

ANNUAL REPORT
Division of Medical Biochemistry
Department of Medicine – Jewish General Hospital
January 1, 2015 – December 31, 2015

SUMMARY

This year, the Diagnostic Medicine Department has been recognized by the Ministry of Health as the most efficient laboratory in Quebec, and if all the laboratories in the Montreal area were performing at the same level, they would save approximately \$30 million from the Health Care Budget in Montreal alone. In addition, the Medical Biochemists have made a special effort this year that lab tests are being requested and used appropriately. This represents an approximate additional annual saving of \$500,000.

Recent progress has been made in improving the Division's academic performance, by partnering with the University of Victoria and the University of British Columbia in writing and obtaining grants (\$7.2 million) funded by Genome Quebec - BC - Canada for proteomic research. Dr. Christoph Borchers was recruited by Dr G. Batist, to the Lady Davis Institute and Diagnostic Medicine as the Segal Family Chair in Molecular Oncology and Chief of Proteomics, Medical Biochemistry. He is spearheading the development of a state of the art Translational Proteomics laboratory, linking it with his fundamental research laboratory at the University of Victoria, and funding from government, industry and donations from partners.

1. Research and publications:

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 centres across Canada to work together collaboratively, and to aid in providing the highest quality genomic technologies and advice to the research community.

2. Teaching and learning (undergraduate and graduate):

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

Undergraduate, McGill University
Medical Student Elective (4 week period)

Medical Biochemistry Observerships – 2-4 MD's, 2-4 months/year

Attendance at Medical Grand Rounds 4 times a month for 10 months/year

Attendance at the Association des Médecins Biochimistes du Québec/Canadian Association of Clinical Biochemists Annual Congress

Lectures given:
Surgical Grand Rounds - Jewish General Hospital, Montreal, Quebec
Overusing Tests, the Costs, the Damage to the Patient, and Our Role Together

Academic Half-Day Family Medicine Lecture – CLSC Cote des Neiges,

Montreal, Quebec

Are We Choosing Wisely When Ordering Laboratory Tests?

MSACL 2015 US- Mass Spectrometry Applications to the Clinical Lab,
San Diego, California

Getting Started with Quantitative LC-MS/MS in the Diagnostic Laboratory

OBGYN Grand Rounds - Jewish General Hospital, Montreal, Quebec

Overusing Tests, the Costs, the Damage to the Patient, and Our Role Together

Leadership for the 21st Century – An Event Inaugurating the McGill Liberal Arts
Program, Montreal, Quebec

The Liberal Arts and the Health Sciences

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

Undergraduate, McGill University

Postgraduate, McGill University

Resident Supervision/One-on-One Teaching

McGill Medical Biochemistry Residents (12 month period)

Residents' Teaching

Journal Club (Ad hoc basis)

Lectures given:

Surgical Grand Rounds - Jewish General Hospital, Montreal, Quebec

Overusing Tests, the Costs, the Damage to the Patient, and Our Role Together

Academic Half-Day Family Medicine Lecture – CLSC Cote des Neiges,
Montreal, Quebec

Are We Choosing Wisely When Ordering Laboratory Tests?

OBGYN Grand Rounds - Jewish General Hospital, Montreal, Quebec

Overusing Tests, the Costs, the Damage to the Patient, and Our Role Together

3. Involvement in the community:

Dr. MacNamara was invited to participate in the Academic Half-Day Family Medicine Lecture held at the CLSC Cote des Neiges in Montreal. Dr. MacNamara also lectured at an event inaugurating the McGill Liberal Arts Program in Montreal.

4. Partnerships:

Continuing development and implementation of a one year “Laboratory Training Program” for technologists from health centres in Gansu Province, China. This is part of the collaboration between the Jewish General Hospital laboratory and the Ministry of Health, Gansu, China.

5. Milestones: No changes in staffing occurred in 2015.

6. **Honours, awards, and prizes:** No awards were presented in 2015.

7. **Fundraising:**

Dr. MacNamara continues to be very active in fundraising to enhance the smooth running of the Diagnostic Medicine Department, for example, the purchase of new, more efficient laboratory equipment, ergonomic furniture for the staff, etc.

SECTION I – DIVISION STATUS UPDATE

1. **Mission and Objectives of the Division**

Mission Statement:

- ... To provide medical laboratory 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.
- ... To encourage and develop all staff to attain their true.

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

Dr. Elizabeth MacNamara, Chief, Department of Diagnostic Medicine, Associate Professor, McGill University (active)

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

Dr. Christoph Borchers, FCAHS, Research Professor, Department of Oncology, McGill University, Montreal, Segal McGill 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)

2. **Scholarly works published in the 2015 calendar year:**

A standardized kit for automated quantitative assessment of candidate protein biomarkers in human plasma.

Percy AJ, Mohammed Y, Yang J, **Borchers CH.**

Bioanalysis. 2015 Dec;7(23):2991-3004. doi: 10.4155/bio.15.222. Epub 2015 Dec 2.

Parker CE, **Borchers CH.**

Methods. 2015 Nov 1;89:1-3. doi: 10.1016/j.jymeth.2015.10.010. No abstract available.

Exploring phlebotomy technique as a pre-analytical factor in proteomic analyses by mass spectrometry.

Penn AM, Lu L, Chambers AG, Balshaw RF, Morrison JL, Votova K, Wood E, Smith DS, Lesperance M, del Zoppo GJ, **Borchers CH**; SpecTRA Study Group. Genome. 2015 Dec;58(12):569-76. doi: 10.1139/gen-2015-0036. Epub 2015 Jul 10.

Metabolome analysis of 20 taxonomically related benzylisoquinoline alkaloid-producing plants.

Hagel JM, Mandal R, Han B, Han J, Dinsmore DR, **Borchers CH**, Wishart DS, Facchini PJ. BMC Plant Biol. 2015 Sep 15;15:220. doi: 10.1186/s12870-015-0594-2.

Multiple Reaction Monitoring Enables Precise Quantification of 97 Proteins in Dried Blood Spots.

Chambers AG, Percy AJ, Yang J, **Borchers CH**. Mol Cell Proteomics. 2015 Nov;14(11):3094-104. doi: 10.1074/mcp.O115.049957. Epub 2015 Sep 4.

Diet and specific microbial exposure trigger features of environmental enteropathy in a novel murine model.

Brown EM, Wlodarska M, Willing BP, Vonaesch P, Han J, Reynolds LA, Arrieta MC, Uhrig M, Scholz R, Partida O, **Borchers CH**, Sansonetti PJ, Finlay BB. Nat Commun. 2015 Aug 4;6:7806. doi: 10.1038/ncomms8806.

An extensive library of surrogate peptides for all human proteins.

Mohammed Y, **Borchers CH**. J Proteomics. 2015 Nov 3;129:93-7. doi: 10.1016/j.jprot.2015.07.025. Epub 2015 Jul 29.

HDX match software for the data analysis of top-down ECD-FTMS hydrogen/deuterium exchange experiments.

Petrotchenko EV, **Borchers CH**. J Am Soc Mass Spectrom. 2015 Nov;26(11):1895-8. doi: 10.1007/s13361-015-1213-z. Epub 2015 Jul 11.

Quest for Missing Proteins: Update 2015 on Chromosome-Centric Human Proteome Project.

Horvatovich P, Lundberg EK, Chen YJ, Sung TY, He F, Nice EC, Goode RJ, Yu S, Ranganathan S, Baker MS, Domont GB, Velasquez E, Li D, Liu S, Wang Q, He QY, Menon R, Guan Y, Corrales FJ, Segura V, Casal JI, Pascual-Montano A, Albar JP, Fuentes M, Gonzalez-Gonzalez M, Diez P, Ibarrola N, Degano RM, Mohammed Y, **Borchers CH**, Urbani A, Soggiu A, Yamamoto T, Salekdeh GH, Archakov A, Ponomarenko E, Lisitsa A, Lichti CF, Mostovenko E, Kroes RA, Rezeli M, Végvári Á, Fehniger TE, Bischoff R, Vizcaíno JA, Deutsch EW, Lane L, Nilsson CL, Marko-Varga G, Omenn GS, Jeong SK, Lim JS, Paik YK, Hancock WS. J Proteome Res. 2015 Sep 4;14(9):3415-31. doi: 10.1021/pr5013009. Epub 2015 Jul 23.

Fast Comparative Structural Characterization of Intact Therapeutic Antibodies Using Hydrogen-Deuterium Exchange and Electron Transfer Dissociation.

Pan J, Zhang S, Chou A, Hardie DB, **Borchers CH**. Anal Chem. 2015 Jun 16;87(12):5884-90. doi: 10.1021/ac504809r. Epub 2015 May 26.

Precise quantitation of 136 urinary proteins by LC/MRM-MS using stable isotope labeled peptides as internal standards for biomarker discovery and/or verification studies.

Percy AJ, Yang J, Hardie DB, Chambers AG, Tamura-Wells J, **Borchers CH**.

Methods. 2015 Jun 15;81:24-33. doi: 10.1016/j.ymeth.2015.04.001. Epub 2015 Apr 6.

Gluten Intake Is Positively Associated with Plasma α 2-Macroglobulin in Young Adults.

Jamnik J, García-Bailo B, **Borchers CH**, El-Sohehy A.

J Nutr. 2015 Jun;145(6):1256-62. doi: 10.3945/jn.115.212829. Epub 2015 Apr 8.

Analysis of disease-associated protein expression using quantitative proteomics—fibulin-5 is expressed in association with hepatic fibrosis.

Bracht T, Schweinsberg V, Trippler M, Kohl M, Ahrens M, Padden J, Naboulsi W, Barkovits K, Megger DA, Eisenacher M, **Borchers CH**, Schlaak JF, Hoffmann AC, Weber F, Baba HA, Meyer HE, Sitek B.

J Proteome Res. 2015 May 1;14(5):2278-86. doi: 10.1021/acs.jproteome.5b00053. Epub 2015 Apr 6.

Serum proteomics in multiple sclerosis disease progression.

Tremlett H, Dai DL, Hollander Z, Kapanen A, Aziz T, Wilson-McManus JE, Tebbutt SJ, **Borchers CH**, Oger J, Cohen Freue GV.

J Proteomics. 2015 Apr 6;118:2-11. doi: 10.1016/j.jprot.2015.02.018. Epub 2015 Mar 6.

Comprehensive identification of disulfide bonds using non-specific proteinase K digestion and CID-cleavable crosslinking analysis methodology for Orbitrap LC/ESI-MS/MS data.

Makepeace KA, Serpa JJ, Petrotchenko EV, **Borchers CH**.

Methods. 2015 Nov 1;89:74-8. doi: 10.1016/j.ymeth.2015.02.021. Epub 2015 Mar 6.

The Application of Multiple Reaction Monitoring to Assess Apo A-I Methionine Oxidations in Diabetes and Cardiovascular Disease.

Yassine HN, Jackson AM, Reaven PD, Nedelkov D, Nelson RW, Lau SS, **Borchers CH**.

Transl Proteom. 2014 Dec 1;4-5:18-24.

Large-Scale Interlaboratory Study to Develop, Analytically Validate and Apply Highly Multiplexed, Quantitative Peptide Assays to Measure Cancer-Relevant Proteins in Plasma.

Abbatiello SE, Schilling B, Mani DR, Zimmerman LJ, Hall SC, MacLean B, Albertolle M, Allen S, Burgess M, Cusack MP, Gosh M, Hedrick V, Held JM, Inerowicz HD, Jackson A, Keshishian H, Kinsinger CR, Lyssand J, Makowski L, Mesri M, Rodriguez H, Rudnick P, Sadowski P, Sedransk N, Shaddox K, Skates SJ, Kuhn E, Smith D, Whiteaker JR, Whitwell C, Zhang S, **Borchers CH**, Fisher SJ, Gibson BW, Liebler DC, MacCoss MJ, Neubert TA, Paulovich AG, Regnier FE, Tempst P, Carr SA.

Structure of EspB from the ESX-1 type VII secretion system and insights into its export mechanism.

Solomonson M, Setiaputra D, Makepeace KA, Lameignere E, Petrotchenko EV, Conrady DG, Bergeron JR, Vuckovic M, DiMaio F, **Borchers CH**, Yip CK, Strynadka NC.

Structure. 2015 Mar 3;23(3):571-83. doi: 10.1016/j.str.2015.01.002. Epub 2015 Feb 12.

Identification and validation of potential new biomarkers for prostate cancer diagnosis and prognosis using 2D-DIGE and MS.

Geisler C, Gaisa NT, Pfister D, Fuessel S, Kristiansen G, Braunschweig T, Gostek S, Beine B, Diehl HC, Jackson AM, **Borchers CH**, Heidenreich A, Meyer HE, Knüchel R, Henkel C. *Biomed Res Int*. 2015;2015:454256. doi: 10.1155/2015/454256. Epub 2015 Jan 15.

Architecture of the RNA polymerase II-Mediator core initiation complex.

Plaschka C, Larivière L, Wenzek L, Seizl M, Hemann M, Tegunov D, Petrotchenko EV, **Borchers CH**, Baumeister W, Herzog F, Villa E, Cramer P. *Nature*. 2015 Feb 19;518(7539):376-80. doi: 10.1038/nature14229. Epub 2015 Feb 4.

Qualis-SIS: automated standard curve generation and quality assessment for multiplexed targeted quantitative proteomic experiments with labeled standards.

Mohammed Y, Percy AJ, Chambers AG, **Borchers CH**. *J Proteome Res*. 2015 Feb 6;14(2):1137-46. doi: 10.1021/pr5010955. Epub 2015 Jan 16.

DXMSMS Match Program for Automated Analysis of LC-MS/MS Data Obtained Using Isotopically Coded CID-Cleavable Cross-Linking Reagents.

Petrotchenko EV, Makepeace KA, **Borchers CH**. *Curr Protoc Bioinformatics*. 2014 Dec 12;48:8.18.1-19. doi: 10.1002/0471250953.bi0818s48.

Metabolic profiling of bile acids in human and mouse blood by LC-MS/MS in combination with phospholipid-depletion solid-phase extraction.

Han J, Liu Y, Wang R, Yang J, Ling V, **Borchers CH**. *Anal Chem*. 2015 Jan 20;87(2):1127-36. doi: 10.1021/ac503816u. Epub 2014 Dec 24.

An isotope-labeled chemical derivatization method for the quantitation of short-chain fatty acids in human feces by liquid chromatography-tandem mass spectrometry.

Han J, Lin K, Sequeira C, **Borchers CH**. *Anal Chim Acta*. 2015 Jan 7;854:86-94. doi: 10.1016/j.aca.2014.11.015. Epub 2014 Nov 15.

An automated assay for the clinical measurement of plasma renin activity by immuno-MALDI (iMALDI).

Popp R, Malmström D, Chambers AG, Lin D, Camenzind AG, van der Gugten JG, Holmes DT, Pugia M, Jaremek M, Cornett S, Suckau D, **Borchers CH**. *Biochim Biophys Acta*. 2015 Jun;1854(6):547-58. doi: 10.1016/j.bbapap.2014.10.008. Epub 2014 Oct 16.

Isotopically-coded short-range hetero-bifunctional photo-reactive crosslinkers for studying protein structure.

Brodie NI, Makepeace KA, Petrotchenko EV, **Borchers CH**. *J Proteomics*. 2015 Apr 6;118:12-20. doi: 10.1016/j.jprot.2014.08.012. Epub 2014 Sep 2.

SECTION III-CONFIDENTIAL INFORMATION

1. Consulting activities: *None*

Respectfully submitted,

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