June 25, 2019

McGill | Faculty of Medicine

Annual Reporting for Faculty Supported Research Centres and Networks

All Centres (provisional Centres; McGill Centres), Research groups and Networks that receive funding from the Faculty of Medicine are required to provide two components of reporting:

1. an Annual Report of Activities and Outcomes (see below),
2. a Financial Statement (see attached Excel document).

The reporting period is May 1, 2018 – April 30, 2019.

Both documents are due May 27th, 2019 at 5pm

Continued support from the Faculty is contingent on:

1. the receipt of the reporting documents on time,
2. the evaluation of reported activities by the Faculty's Committee for Oversight of Research Units (CORU), and
3. the availability of Faculty funds in the next fiscal year.

Please send both documents to Faculty of Medicine's Research Office (riac.med@mcgill.ca).

Your strong engagement in the Faculty's mission for continued research excellence and financial stewardship is truly appreciated.

McGill | Faculty of Medicine

Annual Report of Activities and Outcomes

Please respect the page limits, where indicated, or the report will be returned.
(The accepted font is Times New Roman or Calibri regular 11 pts)

1. Name of the Unit: McGill Centre for Translational Research in Cancer (MCTRC)

2. Director's contact information:

   Dr. Gerald Batist
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3. If the Unit is **a Senate-approved** McGill Research Centre, indicate date of approval: 1996

4. Number of Unit members: 58

5. Number of members affiliated with McGill's Faculty of Medicine: 54

6. **Unit's website**:
   URL: https://www.mcgill.ca/translational-research-cancer/

   Note: The website needs to feature the following:
   - all sources of funding support (including the Faculty of Medicine's logo),
   - the List of Members and their institutional affiliation with appropriate links,
   - the activities supported by the Unit
   - all previous Annual Reports.

7. Summary of past year's **goals and objectives** of the Unit. (**limit: ½ page**)

   The MCTRC's missions are to:
   - Further the advancement of scientific knowledge and generate novel approaches to cancer prevention, screening and treatment
   - Promote the translation of innovative laboratory and clinical research findings into real health improvements of cancer patients

In line with our missions, the Centre outlined the following objectives in 2018:

- Revise the advisory board
  This is still in progress, as efforts are underway to develop an AB that is aligned with others already in existence in the environment, so as to create synergies rather than redundancies.
- Restructure the Centre's website
- Support innovative cancer researches, with a focus on personalized approach to patient care
- Submit team grant applications that involve research collaborations between scientists and clinicians and among the specialists from different areas of cancer research
- Establish a tumor bank management committee at the Jewish General Hospital to harmonize and streamline biobanking practices across all tumor tissue banks of the hospital
- Continue to provide high-quality educational trainings to next-generation scientists

8. **Major achievements** enabled by the support obtained from the Faculty. **(limit: 1 page)**

- MCTRC members published a total of 254 articles in peer-reviewed journals. Of these, an impressive number of publications, 53, resulted from direct collaborations among the MCTRC researchers (**Appendix I**). The list includes publications from highly respected journals such as Cancer Cell (IF=22.844), Cell Metabolism (IF=20.565) and Nature Communications (IF= 12.353) among others.
- MCTRC members obtained 38 new operating grants this year, amounting to more than 16 million dollars in total. 4 of these grants involve collaborative efforts among the Centre's members (**Appendix II**). Of note, Dr. Mader established new collaborations with 3 other MCTRC members, Drs. Ursini-Siegel, Witcher and Pollak, for a project titled "Targeting vulnerabilities to overcome drug resistance in poor outcome breast cancers." The project aims to understand the underlying epigenetic reprogramming that contributes to the development of drug resistance in breast cancer and to identify therapeutically targetable mechanisms to delay or abolish resistance to therapies. They successfully secured a grant from Oncopole.
- With the support of the Terry Fox Research Institute, several MCTRC members partnered with other leading cancer centres and hospitals in Montreal to form a multi-institutional consortium called "Montreal Cancer Consortium." Together, they launched a 2-year pilot project to advance immunotherapy treatments for melanoma and acute leukemia by using the approach of precision and personalized medicine.
- MCTRC members maintain high visibility in the scientific community. This year, they participated in more than 55 conferences at local, national and international levels, including 14 symposiums and workshops which certain members (co-)organized. 2 symposiums were organized by at least two members of the MCTRC (**Appendix III**).
- MCTRC members are principal and/or sub-investigators of 94 on-going clinical trials at the Clinical Research Unit (CRU) of the Jewish General Hospital (**Appendix IV**), including 20 new clinical trials. At least 76 of these trials involve the collaborations of MCTRC members.
- 9 Master's and 12 Ph.D. students from different departments as well as 8 postdoctoral fellows started their training this year at the MCTRC (**Appendix V**). 4 of these trainees are co-supervised by the MCTRC investigators.
- A total of 34 Lady Davis Institute (LDI) Cancer Seminars (**Appendix VI**) were held, with an average of 30 attendees per session. 20 graduate students had the opportunity to present their project and receive constructive feedback from their colleagues and PIs. Additionally, this year's Cancer Seminar Series were marked by the presentations of PI members of the MCTRC. Not only is their participation educational for the trainees, but it also promotes more collaboration among the MCTRC researchers.
- We modified the website to accommodate for the changes the Centre has adapted over the past years. The newly formed research group "Artificial Intelligence-Assisted Radiomics for Advanced

Diagnostics" was added to the list. The descriptions of research themes, core facilities and members were updated to recruit talented trainees and to attract potential collaborators.

- Through our bridge fund for innovative projects, the Centre provided a financial support to Dr. Mark Trifiro's research project investigating the use of nanoparticles to ablate the tumors. The project focuses initially on prostate cancer, but the resulting knowledge will eventually be applied to other types of cancer. The Centre also supported Vincent Turgeon, a resident in Medical Physics Unit at the McGill University. His research focuses on decreasing patient discomfort and minimizing adverse events during a PET scan by developing a non-invasive but effective way to measure radioactive tracer concentration in the blood, called input function.
- The Centre established a tumor bank management committee at the Jewish General Hospital (JGH). With the financial support from the Réseau de Recherche sur le Cancer (RRCancer), all JGH biobanks are currently undergoing a certification process offered by the Canadian Tissue Repository Network (CTRNet).
- The Centre helped develop the Molecular Tumor Board to support the CAPTUR (CCTG) trial of molecular based cancer therapy, with the aim to expand this with increased profiling of patients, and linking with other institutions across McGill and Quebec.
- The Centre established a core genomic profiling unit, in Molecular Pathology, with the addition of the Thermo Fisher Gene Studio S5 system. This grants access to the Oncomine genomic/RNAomic panels, enables a comprehensive sequencing capacity and fuels advancements in molecular diagnostics and innovation in biomarker driven translational research. The Centre facilitated acquisition of the technology, even though the funds do not pass through the Centre. The profiling unit has set the foundation for:
    1. Translational NGS research aimed at Urachal Cancer Research (funded by the Ride to Conquer Cancer)
    2. Innovative multi-Centre liquid biopsy NGS testing in pulmonary oncology (Funded by the Rossy Cancer Network).
    3. Comprehensive Genomic profiling Research and Development initiatives for the JGH molecular diagnostics laboratories
    4. Representing the Quebec Profiling Lab Platform for the pan- Canadian Personalize my Treatment (PMT) Initiative driven by Exactis Innovation.
- The Centre also facilitated the acquisition of Nano-LC system (1260 Infinity) and Agilent Fraction Collector (1260 Infinity II) in the Proteomics Centre.

9. **New Members** who joined the Unit in the past year and their **institutional affiliation(s)**.

Name **Last, First**	**Title** **PI, Staff or Trainee [Graduate student (GS) or post-doctoral fellow (PDF)]**	**Type of Membership** **Full, Associate**	**Affiliation(s)**
Rivera, Barbara	Assistant Professor	Full	Gerald Bronfman Department of Oncology

Dr. Rivera, previously a trainee at the MCTRC in Dr. Foulkes's laboratory, is now Assistant Professor at the Gerald Bronfman Department of Oncology, McGill University. Since then, she has joined the Centre as full member and has established a new collaboration with Dr. Orthwein.

10. Members who have **left the Unit** over the reported year.

N/A

11. State how the current and forecasted activities of your Unit align with the Education or Research mission (Strategic Research Plan) of the Faculty of Medicine and/or other Faculties at McGill (**limit: ½ page**):

MCTRC's activities center around its missions to foster innovative discoveries in the field of oncology and to take these discoveries from bench to bedside to make real impacts in patient care. More specifically, personalized medicine, one of the Faculty's strategic priorities, has been and continues to be the main focus of the Centre. Based on each member's expertise, MCTRC researchers are grouped into 7 research themes. These themes represent crucial components of our approach to personalized and precision medicine, covering from biomarker discovery, drug designing, immunotherapies, to artificial intelligence & computer science applied to diagnostic methods.

Our core facilities provide access to state-of-art equipment and technology platforms required to conduct translational research, along with training, technological support and consulting services. This year, Drs. Borchers and Spatz, directors of Proteomics Centre and Pathology Facility, respectively, organized an educational symposium targeting researchers and trainees in the institute to train them on how to best leverage the Centre's services to increase the clinical relevancy of their research. Furthermore, the Centre's new initiative to improve tissue banking is an important step to ensure high-quality biospecimens is collected for research purpose and to facilitate the accessibility of these materials to researchers. With the support of the Centre, our members maintain highly productive research activities, publishing an average of 200 papers each year and leading more than 80 ongoing clinical trials.

12. Explain why support from the Faculty of Medicine continues to be crucial to the operations of the Unit (**limit: ½ page**):

Support from the Faculty of Medicine is ever more important in attaining the objectives we set out for the coming years, as the Centre plans to launch new supplementary initiatives (outlined below) to better support the members' research activities and education of their trainees. MCTRC's new initiatives consist of:

1) improving the biobanking process and increasing the accessibility of patient materials to researchers
2) developing a funding stream for graduate students working in Translational Medicine at McGill University
3) organizing MCTRC's first annual scientific symposium in efforts to strengthen the network within the Centre and to promote collaborations among the members
4) supporting and expanding the Molecular Tumor Board currently at the Segal, and expanding this to include other Quebec institutions
5) Continued explicit support for the McGill-wide Proteomics Program led by C Borchers

The successful outcomes of these initiatives will undoubtedly add values to the Faculty's research and educational mission.

13. List action items that the Unit has taken or will consider taking in the next year towards growth and sustainability of its operations (**limit: ½ page)**

- Continue to support innovative cancer researches, in particular within large local, national and international Consortia, with a focus on personalized medicine
- Identify funding opportunities and assist the members for team grant applications
- Advance the tumor tissue biobank initiative

We are in the process of creating a website to increase the awareness and participation of patients and to increase the accessibility of resources to researchers.

- Support and expand and integrate Molecular Tumor Boards across the network of hospitals
- Support the development and expansion of the McGill-wide Proteomics Program (C Borchers)
- Develop financial support for graduate students in Translational Medicine
- Organize an annual scientific symposium

14. Provide suggestions about how the Faculty could do better to support the Unit and research efforts in general (e.g., centralized data repositories, institutional data management plans, support for software developments, guidance for adopting open-science practices, simplification of administrative procedures, etc.) (**no page limit but please be specific and unleash your creativity!**)
    - Central leadership with addressing Quebec's legal impediments to bio banking (towards an 'opt out' system)
    - Support for patient data integration within and among the hospitals
    - Free access to publications for trainees other than graduate students (e.g. postdoc fellows)
    - Higher profile for the Centre in McGill's environment

In the attached (Excel) **Year-End Financial Report** please detail:

1. Expenditures of funding provided by the Faculty of Medicine and other sources, towards meeting the objectives of the Unit,
2. Any in-kind contributions provided to the Unit by other partners and sponsors,
3. Projected budget for the coming year (including request to the Faculty of Medicine).

Appendix List

Appendix I: Publications

The researchers of the MCTRC are indicated in bold letters. Only the publications involving collaborations among the PI members of the Centre are listed.

The Lady Davis Institute (LDI) selects a paper each month from recently published articles of the researchers at the institute to highlight its significant contribution to the understanding and/or treatment of a disease. This year, September 2018 edition featured the multidisciplinary work of Drs. **Richard** and **Kleinman** (Calabretta et al., 2018) on deciphering the role of PRMT5, an arginine methyltransferase, in oligodendrocyte differentiation. As PRMT5 is identified as a positive regulator of a growth factor receptor PDGFRα, its inhibitor represents a new therapeutic target for treating PDGFRα-addicted cancer cells such as glioblastoma and gastro-intestinal stromal tumors (GIST). October 2018 edition featured Dr. **Orthwein** lab's article (Findlay et al., 2018), co-authored by Drs. **Mann** and **Greenwood**. In this paper, the researchers discovered that a novel factor SHLD2 interacts with REV7 to initiate non-homologous end joining (NHEJ). The study deepens our understanding of how DNA damage is repaired, a crucial mechanism that is often impaired in malignant tumor cells.

1. Popp R, **Basik M**, **Spatz A**, **Batist G**, **Zahedi RP**, **Borchers CH**. How iMALDI can improve clinical diagnostics. *Analyst*. 2018;143(10):2197-2203. PMID: 29713694
2. Garant A, Florianova L, Gologan A, **Spatz A**, Faria J, Morin N, Vasilevsky CA, **Vuong T**. Do clinical criteria reflect pathologic complete response in rectal cancer following neoadjuvant therapy? *Int J Colorectal Dis*. 2018;33(6):727-733.
3. Daniel P, **Sabri S**, Chaddad A, Meehan B, Jean-Claude B, Rak J, **Abdulkarim B**. Temozolomide induced hypermutation in glioma: evolutionary mechanisms and therapeutic opportunities. *Frontiers in Oncology,* 2019,9:41.
4. **Gottlieb B**, Babrzadeh F , Oros KK, Alvarado1 C, Wang C, Gharizadeh B , **Basik M** , **Greenwood C**, Beitel LK, **Trifiro M** . New insights into the role of intra-tumor genetic heterogeneity in carcinogenesis: identification of complex single gene variance within tumors. *J Cancer Metastasis Treat.* 2018;4:37.
5. Hulea L, Gravel S-P, Morita M, Cargnello M, Uchenunu O, Im YK, McLaughlan S, Larsson O, Ohh M, Ferreira T, **Greenwood C**, Bridon G, Avizonis D, **Ursini-Siegel J**, St-Pierre J, **Pollak M**, **Topisirovic I**. Translational and HIF1α-dependent metabolic reprograming underpin oncometabolome plasticity and synergy between oncogenic kinase inhibitors and biguanides. *Cell Metabolism*. 2018;28(6): 817-832. PMID: 30244971
6. Findlay S, Heath J, Luo VM, Malina A, Morin T, Coulombe Y, Djerir B, Li Z, Samiei A, Cheyou ES, Karam M, Bagci H, Rahat D, Grapton D, Lavoie EG, Dove C, Khaled H, Kuasne H, **Mann KK**, Klein KO, **Greenwood CM**, Tabach Y, Park M, Côté JF, Masson JY, Maréchal A, **Orthwein A**. SHLD2/FAM35A co-operates with REV7 to coordinate DNA double-strand break repair pathway choice. *EMBO J.* 2018;37(18): e100158.
7. **Zahedi RP**, Parker CE, **Borchers CH**. Immuno-MALDI-TOF-MS in the Clinic. *Clin Chem*. 2018;64(9):1271-1272. PMID: 30018057
8. Mnatsakanyan R, Shema G, **Basik M**, **Batist G**, **Borchers CH**, Sickmann A, **Zahedi RP**. Detecting post-translational modification signatures as potential biomarkers in clinical mass spectrometry. *Expert Rev Proteomics*. 2018;15(6):515-535. PMID: 29893147
9. Vadnais C, Chen R, Fraszczak J, Yu Z, Boulais J, Pinder J, Frank D, Khandanpour C, Hebert J, Dellaire G, Cote JF, **Richard S**, **Orthwein A**, Drobetsky E, Moroy T. GFI1 is required for efficient DNA Repair by regulating PRMT1 dependent methylation of MRE11 and 53BP1. *Nat Commun*. 2018;9(1):1418.
10. Litzler LC, Zahn A, Meli A, Hébert S, Patenaude AM, Methot SP, Sprumont A, Bois T, Kitamura D, Costantino S, King IL, **Kleinman CL**, **Richard S**, Di Noia JM. PRMT5 is essential for B cell development and germinal center dynamics. *Nature Communications.* 2019;10(1):22.
11. Gomes CC, Gayden T, Bajic A, Harraz OF, Pratt J, Nikbakht H, Bareke E, Diniz MG, Henriques Castro W, St-Onge P, Sinnett D, Han H, **Rivera B**, Mikael LG, De Jay N, **Kleinman CL**, Valera ET, Bassenden

AV, Berghuis AM, Majewski J, Nelson MT, Gomez RS, Jabado N. TRPV4 and KRAS and FGFR1 gain-of-function mutations drive giant cell lesions of the jaw. *Nature Communications.* 2018;9(1):4572.

12. Calabretta S, Vogel G, Yu Z, Choquet K, Darbelli L, Nicholson TB, **Kleinman CL**, **Richard S**. Loss of PRMT5 promotes PDGFRα degradation during oligodendrocyte differentiation and myelination. *Developmental Cell.* 2018;46(4):426-440.
13. Ha JR, Ahn R, Smith HW, Sabourin V, Hébert S, Cepeda Cañedo E, Im YK, **Kleinman CL**, Muller WJ, **Ursini-Siegel J**. Integration of distinct ShcA signaling complexes promotes breast tumor growth and tyrosine kinase inhibitor resistance. *Molecular Cancer Research.* 2018;16(5):894-908.
14. Alahmad YM, Aljaber M, Saleh AI, Yalcin HC, **Aboulkassim T**, Yasmeen A, **Batist G**, Moustafa AA. Effect of cell-phone radiofrequency on angiogenesis and cell invasion in human head and neck cancer cells. *Head Neck*. 2018;40(10):2166-2171. doi: 10.1002/hed.25210
15. Banerji U, Dean EJ, Pérez-Fidalgo JA, **Batist G**, Bedard PL, You B, Westin SN, Kabos P, Garrett MD, Tall M, Ambrose H, Barrett JC, Carr TH, Cheung SYA, Corcoran C, Cullberg M, Davies BR, de Bruin EC, Elvin P, Foxley A, **Lawrence P**, Lindemann JPO, Maudsley R, Pass M, Rowlands V, Rugman P, Schiavon G, Yates J, Schellens JHM. A Phase I Open-Label Study to Identify a Dosing Regimen of the Pan-AKT Inhibitor AZD5363 for Evaluation in Solid Tumors and in *PIK3CA*-Mutated Breast and Gynecologic Cancers. *Clin Cancer Res*. 2018;24(9):2050-2059. doi: 10.1158/1078-0432.CCR-17-2260.
16. Al-Thawadi H, Ghabreau L, **Aboulkassim T**, Yasmeen A, Vranic S, **Batist G**, Al Moustafa AE. Co-Incidence of Epstein-Barr Virus and High-Risk Human Papillomaviruses in Cervical Cancer of Syrian Women. *Front Oncol*. 2018;8:250. doi: 10.3389/fonc. 2018.00250.
17. Im YK, Najyb O, Gravel SP, McGuirk S, Ahn R, Avizonis DZ, Chénard V, Valerie Sabourin V, Hudson J, Pawson T, **Topisirovic I**, **Pollak M**, St-Pierre J, **Ursini-Siegel J**. Interplay between ShcA signaling and PGC-1α triggers targetable metabolic vulnerabilities in breast cancer. *Cancer Res*. 2018;78(17):4826-4838. doi: 10.1158/0008-5472.CAN-17-3696.
18. Uchenunu O, **Pollak M**, **Topisirovic I**, Hulea L. Oncogenic kinases and perturbations in protein synthesis machinery and energetics in neoplasia. *Journal of Molecular Endocrinology.* 2019;62(2): R83-R103. doi: 10.1530/JME-18-0058
19. Zaja F, Salvi F, Rossi M, Sabattini E, Evangelista A, Ciccone G, Angelucci E, Gaidano G, Zanni M, Ladetto M, Chiappella A, Vitolo U, Zinzani PL, Califano C, Tucci A, Patti C, Pileri SA, Lenti V, Piccaluga PP, Cavallo F, Volpetti S, Perali G, **Assouline S**, **Mann KK** , Morin R, Alcaide M, Bushell K, Fanin R, Levis A. Single-agent panobinostat for relapsed/refractory diffuse large B-cell lymphoma: clinical outcome and correlation with genomic data. A phase 2 study of the Fondazione Italiana Linfomi. *Leuk Lymphoma*. 2018;59(12):2904-2910.
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21. Dahabieh MS, Di Pietro E, Jangal M, Goncalves C, **Witcher M**, Braverman NE, **Del Rincón SV**. Peroxisomes and Cancer: The Role of a Metabolic Specialist in a Disease of Aberrant Metabolism. *Biochim Biophys Acta Rev Cancer*. 2018;1870(1):103-121.
22. Wever CM, Geoffrion D, Grande BM, Yu S, Alcaide M, Lemaire M, Riazalhosseini Y, Hébert J, Gavino C, Vinh DC, Petrogiannis-Haliotis T, Dmitrienko S, **Mann KK**, Morin RD, **Johnson NA**. The genomic landscape of two Burkitt lymphoma cases and derived cell lines: comparison between primary and relapse samples. *Leuk Lymphoma*. 2018;59(9):2159-2174.
23. Meti N, **Esfahani K**, **Johnson NA**. The Role of Immune Checkpoint Inhibitors in Classical Hodgkin Lymphoma. *Cancers (Basel)*. 2018;10(6). doi: 10.3390/cancers10060204.
24. Klil-Drori AJ, Yin H, **Azoulay L**, Del Corpo A, Harnois M, Gratton MO, Olney HJ, Delage R, Laneuville P, Mollica L, Busque L, **Assouline SE**, Groupe Québécois de Recherche en Leucémie Myéloïde Chronique et Néoplasies Myéloprolifératives (GQR LMC-NMP). Molecular monitoring of therapeutic milestones and clinical outcomes in patients with chronic myeloid leukemia. *Cancer*. 2019;125(4):618-625.
25. Leech AO, Vellanki SH, Rutherford EJ, Keogh A, Jahns H, Hudson L, O'Donovan N, **Sabri S**, **Abdulkarim**

B, Sheehan KM, Kay EW, Young LS, Hill ADK, Smith YE, Hopkins AM. Cleavage of the extracellular domain of Junctional Adhesion Molecule-A is associated with resistance to anti-HER2 therapies in breast cancer settings. *Breast Cancer Res.* 2018; 20(1):140. PMID: 30458861.

26. Chaddad A, **Sabri S**, **Niazi T** and **Abdulkarim B**. Prediction of survival with multi-scale radiomic analysis in glioblastoma patients. *Med Biol Eng Comput.* 2018;56(12):2287-2300.
27. Xue Y, Meehan B, Macdonald E, Venneti S, Wang SX, Witkowski L, Jelinic P, Kong T, Martinez D, Morin G, Firlit M, Abedini A, Johnson R, Cencic R, Patibandla J, Chen H, Papadakis A, Auguste A, de Rink I, Kerkhoven R, Bertos N, **Gotlieb W**, Clarke B, Leary A, **Witcher M**, Guiot M, Pelletier J, Dostie J, Park M, Judkins A, Hass R, Levine D, Rak J, Vanderhyden B, **Foulkes WD**, Huang S. CDK4/6 inhibitors target SMARCA4-determined cyclin D1 deficiency in hypercalcemic small cell carcinoma of the ovary. *Nature Commun*. 2019;10(1):558.
28. Gotlieb R, Abitbol J, How JA, Ben-Brith I, Abenhaim HA, Lau SK, **Basik M**, Rosberger Z, Geva N, **Gotlieb WH**, Mintz A. Gender differences in how physicians access and process information. *Gynecol Oncol Rep.* 2019;27:50-53.
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31. Castellsagué E, Li R, Aligue R, González S, Sanz J, Martin E, Velasco À, Capellá G, Stewart CJR, Vidal A, Majewski J, **Rivera B**, Polak P, Matias-Guiu X, Brunet J, **Foulkes WD**. Novel POLE pathogenic germline variant in a family with multiple primary tumors results in distinct mutational signatures. *Hum Mutat*. 2019;40(1):36-41.
32. Sharif-Askari B, Amrein L, **Aloyz R**, **Panasci L**. PARP3 inhibitors ME0328 and olaparib potentiate vinorelbine sensitization in breast cancer cell lines. *Breast Cancer Res Treat*. 2018;172(1):23-32.
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Appendix II: Grants

Only the grants that involve multiple PI members of the Centre are listed.

Years	Project title	MCTRC members	Funding Agency	Amount
2018-2020	Montreal Cancer Consortium: Pilot Project	Wilson Miller, Gerald Batist, Mark Basik, Alan Spatz, Sarit Assouline, Cristiano Ferrario, Sonia del Rincon	Terry Fox Research Institute	$ 2,000,000
2019-2021	Targeting vulnerabilities to overcome drug resistance in poor outcome breast cancers	Sylvie Mader, Michael Pollak, Claudia Kleinman, Mark Basik, Michael Witcher, Josie Ursini-Siegel	Oncopole	$ 1,500,000
2018-2020	Innovative cleavable linker strategy for mass spectrometry-based elucidation of drug binding sites	Christoph Borchers, Rene Zahedi	FRQNT	$ 300,000
2018-2019	Radiogenomics Models with Artificial Intelligence for Detections of Nodal Micrometastases to Reduce Unnecessary Neck Dissections in Head and Neck Cancer Patients	Reza Forghani, Caroline Reinhold, Jaron Chong, Behzad Forghani, Michael Hier, Marcin Mlynarek, Alan Spatz, Jan Seuntjens, Khalil Sultanem	Rossy Cancer Network	$ 100,000

Appendix III: Conferences

Only the conferences that involve participation of more than one member of the Centre are listed.

1. **Translating Proteomics into the Clinic Symposium,** Jewish General Hospital, Montreal. January 14, 2019.
   Christoph Borchers: hosted the symposium and delivered the lecture "Introduction to the Pan Canadian Proteomics Centre."
   Alan Spatz: delivered the lecture "PD-L1: How proteomics can help to meet unmet needs in pathology."

2. **9th Annual Lady Davis Institute Scientific Retreat**, Montreal. May 4, 2018.
   Alexandre Orthwein: co-organized the event along with Dr. Colin Crist and Dr. Marc Fabian.
   Session 1 chair: Gerald Batist; Session 4 chair: Koren Mann.

3. **10th Worldwide Innovative Network (WIN) Symposium: "Global Implementation of Precision Oncology: Winning the War against Cancer"**, Paris, France. June 25-26, 2018.
   Alan Spatz: chaired the sesson 4 "New Concepts and Therapeutics Avenues in Precision Oncology" and moderated "The future of drug development for Precision Oncology," an open forum and debate with the audience on June 26.
   Gerald Batist: participated in this event as well as the Annual General Assembly.

4. **104th Scientific Assembly and Annual meeting of the Radiological Society of North America (RSNA)**, Chicago, IL. November 25-30, 2018.
   Reza Forghani: moderated the session "SSM17 - Neuroradiology/Head and Neck (Dual-Energy CT in Head and Neck Imaging)." He is also a member of RSNA Education Exhibits Awards Committee – Team Neuroradiology and of RSNA Neuroradiology/Head & Neck Subcommittee of the Scientific Program Committee.
   Eugene Yu: moderated "Head and Neck Cancer Imaging Series" on November 25.

5. **23rd Annual McGill University Update in Otolaryngology – Head and Neck Surgery**, Mont-Tremblant, Quebec. March 15-17, 2019.
   Michael Hier: moderated Head & Neck session on March 16.
   Khalil Sultanem and Marcin Mlynarek: participated as panelists in the discussion "Diagnosis and Management of Benign Salivary Gland Tumours" on March 16.
   Marcin Mlynarek: also participated as panelists in the discussion titled "Rehabilitation of Persistent Facial Paralysis/Paresis" on March 16.

Appendix IV: Clinical Trials

The MCTRC investigators take part in designing and conducting clinical studies to evaluate the safety and efficacy of new drugs or more effective ways to use existing drugs. Closely tied to the MCTRC, the Clinical Research Unit (CRU) of the Jewish General Hospital plays a key role in the Centre's bench-to-bedside approach. There are currently more than 80 ongoing clinical trials involving the members of the MCTRC. For more information on these trials, please refer to the separate document entitled "2018-2019 Ongoing Clinical Trials".

This year, we would like to highlight the success of the following phase I trial at the CRU:

A Phase I/II Open-Label Multicenter Study to Evaluate the Safety and Efficacy of AK-01 as Monotherapy in Patients with Locally Advanced or Metastatic Solid Tumors
Aurka, Protocol: AURA-001, 2017 – closed in late 2018.

This was a unique opportunity to work on a phase I trial at more than one site in Montreal. The trial was completed in record time, and two posters are being presented at the American Society of Clinical Oncology meeting in Chicago in April 2019. This study was rapid, and showed some exciting signals of clinical activity, and so the licence for this molecule's further development was purchased back to Eli-Lilly. The CRU and the investigators are currently working on participating in the phase II development.

Appendix V: New graduate students and trainees

The researcher members of the MCTRC continue to dedicate their time to mentor and train graduate students, postdocs and fellows. Below is the list of trainees who started their degree during the current reporting period.

The members also put efforts into educating younger aspiring scientists in their undergraduate program. This year, we would like to highlight the contribution of Dr. Josie Ursini-Siegel's laboratory in supervising 7 undergraduate students from different programs in Sciences and Engineering as a part of a yearlong project from a student-led initiative called iGEM McGill (international genetically engineered machine competition – McGill team).

Christoph Borchers

Student : Makepeace, Karl
3rd cycle

Student : Fröhlich, Björn
3rd cycle

Student: Vincent Lacasse
3rd cycle

Claudia Kleinman

Student : Hu, Yixing
Project title : Computational methods for single-cell sequencing transcriptomics
2nd cycle

Student : Worme, Samantha
Project title : Single cell analysis of leukaemia tumors
2nd cycle

Student : Coutelier, Marie
Post doctoral fellow

Gerald Batist

Student : Mitsa, Georgia
Project title : Proteogenomics of colorectal cancer as a tool to improve patient stratification
Distinction : Travel award by the Division of Experimental Medicine (Feb 2019)
3rd cycle

Ivan Topisirovic

Student : Kim, Ha Eun
Project title : Defining the role of mTOR in epigenetic landscape in cancer
3rd cycle

Student : Jovanovic, Predrag
(co-supervised with **Josie Ursini-Siegel**)
Project title : Role of 4E-BP1/2 in breast cancer progression
2nd cycle

Student : Papadopoli, David
Project title : Canagliflozin inhibits bioenergetics of cancer cells through perturbation of glutamine metabolism
(co-supervised with **Michael Pollak**)
Post doctoral fellow

Koren Mann

Student : Wright, Cassandra
3rd cycle

Laurent Azoulay

Student : Cao, Dai
2nd cycle

Student : Pradhan, Richeek
Funding Source : CIHR Drug Safety and Effectiveness Cross-Disciplinary Training Program
3rd cycle

Mark Basik

Student : Bozik, Kathryn
Project title: Overcoming drug resistance in HER2 positive breast cancers
2nd cycle

Thierry Muanza

Student : Jooya, Alex Alborz
2nd cycle

Student : Dumut, Catalina
Project title: Optimal delivery of therapeutics to prostate cancer based on magneto-aerotactic MC-1 bacterial agents
2nd cycle

Walter Gotlieb

Student : Matanes, Emad
Project title: Inhibition of PARG, sensitizes ovarian cancer cells to PARP inhibitors and DNA damaging agents
Postdoctoral fellow

Student : Raban, Oded
Project title : Genes involved in homologous recombination and ovarian cancer pathogenesis
Fellow

Wilson Miller

Student : Khoury, Elie
Project title : Identifying novel functions of Mnk1/2 kinases
2nd cycle
(co-supervised with **Sonia del Rincon**)

Student : **Khashayar, Esfahani**
Project title : Predictive biomarkers of immune-related adverse events in melanoma patients treated with checkpoint inhibitors
Distinction: 2018 Edith Strauss Clinician Scientist Fellowship Award
2nd cycle & Clinician Scientist Fellow
(co-supervised with **Gerald Batist**)

Student : Preston, Sam
Project title : Investigating the role of the MNK/eIF4E axis in the regulation of the tumour microenvironment in pregnancy-associated breast cancer
3rd cycle

Student : Bartish, Margarita
Project title : Role of MNK1/2 in anti-tumor immunity
Post doctoral fellow

Sonia del Rincon

Margarita Bartish
Post doctoral fellow

Samuel Preston
3rd cycle

Sakktee Krisna
3rd cycle

Katherine Borden

Student : Rahardjo, Amanda
Project title : Studying the protein interaction between VPg and eIF4E
1st cycle

Student : d'Asti, Esterina
Project title : eIF4E generated micro vesicles
Post doctoral fellow

Student : Moros, Gavin
Project title : Biochemical understanding of multiple functions of eIF4E
Post doctoral fellow

Student : Ghramm, Mehdi
Project title : eIF4E and polyadenylation
Post doctoral fellow

Nathalie Johnson

Student : Rys, Ryan
Project title : Understanding the mechanisms of relapsed refractory DLBCL
3rd cycle

Siham Sabri

Student : Bagchi, Monisha
Project title : Investigating PRIMA-1^{MET} as a new strategy to overcome resistance to Temozolomide in Glioblastoma
3rd cycle, enrolled in Graduate Diploma in Clinical Research

Appendix VI: Lectures and Seminar Series

Our trainees have access to various seminars, lectures and workshops offered by the Segal Cancer Centre (SCC) and the Lady Davis Institute (LDI). Among these programs are the LDI Cancer Seminar Series that are composed of talks from invited speakers from all around the world and presentations of trainees in the LDI Cancer Axis. Both published and unpublished data are presented, and preliminary data or outlines of new research proposals can be discussed as well. All trainees are encouraged to practice their communication skills in a formal setting and to obtain constructive feedback on their projects. To further encourage our trainees, a prize for best talk in the M.Sc., Ph.D. and Postdoc categories are awarded starting from this year. Additionally, the investigators of the institute also started to present their research, thereby serving as exemplary models for effective communications as well as fostering collaborations among the laboratories within the institution. Furthermore, LDI Cancer Axis partners with other axes of the institute to bring multidisciplinary perspectives on cancer research. One example of this is when the Cancer Axis, in collaboration with Biomedical Ethics Unit, hosted Dr. Mark. J. Ratain to give lectures titled "Interventional Pharmacoeconomics: A Strategy to Reduce Prescribing Costs of Modern Cancer Therapeutics" over two days.

Additionally, LDI Trainee Committee, formed by graduate students and postdoctoral fellows at the LDI, offers a monthly journal club and various workshops covering a wide range of topics, from research techniques to activities that shape trainees for their future careers in the field of biomedical research. The committee also holds monthly seminar series where the postdoctoral fellows present their research. The active student representation and involvement is crucial in creating rich learning environment for our trainees.

LDI Cancer Seminars

Tuesday, May 1, 2018

The mechanism and relevance of translational control of metabolism in cancer cells
Stefano Biffo, Ph.D.
Professor of Cell Biology and Comparative Anatomy, University of Milano & Program Leader INGM "Romeo ed Enrica Invernizzi"
Hosted by: Dr. Ivan Topisirovic

Thursday, May 3, 2018

In vivo screen identifies receptor for organ-selective neutrophil and cancer cell recruitment to the lungs and liver
Donna L. Senger Ph.D.
Associate Professor, Arnie Charbonneau Cancer Institute Department of Oncology, Cumming School of Medicine, University of Calgary
Hosted by: Dr. Josie Ursini-Siegel

Friday, May 11, 2018

Epigenetic characterization and therapeutic targeting of cancers harboring dysfunctional CTCF
Maika Jangal, Postdoc Fellow
Dr. Michael Witcher's Lab

& **Characterization of a dual kinase inhibitor targeting PKCα and Aurora A kinases in leukemic cells**
Mariana Asslan, M.Sc.
Dr. Alaoui Jamali's Lab
Hosted by: Dr. Josie Ursini-Siegel

Thursday, May 17, 2018

Fertilizing the metastatic soil: how primary tumours influence the microenvironment in lungs and tumour-draining lymph nodes
Kevin L. Bennewith, Ph.D.
Senior Scientist, Michael Smith Foundation for Health Research Scholar, Department of Integrative Oncology, BC Cancer Research Centre
Hosted by: Dr. Ivan Topisirovic

Friday, May 18, 2018

Progress toward a cell model for DICER1 syndrome
Mona Wu, Ph.D.
Drs. William Foulkes and Marc Fabian's Lab

& **The role of thioredoxin-interacting protein in biguanide-induced metabolic reprogramming**
Kristofferson Tandoc, M.Sc.
Drs. Ivan Topisirovic and Michael Pollak's Lab
Hosted by: Dr. Josie Ursini-Siegel

Friday, May 25, 2018

Peroxisome metabolism in health and disease
Dr. Nancy Braverman
Associate Professor, Department of Pediatrics, Faculty of Medicine McGill University & Scientist, RI-MUHC Child Health and Human Development Program
Hosted by: Dr. Sonia del Rincon

Friday, June 15, 2018

PRMT5/PDGFRα axis: implications for cancer
Sara Calabretta
Stephane Richard's Lab

& **Interferon-driven STAT1 activation sensitizes breast cancers to biguanides as anti-cancer agents**
Stephanie Totten
Josie Ursini-Siegel's Lab

Friday, September 21, 2018

Elimination of signaling receptors in cancers
Serge Y. Fuchs, PhD, MD
Professor of Cell Biology, Department of Biomedical Sciences, University of Pennsylvania, School of Veterinary Medicine
Hosted by: Dr. Ivan Topisirovic

Friday, September 28, 2018

(In collaboration w/ Biomedical Ethics Unit)
Interventional Pharmacoeconomics: A Strategy to Reduce Prescribing Costs of Modern Cancer Therapeutics
Mark. J. Ratain, MD
Leon O. Jacobson Professor of Medicine Director, Center for Personalized Therapeutics Associate Director for Clinical Sciences Comprehensive Cancer Center, University of Chicago
Hosted by: Dr. Gerald Batist

Friday, September 28, 2018

(In collaboration w/ Biomedical Ethics Unit)
Interventional Pharmacoeconomics: A Strategy to Reduce Prescribing Costs of Modern Cancer Therapeutics
Mark. J. Ratain, MD
Leon O. Jacobson Professor of Medicine Director, Center for Personalized Therapeutics Associate Director for Clinical Sciences Comprehensive Cancer Center, The University of Chicago
Hosted by: Dr. Gerald Batist

Friday, October 5, 2018

A mouse model of metabolic syndrome -what it means to oncology?
Dr. Mark Trifiro
Senior Investigator & Professor, Department of Medicine, McGill University
Hosted by: Dr. Josie Ursini-Siegel

Friday, October 12, 2018

Potential Mechanisms of Action of Metformin in Early Breast Cancer
Ryan Dowling, Ph.D.
Affiliate Scientist Princess Margaret Cancer Centre University Health Network, Toronto
Hosted by: Dr. Josie Ursini-Siegel

Friday, October 19, 2018

The adaptive trait of the integrated stress response promotes KRAS lung tumorigenesis
Nour Ghaddar, MSc Student
Dr. Antonis Koromilas' Lab

& **Promoting pexophagy to overcome therapy reistance**
Michael Dahabieh, PhD Student
Dr. Wilson Miller's Lab
Hosted by: Dr. Josie Ursini-Siegel

Friday, October 26, 2018

Functional proteomics as a pathway to precision medicine
Shawn S. Li, PhD
Canada Research Chair in Molecular and Epigenetic Basis of Cancer & Professor of Biochemistry, Oncology and Chemistry
Scientist, Child Health Research Institute, Lawson Research Institute, University of Western Ontario
Hosted by: Dr. Stephane Richard

Friday, November 2, 2018

State of the Arg!
Dr. Stephane Richard
Senior Investigator, Lady Davis Institute & Professor, Departments of Medicine and Oncology, McGill University
Hosted by: Dr. Josie Ursini-Siegel

Friday, November 9, 2018

(In collaboration w/ Molecular & Regenerative Medicine Seminar)
Seeing and modeling tumours: The role of advanced materials in oncology
Matt J. Kinsella, Ph.D.
Associate Professor, Department of Bioengineering, McGill University

Hosted by: Dr. Josie Ursini-Siegel

Friday, November 23, 2018

Negative growth control and survival mechanisms in ovarian cancer cell dormancy
Fred Dick, Ph.D.
Professor of Biochemistry and Oncology
Distinguished Scientist, London Health Sciences Centre University of Western Ontario
Hosted by: Dr. Ivan Topisirovic

Friday, November 30, 2018

A distinct adaptive response can support breast tumor growth in the presence of oxidative stress
Rachel La Selva, Ph.D. Student
Dr. Ursini-Siegel's Lab
& **Arginine methylation of RBMX by PRMT5 modulates P53 response via MDM4 alternative splicing**
Ting Cai, Ph.D. Student
Dr. Stéphane Richard's Lab
Hosted by: Dr. Josie Ursini-Siegel

Friday, December 7, 2018

The diverse pathologies associated with metal toxicology: lessons from arsenic and tungsten
Dr. Koren K. Mann
Director, Molecular and Regenerative Medicine Axis Associate Professor, Department of Oncology McGill University
Hosted by: Dr. Josie Ursini-Siegel

Friday, December 14, 2018

(In collaboration w/ Molecular & Regenerative Medicine Seminar)
New players in mammalian post-transcriptional gene silencing pathways
Dr. Marc Fabian
Investigator Assistant Professor, Department of Oncology, McGill University
Hosted by: Dr. Josie Ursini-Siegel

Friday, January 11, 2019

Aberrant mRNA translation in the tumor microenvironment of postpartum breast cancer (PPBC)
Qianyu Guo, Ph.D. Student
Dr. Wilson Miller's Lab, co-supervised by Dr. Sonia del Rincon

& **BORIS/CTCFL mediates melanoma phenotype switching**
Sanne Janssen, Ph.D. Student
Dr. Alan Spatz's Lab
Hosted by: Dr. Josie Ursini-Siegel

Friday, January 18, 2019

New tricks for old dogs: endocytosis proteins promote oncogenic signaling yet can also be 'trained' for drug delivery
Costin N. Antonescu, Ph.D.
Associate Professor Department of Chemistry and Biology Ryerson University
Hosted by: Dr. Ivan Topisirovic

Friday, January 25, 2019

The role of mutated STAT6 in relapse/refractory DLBCL
Alexandre Benoit, Ph.D. Student
Dr. Koren Mann's Lab

& **Targeting thyroid cancer stem cells through inducing centrosome declustering**
Henry Yu, Ph.D. Student
Dr. Alaoui-Jamali's Lab
Hosted by: Dr. Josie Ursini-Siegel

Friday, February 1, 2019

FER, Calpain and Ezrin: novel therapeutic targets and biomarkers in breast cancer
Peter Greer, Ph.D.
Professor, Department of Pathology and Molecular Medicine, Queen's University & Division of Cancer Biology & Genetics, Queen's Cancer Research Institute
Hosted by: Dr. Ivan Topisirovic

Friday, February 15, 2019

MNK1/2 drives the expression of a novel subset of pro-tumorigenic and pro-invasive genes in melanoma
Elie Khoury, M.Sc. Student
Dr. Wilson Miller and co-supervised by Dr. Sonia del Rincon

& **Oncogenic Impact of CTCF Mutations**
Benjamin Lebeau, M.Sc. Student
Dr. Michael Witcher's Lab
Hosted by: Dr. Josie Ursini-Siegel

Friday, February 22, 2019

The role of cholesterol metabolism in cellular senescence
Frédérick A. Mallette, Ph.D
Professeur agrégé Département de Médecine, Université de Montréal Centre de Recherche de l'Hôpital Maisonneuve-Rosemont
Hosted by: Dr. Josie Ursini-Siegel

Thursday, February 28, 2019

The inner workings of nonribosomal peptide synthetases, nature's antibiotic nanofactories
Martin Schmeing, PhD
Associate Professor, Department of Biochemistry, McGill University
Hosted by: Dr. Ivan Topisirovic

Friday, March 1, 2019

Pinpointing the origins of pediatric brain tumors using single cell transcriptomic analysis
Selin Jessa, Ph.D. Student
Dr. Claudia Kleinman's lab

& **PTEN and its C-tail phosphorylation as a clinically relevant biomarker for Breast cancer therapy resistance**
Sahar Ibrahim, Ph.D. Student
Dr. Christoph Borchers' Lab
Hosted by: Dr. Josie Ursini-Siegel

Friday, March 15, 2019

Single cell transcriptomics identifies a maturation continuum in acute myeloid leukemia
Samantha Worme, MSc Student
Dr. Francois Mercier's Lab

& **Novel negative regulatory mechanisms for receptor tyrosine kinase signaling in breast cancer**
Jacqueline Ha, PhD Student
Dr. Josie Ursini-Siegel's Lab
Hosted by: Dr. Josie Ursini-Siegel

Thursday, March 21, 2019

Impact of microRNA alterations on target pathways linked to cancer metastasis
Andrew Craig, PhD
Associate Professor, Department of Biomedical and Molecular Sciences, Queen's University
Hosted by: Dr. Ivan Topisirovic

Friday, March 22, 2019

Mass spectrometry-based proteogenomics to complement precision oncology
Vincent Richard, Ph.D. Student
Dr. Christoph Borcher's Lab

& **Investigating the role of 4E-BPs in polyomavirus (PyV) middle-T oncogene mouse model of mammary tumorigenesis**
Sophie Guénin, M.Sc. Student
Dr. Ivan Topisirovic's Lab
Hosted by: Dr. Josie Ursini-Siegel

Friday, March 29, 2019

Oncogenic activities for a negative regulator of the small GTPases Rac1 and Cdc42
Nathalie Lamarche-Vane, Ph.D.
Professor, Research Institute-MUHC, Cancer Research Program
Hosted by: Dr. Josie Ursini-Siegel

Friday April 5, 2019

Emerging roles of ZNF280E/POGZ as a regulator of genomic stability and cell cycle progression
John Heath, Ph.D. Student
Dr. Alexandre Orthwein's Lab

& **Carbohydrate-based vaccines for cancer therapy**
Rajarshi Roy Choudhury, Postdoctoral Fellow
Dr. Uri Saragovi's Lab
Hosted by: Dr. Josie Ursini-Siegel

Friday, April 26, 2019

Cell-surface proteomics for the identification of novel immunotherapeutic targets in cancer
Philippe P. Roux, PhD Professor, Department of Pathology and Cell Biology, Faculty of Medicine Université de Montréal
Hosted by: Dr. Josie Ursini-Siegel

Distinguished Lecture Series

Trainees also benefit from the Distinguished Lecture Series, which has attracted world renowned scientists like James D. Watson (lecture on October 12, 2011). The lectures shown here are only those relative to the context of oncology.

Tuesday, May 15, 2018

Intracellular and extracellular nitric oxide transport and its role in M1 and M2 macrophages as a novel mechanism involved in tumor cell killing or promotion
Des R. Richardson, Ph.D.
Professor of Cancer Cell Biology National Health & Medical Research Council of Australia Senior Principal Research Fellow Director, Molecular Pharmacology & Pathology Program, University of Sydney
Hosted by: Dr. Prem Ponka

Tuesday, June 5, 2018

Metabolic dysregulation in cancer and other diseases
Ralph DeBerardinis, MD, Ph.D.
Professor, Children's Research Insitute, UT Southwestern Medical Center

Tuesday, October 2, 2018

The multifaceted DNA damage response
Roger A. Greenberg, M.D., Ph.D.
Professor of Cancer Biology Director of Basic Science Basser Center for BRCA Perelman School of Medicine University of Pennsylvania
Hosted by: Dr. Alexandre Orthwein

Tuesday, October 16, 2018

Mapping Genetic Networks in Yeast and Human Cells
Charles Boone, Ph.D.
Professor, Department of Molecular Genetics, University of Toronto
Hosted by: Dr. Alexandre Orthwein

Tuesday, November 20, 2018

Telomeres and the DNA damage response Titia de Lange, Ph.D.
Leon Hess Professor, American Cancer Society & Professor Head, Laboratory of Cell Biology and Genetics Director, Anderson Center for Cancer Research Click
Hosted by: Dr. Alexandre Orthwein

Monday, March 25, 2019

The Brain Tumor Microenvironment and its Role in Tumor Progression and Therapeutic Resistance
Stephen M. Robbins, PhD
Scientific Director, CIHR Institute of Cancer Research & Professor, Department of Oncology, Biochemistry and Molecular Biology, University of Calgary
Hosted by: Dr. Alexandre Orthwein

Tuesday, March 26, 2019

Design of Lipid Nanoparticle Systems to Enable Gene Therapies
Pieter Cullis, PhD, FRSC, FNAI (USA)
Professor, Department of Biochemistry and Molecular Biology & Director, NanoMedicines Research Group, University of British Columbia
Hosted by: Dr. Alexandre Orthwein

Thursday, April 11, 2019

Genomic screens for drug resistance studies
Marc Ouellette, Ph.D.
Professor Department of Microbiology & Immunology Laval University
Hosted by: Dr. Koren Mann

Tuesday, April 16, 2019

The metabolic regulation of stem cells and cancer
Sean J. Morrison, Ph.D.
Professor and Director, Children's Medical Center Research Institute at UT Southwestern / Pediatrics Kathryne and Gene Bishop Distinguished Chair in Pediatric Research at Children's Research Institute at UT Southwestern; Mary McDermott Cook Chair in Pediatric Genetics
Hosted by: Dr. Colin Crist