Submitted by

J. Madrenas, MD, PhD, FCAHS
Canada Research Chair in Human Immunology
Professor and Chairman

On behalf of the

Primary members of the
Department of Microbiology and Immunology
I

Executive Summary

2012 witnessed a continuous growth and renewal of the department of Microbiology and Immunology at McGill. We had our first “State of the Union” retreat in which departmental operations in research, teaching and service were reviewed, resulting in a plan for operational optimization.

During this year, the department started a recruitment drive for 3 new, tenure-track faculty positions. Upon a global search for “the best and the brightest”, we were able to recruit Drs. Irah King, a cellular immunologist from the Trudeau Institute, and Dr. Selena Sagan, a virologist from Stanford University (and former graduate of our department!). Dr. King arrived in August 1, 2012 and Dr. Sagan is starting on August 1, 2013. The third position is under the last stages of negotiation. These recruits have brought to the department a new wave of academic excitement and momentum. We work and appreciate also associate and affiliate members supporting and bringing expertise to the department.

In 2012, our investigators captured over $19 million in peer reviewed funding from the most stringent funding agencies (CIHR, NIH, NSERC, CFI, etc.). Of note, our success rate in the September ’12 reference standard CIHR competition was 87% compared to a National rate of 17%. New infrastructure was brought into the department and McGill, including a state-of-the-art flow cytometry and cell sorting facility. Our research efforts translated into discoveries documented in over 110 publications in international peer-reviewed journals with high profile in the scientific and medical communities. This productivity would not have been possible without funding but, above all, without the continuous unwavering commitment of our faculty members to academic excellence and our bright and energetic trainees. As part of this commitment, we started to align components of our research programs to establish McGill’s Microbiome and Disease Tolerance Centre (MDTC), the first centre of its kind, which received Board of Governors approval on May 2013.

Associated with this excellent performance, 2012 also saw our members receiving many awards, an impressive list that includes Killam award, Queen’s Jubilee Medal, CIHR/CMAJ Health Research Achievement Award, five Canada Research Chairs (3 Tier I and 2 Tier II), CIHR New Investigatorships, McGill Professorship and Dawson Professorship, FRQ-S bourses, and honorary degrees. In all, our members excel at the National and International levels, enhancing the profile of the Faculty of Medicine and McGill University.

In terms of teaching, our programs are educational references across the world. With a population of over 250 undergraduate students and 70 graduate students, our department strives to provide the best learning experience. We graduated 8 PhD students and 14 MSc students during 2012, and they will enhance the reputation of our department with their achievements. To ensure this top tier status, we have embarked in an ambitious program of redevelopment of our undergraduate and graduate programs, with the recruitment of a Teaching Specialist (Dr. Claire Trottier).

We are committed to community outreach and public education. The department projects its energy and activities to the public, participating in McGill activities (Homecoming, Open Houses) and to the regional community and beyond. Our members are present in review panels and committees of federal and provincial institutions, and advise public agencies on issues related to public health and policy.

Altogether, it is a true privilege and honor for me to submit the 2012 report documenting the excellence of the members of the Department of Microbiology and Immunology at McGill University.
### Research

#### a. Major Research Grants Awarded in 2012
(listed are only those in which members were nominated principal applicants and brought more than $500,000. TOTAL FUNDING FOR 2012 = $19,843,662.00)

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<th>Agency</th>
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<td>Structural studies for combating infectious diseases</td>
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### Department of Microbiology & Immunology: 2012 Annual report

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<td>Bacterial Pathogenesis</td>
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<td>CRC</td>
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<td>FQRNT</td>
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<td>Drugs for Negl. Diseases</td>
<td>Novel treatment modalities for visceral leishmaniasis</td>
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<td>Point of care diagnosis of Visceral leishmaniasis in India</td>
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<td>NIH</td>
<td>Functional biology of OGR1</td>
<td>Training Program in Bionanomachines</td>
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<td>NIH</td>
<td>CREATE grant</td>
<td>Cellular dynamics of macromolecular complexes</td>
<td>2010-15</td>
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### b. Selected Keynote lectures, plenary Lectures, other significant presentations

**Berghuis, Albert**

**Gotte, Matthias**
- International Roundtable on Nucleosides, Nucleotides and Nucleic Acids, Montreal, QC, Canada, August 5-9.
- Li Ka Shing Inst. of Virology & Gairdner Foundation Symposium: Meeting the Challenge of Emerging, Acute and Persistent Viral Diseases”, University of Alberta, Edmonton, AB, May 31- June 1.

**Gruenheid, Samantha**
- Banff Conf. on Infectious Diseases, Canada. NleA, a bacterial virulence factor that inhibits COPII.

**Le Moual, Herve**
- Targeting bacterial resistance to host antimicrobial peptides as an alternative strategy to treat infections. 2nd Annual World Congress of Microbes, Guangzhou, China. July 2012.
- Antimicrobial peptide resistance mechanisms in Enterohemorrhagic and Enteropathogenic *Escherichia coli*. International Conference on Clinical Microbiology and Microbial Genomics, San Antonio, TX.

**Madrenas, Joaquin**
- Infectious Music: how microbes have shaped our music. TEDx Montreal, May 5, Montreal, QC.
- A Career in Arts and Sciences: my own experience. CIHR National Medical Student Research Meeting, Winnipeg, MB, June 12.
Madrenas, Joaquin (cont’d)

Matlashewski, Greg

Olivier, Martin
- Hemozoin and Inflammatory Biomarkers: Impact on Innate Immunity and Malaria Progression. XXVIII Annual Meeting of SBPZ and XXXIX Meeting on Basic Research in Chagas Disease, Caxambu, Brazil. October.

Piccirillo, Ciriaco
- Translational control of gene expression and environmental sensing in CD4⁺Foxp3⁺Treg. FOCIS Annual meeting, Vancouver, BC.
- The ICOS pathway in CD4⁺Foxp3⁺ regulatory T cell stability in T1D. Intl. Diabetes Society, Victoria, BC.
- Translational control of gene expression and environmental sensing in CD4⁺Foxp3⁺ regulatory T cells. FOCIS Satellite Symposium (CHIN) Immune Regulatory Mechanisms in Health & Disease. Vancouver, BC.
- International Conference on Clinical & Cellular Immunology, Chicago, USA.

Sheppard, Donald
- American Society for Hematology, Meet the Expert Session. Atlanta, Georgia USA- Integrating diagnostics into management of fungal infections. December 6.

Vidal, Silvia
- Mouse ENU mutagenesis to understand gene function during inflammatory and immune responses against pathogens. Cdn Human and Statistical Genetics Meeting. Niagara-on-the-lake ON, Ap 29/May 2
c. Publications

For the list of all publications, please refer to:

d. Major Awards

Berghuis, Albert
- Tier I Canada Research Chair in Structural Biology

Cousineau, Benoit
- William Dawson Scholar Award
- Chercheur-Boursier Senior FRQ-S

Fritz, Jorg
- CIHR New Investigator Award.

Gotte, Matthias
- Career award (Chercheur-boursier Senior) - Fonds de la recherche en santé (FRQ-S)

Gruenheid, Samantha
- Tier II Canada Research Chair

Madrenas, Joaquin
- Tier I Canada Research Chair in Human Immunology at McGill University

Piccirillo, Ciriaco
- Tier II Canada Research Chair

Sheppard, Donald
- FRQS Chercheur-Boursier Senior.
Vidal, Silvia
- Tier I Canada Research Chair in Host Response to Viruses.

Wainberg, Mark
- Killam Prize for Health Sciences, Canada Council for the Arts and the Killam Trust
- Honorary Doctorate in Science (D.Sc) (Honoris causa), Faculté de Médecine, l’Université Laval, Québec, Qc.
- James McGill Professor, Faculty of Medicine, McGill University
- Queen’s Diamond Jubilee Medal, Governor-General of Canada
- CIHR and CMAJ Top Achievements in Health Research Award, CIHR and CMAJ

e. Patents
Berghuis, Albert
- Thienopyrimidine Inhibitors of farnesyl and/or geranylgeranyl pyrophosphate synthase. US provisional patent application; filing date: Nov. 20, 2012; Serial number 61/728,489

Olivier, Martin
- Controlled release formulation based on hematin anhydride crystals for the induction of an innate immune reaction” (US provisional patent application US 61/327,255; Bundling IP US 12/305672).

Sheppard, Donald

III
TEACHING

Initiatives and Innovations related to Teaching Programs

a. Graduate Program
The Graduate Program Committee has revised the MSc and PhD programs to better take into account the diversity of the disciplines covered by the department and the location of our students at different sites across McGill. The changes include two new permanent graduate courses align with the priorities of our department namely the Microbiome and Disease Tolerance Centre and the seminar series in Infection and Immunity.

- 1st Annual Graduate Student Research Day
  The Graduate Committee organized the 1st Annual Graduate Student Research Day which included a keynote lecture and presentations (oral and poster) by graduate students and postdoctoral fellows who shared the latest developments in their research projects. The goals of this meeting were to facilitate information sharing among members of our Department, to discuss gaps in research knowledge as well as research opportunities and to network and develop collaborations.

- MIMM 386
  Claire Trottier PhD, from the Centre for Advanced Training Coordinator, Research Institute of the MUHC and funded by SALTISE (Supporting Active Learning and Technological Innovation in Science Education), and Prof. S. Fournier are re-designing the immunology section of the undergraduate laboratory course MIMM386. The scientific component of the course is being updated to reflect current content and practices in teaching immunology. The re-design uses a Constructivist approach to build on existing knowledge using clear learning objectives, and aligns new instructional strategies such as problem-based learning projects.
b. Undergraduate Program
One of our major tasks at McGill is to teach a curriculum to MIMM undergraduate students in the Faculty of Science. The last time we reviewed our department’s curriculum was during a retreat in March 2010; recommendations at that retreat had significant impact on our educational programs. In 2012, the Undergraduate Committee, newly chaired by James Coulton, advocated assessment of our undergraduate program and identification of the needs and opportunities to make it even better.

Throughout 2012 and in consultation with Teaching and Learning Services (TLS), a Teaching Retreat was planned for early 2013 to discuss our teaching and our curriculum: content, assessment, strategy, and outcomes. Dr. Mariela Tovar and her team, professionals at TLS, guided our deliberations and offered their experience to enhance and to evolve our teaching. Discussions gave us the opportunity to consider ideas about our courses and programs and to develop renewed understanding of our potential and challenges for our department’s teaching and curriculum.

The immunology stream of the MIMM curriculum has seen significant changes. A new course: MIMM 214, Introductory Immunology: Elements of Immunity, was prepared to be delivered in winter semester 2013, with projected enrollment of 332 students. The course was tabled at the Academic Committee, Faculty of Science, deliberated, discussed, modified and approved, also by the Faculty of Medicine for launch in January 2013.

Claire Trottier, doctoral graduate of MIMM, was engaged as Research Associate and Educational Consultant under an award from Supporting Active Learning and Technological Innovation in Science Education (SALTISE). Partnering with the Faculty of Education at McGill and with Dawson College, she facilitates our transition to active learning through the re-design of the immunology section of our U2 undergraduate lab course MIMM 386. The goals of the project are to modernize the scientific component of the course and to utilize novel pedagogical approaches, including problem-based learning.

c. Success Stories
Sarah McCuaig, undergraduate student was awarded the McGill’s 134th Rhodes Scholar on November 2012. The Rhodes Scholarships rewards individuals who have achieved high academic standing and who have demonstrated respect for their fellows, an unselfish spirit and the potential for leadership. The world’s oldest and pre-eminent academic fellowship, the Rhodes covers two years of study, valued at approximately, $20,000 U.S. per year, with the possibility of renewal for a third year, at Oxford. On top of being an award-winning student, McCuaig is an accomplished distance runner and team captain of the McGill track and cross-country teams. One of the most decorated student-athletes at the University, in both the classroom and on the track, the conference all-star runner earned Academic All-Canadian status, made the Principal’s Student-athlete Honour Roll and qualified for the Dean’s Honour List.

Edward Mason, a Star undergraduate Honors student was awarded the Top prize at the 2012 McGill Undergraduate research Day.

Natan Bensoussan, Undergraduate student, CSM Undergraduate was awarded the Canadian Society of Microbiologists, CSM Undergraduate award of $500. The award will be presented to him at the annual CSM conference banquet held in Ottawa on June 20, 2013.

Daisy Ji, undergraduate student in the Interdepartmental Honors Immunology program in our departmt, got the Governor General’s Silver Medal.

Mara Kornete, a PhD student was awarded the Federation of Clinical Immunology Societies (FOCIS) 2012, Travel Award on June 2012.

d. List of Students who received M. Sc. degrees

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<th>Name</th>
<th>Project Description</th>
<th>Advisor</th>
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<td>High-resolution electron microscopy of energy-transducing proteins of «Escherichia coli»</td>
<td>Dr. James W Coulton</td>
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<td>Donato, Samuel</td>
<td>Analysis of genetic variability within the Beijing lineage of «Mycobacterium tuberculosis»</td>
<td>Dr. Michael Reed</td>
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<td>Student Name</td>
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<td>Supervisor(s)</td>
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<td>Dufort, Alexander</td>
<td>The identification of a novel regulator of «Mycobacterium tuberculosis» Sigma Factor K through the use of transposon mutagenesis</td>
<td>Dr. Marcel A Behr</td>
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<td>Lalande, Jean-Daniel</td>
<td>NOD2 mediates innate and adaptive immunity to «Mycobacterium avium paratuberculosis»</td>
<td>Dr. Marcel A Behr</td>
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<td>Sverzhinsky, Aleksandr</td>
<td>Energy-transducing proteins of «Escherichia coli»: lipid-based crystallization trials</td>
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<td>Mapping HIV-1’s evasion of host defense</td>
<td>Dr. Andrew J Moulant</td>
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<td>Concentration of antifungal agents within host cell membranes: a new paradigm governing the efficacy of prophylaxis</td>
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<td>The role of the stringent response in the regulation of antioxidant defenses in «Pseudomonas aeruginosa»</td>
<td>Dao Nguyen</td>
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<td>Zaguia, Fatma</td>
<td>Cytotoxic NKG2C+ CD4+ T cells target oligodenfrocytes in Multiple Sclerosis</td>
<td>Jack P Patel, Nathalie Arbour</td>
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<td>Sabah N A Hussain</td>
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<td>Xiao, Bei</td>
<td>Functional characterization of zinc cluster transcriptional regulators Ert1 and Uga3 in gluconeogenesis and gamma-amino butyrate catabolism in «Saccharomyces cerevisiae»</td>
<td>Dr. Bernard Turcotte</td>
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<td>Dr. Ciriaco Piccirillo</td>
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<td>The role of acrA in arsenic resistance of «Asperillus niger» and its use as the basis for the development of an arsenic detecting biosensor</td>
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<td>Lawrie, Sarah</td>
<td>Characterization of differentially activated human B cells and effects of their soluble products on regulatory T cell suppressive function: assay development and design</td>
<td>Dr. Amit Bar-Or</td>
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<td>SHP-1/PTP-1B Macrophage interactome upon «Leishmania mexicana» infection</td>
<td>Dr. Martin Olivier</td>
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<td>Citrobacter rodentium» causes fatal diarrhea through R-spondin 2-mediated activation of Wnt signaling</td>
<td>Dr. Samantha Gruenheid</td>
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<td>Yao, Edmund</td>
<td>Effects of DNA methyltransferase-inhibition on FOXP3 expression in CD4+ T cells</td>
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**List of Students who received Ph.D. degrees**

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<td>The role of natural killer cell receptors in the control of natural killer cell functions</td>
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List of Students who received Ph.D. degrees (cont’d)

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<td>Powdrill, Megan</td>
<td>Characterization of the hepatitis C virus NS5b RNA-dependent RNA polymerase: novel inhibitors and antiviral resistance</td>
<td>Dr. Matthias Gotte</td>
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<td>Schader, Susan</td>
<td>The evaluation of candidate microbicide antiretrovirals against wild type and drug resistant HIV-1 «in vitro»</td>
<td>Dr. Mark Wainberg</td>
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<td>HIV-1 reverse transcriptase-associated ribonuclease H activity: novel mechanisms of inhibition</td>
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<tr>
<td>Hugentobler, Felix</td>
<td>Engineered «Lactoccus lactis» live vaccines against «Leishmania major»</td>
<td>Dr. Benoit Cousineau</td>
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<tr>
<td>Urb, Mirjam</td>
<td>Mechanisms of «Aspergillus fumigatus» chronic airway disease</td>
<td>Dr. Donald Sheppard</td>
</tr>
<tr>
<td>Leveille, Simon</td>
<td>Combination strategies in oncolytic cancer therapy</td>
<td>Dr. John Hiscott</td>
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IV

Selected External Academic & Community Service

Berghuis, Albert
- Internal member - Life science strategic review panel for the large infrastructure fund competition, Ontario Research Fund
- Full member - DDR study section, NIH (USA)
- Editorial Board Member - Antimicrobial Agents and Chemotherapy (ASM Journal)
- Editorial Board Member - Protein Engineering Design & Selection (Oxford Journal)

Coulton, James
- Co-organizer, Annual GRASP Symposium; Montreal
- Invited reviewer: Centre de Recherche du Centre Hospitalier de l’Université de Montréal (CHUM)
- Invited reviewer: Leaders Opportunity Fund, Canada Foundation for Innovation, November 2012
- Organizer of the annual international symposium of 11 speakers, June 2012: Cellular dynamics of macromolecular complexes, Université de Montréal
- Member of the Local Organizing Committee, International Congress of Crystallography 2014, Montreal.

Fritz, Jorg
- Academic Editor for PLOSOne: handling of 25 manuscripts.
- Editorial Board Member of the Journal of Clinical & Cellular Immunology
- Invited Member – Canadian Arthritis Society – Grant Review Panel
- Invited Member - Canadian Institutes of Health Research (CIHR)/Fall Competition

Götte, Matthias
- Organizer of Canadian Symposium on Hepatitis C Virus, Montreal, Canada
- International HIV & Hepatitis Virus Drug Resistance Workshop
- Member of the Scientific Committee (Since 2007); Sessions Chair ‘HCV Drug Resistance’
- NIH AIDS special emphasis, ad hoc
- FRQ-S, ‘chercheur boursier’ Junior 1, ad hoc
- The Ontario HIV Treatment Network, ad hoc
Gruenheid, Samantha
- ALFA Travel Award review panel June 2012
- Poster judge Canadian Society for Microbiology annual meeting 2012

Madrenas, Joaquin
- International Reviewer, Agencia Nacional de Promoción Científica y Tecnológica, Secretaría de Ciencia y Técnica, Ministerio de Cultura y Educación, Argentina
- Member, Medical Review Panel of the Canada Gairdner Foundation Awards
- Member, Board of Directors of Immunology Montreal
- Member, Alberta Innovates – Health Collaborative Reseach and Innovation Opportunities Review Panel.
- Reviewer, The Medical Research Council, UK
- Member, Canadian College of Reviewers
- Chair Organizing Committee, Immune Regulatory Mechanisms In Health And Disease: A Jointly CIHR Human Immunology Network-Canadian Society of Immunology Sponsored Satellite Symposium of the 2012 FOCIS International Meeting, Vancouver, BC, June 20, 2012.
- Chair Organizing Committee, 2012 Faculties of Science and of Medicine Homecoming Weekend, Department of Microbiology and Immunology, McGill University, October 12-15, 2012.
- Member, Scientific Advisory Board of the CIHR New Emerging Team in Clinical Autoimmunity
- Expert Member, Skolkovo Foundation, Moscow, Russia

Marczynski, Greg
- Local organizer of the 4th International Caulobacter Meeting, held 4-6 May.

Matlashewski, Greg
- Associate editor: PLoS Neglected tropical diseases
- Advisor to the World Health Organization on visceral leishmaniasis elimination.

Olivier, Martin
- Member of the Selection Committee for the World Leish 5 meeting (2011-2012)
- Member of the LOC (Since January 2012), The Neutrophil in Immunity, Montréal, Canada. (June 2014)

Piccirillo, Ciriaco
- JDRF Center review panel
- NIAID Special Emphasis Panel: Investigator Initiated Program Project Applications (P01)
- NIDDK Special Emphasis Panel (PAR-11-350-DP3)
- FOCIS Satellite Symposium *Immune Regulatory Mechanisms in Health & Disease*, June 2012 (CHIN)
- FOCIS Annual Meeting- CHAIR: Effector/Regulatory T cell balance in Inflammatory Disease.

Sheppard, Donald
- Member, CIHR Microbiology and Infectious Diseases Panel
- Member, FRQS Chercheur-Boursier review panel.
- Reviewer, Awards Committee of the Assoc. of Med. Microbiology and Infectious Disease Society of Canada
- Member, Scientific and Organizing Committee for the 6th Advances Against Aspergillosis Meeting, Madrid
**Vidal, Silvia**

- CIHR, Immunology and Transplantation Panel
- CIHR, Genetics Panel
- Alberta Innovates Health Solutions: Collaborative Research and Innovation Opportunities Member

**Wainberg, Mark**

- Retrovirology Editor
- Journal of International AIDS Society – Editor-in-chief
- Plos One Editor
- Journées Québécoises VIH March 2012