

Annual Report
Division of Medical Biochemistry
Department of Medicine - Jewish General Hospital
January 1, 2017 - December 31, 2017

SUMMARY

(1) Dr. Elizabeth MacNamara, Medical Lead of the Patient Order Sets project, has been instrumental in implementing digitalized Patient Order Sets throughout the Jewish General Hospital. They have had a significant decrease in length of stay in Surgery, and will be implemented in the Emergency Department and Medicine early in 2017. Since the launch of the Patient Order Sets project, 77 have been implemented with 9,301 used to date. This is in spite of having inadequate support from the hospital both clerical and IT, but an excellent nurse coordinator.

Patient Order Sets allow access to the accumulated data sets covering a vast array of diseases, illnesses and medical conditions. This data represents best practices from numerous hospitals and other Health Care Institutions that subscribe to the service. The Jewish General Hospital was the first to implement patient Order Sets in Quebec.

(2) Continue to meet the challenges of Optilab, while continue to evaluating and controlling unnecessary laboratory testing. Improve on the laboratory's service to the Hospital and outside sources. Expand Special Chemistry testing by incorporating Mass Spectrometry in separation techniques, to further reduce costs and integrate proteomics into the routine laboratory.

(3) To work on a Mobile app development for critical values alert service. The purpose of the App is to allow instantaneous transfer of the critical patient result to the physician's phone. This will have multiple benefits primarily for the patient but also for the physician, who is responsible for dealing with his patient's results in a timely fashion as well as the laboratory which wastes time and creates stress trying to reach the physician.

(4) Try to get funds for Research Proteomics at the Jewish General Hospital

(5) Dr. Christoph Borchers has been appointed Head of the Division of Clinical and Research Proteomics at the Jewish General Hospital. The Proteomics Department has expanded to two post-doctoral fellows, three Ph.D. students and a manager. More state-of-the-art equipment has been acquired for the Proteomics Laboratory, in order to develop advanced technologies that increase the range of high-quality proteomics. Applications have been made for CFI, CIHR and Genome Canada funding

1. Research and publications:

Research

- Dr. MacNamara is continuing her interest in proteomics research. She has become actively involved in the *Genomics Innovation Network* (GIN). The goal, or mission, of this network is to create a mechanism for the innovation centers across Canada to work.

- 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.

Funding sources:

- Genome Canada/Genome Quebec GENOMIC APPLICATIONS PARTNERSHIP PROGRAM (GAPP) (project title: iMALDI-based Assays for Protein Activity to Improve Patient Selection for Therapeutic Akt Inhibitors in Cancer Treatment)

Publications:

See list of publications in Section II, #2 below

2. Teaching and learning (undergraduate and graduate):

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

Undergraduate, McGill University
 Medical Student Elective (4 week period)
 Medical Biochemistry Resident (12 month/year)
 Medical Student elective (4 week period)
 Residents' Teaching on wards
 Attendance at Medical Grand Rounds (4/month)
 Internal Medicine Rounds
 Palliative Care Attending on 4M, (26weeks/year)
 CTU Attending on K7 (4 weeks/year)
 IIM Teaching (7weeks/year)
 IIM examiner/reviewer (6 hours/year)
 LDI Cancer Seminars
 Attendance at the Association des Médecins Biochimistes du Québec/Canadian Association of Clinical Biochemists Annual Congress
 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:

Palliative Care-JGH

- ***Management of Nausea, Vomiting, Constipation and SBO***
- ***Artificial Feeding in Palliative Patients***

Medical Grand Rounds – Jewish General Hospital, Montreal, Quebec

- ***Should We Stop Doing Venous Blood Gases: A Debate***

Medical Grand Rounds - Jewish General Hospital, Montreal, Quebec

- ***The JGH Patient Order Set Quality Improvement Initiative***

Biochemistry and Metabolic Medicine Program
 Kuwait Institute for Medical Specializations (KIMS)

- *Clinical Audits- Theory And What Makes A Good And Bad Audit*
- *Examples in the Laboratory*
- *Laboratory Errors- Do They Matter*
- *Bariatric Surgery- Pre and Post Op Complications*

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

Journal Club (Ad hoc basis)

Lectures given:

Endocrinology Grand Rounds - Jewish General Hospital, Montreal, Québec

- *Biotin immunoassay interference*

3. Involvement in the community:

4. Partnerships:

- Continuing development and implementation of a Laboratory Training Program for technologists from Health Centers in Gansu Province, China. This is part of the collaboration between the Jewish General Hospital laboratory and the Ministry of Health, Gansu, China.
- 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
- Vice President of Canadian Association of Medical Biochemist-2016-present
- Dawson College

5. Milestones:

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

Dr. André Leblanc 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, Division of Medical Biochemistry, Associate Professor, McGill University (active)

Dr. Shaun Eintracht, Medical Biochemist, Division of Medical Biochemistry, Assistant Professor, McGill University (active)

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:

Grant awarded from Genome Canada/Genome B-C in 2012, with the current goal of continuing Genome testing and development within the Proteomics laboratory.

Project Title: Clinical implementation and Outcomes Evaluation of Blood-based Biomarkers for COPD Management (Total: \$7,200,000 JGH: \$1,516,575)

Agency	Title	PI	Time Period	Total amount awarded to Dr. Borchers
The Fonds de recherche du Québec and the Flemish Research Foundation	Innovative cleavable link strategy based on mass spectrometry for the elucidation of drug binding sites	C. Borchers	2017-20	\$298,450
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

2. Scholarly works published in the 2017 calendar year:

Publications

--Chen M, Gerson H, **Eintracht S**, Nessim SJ, **MacNamara E**. Effect of Hemodialysis on Levels of High-Sensitivity Cardiac Troponin T. *Am J Cardiol*. 2017 Dec 1;120(11):2061-2064.

--Glisovic S, **Eintracht S**, Longtin Y, Oughton M, Brukner I. Rectal swab screening assays of public health importance in molecular diagnostics: Sample adequacy control. *J Infect Public Health*. 2017 Aug 8. pii: S1876-0341(17)30183-1.

--Chen M, Eintracht S, **MacNamara E**. Successful protocol for eliminating excessive urine microscopies: Quality improvement and cost savings with physician support. *Clin Biochem*. 2017 Jan; 50(1-2):88-93.

--Mohammed Y, Bhowmick P, Smith DS, **Domanski D**, Jackson AM, Michaud SA, Malchow S, Percy AJ, Chambers AG, Palmer A, Zhang S, Sickmann A, **Borchers CH**. PeptideTracker: A knowledgebase for collecting and storing information on protein concentrations in biological tissues. *Proteomics*, 17 (7). doi: 10.1002/pmic.201600210. Epub 2016 Dec 14 (2017)

--Guarna MM, Hoover SE, Huxter E, Higo H, Moon KM, **Domanski D**, Bixby MEF, Melathopoulos AP, Ibrahim A, Peirson M, Desai S, Micholson D, White R, **Borchers CH**, Currie RW, Pernal SF, Foster LJ. Peptide biomarkers used for the selective breeding of a complex polygenic trait in honeybees. *Sci Rep*, 7(1): 8381 (2017)

--Richard VR, **Domanski D**, Percy AJ, **Borchers CH**. An online 2D-reversed-phase - Reversed-phase chromatographic method for sensitive and robust plasma protein quantitation. *J Proteomics*, 168:28-36. doi: 10.1016/j.jprot.2017.07.018. (2017)

--Eshghi A, **Borchers CH**. Multiple Reaction Monitoring Using Double Isotopologue Peptide Standards for Protein Quantification. *Methods Mol Biol*, 2017 Dec 19. doi: 10.1007/7651_2017_112. [Epub ahead of print]

--Urao N, Mirza RE, Corbiere TF, Hollander Z, **Borchers CH**, Koh TJ. Thrombospondin-1 and disease progression in dysferlinopathy. *Hum Mol Genet*, 6(24): 4951-4960 (2017)

--Han J, Higgins R, Lim MD, Lin K, Yang J, **Borchers CH**. Short-Term Stabilities of 21 Amino Acids in Dried Blood Spot. *Clin Chem*, 2017 Nov 2. pii: clinchem.2017.278457. doi: 10.1373/clinchem.2017.278457. [Epub ahead of print]

--Dilworth D, Upadhyay SK, Bonnafoos P, Edoos AB, Bourbigot S, Pesek-Jardim F, Gudavicius G, Serpa JJ, Petrotchenko EV, **Borchers CH**, Nelson CJ, Mackereth CD. The basic tilted helix bundle domain of the prolyl isomerase FKBP25 is a novel double-stranded RNA binding module. *Nucleic Acids Res*, 45(20): 11989-12004 (2017)

--Bowden JA, Heckert A, Ulmer CZ, Jones CM, Koelmel JP, Abdullah L, Ahonen L, Alnouti Y, Armando A, Asara JM, Bamba T, Barr JR, Bergquist J, **Borchers CH**, Brandsma J, Breitkopf SB, Cajka T, Cazenave-Gassiot A, Checa A, Cinel MA, Colas RA, Cremers S, Dennis EA, Evans JE, Fauland A, Fiehn O, Gardner MS, Garrett TJ, Gotlinger KH, Han J, Huang Y, Neo AH, Hyotylainen T, Izumi Y, Jiang H, Jiang H, Jiang J, Kachman M, Kiyonami R, Klavins K, Klose C, Kofeler HC, Kolmert J, Koal T, Koster G, Kuklenyik Z, Kurland IJ, Leadley M, Lin K, Maddipati KR, McDougall D, Meikle PJ, Mellett NA, Monnin C, Moseley MA, Nandakumar R, Oresic M, Patterson RE, Peake D, Pierce JS, Post M, Postle AD, Pugh R, Qui Y, Quehenberger O, Ramrup P, Rees J, Rembiesa B, Reynaud D, Roth MR, Sales S, Schuhmann K, Schwartzman ML, Serhan CN, Shevchenko A, Somerville SE, John-Williams LS, Surma MA, Takeda H, Thakare R, Thompson JW, Torta F, Triebel A, Trotzmuller M, Ubhayasekera SJK, Vuckovic D, Weir JM, Welti R, Wenk MR, Wheelock CE, Yao L, Yuan M, Zhao XH, Zhou

S.Harmonizing Lipidomics: NIST Interlaboratory Comparison Exercise for Lipidomics using Standard Reference Material 1950 Metabolites in Frozen Human Plasma. *J Lipid Res*, 58(12): 2275-2288 (2017)

--Mohammed Y, Pan J, Zhang S, Han J, **Borchers CH**. ExSTA: External Standard Addition Method for Accurate High-throughput Quantitation in Targeted Proteomics Experiments. *Proteomics Clin Appl*, 2017 Sep 11. doi: 10.1002/prca.201600180. [Epub ahead of print]

--Li H, Popp R, Frohlich B, Chen MX, **Borchers CH**. Peptide and Protein Quantification Using Automated Immuno-MALDI (iMALDI). *J Vis Exp*, 126 (2017)

--Popp R, Li H, LeBlanc A, Mohammed Y, Aguilar-Mahecha A, Chambers AG, Lan C, Poetz O, Basik M, Batist G, **Borchers CH**. Immuno-MALDI (iMALDI) for quantifying AKT1 and AKT2 in breast and colorectal cancer cell lines and tumors. *Anal Chem*, 89(19): 10592-10600 (2017)

--M Larina I, Percy AJ, Yang J, **Borchers CH**, M Nosovsky A, I Grigoriev A, N Nikolaev E. Protein expression changes caused by spaceflight as measured for 18 Russian cosmonauts. *Sci Rep*, 7(1): 8142 (2017)

--Pedde RD, Li H, **Borchers CH**, Akbari M. Microfluidic-Mass Spectrometry Interfaces for Translational Proteomics. *Trends Biotechnol*, 35 (10): 954-970 (2017)

--Brodie NI, Popov KI, Petrotchenko EV, Dokholyan NV, **Borchers CH**. Solving protein structures using short-distance cross-linking constraints as a guide for discrete molecular dynamics simulations. *Science Advances*, 3(7): e1700479 (2017)

--Mohammed Y, van Vlijmen BJ, Yang J, Percy AJ, Palmblad M, **Borchers CH**, Rosendaal FR. Multiplexed targeted proteomic assay to assess coagulation factor concentrations and thrombosis-associated cancer. *Blood Advances*, 1(15): 1080-1087 (2017)

--LeBlanc A, Michaud SA, Percy AJ, Hardie DB, Yang J, Sinclair NJ, Proudfoot JI, Pistawka A, Smith DS, **Borchers CH**. Multiplexed MRM-based Protein Quantitation Using Two Different Stable Isotope Labeled Peptides for Calibration. *J Proteome Res*, 16(7): 2527-2536 (2017)

--Li H, Han J, Pan J, Liu T, Parker CE, **Borchers CH**. Current Trends in Quantitative Proteomics: an update. *J Mass Spectrom*, 2(5): 319-341 (2017)

--Reynolds LA, Redpath SA, Yurist-Doutsch S, Gill N, Brown EM, van der Heijden J, Brosschot TP, Han J, Marshall NC, Woodward SE, Valdez Y, **Borchers CH**, Perona-Wright G, Finlay BB. Enteric helminths promote Salmonella co-infection by altering the intestinal metabolome. *J Infect Dis*, 215(8): 1245-1254 (2017)

--Streijger F, Skinnider M, Rogalski JC, Balshaw R, Shannon CP, Prudova A, Belanger LM, Ritchie L, Tsang A, Christie S, Parent S, Mac-Thiong JM, Bailey C, Urquhart J, Ailon T, Paquette SJ, Boyd MC, Street J, Fisher CG, Dvorak MF, **Borchers CH**, Foster LJ, Kwon BK. A Targeted Proteomics Analysis of Cerebrospinal Fluid after Acute Human Spinal Cord Injury. *J Neurotrauma*, 43(12): 2054-2068 (2017)

--Abbatiello SE, Ackermann BL, **Borchers CH**, Bradshaw RA, Carr SA, Chalkley RJ, Choi M, Deutsch EW, Domon B, Hoofnagle AN, Keshishian H, Kuhn E, Liebler DC, MacCoss MJ, MacLean B, Mani DR, Neubert H, Smith D, Vitek O, Zimmerman L. New Guidelines for Publication of Manuscripts Describing Development and Application of Targeted Mass Spectrometry Measurements of Peptides and Proteins. *Mol Cell Proteomics*, 16(3): 327-328 (2017)

--Qiu YL, Gong JY, Feng JY, Wang RX, Han J, Liu T, Lu Y, Li LT, Zhang MH, Sheps JA, Wang NL, Yan YY, Li JQ, Chen L, **Borchers CH**, Sipos B, Knisely AS, Ling V, Xing QH, Wang JS. Defects in MYO5B are associated with a spectrum of previously undiagnosed low γ -glutamyltransferase cholestasis. *Hepatology*, 65(5): 1655-1669 (2017)

--Wang X, Han J, Hardie DB, Yang J, Pan J, **Borchers CH**. Metabolomic profiling of prostate cancer by matrix assisted laser desorption/ionization-Fourier transform ion cyclotron resonance mass spectrometry imaging using Matrix Coating Assisted by an Electric Field (MCAEF). *Biochim Biophys Acta*, 1865(7): 755-767 (2017)

--Percy AJ, Michaud SA, Jardim A, Sinclair NJ, Zhang S, Mohammed Y, Palmer AL, Hardie DB, Yang J, LeBlanc AM, **Borchers CH**. Multiplexed MRM-based assays for the quantitation of proteins in mouse plasma and heart tissue. *Proteomics*, 17(7). doi: 10.1002/pmic.201600097. Epub 2016 Nov 18. (2017)

--Percy AJ, Hardie DB, Jardim A, Yang J, Elliott MH, Zhang S, **Borchers CH**. Multiplexed panel of precisely quantified salivary proteins for biomarker assessment. *Proteomics*, 17(6). doi: 10.1002/pmic.201600230. Epub 2016 Oct 19. (2017)

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)

Other publications:

CH Borchers, "MALDI Assay Shows Potential as Clinical Cancer Biomarker Tool". Interview for Genomeweb, (09/07/2017)

CH Borchers, "Protein modeling brings hope for dementia treatment". Interview for UVic Communications and Media Relations, (07/17/2017)

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

a. Conference organizational committees:

- Symposium organizer, "Advances in Clinical Proteomics and Metabolomics", Montreal, Nov 6 2017
- Canadian Association of medical Biochemist -2017

SECTION III-CONFIDENTIAL INFORMATION

1. Consulting activities: *None*

Respectfully submitted,

Elizabeth MacNamara, MD
Chief, Division of Medical Biochemistry