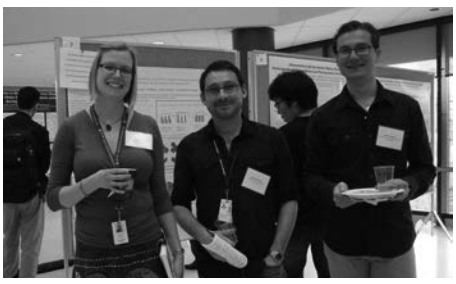
Correspondent: Fiona McMurray

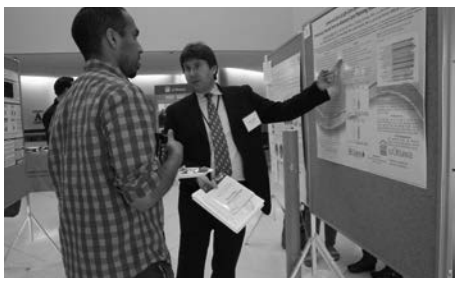
In collaboration with the Faculty of Medicine, the Postdoctoral Association organized its 7th Annual Post-doctoral Fellow Research Day on May 1st, 2015. Drawing on a large number of PDFs, research associates, faculty, and students from across the University, the day featured three oral presentations from post-docs, a keynote address from Dr. Julie Fradette (Université Laval), and a poster session. The event was deemed a great success, enabling communication, learning and networking opportunities for the group of aspiring researchers, alongside a showcasing of the high quality and breadth of research undertaken at the institution.

Spanning the circle from alveolar epithelial cell therapy (Dr. Mehdy Shafa), to skeletal mitochondrial respiration (Dr. Brianne Thrush) and virtual reality training (Dr. Lisa Sheehy), the excellent oral presentations provided a glimpse into the variety of cutting-edge research endeavours undertaken at the Faculty of Medicine and affiliated Institutes. The poster session featured submissions from multiple areas of health research that were judged by faculty, under the stewardship of Drs. Julie Fradette and Katey Raynor. With the support of a number of sponsors, including the Faculty of Medicine itself and the Canadian Society for Molecular Biosciences (CSMB), represented by Dr. Kristen Baetz, our researchers were awarded prizes for oral and poster presentations. We would like to thank all participants, faculty members, and the Faculty of Medicine Graduate and Post-doctoral Studies, and CSMB for the generous contribution.

PDF Research Day award winners

Dr. Kristin Baetz (CSMB President) at the PDF Research Day





Student talks and poster presentations

FRONT COVER IMAGE

Nuclear divisions by mitosis in a Drosophila syncytial embryo.

The embryo was fixed and analysed by immunofluorescence to reveal microtubules in green, the nuclear envelope and centrosomes in red and DNA in blue. The image was obtained by scanning confocal microscopy (credit: Haytham Mehsen).

BACK COVER IMAGE

X-ray crystal structure of human IDUA expressed in the plant *Arabidopsis thaliana*.