APP FACULTY
AREAS of RESEARCH
APP Faculty Members

**Dr. Stan Bardal**  
Associate Professor, APP  
Email: stan.bardal@usask.ca

Research Interests:  
Issues around safe and effective use of medications. This work focuses on clinical pharmacology, employing either evidence-based systematic reviews of the literature to assess relative efficacy/safety of drug classes or other issues around optimal prescribing of medications. This work also includes use of new technologies to enhance safe and effective prescribing, including pharmacogenomics.

Medical education research. My current area of focus includes the use of information technology to enhance clinical learning. Specifically, this relates to the use of smartphone apps to facilitate application of scientific principles to clinical medicine, as it relates to the prescribing of medications.

Select Publications:


**Dr. Lane Bekar**  
Assistant Professor, APP  
Email: lane.bekar@usask.ca

Research Interests:  
One in 80 Canadians are afflicted with Alzheimer or Parkinson disease. Neurodegenerative diseases appear to have at their root a common loss of locus coeruleus (LC) neurons. The loss of LC neurons in aging and neurodegenerative disease is likely a key factor given its function in regulating CNS energy utilization, modulating thresholds for synaptic plasticity, providing neurotrophic/anti-inflammatory support.
and regulating blood flow.

My research focuses on evaluating the physiological/pathological aspects of the LC neuromodulatory network with a specific interest in the role played by glial cells. My projects center on whole animal and slice preparations with extracellular, ion selective, electrochemical and patch-clamp electrophysiological recording techniques. Whole animal work is complemented by studies using live mouse brain slices to further delineate and characterize electrophysiological and pharmacological mechanisms.

Department profile: https://medicine.usask.ca/profiles/anatomy-physiology-pharmacology/lane-bekar.php

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**Dr. Julia Boughner**  
Associate Professor, APP  
Email: julia.boughner@gmail.com

Research area: Developmental Biology  
My lab works on two main questions. First, what are the mechanisms that coordinate healthy pre- and postnatal developmental changes among the face, jaws and teeth? Second, what do these mechanisms tell us about how teeth and jaws evolve in a coordinated way? I use mouse and primate models to study these questions. My methods combine molecular, morphological and high-resolution imaging data. The hope is that this work will help clarify how teeth and jaws have developed and evolved such an amazing variety of different yet functional forms across living and extinct mammals.

Department profile: https://medicine.usask.ca/profiles/anatomy-physiology-pharmacology/boughner-julia.php

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**Dr. Veronica Campanucci**  
Associate Professor, APP  
Email: veronica.campanucci@usask.ca

Research Interests: The impact of diabetes and inflammation on the nervous system

Research in my laboratory concentrates on three main areas aimed to investigate mechanisms underlying the onset and progression of deleterious effects of diabetes on the nervous system:
1) Diabetic Peripheral Neuropathy

Diabetic peripheral neuropathy is the most common complication of diabetes affecting over half of diabetic patients. The impact of neuropathy can extend to all components of the peripheral nervous system, including sensory and autonomic nerves. Damage of sensory nerves leads to Diabetic Sensory Neuropathy, which has a significant impact of quality of life causing pain-related abnormalities, “diabetic foot”, and amputations. On the other hand, damage of autonomic nerves leads to the onset of Diabetic Autonomic Neuropathy, which is an under-recognized complication of diabetes that impacts multiple organ systems and has widespread clinical manifestations, including cardiovascular dysfunction associated with a high risk of mortality. We use electrophysiology, molecular and biochemical methods to study ion channels, synaptic transmission, expression of pro-inflammatory proteins and oxidative stress.

2) Mitochondrial Abnormalities in diabetes

Mitochondria are the cell’s powerhouse. They produced the energy required for neurons, and therefore, their dysfunction leads to impairment of synaptic transmission in both the peripheral and central nervous system. Mitochondrial health and function is reflected by their structure and morphology, and their efficiency in energy (ATP) production. In my research laboratory we investigate mitochondrial morphology, traffic along axons and dendrites, and ATP production using live imaging techniques under elevated glucose conditions.

3) Cognitive impairment in diabetes

The effects of diabetes in the central nervous system are linked to brain atrophy, white matter defects, and cognitive impairments, all phenotypes suggesting that diabetic patients are at higher risk of developing dementia. In fact recent epidemiologic studies have provided direct evidence that type 2 diabetes is a strong risk factor for Alzheimer’s disease (AD). However, the underlying mechanisms for the association between type 2 diabetes and AD remain largely unknown. Thus, we concentrate on studying mechanisms associated to neuronal oxidative stress in diabetes that have the potential to lead to electrophysiological and biochemical abnormalities associated to AD.

Department profile: https://medicine.usask.ca/profiles/anatomy-physiology-pharmacology/veronica-campanucci.php#About

Dr. L. Dean Chapman
Professor, APP
Email: dean.chapman@usask.ca

Research Area: Biomedical Imaging
Most of my research interests’ center on the use of diffractive x-ray optics applied to a variety of problems in medical imaging and x-ray research, primarily using synchrotron
x-ray sources. A major area of research is understanding and using a new technique, Diffraction Enhanced Imaging (DEI), both at synchrotron sources and in the laboratory. DEI shows great promise for soft tissue imaging as it has sources of x-ray contrast that are not absorption based (x-ray refraction and ultra-small angle scattering) and these contrast mechanisms have been shown to be significantly larger than just absorption alone. I and my group are developing a laboratory based DEI system, developing a biomedical imaging and therapy beamline at the Canadian Light Source of which I am principal investigator, and continuing active research in a variety of medically related problems at various synchrotron sources.

Department profile: https://medicine.usask.ca/profiles/anatomy-physiology-pharmacology/dean-chapman.php#About

**Dr. Jennifer Chlan**  
Assistant Professor, APP  
Email: jmc134@mail.usask.ca

Research area: Neurobiology  
My research involves examining the neuropathology of various neurological and psychiatric diseases including Alzheimer’s disease, schizophrenia, autism, and fetal alcohol syndrome. Most of my research is done in animal/transgenic models of these diseases.

**Dr. David Cooper**  
Associate Professor, APP  
(dml.cooper@usask.ca):

Research area: Biomedical Imaging  
My primary research interests focus on the dynamic microstructure of the dense outer cortical shell of bones, including growth and development, functional adaptation, and deterioration with aging and disease. My research extensively employs high resolution 3D imaging, including conventional and synchrotron-based micro-computed tomography (Micro-CT). As my background includes training in biomedicine and biological anthropology, I am keenly interested in employing imaging in the context of interdisciplinary research between these areas. I currently have active partnerships with the Department of Archaeology (UofS), College of Kinesiology (UofS), Center for Hip Health (UBC) and the University of Melbourne in Australia.

Department profile: https://medicine.usask.ca/profiles/anatomy-physiology-pharmacology/david-cooper.php#About
Dr. Kaushik (Kash) Desai  
Associate Professor, APP  
E-mail: k.desai@usask.ca  

Research Interests: Two research projects are currently underway in the lab:  
(1) Physiological impact of arginine supplements in Sprague Dawley rats. A multiphase study involving short and long term oral administration of oral doses from the upper end and lower end of doses commonly used. The whole spectrum of enzymes and metabolites in various pathways will be covered. The MG scavenging property of arginine is of special interest. Extension of the study to human volunteers is possible. Development of preventive strategies against hyperfructosemia- and hyperglycemia-induced pathology.  
(2) Preventive effects of arginine supplements against type 2 diabetes-induced pathology in Zucker diabetic rats. The Zucker diabetic rat, a genetic model of type 2 diabetes, will be treated with two doses for arginine for 12 weeks. Tests for glucose tolerance, insulin levels, GLUT 4 expression and other parameters of type 2 diabetes will be measured. Significant prevention with arginine will enable extension of studies in rat models of hypertension.  
(3) Establishing a mechanistic link between thyroid dysfunction and metabolic syndrome and obesity. We are investigating the mechanisms by which metabolic abnormalities found in the metabolic syndrome and obesity cause thyroid dysfunction, which in turn would aggravate those metabolic abnormalities further and set up a vicious cycle.  

Research Techniques and Expertise:  
Highly skilled in a variety of in vivo, in vitro, immunohistochemical, cell culture and molecular biology techniques.  
In vivo studies - arterial, venous, ventricular, tracheal cannulations, hemodynamic measurements and analysis, use of perfused microspheres for regional blood flow and hemodynamic studies, telemetry probe implantations, subcutaneous mini-pump implantation.  
In vitro studies - isolated organ bath studies using perfused mesentery, kidney, aortic rings, ileum, tracheal chains, vas deferens, whole stomach.  
Cell culture - isolation of fresh rat aortic endothelial cells and culture, culture of endothelial cells in 3D collagen gel for capillary angiogenesis, vascular smooth muscle cell culture, laminar flow and shear stress studies using a parallel plate chamber.  
Immunohistochemistry – fixing of fresh tissues, embedding, cutting sections, use of a cryostat, immunofluorescence and horseradish peroxidase staining techniques, immunofluorescence and confocal microscopy.  
Others – HPLC, western blotting  

Department profile & publications:  
https://medicine.usask.ca/profiles/anatomy-physiology-pharmacology/kaushik-desai.php
Dr. Brian Eames
Associate Professor, APP
Email: b.frank@usask.ca

Research area: Developmental Biology
My lab seeks to understand the cellular and molecular mechanisms that drive formation of the skeleton in the embryo, and also to reveal how programs of skeletal development change during evolution. In particular, my research is focused on using zebrafish mutants and transgenics to assess the role of proteoglycans in skeletal cell differentiation, meanwhile keeping an eye on how genetic programs of bone and cartilage cell differentiation have evolved among different vertebrate clades.

Department profile: https://medicine.usask.ca/profiles/anatomy-physiology-pharmacology/brian-eames.php#ResearchAreas

Dr. Thomas Fisher
APP Department Head & Professor, APP
E-mail: thomas.fisher@usask.ca

Our laboratory studies the critical homeostatic process of osmoregulation. All cells shrink when the external osmolality increases and swell when the osmolality decreases and such changes can be very harmful if not tightly regulated (think of all of the neurons encased in the skull). The body has therefore evolved mechanisms to keep the osmolality of our body fluids to within a very narrow range. Increases in blood osmolality activate thirst (which motivates us to increase our water intake) and also stimulates the release of the hormone vasopressin, which acts to decrease the volume of urine production and thereby preserve body water. The neurons that release vasopressin are “osmosensitive” in that they are capable of sensing changes in serum osmolality and converting that signal into electrical activity and the release of vasopressin. We are interested in the mechanisms by which this occurs. Part of the explanation lies in the fact that these neurons express “mechanosensitive” ion channels whose activity varies with the changes in membrane tension caused by cell shrinkage or swelling. We recently discovered, however, another mechanism that contributes to neuronal osmosensitivity. The osmotically-induced increase in firing that occurs in these neurons also leads to the activation of the enzyme phospholipase C (PLC) and activation of this enzyme is necessary for the full activation of the mechanosensitive channels mentioned above. The osmotic activation of PLC could therefore be a critical component of osmosensitivity and we have identified a specific isoform of PLC (PLCα1) that appears to be primarily responsible for this mechanism. We have a strain of transgenic mouse that lacks this isoform and these mice have a marked defect in their ability to osmoregulate. In other words, these mice continue to produce urine when they should be decreasing urine volume to preserve water. We are using these mice and other tools to study the
mechanisms by which PLC contributes to neuronal osmosensitivity and thus to the essential process of osmoregulation.

Publications:
Department profile:
https://medicine.usask.ca/profiles/anatomy-physiology-pharmacology/thomas-fisher.php

Dr. John G. Howland
Professor, APP
Email: john.howland@usask.ca

Research Interests:
1. Effects of acute stress on cognition and synaptic plasticity: The neurobiological mechanisms enabling cognition remain poorly characterized. Converging lines of evidence suggest that various forms of synaptic plasticity may underlie cognitive processes such as learning and memory, although direct evidence supporting this hypothesis is lacking. As a result, novel experimental models and pharmacological tools to test these mechanisms are critically needed. Acute stress has profound and complex effects on learning and memory, as well as synaptic plasticity. Therefore, understanding how acute stress influences learning and memory will provide insight into the neurobiological mechanisms underlying cognition. Experiments performed in this line of research focus on understanding the effects of acute stress on cognition and synaptic plasticity using a combination of sensitive behavioral testing, in vivo extracellular electrophysiology recording techniques, and novel pharmacological strategies in rodent models. These experiments will significantly improve our understanding of advanced cognitive functions from an integrated behavioural and physiological perspective.

2. Neurodevelopmental models of severe psychiatric illness: Psychiatric illness severely affects many thousands of Canadians. Increased understanding of the causes of psychiatric illness may aid in the goal of developing improved treatments or preventative therapies. Adverse events early in life are strongly associated with psychiatric illnesses such as schizophrenia and autism. Recent evidence provides direct support for the role of prenatal infection (i.e., exposure to an infection while in utero) as a predisposing factor for psychiatric illness in the offspring. Experiments performed in this line of research seek to further understand the specific consequences of prenatal infection using a rat model of viral infection. Discrete measures of cognition are correlated with electrophysiological recordings from brain areas thought be involved in
neurodevelopmental psychiatric disorders (i.e., hippocampus, prefrontal cortex, nucleus accumbens) in rats whose mothers were exposed to either a viral mimetic compound or a control treatment while pregnant. In addition, the effects of novel therapeutic strategies are also tested. These experiments will significantly increase understanding of the consequences of prenatal infection and potentially provide novel avenues for prevention of psychiatric illnesses such as schizophrenia and autism.

Publications:
http://www.usask.ca/johnhowlandlab/publications.php

Webpage:
https://research-groups.usask.ca/johnhowlandlab/

Dr. Juan Ianowski
Associate Professor, APP
E-mail: juan.ianowski@usask.ca

Research Interests:
Mechanisms of epithelial transport in health and disease.
My research program focus on the mechanisms of epithelial solute transport, its regulation by extracellular and the intracellular signals, and the pathological consequences of transport failure.
Currently we have two main research programs involving:
1) Cystic fibrosis airway disease pathobiology:
Cystic fibrosis (CF) is the most common, fatal genetic disease affecting young Canadians. CF is an autosomal recessive condition caused by mutations in the gene encoding the cystic fibrosis transmembrane conductance regulator (CFTR) anion channel. It is estimated that one in every 3,600 children born in Canada has CF and approximately one in every 25 Canadians carries a defective version of the gene responsible for CF. Thanks to advances in research and clinical care, growing numbers of children with CF are surviving into adulthood. In 1960 the median age of survival of Canadian patients with CF was 4 years; today, it is 37 years of age. However, controversies still surround the pathogenesis of airway disease. We lack answers to many questions and CF remains a lethal disease, thus, current treatments are inadequate.
The main objective of my research program is to study the link between the mutation of CFTR and the failure in CF patients of the innate defense mechanisms that normally protects airways from infection. There is evidence showing that cystic fibrosis lung disease reflects the failure of the innate defense mechanisms of the lung against inhaled organisms such as Pseudomonas aeruginosa. Normal airways are protected from inhaled ‘insults’ by a complex immune defense system that includes mucus containing antimicrobial factor that traps and inactivates bacteria favoring clearance
Specific research aims:

a. Response of airway submucosal glands to proinflammatory cytokines
b. Stimulation of mucus secretion by bacteria inhalation by swine in vivo using synchrotron light

2) Molecular and cellular mechanisms of epithelial transport:
The laws of thermodynamic govern the direction and rate of movement of solutes across epithelial cells, i.e. Down the electrochemical gradient for any molecule. The fundamental function of transporting epithelia is to generate the electrochemical gradients that will force movement of molecules in the desired direction. This is achieved by the asymmetrical distributions of transport systems (channels, ATPases, cotransporters and exchangers) in the apical and basolateral membranes of polarized epithelial cells. Primary active transport by ATPases generates electrochemical gradients that are exploited by membranes with selective permeability to produce unidirectional movement of solutes that would otherwise be thermodynamically unfavorable. Our lab seeks to understand the molecular and cellular mechanisms that allow that transport machinery to work in unisons using the insect models Drosophila melanogaster and Rhodnius prolixus Malpighian (renal) tubule.

Specific research aim:
a. The role of intracellular Ca2+ in the cross-talk between apical and basolateral transporters in Rhodnius prolixus Malpighian tubules

Publications:
Department profile:
http://www.usask.ca/ianowskilab/index.php

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**Dr. Anand Krishnan**  
Assistant Professor, APP  
Email: kra830@usask.ca

Research Interests: Understanding the tumor-nerve interface to reveal novel molecular targets for cancer and nerve regeneration  
Recent investigations have demonstrated a mutual, growth stimulatory interaction between tumor tissues and peripheral nerves. The tumor cells secrete growth modulators and guidance cues to attract nerves while the growth factors released from the nerves promote tumor survival and metastasis. However, the molecular framework of this mutual interaction is not established. My lab is interested in studying the molecular network at the tumor-nerve interface. The molecular characterization of the interface will reveal novel therapeutic targets for cancer and nerve regeneration.
Department profile and publications: https://medicine.usask.ca/profiles/anatomy-physiology-pharmacology/anand-krishnan.php#ResearchAreas

Dr. William M. Kulyk
APP Undergrad Chair & Professor, APP
Email: william.kulyk@usask.ca

Research area: Developmental Biology
My principal research program is focused on studying the interactions of extracellular matrix macromolecules, signal-transducing protein kinases, and nuclear transcription factors in the regulation of cartilage differentiation during embryonic development of the limb and facial skeletons. I am also involved in interdisciplinary research on cartilage tissue engineering. Our studies employ a wide variety of modern analytical techniques including tissue culture, RNA dot-blot analysis, Western blot protein analysis, reverse transcriptase PCR, recombinant gene transfection, immunocytochemistry, and in situ hybridization.

Department profile: https://medicine.usask.ca/profiles/anatomy-physiology-pharmacology/william-kulyk.php

Dr. Lixin Liu
Associate Professor, APP
Email: lixin.liu@usask.ca

Research Interests:
The recruitment of leukocytes from the flowing bloodstream into inflamed tissue is of critical importance in inflammation. This recruitment involves complex interactions between leukocytes and vascular endothelial cells, characterized as firstly the tethering and rolling of leukocytes along the endothelium followed by leukocyte activation and firm adhesion to the endothelium, the transmigration of leukocytes across the endothelium (diapedesis or extravasation), and finally the chemotactic migration of emigrated leukocytes toward the site of infection or injury (chemotaxis). These dynamic processes involve sophisticated cellular and molecular interactions and multiple signaling events among cell adhesion molecules, chemotactic signals and intracellular signaling pathways. The cellular and molecular mechanisms and the role of intracellular signaling molecules in both leukocytes and endothelial cells involved in leukocyte recruitment are our research interests in the lab. Our major technique is the intravital microscopy using real-time and time-lapse video microscopy and imaging in tissues in anaesthetized mice to investigate the role of intracellular signaling molecules in leukocyte recruitment. Techniques in vitro using isolated cells (e.g., cell migration and chemotaxis in vitro) are also used in the lab.
Current projects in the lab:
• The role of LSP1 (leukocyte-specific protein 1) in neutrophil recruitment.
• The interactions of LSP1 with other intracellular proteins during neutrophil recruitment.
• The role of Bam32/DAPP1 in neutrophil recruitment

Publications:
https://medicine.usask.ca/profiles/pharmacology/lixin-liu.php#SelectedPublications
Department profile:
https://medicine.usask.ca/profiles/pharmacology/lixin-liu.php

Dr. Adel Mohamed
Associate Professor, APP
Email: adel.mohamed@usask.ca

Research area: Neurobiology
My local research interest is looking at therapeutic modalities to treat experimental allergic encephalomyelitis (EAE), an animal model for human multiple sclerosis using different antioxidants agents. The research involves mainly histopathological and biochemical techniques. My local research collaboration includes pathological evaluation of animal nervous tissues with brain lesions after being exposed to beam light source. My abroad research collaboration is studying the mechanism of steroid action on chronic inflammation using histochemical techniques.

Department profile: https://medicine.usask.ca/profiles/anatomy-physiology-pharmacology/adel-mohamed.php

Dr. Joseph Ndisang
Associate Professor, APP
E-mail: joseph.ndisang@usask.ca

Research Interests:
Vasoactive gaseous mediators (carbon monoxide, nitric oxide etc.) and cardiovascular pathologies; particularly we are investigating the role of the heme oxygenase system in hypertension, diabetes (types-1 and -2), and obesity.

Publications:
Department profile:
Dr. Nick Ovsenek
Professor, APP
Email: nick.ovsenek@usask.ca

Research area: Cell Biology
The mechanism by which cells of all organisms respond to environmental stress is not known. In our laboratory, we examine the first steps along the stress gene induction pathway. We focus on the activation of a transcription factor called HSF. We also study the behaviour of a transcription factor called YY1. Xenopus oocytes are used as a model system in which cellular parameters are experimentally manipulated.

Department profile: https://medicine.usask.ca/profiles/anatomy-physiology-pharmacology/nick-ovsenek.php

Dr. Bogdan Popescu
Assistant Professor, APP
Email: bfp180@mail.usask.ca

Research area: Neurobiology
Research areas include brain metabolism; multiple sclerosis and other neuroimmunological diseases; pathogenesis and disease treatment.

Department profile: https://medicine.usask.ca/profiles/anatomy-physiology-pharmacology/bogdan-popescu.php#ResearchAreas

Dr. Grzegorz (Greg) Sawicki
Professor, APP
E-mail: greg.sawicki@usask.ca

Research Interests:
• Molecular mechanisms of heart injury triggered by oxidative stress and its protection from contractile dysfunction.
• Use of the pharmaco-proteomics approach in pathological and physiological heart studies.
• Novel intracellular function of matrix metalloproteinase-2 in heart injury.
• Posttranslational modifications of contractile proteins triggered by oxidative stress and their role the injury.

For Select Publications please view faculty profile. Articles 1-8.
Dr. Changiz Taghibiglou  
Associate Professor, APP  
E-mail: changiz.taghibiglou@usask.ca  

Research Interests:  
• Excitotoxicity-induced neuronal apoptosis in stroke, neurodegenerative diseases, and traumatic brain injury (TBI)  
• Lipid rafts and neuronal receptor signaling and trafficking, Lipid Neurobiology  
• Brain insulin signaling pathways, Role of the cellular prion protein (PrPc) in health and disease  
• Designing bioactive short peptides  
• Biomarker discovery in neurological diseases  
• Pathophysiology of Concussion/mTBI  
• Skin Pharmacology

Department profile & publications: https://medicine.usask.ca/profiles/anatomy-physiology-pharmacology/grzegorz-sawicki.php#ResearchAreas

Dr. Valerie M.K. Verge  
Professor, APP  
Email: valerie.verge@usask.ca  

Research area: Neurobiology  
The design of more effective nerve repair paradigms without maladaptive consequences is a major goal of our laboratory. Our current research is aimed at obtaining a greater understanding, at the cellular level, of the role of neurotrophic molecules and their receptors in the maintenance and repair of adult mammalian neurons, with special reference to their potential therapeutic roles in sensory neuron regeneration, neuropathic pain states and remyelination of axons.

Department profile: https://medicine.usask.ca/profiles/anatomy-physiology-pharmacology/valerie-verge.php

Dr. Scott Widenmaier  
Assistant Professor, APP  
Email: scott.widenmaier@usask.ca  

Research Interests:
Obesity-linked metabolic disorders underlie a cluster of diseases that have emerged as major challenges to health systems in Canada and around the globe. Aberrant interactions between the immune and metabolic systems significantly contribute to these diseases, so much so they are now commonly referred to as ‘immunometabolic diseases’. What this refers to is the established and well accepted evidence that the elevated metabolic burden of excess nutrient intake in the context of chronic obesity can be stressful to the cells and tissues mainly responsible for coordinating metabolic homeostasis. If the stress is unresolved, it can lead to a chronic low-grade state of inflammation that will disrupt metabolic homeostasis and thereby cause disease progression. I propose that by learning how to mitigate the stress caused by the metabolic burdens and stresses of excess nutrient exposure, we may identify a more effective approach for the treatment and prevention of obesity-linked metabolic disorders.

The goal of my program is to delineate the molecular interface between cellular stress and metabolic homeostasis, determine how this relates to immunometabolic diseases, and identify interventions that influence this interface in a manner that improves immunometabolic health. To this end, we employ a multidisciplinary approach integrating molecular biology, molecular genetics, biochemistry, systems biology, and physiology on in vitro and in vivo model systems of human obesity. We currently undertake 2 main projects. 1) We are investigating the role of a family of stress-adaptive transcription factors in the regulation of metabolic homeostasis and cellular resistance to stress. 2) We are systematically identifying the molecular mechanisms by which cells control homeostatic levels of one specific nutrient that has important roles in health & disease, cholesterol.

Students and fellows interested in joining the lab should contact me at my e-mail address. When doing so, please include a detailed ‘statement of interest’ explaining why you would like to join the lab as well as unofficial transcripts and contact information of at least 2 references.
Associate Members

**Dr. Terra Arnason**  
Department of Medicine  
Associate member APP  
Email: terra.arnason@usask.ca

Research areas include cancer biology, cellular metabolism, diabetes, endocrinology, and yeast genetics.

Department profile: https://medicine.usask.ca/profiles/department-of-medicine/endocrinology-and-metabolism/terra-arnason.php

**Dr. Don W. Cockcroft and Dr. Beth Davis**  
Professor, Medicine (Respirology) and Associate Member, Physiology; Research Scientist, Medicine (Respirology)  
Email: don.cocokcroft@usask.ca; beth.davis@usask.ca

Research Interests:  
Drs. Cockcroft and Davis conduct clinical research investigating mechanisms, pharmacological treatments and testing methodologies of (predominantly) allergic asthma. For detailed information regarding procedures/tests conducted in the lab, visit the lab website at http://www.usask.ca/asthmaresearchlab/

Recent [student] projects include:
4. [S. Stewart]. Low levels of fractional exhaled nitric oxide and deep inhalation bronchoprotection are associated with mannitol non-responsiveness in asthma. Respir Med. 2014;108:859-864.

Select Publications:  

Asthma Lab Webpage:  
http://www.usask.ca/asthmaresearchlab/
Dr. Andrew Freywald  
Department of Pathology & Laboratory Medicine  
Associate member APP  
Email: andrew.freywald@usask.ca  

Research is focused on the molecular mechanisms that determine tumor aggressiveness, especially the roles of Eph receptor tyrosine kinases (EphRs) in controlling cancer cell behavior.


Dr. Jack Gray  
Vice-Dean Research, Scholarly and Artistic Work, College of Arts and Science  
Associate member, APP  
Email: jack.gray@usask.ca  

Research Interests:  
My long-term research goal is to discover general principles of how nervous systems produce and control complex adaptive behaviours and how these behaviours are affected by environmental stressors, such as pesticides. Attaining these goals requires a comprehensive approach to investigating interactions between an animal's external environment and its nervous system. To address this issue I study behavioural and neurophysiological aspects of adaptive flight in tractable insect systems. Specifically, we study collision avoidance in locusts and orientation behaviour in bees. We also use our data to derive biologically-inspired algorithms for computer models and potential robotic control. To meet my long-term goal my research addresses four specific objectives: 1) To describe the specific components of multi-modal sensory stimuli that evoke adaptive flight behaviours in model insect species. 2) To determine how relevant multi-modal sensory information is encoded into patterns of premotor neural activity during adaptive flight behaviours. 3) To identify common principles of adaptive insect flight behaviour by comparing behavioural and neurophysiological control mechanisms between different insect species. 4) To understand how sublethal doses of pesticides affects avoidance behaviours and the underlying neural circuits. Experiments involve a wind tunnel equipped with high speed video cameras for behavioural and muscle physiology experiments and a virtual reality-based flight simulator for neurophysiology experiments that use standard or multichannel extracellular recording techniques. Honours projects in my lab would expose students to these recording techniques. These students would, ideally, collect new data that would add to the objectives listed above and potentially lead to publication.
Department profile and Publications:
http://artsandscience.usask.ca/faculty/jackgray/

Dr. Troy Harkness
Professor, BMI
Department of Biochemistry, Microbiology and Immunology
Associate member APP
Email: troy.harkness@usask.ca

Research is focused on the molecular genetics regulating chromatin assembly and aging in yeast.

Department profile: https://medicine.usask.ca/profiles/biochemistry-microbiology-immunology/troy-harkness.php

Dr. Michael Kelly
Department of Surgery
Associate member APP
Email: m.kelly@usask.ca

Research areas include cardiovascular disease, stroke, and vascular tissue engineering.

Department profile: https://medicine.usask.ca/profiles/surgery/neurosurgery/m.-kelly.php

Dr. Michael Levin
Department of Medicine
Associate APP member
Phone: 306-655-8350

Research Interests:
Dysfunctional RNA binding proteins in MS
The long-term goal of research in the Levin Lab is to better understand the cause of neurodegeneration, a salient feature and cause of permanent disability in progressive multiple sclerosis (MS) patients. For more than 20 years, we have studied the function of the RNA binding protein heterogeneous nuclear ribonuclear protein A1 (hnRNP A1 - ‘A1’), with a focus on ‘M9’. M9 is A1’s nucleocytoplasmic transport domain, and is required for transport of A1 between the nucleus and cytoplasm. Our lab has discovered that MS patients make antibodies to M9 and the brains and lymphocytes of MS patients contain somatic DNA mutations within M9. Using a number of molecular, in vitro and in vivo techniques, our data indicate that DNA mutations within M9 and autoimmunity to M9 result in A1 dysfunction and subsequent neuronal and axonal degeneration. Using
this model, we examine potential mechanisms of neurodegeneration in MS resulting from A1 dysfunction.

**Research Topics**
- Multiple Sclerosis
- Neuroinflammation
- Neurological Disorders
- Neurodegeneration
- RNA Binding Proteins
- RNA Metabolism

Department profile: [https://medicine.usask.ca/profiles/department-of-medicine/neurology/michael-levin.php#ResearchAreas](https://medicine.usask.ca/profiles/department-of-medicine/neurology/michael-levin.php#ResearchAreas)
[https://research-groups.usask.ca/skms-office/ms-research-centre/research-positions.php](https://research-groups.usask.ca/skms-office/ms-research-centre/research-positions.php)

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**Dr. Daniel MacPhee**
Associate Professor, Reproductive and Developmental Biology
Veterinary Biomedical Sciences, One Reproductive Health Group
([http://www.usask.ca/groups/onereproductivehealth](http://www.usask.ca/groups/onereproductivehealth))
Associate Member, Physiology
Email: d.macphee@usask.ca

Research Interests:
1. Mammalian placental development
2. Integrin-mediated signaling in embryonic development
3. Uterine adaptation and differentiation during pregnancy
4. Stress proteins and co-chaperones and their role in the uterus during labour

Department profile & publications: [https://wcvm.usask.ca/departments/biomedical/biomedical-people/daniel-macphee.php#AcademicCredentials](https://wcvm.usask.ca/departments/biomedical/biomedical-people/daniel-macphee.php#AcademicCredentials)

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**Dr. Darrell D. Mousseau**
Professor, Psychiatry
Associate Member, APP
Email: darrell.mousseau@usask.ca

Research Interests:
Research interests focuses on how modifications of proteins affect cell function and fate within the context of neurodegenerative disorders, with a particular emphasis on Alzheimer disease. The major research objective at this juncture is to determine what biochemical events are common to depression and Alzheimer disease;
However, models of diabetes and breast cancer are also being examined for depression-related factors. His laboratory routinely uses cell cultures and mice, and such techniques as cDNA manipulation and western blotting, qRT-PCR, enzymatic assays, immunohistochemistry, microscopy (fluorescence and confocal), and various viability assays.

Department profile & publications:
https://researchers.usask.ca/darrell-mousseau/

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**Dr. Jonathan Norton**  
Assistant Professor and Clinical Neurophysiologist, Surgery; Biomedical Engineering  
Associate Member, Physiology; Small Animal Clinical Sciences  
Email: j.norton@usask.ca

Research Interests:  
Clinical Neurophysiology, Evoked Potentials & Intraoperative Neurophysiology.  
Functional Electrical Stimulation.  
Acute Spinal Cord Injury Therapies.  
Intermuscular Coherence and Signal Processing in Clinical Neurophysiology.

Department profile and publications:  
https://medicine.usask.ca/profiles/surgery/neurosurgery/j.-norton.php