

Annual report
Division of Medical Biochemistry
Department of Medicine - Jewish General Hospital
January 1, 2019 - December 31, 2019

SUMMARY

(1) Continuing the implementation of the digitalized Patient Order Sets throughout the Jewish General Hospital and continue to expand this throughout the CIUSSS including LTC and eReferrals.

(2) To expand Special Chemistry testing by incorporating Mass Spectrometry in separation techniques, to further reduce costs and developing mass spectrometry assays.

(3) Upgrade out-of-date, overtaxed and sluggish instrumentation particularly in the Corelab and Special Hematology sections.

(4) To work on a Mobile app development for critical values alert service with Concordia. The purpose of the App is to allow instantaneous transfer of the critical patient result to the physician's phone.

(5) Try to get funds and continue the upgrading of the Proteomics Laboratory at the Jewish General Hospital.

(6) Digital Health and IT upgrade implementation

1. Research and publications:

Research

- The Proteomics Department at the Jewish General Hospital has had 14 projects that were either completed or ongoing this past year, including 7 collaborations with different researchers within the Lady Davis Institute/Jewish General Hospital.

2. Teaching and learning (undergraduate and graduate):

2.1 MacNamara, Elizabeth, M.D., FRCPS(C)

Undergraduate and graduate, McGill University

Medical Student Elective Medical Biochemistry (4 week)

Medical Biochemistry Resident (8 month/year)

Palliative Care Attending on 4M, (26weeks/year supervision of Resident and/or Medical student)

McGill Palliative Care Residents Teaching 22 x1 hour per year

Attendance at Medical Grand Rounds (17/year)

Attendance at the Association des Médecins Biochimistes du Québec/Canadian

Association of Clinical Biochemists Annual Congress

Comité de suivi des examens (FMSQ)

Mass Spectrometry: Applications to the Clinical Lab (MSACL)

Canadian Society of Palliative Care Physicians Conference, Alberta

Palliative Care Continuing Professional Education Day, McGill

Abstract Reviewer for the 22nd International Palliative Care Congress of Canada

Lectures given(EM):

AMBQ / CAMB 2019 Annual Congress, Montreal, Quebec

The Ketogenic Diets

Medical Grand Rounds – Jewish General Hospital, Montreal, Quebec

Ketogenic Diet and Diabetes: Why the Resistance?

Family Medicine Rounds- Jewish General Hospital, Montreal, Quebec

Ketogenic Diet and Diabetes: Why the Resistance?

2.2 Eintracht, Shaun, M.D., FRCPS(C)

Undergraduate, McGill University

Postgraduate, McGill University

Resident Supervision/One-on-One Teaching

McGill Medical Biochemistry Residents teaching (12 month period)

Teaching of Hematology and Rheumatology Resident

Attendance at Medical Grand Rounds (4/month)

Attendance at the Association des Médecins Biochimistes du Québec/Canadian

Association of Clinical Biochemists Annual Congress

Internal Medicine Rounds

Journal Club (Ad hoc basis)

Lectures given(SE):

AMBQ / CAMB 2019 Annual Congress, Montreal, Quebec

Approach to Data Analysis.

AMBQ / CAMB 2019 Annual Congress, Montreal, Quebec

The Ketogenic Diets

Medical Grand Rounds – Jewish General Hospital, Montreal, Quebec

Ketogenic Diet and Diabetes: Why the Resistance?

4. Partnerships:

- Dr. MacNamara has been appointed as the Chair and External Examiner for the Medical Biochemistry and Metabolic Medicine Program, Kuwait Institute for Medical Specialization (KIMS). Duties include reviewing the exam questions, participating in the oral module of the final exam, and marking the exam with the members of the exam committee.
- Abstract Reviewer for the 22nd International Palliative Care Congress of Canada

5. Milestones:

Dr. Christoph Borchers has been appointed Head of the Division of Clinical and Research Proteomics at the Jewish General Hospital.

Dr. René Zahedi has been appointed the facility manager of the Proteomics Laboratory, Jewish General Hospital.

SECTION I – DIVISION STATUS UPDATE

1. Mission and Objectives of the Division Mission Statement

To provide laboratory and clinical services consistent with the needs of the health care team and their patients in a professional and caring manner.

To initiate and collaborate in research activities directed towards the improved understanding of disease, its diagnosis and monitoring.

To ensure the optimal use of the laboratory service.

2. A nominative list of academic staff, their academic rank

Dr. Elizabeth MacNamara, Medical Biochemist, Chief, Division of Medical Biochemistry, Jewish General Hospital
Associate Professor of Medicine, McGill University (active)

Dr. Shaun Eintracht, Medical Biochemist, Division of Medical Biochemistry, Jewish General Hospital
Assistant Professor of Medicine, McGill University (active)
JGH Medical Biochemistry Site Director-Optilab

Dr. Christoph Borchers, FCAHS
Research Professor, Department of Oncology, McGill University, Montreal
McGill- Segal Chair in Molecular Oncology

SECTION II – GRANTS, PUBLICATIONS AND SERVICE OUTSIDE OF MCGILL

1. Grants and Awards received: currently active

Agency	Title	PI	Time Period	Total amount awarded to Dr. Borchers
Ministry of Economy and Innovation - Quebec	Curbing Atherosclerosis Through Precision Medicine	C. Borchers T. Alquier JC. Tardiff	2018-22	\$237,500
Genome Canada / Genome BC	Proteogenomic Improved Guided Quantification Pipeline (PIGQpipe): Toward Personalized Targeted Proteomics	C. Borchers	2018-21	\$556,472
NSERC - EGP	Molecular characterization of SSI products from Qu biologics	C. Borchers	2018-19	\$25,000
The Fonds de recherche du Québec and the Flemish Research	Innovative cleavable link strategy based on mass spectrometry for the elucidation of drug binding sites	C. Borchers	2017-20	\$298,450

Foundation				
Genome Canada / Genome BC	The Pan-Canadian Proteomics Centre: An Integrated Platform for Comprehensive, Innovative, Translational Proteomics Research in Canada	C. Borchers L. Foster	2017-22	\$7,467,485
Genome Canada / Genome BC	The Metabolomics Innovation Centre	C. Borchers D. Wishart	2017-22	\$1,782,990
CFI-MSI	The Metabolomics Innovation Centre	C. Borchers D. Wishart	2017-22	\$899,215

Personal Support Awards (Indicate type of award, agency, term)

Agency	Subject	\$ /Year	Year
The Warren Y. Soper Charitable Trust	The Innovative Translational Proteomics Program	100,000	2015 - 24
Segal McGill Chair	Molecular Oncology	40,000	2014 - 19
BC Leading Edge Endowment	LEEF Chair	200,000	2011 - 28

2. Scholarly works published in the 2019 calendar year:

Publications

Pang SA, Eintracht S, Schwartz JM, Lobo B, MacNamara E.
Hypersensitivity reactions to high osmolality Total Parenteral Nutrition: a case report. Allergy
Asthma Clin Immunol. 2019 Aug 30;15:51.

Srinivasan Sridhar V, Chen M, Gerson H, MacNamara E, Nessim SJ.
Variation of High-Sensitivity Troponin T Results in Patients Undergoing Continuous Renal
Replacement Therapy. Can J Kidney Health Dis. 2019 Feb 15;6:2054358119828386. doi:
10.1177/2054358119828386. eCollection 2019.

Chertkow H., Borrie M., Whitehead V., Black H. Feldman, MacNamara E.,
The Comprehensive Assessment of Neurodegeneration and Dementia Canadian Cohort
Study.(The Canadian Journal of Neurological Sciences,2019;00:1-13)

Brukner I, Eintracht S, Forgetta V, Papadakis AI, Spatz A, Oughton M.
Laboratory-developed test for detection of acute Clostridium difficile infections with the
capacity for quantitative sample normalization. Diagn Microbiol Infect Dis. 2019 Oct;95(2):113-
118.

Borchers C.H.

Articles published in refereed journals (19 papers in 2019, h-factor: 68, 1824 cited in
2019)Parker CE, Warren Hines MRE, Mocanu V, Greer SF, Borchers CH.

1. LC-MS/MS based comparative proteomics of floral nectars reveal different mechanisms involved in floral defense of *Nicotiana* spp., *Petunia hybrida* and *Datura stramonium*.

Silva F, Guirgis A, von Aderkas P, Borchers CH, Thornburg R.

J Proteomics. 2019 Dec 14;213:103618. doi: 10.1016/j.jprot.2019.103618. [Epub ahead of print] PMID: 31846763. IF:3.537

2. The intestinal microbiome potentially affects thrombin generation in human subjects.

Mohammed Y, Kootte RS, Kopatz WF, Borchers CH, Büller HR, Versteeg HH, Nieuwdorp M, van Mens TE.

J Thromb Haemost. 2019 Dec 6. doi: 10.1111/jth.14699. [Epub ahead of print] PMID:31808596. IF:4.662

3. Proteogenomics of Colorectal Cancer Liver Metastases: Complementing Precision Oncology with Phenotypic Data.

Blank-Landeshammer B, Richard VR, Mitsa G, Marques M, LeBlanc A, Kollipara L, Feldmann I, Couetoux du Tertre M, Gambaro K, McNamara S, Spatz A, Zahedi RP, Sickmann A, Batist G, Borchers CH.

Cancers (Basel). 2019 Dec 1;11(12). pii: E1907. doi: 10.3390/cancers11121907. PMID:31805664. IF:6.162

4. Targeted and Untargeted Proteomics Approaches in Biomarker Development.

Sobsey CA, Ibrahim S, Richard VR, Gaspar V, Mitsa G, Lacasse V, Zahedi RP, Batist G, Borchers CH.

Proteomics. 2019 Nov 15:e1900029. doi: 10.1002/pmic.201900029. [Epub ahead of print] Review. PMID: 31729135. IF:3.106

5. Ligand-induced disorder-to-order transitions characterized by structural proteomics and molecular dynamics simulations.

Makepeace KAT, Brodie NI, Popov KI, Gudavicius G, Nelson CJ, Petrotchenko EV, Dokholyan NV, Borchers CH.

J Proteomics. 2020 Jan 16;211:103544. doi: 10.1016/j.jprot.2019.103544. Epub 2019 Nov 1. PMID: 31683063. IF:3.537

6. Insight into the Structure of the "Unstructured" Tau Protein.

Popov KI, Makepeace KAT, Petrotchenko EV, Dokholyan NV, Borchers CH.

Structure. 2019 Nov 5;27(11):1710-1715.e4. doi: 10.1016/j.str.2019.09.003. Epub 2019 Oct 15. PMID: 31628033. IF:4.576

7. MeCP2-E1 isoform is a dynamically expressed, weakly DNA-bound protein with different protein and DNA interactions compared to MeCP2-E2.

Martínez de Paz A, Khajavi L, Martin H, Claveria-Gimeno R, Tom Dieck S, Cheema MS, Sanchez-Mut JV, Moksa MM, Carles A, Brodie NI, Sheikh TI, Freeman ME, Petrotchenko EV, Borchers CH, Schuman EM, Zytynicki M, Velazquez-Campoy A, Abian O, Hirst M, Esteller M, Vincent JB, Malnou CE, Ausió J.

Epigenetics Chromatin. 2019 Oct 10;12(1):63. doi: 10.1186/s13072-019-0298-1. PMID: 31601272. IF:4.185

8. Evaluation and Validation of Plasma Proteins Using Two Different Protein Detection Methods for Early Detection of Colorectal Cancer.

Bhardwaj M, Gies A, Weigl K, Tikk K, Benner A, Schrotz-King P, Borchers CH, Brenner H. *Cancers (Basel)*. 2019 Sep 25;11(10). pii: E1426. doi: 10.3390/cancers11101426. PMID: 31557860. IF:6.162

9. The Gut Microbiome and Metabolome of Two Riparian Communities in the Amazon. Pires ES, Hardoim CCP, Miranda KR, Secco DA, Lobo LA, de Carvalho DP, Han J, Borchers CH, Ferreira RBR, Salles JF, Domingues RMCP, Antunes LCM. *Front Microbiol*. 2019 Sep 4;10:2003. doi: 10.3389/fmicb.2019.02003. eCollection 2019. PMID: 31555238. IF:4.076

10. A Unique Morphological Phenotype in Chemoresistant Triple-Negative Breast Cancer Reveals Metabolic Reprogramming and PLIN4 Expression as a Molecular Vulnerability. Sirois I, Aguilar-Mahecha A, Lafleur J, Fowler E, Vu V, Scriver M, Buchanan M, Chabot C, Ramanathan A, Balachandran B, Légaré S, Przybytkowski E, Lan C, Krzemien U, Cavallone L, Aleynikova O, Ferrario C, Guilbert MC, Benlimame N, Saad A, Alaoui-Jamali M, Saragovi HU, Josephy S, O'Flanagan C, Hursting SD, Richard VR, Zahedi RP, Borchers CH, Bareke E, Nabavi S, Tonellato P, Roy JA, Robidoux A, Marcus EA, Mihalcioiu C, Majewski J, Basik M. *Mol Cancer Res*. 2019 Dec;17(12):2492-2507. doi: 10.1158/1541-7786.MCR-19-0264. Epub 2019 Sep 19. PMID: 31537618. IF:4.484

11. Intense Light-Mediated Circadian Cardioprotection via Transcriptional Reprogramming of the Endothelium. Oyama Y, Bartman CM, Bonney S, Lee JS, Walker LA, Han J, Borchers CH, Buttrick PM, Aherne CM, Clendenen N, Colgan SP, Eckle T. *Cell Rep*. 2019 Aug 6;28(6):1471-1484.e11. doi: 10.1016/j.celrep.2019.07.020. PMID: 31390562. IF:7.815

12. Recommendations for performing, interpreting and reporting hydrogen deuterium exchange mass spectrometry (HDX-MS) experiments. Masson GR, Burke JE, Ahn NG, Anand GS, Borchers C, Brier S, Bou-Assaf GM, Engen JR, Englander SW, Faber J, Garlish R, Griffin PR, Gross ML, Guttman M, Hamuro Y, Heck AJR, Houde D, Iacob RE, Jørgensen TJD, Kaltashov IA, Klinman JP, Konermann L, Man P, Mayne L, Pascal BD, Reichmann D, Skehel M, Snijder J, Strutzenberg TS, Underbakke ES, Wagner C, Wales TE, Walters BT, Weis DD, Wilson DJ, Wintrode PL, Zhang Z, Zheng J, Schriemer DC, Rand KD. *Nat Methods*. 2019 Jul;16(7):595-602. doi: 10.1038/s41592-019-0459-y. Epub 2019 Jun 27. Review. PMID: 31249422. IF: 28.467

13. Increased sulfation of bile acids in mice and human subjects with sodium taurocholate cotransporting polypeptide deficiency. Mao F, Liu T, Hou X, Zhao H, He W, Li C, Jing Z, Sui J, Wang F, Liu X, Han J, Borchers CH, Wang JS, Li W. *J Biol Chem*. 2019 Aug 2;294(31):11853-11862. doi: 10.1074/jbc.RA118.007179. Epub 2019 Jun 14. PMID: 31201272. IF:4.106

14. First Community-Wide, Comparative Cross-Linking Mass Spectrometry Study. Iacobucci C, Piotrowski C, Aebersold R, Amaral BC, Andrews P, Bernfur K, Borchers C, Brodie NI, Bruce JE, Cao Y, Chaignepain S, Chavez JD, Claverol S, Cox J, Davis T, Degliesposti G, Dong MQ, Edinger N, Emanuelsson C, Gay M, Götze M, Gomes-Neto F, Gozzo FC, Gutierrez C, Haupt C, Heck AJR, Herzog F, Huang L, Hoopmann MR, Kalisman N, Klykov O, Kukačka Z, Liu F, MacCoss MJ, Mechtler K, Mesika R, Moritz RL, Nagaraj N, Nesati V, Neves-Ferreira

AGC, Ninnis R, Novák P, O'Reilly FJ, Pelzing M, Petrotchenko E, Piersimoni L, Plasencia M, Pukala T, Rand KD, Rappsilber J, Reichmann D, Sailer C, Sarnowski CP, Scheltema RA, Schmidt C, Schriemer DC, Shi Y, Skehel JM, Slavin M, Sobott F, Solis-Mezarino V, Stephanowitz H, Stengel F, Stieger CE, Trabjerg E, Trnka M, Vilaseca M, Viner R, Xiang Y, Yilmaz S, Zelter A, Ziemianowicz D, Leitner A, Sinz A.
Anal Chem. 2019 Jun 4;91(11):6953-6961. doi: 10.1021/acs.analchem.9b00658. Epub 2019 May 22.
PMID: 31045356. IF:6.35

15. Conformational ensemble of native α -synuclein in solution as determined by short-distance crosslinking constraint-guided discrete molecular dynamics simulations.
Brodie NI, Popov KI, Petrotchenko EV, Dokholyan NV, Borchers CH.
PLoS Comput Biol. 2019 Mar 27;15(3):e1006859. doi: 10.1371/journal.pcbi.1006859.
eCollection 2019 Mar.
PMID: 30917118. IF:4.428

16. The molecular mechanisms driving physiological changes after long duration space flights revealed by quantitative analysis of human blood proteins.
Kashirina DN, Percy AJ, Pastushkova LK, Borchers CH, Kireev KS, Ivanisenko VA, Kononikhin AS, Nikolaev EN, Larina IM.
BMC Med Genomics. 2019 Mar 13;12(Suppl 2):45. doi: 10.1186/s12920-019-0490-y.
PMID: 30871558. IF:3.317

17. Chaperone activation and client binding of a 2-cysteine peroxiredoxin.
Teixeira F, Tse E, Castro H, Makepeace KAT, Meinen BA, Borchers CH, Poole LB, Bardwell JC, Tomás AM, Southworth DR, Jakob U.
Nat Commun. 2019 Feb 8;10(1):659. doi: 10.1038/s41467-019-08565-8.
PMID: 30737390. IF:11.878

18. Multiplexed LC-ESI-MRM-MS-based Assay for Identification of Coronary Artery Disease Biomarkers in Human Plasma.
Anwar MA, Dai DL, Wilson-McManus J, Smith D, Francis GA, Borchers CH, McManus BM, Hill JS, Cohen Freue GV.
Proteomics Clin Appl. 2019 Jul;13(4):e1700111. doi: 10.1002/prca.201700111. Epub 2019 Jan 28.
PMID: 30632678. IF: 2.324

19. Changing the Apoptosis Pathway through Evolutionary Protein Design.
Shultis D, Mitra P, Huang X, Johnson J, Khattak NA, Gray F, Piper C, Czajka J, Hansen L, Wan B, Chinnaswamy K, Liu L, Wang M, Pan J, Stuckey J, Cierpicki T, Borchers CH, Wang S, Lei M, Zhang Y.
J Mol Biol. 2019 Feb 15;431(4):825-841. doi: 10.1016/j.jmb.2018.12.016. Epub 2019 Jan 6.
PMID: 30625288. IF: 5.067

(c) Patents and patent applications

A Penn, CH Borchers, Panel of ACVS-Associated Proteins for Diagnosis and Prognosis.
US provisional patent application filed: 17/03/2017 (62/473,214) 15/05/2017 (62/506,392)

H Li, CH Borchers, Immuno-MALDI (iMALDI) Technology for Quantitation and Identification of Peptides and Proteins.
US provisional patent application filed: 06/06/2017 (62/346,080). (Expired)

R Popp, CH Borchers, Immuno-MALDI to Measure AKT1 and AKT2 Phosphorylation.

US provisional patent application filed: 17/04/2017 (15/489,485). Priority Date: April 15, 2016

J Han, X Wang, CH Borchers, System and Method for Matrix-Coating Samples for Mass Spectrometry.

US provisional patent application filed: 27/07/2014 (#62/018,346)

EV Petrotchenko, CH Borchers, Methods for Early Detection of Blood Disorders.

Patent No.: US 8,691,515 B2 Date of Patent: April 8 2014

Patent No.: EP 2,451,966 A1 Date of Patent: May 16 2012

CH Borchers, Methods of Quantitation and Identification of Peptides and Proteins

Patent No.: Canadian Patent 2,507,864 Date of Patent: Oct 10 2011

CH Borchers, Methods of Quantitation and Identification of Peptides and Proteins.

Patent No.: US 7,846,748 B2 Date of Patent: Dec 7 2010

(d). Other publications

CH Borchers, “Biodesix, MRM Proteomics Partner on Lung Cancer Assays”.

Interview for Genomeweb (29/01/2019)

3. Academic and community engagement service outside of McGill by individual members of the unit

In 2019, a collaboration was formally established with the Skolovo Institute of Science and Technology in Moscow, Russia where I now hold an appointment as Full Professor. The collaboration has already led to the funding of a major “mega grant” proposal with McGill for \$2.4M (see section 1).

a. Conference organizational committees

MRM & PRM Proteomics Workshop, Workshop Organizer, Tuebingen, Germany 05/11 – 08/11/19

9th Symposium of Structural Proteomics, Symposium Organizer, Göttingen, Germany, 03/11 - 06/11/19

3rd Int. Workshop of PROTEOMICS – from Introduction to Clinical Applications, Workshop Organizer, Iasi, Romania, 08/07 - 12/07/19

MRM & PRM Proteomics Workshop, Workshop Organizer, Montreal, 14/07 – 17/06/19

b. Membership and service on international, national and provincial professional bodies and societies

HUPO Council	Committee member, 2009-2018, once per year, 4 hrs per year
HUPO Standards Committee	Committee member, 2006-2008, 12 hours/year
HUPO Marketing Committee	Member & chair, 2015-2018, 24 hours/year
Structural Proteomics Society	Founding member, 2018, 24 hours/year
CNPN Human Proteome Project “white paper”	Committee member, 2011, 40 hours per year

c. Grant committees

2018: NIH Diabetes – DiaComp Collaborative Funding Program
Ontario Research Fund

d. Grant proposals reviewed

2018: NIH Diabetes – DiaComp Collaborative Funding Program
Ontario Research Fund

e. Thesis review

2019: Nicholas I. Brodie, University of Victoria

f. Visiting scientists hosted in 2019 (include lab visitors who have spent more than two weeks in your group)

09/18-03/19 Mengxuan Wang, UVic GBC Proteomics Centre (Visiting student)

01/19-04/19 Mia Frier, UVic GBC Proteomics Centre (Co-op student)

04/19-08/19 Nicole York, UVic GBC Proteomics Centre (Co-op student)

08/19-09/19 Abbey Wilson, UVic GBC Proteomics Centre (Visiting Post-Doc)

09/19-12/19 Alexandra Klem, UVic GBC Proteomics Centre (Co-op student)

09/19-12/19 Jiajia Jia, UVic GBC Proteomics Centre (Visiting student)

09/18-04/19 Evgeniy Petrochenko, McGill University (Visiting scientist)

03/19-04/19 Marius Gramlich, UVic GBC Proteomics Centre (Visiting scientist)

g. Editorships

Journals

Editor, special issue - Proteomics Clinical Applications	2017
Editor: Journal of Proteomics, Special issue HUPO 2015	2016
Editor: Future eBook, Advanced LC-MS Applications in Metabolomics	2015
Editor: Methods, Special issue on Structural Proteomics (2014/2015)	2014

Editorial Boards (Journal name, years)

Ad hoc reviews (List journals for last three years)

American Journal of Tropical Medicine & Hygiene
Analytical and Bioanalytical Chemistry
Analytical Chemistry
BBA GEN
BBA PRO
Bioanalysis
Bioinformatics
Chemical Science
Clinical Mass Spectrometry
Current Medicinal Chemistry
Expert Reviews of Proteomics
International journal of proteomics
Journal of Chromatography A
Journal of Mass Spectrometry
Journal of Pharmaceutical and Biomedical Analysis
Journal of Proteome Research

Journal of Proteomics
Journal of the American Society for Mass Spectrometry
Molecular and Cellular Proteomics
Nature Biotech
Nature Communications
Oncotarget
Phytochemical Analysis
Proceedings of the Natl Acad of Science USA
Proteome Science
Proteomics
Proteomics Clinical Applications
Scientific Reports

h. Reviews for journals, book reviews, published commentaries (12 papers reviewed in 2019)

Analytical and Bioanalytical Chemistry, Molecular and Cellular Proteomics, Journal of Proteome Research, Nucleic Acids Research, Expert Review of Molecular Diagnostics, EMBO Molecular Medicine, Computational and Structural Biotechnology Journal

SECTION III-CONFIDENTIAL INFORMATION

1. Consulting activities: None reported

Respectfully submitted,

Elizabeth MacNamara, MD
Chief, Division of Medical Biochemistry
Department of Medicine-JGH