BIOCHEMISTRY AND BIOMEDICAL SCIENCES
FACULTY RESEARCH AREAS

To view Faculty homepages, please refer to the BBS Graduate Program website: http://biochemgraduateprogram.ca/faculty/

Questions? **Lisa Kush, Graduate Officer -> KUSHL@mcmaster.ca**

CORE MEMBERS – 19 Faculty

ANDRES, Sara *andressn@mcmaster.ca*	The Andres lab is interested in understanding the molecular mechanisms of bacterial DNA damage response the repair through protein-protein and protein-DNA interactions and the role these interactions play in driving the evolution of antimicrobial resistance. Some favorite structural techniques include small angle x-ray scattering (SAXS), atomic force microscopy (AFM) and x-ray crystallography. **(Structural Biology and Protein/Nucleic Acid Structure/Function)**
BHATIA, Mick *mbhatia@mcmaster.ca*	The core of Dr. Bhatia's research program is understanding how human cells identify changes. In studying both normal and cancerous [Acute Myeloid Leukemia (AML)] development in the human blood system, the Bhatia lab seeks to understand why this disease occurs and how to stop it. The program is focused on understanding the molecular processes (signaling, epigenetics and transcriptional changes) that govern somatic and pluripotent human stem cell development. (**Stem Cell Biology and Drug Discovery)**
BISHOP, Russell *bishopr@mcmaster.ca*	Research in the Bishop Lab is focused on the biogenesis of bacterial cell envelopes, including biochemical studies of lipid transport, the bacterial outer membrane enzyme PagP, as well as enzymology and signal transduction of lipid A (endotoxin). (**Biogenesis of the Gram-negative Cell Envelope**)
BROWN, Eric *ebrown@mcmaster.ca*	Brown lab researchers are investigating enigmatic processes that are essential for the survival of bacterial pathogens and are working to understand these processes in the context of complex cell systems. They are also developing creative chemical-biology platforms to enable the discover and characterization of new chemical probes with utility as tool compounds in exploring complex biology. (**Microbiological Biochemistry and Antimicrobial Research**)
BURROWS, Lori *burrowl@mcmaster.ca*	Many bacteria use retractable, grappling hook-like fibres called type IV pili (T4P) to stick to, and pull themselves along surfaces. T4P are related to type II secretion (T2S) systems used to release toxic proteins from the cell. We study these two systems in the opportunistic pathogen *Pseudomonas aeruginosa* with the goals of understanding their function and identifying vulnerabilities that could be exploited for drug development. **(Bacterial Adhesions and Biofilm Formation)**
COOMBES, Brian *coombes@mcmaster.ca*	The Coombes laboratory investigates the genetics and molecular pathogenesis of human and animal infectious diseases. Coombes lab scientists use genetic, genomic and proteomics techniques to understand how bacterial virulence factors are expressed and function in the context of a host. We use model systems to then understand the complexity of the biological processes affected by these virulence factors, including subversion of the immune system, colonization dynamics and host damage. We have initiated research projects in four major areas that focus on the evolution, mechanisms and host responses to pathogenic processes caused by bacteria. **(Gene Regulation)**
GUPTA, Radhey *gupta@mcmaster.ca*	The Gupta lab uses genome sequences to identify novel molecular markers that are useful for diagnostic, therapeutic, and evolutionary studies. **(Comparative Genomics and Cell Biology)**
LI, Yingfu ***Liying@mcmaster.ca***	Our group works at the interface between chemistry and biology. Our overall research interest is to examine unusual functions of nucleic acids and to be creative about them. We continue to innovate with DNA by making various DNA-based enzymes (DNAzymes) and receptors (DNA aptamers) and putting them in use in diverse applications. **(Structural Biology and Protein/Nucleic Acid Structure/Protein)**
MacNEIL, Lesley *macneil@mcmaster.ca*	Two important determinants of health are genetics and environment. The MacNeil group seeks to understand how these factors work together to influence health, development and disease progression. They use the nematode *C. elegans* and its bacterial diet to study diet and microbiota. (**Gene-Environment Interactions and Diet, Metabolism and Microbiota)**

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MAGARVEY, Nathan *magarv@mcmaster.ca*	Dr. Magarvey aims to find natural products that could be used to develop new drugs through the discovery and genomic mining of small molecules that are produced by environmental and human-associated microbes. This research could lead to the development of several new medicines that contain natural products to treat disease. **(Natural Product Biosynthesis and Drug Discovery)**
MAGOLAN, Jakob *magolanj@mcmaster.ca*	We pursue the discovery and pre-clinical development of pharmaceutical leads in a variety of therapeutic areas including: antimicrobial, anti-pancreatic cancer, and anti-depression. We specialize in the chemical synthesis of lead compounds and their structural derivatives with a particular interest in natural product-based leads. **(Pre-Clinical Drug Discovery and Development)**
McARTHUR, Andrew *mcarthua@mcmaster.ca*	The McArthur laboratory's research program is rooted in bioinformatics, functional genomics, and computational biology. It spans complex informatics approaches to the functional genomics of microbial drug resistance, development of biological databases, next generation sequencing for genome assembly and molecular epidemiology, automated literature curation approaches, controlled vocabularies for biological knowledge integration, and functional genomics approaches in environmental toxicology. (**Biological database design and predictive analytics / Comprehensive Antibiotic Resistance Database / Bioinformatics workflows and Cloud computing for gene expression, gene regulation, and population genomics)**
MILLER, Matthew *mmiller@mcmaster.ca*	The Miller Laboratory is focused on understanding the intimate relationship between viral pathogens and their hosts. Upon infection, both the innate and the adaptive branches of the immune system are mobilized with the aim of protecting the host from virus-mediated pathologies. However, improper regulation of anti-viral immune responses can themselves lead to disease. In addition, viruses have - and continue to - evolve elegant strategies through which to avoid host-mediated immune recognition. Thus, understanding the qualities of immune responses which are effective in protecting the host, as well as those qualities that may cause harm, is essential to informing the development of novel vaccines and therapeutics. **(Innate and Adaptive Immunity)**
SCHERTZER, Jonathan *schertze@mcmaster.ca*	My lab uses physiology in genetic mouse models coupled with cell biology and biochemistry to understand the inflammatory basis of metabolic disease. We collaborate with immunologists, microbiologists and gastroenterologists in order to understand how the food we eat and the bacteria that colonize us can cause (or prevent) metabolic diseases. **(Immunometabolism)**
SLOBODA, Deborah *sloboda@mcmaster.ca*	The Sloboda lab studies the early life origins of health and disease. They are interested in understanding the impact of the early life adversity on the mother, and the developing fetus and how fetal adaptations to adversity influence the risk of chronic disease later in life. **(Perinatal Programming, Reproduction and Metabolism)**
TRIGATTI, Dino *Bernardo.trigatti@taari.ca*	Atherosclerosis is a major cause of heart disease and stroke. Many people suffering from atherosclerosis have trouble moving cholesterol to the liver so it builds up, hardening in their arteries. Our group is studying how cells interact with each other and with the lipoproteins to better understand the process. **(Cell Biology and Regulation)**
TRUANT, Ray *truantr@mcmaster.ca*	The Truant lab is multidisciplinary and strives to develop a therapy for Huntington's disease by any means necessary. This includes methods like: fluorescence microscopy, laser confocal microscopy and Structured Illumination Microscopy. Our major focus is on humans with neurodegeneration. **(Cell Biology and Regulation)**
WHITNEY, John *jwhitney@mcmaster.ca*	Research in the Whitney lab employs a multidisciplinary approach to uncover the molecular details of pathways that shape the composition of bacterial communities. Specific areas include interbacterial competition and bacterial adhension. It is our long-term goal to be able to rationally manipulate bacterial populations relevant to human health. **(Interbacterial competition and Structure/function of Bacterial Toxins).**
WRIGHT, Gerry *wrightge@mcmaster.ca*	Antibiotics are vital components of modern medicine. However, their use is jeopardized by the spread of bacteria that have acquired resistance to their activity. To address the problem of antibiotic resistance, the Wright lab is using complementary research strategies. The first is the direct study of the molecular mechanisms of bacterial antibiotic resistance using chemical biology and chemical genetics. The second is the identification of new antibiotics and new antimicrobial strategies. **(Microbiological Biochemistry and Antimicrobial Research)**

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JOINT MEMBERS – 8 Faculty	
BERTI, Paul Chemistry *berti@mcmaster.ca*	Our lab studies enzymatic transition states. Enzymes catalyze reactions by binding more tightly to their transition states than anything else, up to 1020 times tighter than their substrates or products. Once we have solved a transition state structure, we can design stable molecules that mimic its charge and shape, and thus create powerful inhibitors. There are also a lot of good reasons to inhibit enzymes, such as killing pathogenic bacteria with new antibiotics. **(Microbiological Biochemistry and Antimicrobial Research)**
FRADIN, Cecile Physics *fradin@physics.mcmaster.ca*	Our focus is the experimental investigation of the dynamics of single molecules inside biological systems using optical tools as well as x-ray and neutron scattering. **(Molecular Biophysics)**
HIGGS, Paul Physics *higgs@mcmaster.ca*	Dr. Higgs' research group uses computational and theoretical methods to study problems in Biophysics, Molecular evolution and origins research. **(Biophysics and Bioinformatics)**
MELACINI, Giuseppe Chemistry *melacin@mcmaster.ca*	We are primarily interested in two main fields of research: the allosteric conformational switches that control signaling pathways and the early steps of amyloid fibril formation. Our projects have several medical implications ranging from cardiac tumors to Alzheimer's disease and type II diabetes. **(Biological NMR / Protein Structure / Structural Genomics)**
POINAR, Hendrik Anthropology *poinarh@mcmaster.ca*	Dr. Poinar is a molecular evolutionary geneticist and biological anthropologist by training, and relies heavily on interdisciplinary research. He uses both chemical and molecular techniques to elucidate the state of preservation within forensic, archeological and paleontological remains.
STEINBERG, Gregory Medicine *gstein@mcmaster.ca*	Our laboratories main interest involves studying how obesity, nutrition and exercise influence health with a major focus on inflammation and lipid metabolism. For the past several years a major area of focus in the laboratory has been around the metabolic sensor AMP-activated protein kinase (AMPK). **(Metabolism, Obesity and Type 2 Diabetes)**
SURETTE, Michael Medicine *surette@mcmaster.ca*	Michael Surette's Laboratory's primary area of research investigates the role of normal flora-pathogen interactions in health and disease in the area of respiratory infections with a focus in cystic fibrosis. A polymicrobial perspective on these infections has lead to identification of overlooked pathogens in airway disease as well as synergistic interactions between avirulent organisms and pathogens. This is a fundamentally different view of airway infections and has lead to direct benefits to patients through altered treatment strategies. **(Microbiology / Comparative Genomics / Metagenomics, Microbiome Research / Host-pathogen Interactions)**
WERSTUCK, Geoff Medicine *Geoff.Werstuck@taari.ca*	The Werstuck laboratory is located at the Henderson Research Centre, a facility dedicated to basic, clinical, and epidemiologic research in thrombosis, atherosclerosis, and cardiovascular disease. Our research is focused upon delineating the mechanisms by which diabetes mellitus promotes the progression and development of cardiovascular disease. Our laboratory employs a broad range of molecular and cellular techniques to examine cell and tissue-specific responses to hyperglycemia, obesity and diabetes. **(Metabolism, Obesity and Diabetes)**

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ASSOCIATE MEMBERS – 19 Faculty	
ATKINSON, Stephanie Pediatrics *satkins@mcmaster.ca*	Environmental (nutrition), genetic and biochemical factors during fetal, neonatal and early childhood life that play a role in defining the offspring phenotype and as risk determinants for non-communicable diseases. **(Metabolism and Toxicology)**
BERG, Tobias Oncology *bergt1@mcmaster.ca*	Understanding determinants of treatment response in AML and to develop novel treatments based on this understanding. We are also studying processes that happen in residual cells after treatment and that could explain why AML unfortunately often relapses after treatment. **(Hematopoietic Stem Cell Translational Research)**
BRAMSON, Jonathan Pathology and Mol. Med. *bramsonj@mcmaster.ca*	Maintenance of immune homeostasis with particular emphasis on the ways that tumors disturb this homeostasis. Our objective is to use this understanding to develop novel immune therapies to treat cancer. **(Engineered Immune Cells for Cancer Therapy)**
BRENNAN, John Chemistry *brennanj@mcmaster.ca*	Our goal is to develop solid-phase affinity-based assays suitable for: 1) high-throughput screening of complex small molecule mixtures against immobilized protein targets and; 2) biosensing of toxins and pathogens. Our research encompasses the development of new sol-gel methods for protein immobilization, evaluation of entrapped protein performance, and the design of new devices and assay formats for sensing and HTS. **(Bioanalytical Chemistry and Optical Biosensors)**
CAMPBELL, Clinton Pathology and Mol. Med. *campbecj@mcmaster.ca*	Dr. Campbell is a hematopathologist with clinical experience in blood and bone marrow morphology, transfusion medicine, special coagulation, red cell disorders, digital pathology and laboratory management.
ELLIOT, Marie Biology *melliot@mcmaster.ca*	We work with Streptomyces bacteria, which are remarkably complicated microbes: they are multicellular, have different 'tissue' types, and are little pharmaceutical factories – they make more than 2/3 of known antibiotics, along with chemotherapeutics, immunosuppressants, fungicides, anti-parasitic agents. **(Antimicrobial Research)**
HAWKE, Thomas Pathology and Mol. Med. *hawke@mcmaster.ca*	Dr. Hawke's research focus is on the role and regulation of muscle satellite cells, the stem cell population of skeletal muscle, in health and disease states such as diabetes mellitus and limb girdle muscular dystrophy. Techniques used in the lab include: histology, immunohistochemistry, protein and RNA expression assays, isolated single fibre and primary myoblast cultures, in situ muscle stimulation to assess contractile function, adenoviral mediated overexpression and/or silencing and metabolic enzyme assays.
HILL, Stephen Pathology and Mol. Med. *hillstev@hhsc.ca*	Biomarkers of cardiac injury and evidence-based laboratory medicine. Program Director, Clinical Biochemistry Training Program.
HOLLOWAY, Alison Obstetrics and Gynecology *hollow@mcmaster.ca*	The overall goal of my research program is to understand the mechanism(s) by which chemical insults can cause metabolic endocrine disruption in animal and human populations. In particular, I am interested in determining how fetal exposure to chemical insults results in adverse postnatal health outcomes in the offspring including type 2 diabetes and obesity. **(Reproductive Biology)**
HYNES, Alexander Medicine *hynes@mcmaster.ca*	My group's research focuses on establishing the role of phages in shaping key bacterial populations, notably those of the gut microbiome. Current research topics are: Isolation of new gut-associated bacteriophages, Exploring the role of phages in shaping bacterial populations, and Tracking phage populations and disease.
KAUSHIC, Charu Pathology and Mol. Med. *kaushic@mcmaster.ca*	The Kaushic Lab focuses mainly on understanding host-pathogen interactions within the female genital tract. We are interested in innate and mucosal immunity against the STIs. We focus on key factors such as sex hormones, co-infections, microbiome in the local microenvironment of the reproductive tract to understand how they affect the interactions with sexually transmitted viruses, HIV-1 and HSV-2, to determine the outcome of exposure. Currently, the laboratory is funded by three CIHR projects and an OHTN Applied HIV Chair to Dr. Kaushic. **(Mucosal Immunity to HIV and sexually transmitted infections)**

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LARCHE, Mark Medicine *larche@mcmaster.ca*	In his current research, Dr. Larché has singled out asthma as the perfect model to study these mechanisms, because asthmatics respond swiftly to their triggers, and the responses can be measured easily. His research into asthma includes a study of the pathway that links the "switching on" of the immune response with the symptoms of asthma (such as constriction of the airways), as well as the process of identifying the biomarkers that will help the diagnosis and treatment of asthma, and the screening of anti-asthma drugs. In the long run, he hopes his research will lead to the production of peptide vaccines for the treatment of a wide range of chronic immune diseases.
MOSSMAN, Karen Pathology and Mol Med *mossk@mcmaster.ca*	Our laboratory studies virus–host interactions with a focus on innate cellular antiviral responses and virus counter-responses. In addition, we are developing viruses as oncolytic viruses for cancer therapy, based on deficiency of innate cellular pathways in cancer cells. **(Cell Biology and Regulation)**
MUKHERJEE, Manali Medicine mukherj@mcmaster.ca	Autoimmunity, Immunology and Respiratory diseases.
NAZY, Ishac Medicine *nazii@mcmaster.ca*	Dr. Nazy's research interests include: Translational research in immuno-hematology, cellular and humoral mechanisms of disease, drug discovery, translation of basic science findings to clinical applications, heparin-induced and immune thrombocytopenia, and platelet disorders. Specifically, Ishac's interests lie in the specific interactions between antibodies and their target platelet-related antigens, leading to thrombocytopenia and thrombosis.
PARE, Guillaume Pathology and Mol. Med. *pareg@mcmaster.ca*	My main research focus is Genetic and Molecular Epidemiology, whereby I aim to identify genetic determinants of complex disease such as hypertension, coronary artery disease, cerebrovascular disease and other types of chronic disease. Genetic and molecular markers of disease are expected to lead to better understanding, prediction, and ultimately prevention of diseases. **(Stroke genetics / Lipoprotein genetics / Pharmacogenetics and antithrombotic drugs / Novel statistical genetic methods)**
RAHA, Sandeep Pediatrics *rahas@mcmaster.ca*	My lab focuses on understanding the role of mitochondrial function/dysfunction in modulating uterine stress as a consequence of maternal obesity. We focus on how physiological stressors affect mitochondrial function and one of their primary by-products, reactive oxygen species. We are interested in understanding the role of mitochondria in contributing to fetal stress in the obese mother. Furthermore, we also focus on how in utero stress can affect mitochondrial function and signaling in dictating fetal and neonatal health of obese mothers.
SINGH, Sheila Surgery (Neurosurgery) *ssingh@mcmaster.ca*	Dr. Sheila Singh's research program is dedicated to applying a developmental neurobiology approach to the study of human brain tumours. As a pediatric neurosurgeon, Dr. Singh is acutely aware of the needs of patients and clinicians dealing with these diseases. Her unique perspective as a surgeon-scientist guides her research questions and areas of focus. The three types of tumours studied by Dr. Singh's lab are glioblastoma, medulloblastoma and brain metastases. **(Cancer / Drug Discovery / Pre-Clinical Modelling)**
STEARNS, Jennifer Medicine *stearns@mcmaster.ca*	**Microbial community maturation within the context of a maturing host environment.** My lab is developing and applying computational, molecular and culture based methods to study human associated microbial communities longitudinally. **Early infant nutrition choices on bacterial succession.** By combining molecular profiling, with in vitro and in vivo experiments we are exploring how the infant diet helps to shape microbial communities. **Microbial contribution to early life origins of disease.** By studying large populations of individuals, we are connecting the gut microbiome and microbially derived metabolites in early life with evolving phenotypes of human disease, such as obesity, metabolic syndrome and atopy.
WEITZ, Jeffrey Medicine weitzj@taari.ca	By focusing on the basic mechanisms by which anticoagulants (blood thinners) and thrombolytic agents (clot digesting drugs) work, Dr. Weitz has opened new avenues of investigation. His demonstration that thrombin bound to fibrin is resistant to inactivation by available anticoagulants stimulated the development of new drugs, some of which are already being used in clinical practice. Through other research, Dr. Weitz has provided an explanation for the puzzling clinical observation that the clot digesting drug, tissue-type plasminogen activator or t-PA, produces more bleeding than was originally anticipated. This work has paved the way for new drugs that may be safer than t-PA.