Dr. Michael Zaugg

Research in the Zaugg Lab seeks to understand the signaling networks involved in the stress response related to ischemia-reperfusion injury in mammalian cells and tissues, with the goal of translating this knowledge into potential therapies aiming at improving perioperative patient care and outcomes. In addition, we strive to understand the role of metabolic stress and of inflammatory pathways in conditions relevant to perioperative medicine such as major trauma (surgery), transplantation, cardiovascular, and thoracic surgery. Finally, we understand that the enhancement and optimization of nutritional support in surgical and critically ill patients is of great importance at a time of major stress with synthesis of key blood/tissue components and necessary for proper wound healing and recovery (regeneration).

We have currently two major areas of investigation:

1. **Conditioning of the heart in cardiac surgery and cardiac transplantation with the aim at reducing reperfusion injury**. While we extensively investigated the efficacy of mostly single pharmacological agents such as volatile anesthetics and other commonly used drugs in anesthesia/perioperative medicine in the past, mainly in rodent models but also clinical studies with patients, we are currently testing multi-drug conditioning therapies in a large animal (porcine) model of Cardiac Donation after Circulatory Death (DCD). The porcine DCD heart transplant model is a unique model to study cardiac resuscitation in general, but also has a great potential of expanding the donor pool for cardiac transplants by successfully resuscitating hearts after circulatory arrest. Resuscitated hearts are perfused ex vivo for hours in a more natural protective beating state as opposed to preservation with cardioplegia, and can be tested whether they are suitable for transplantation. Optimizing the treatment and prolonging the time between procurement and transplantation will greatly increase the number of suitable hearts for transplantation.

2. **Immuno-metabolism**: we are studying the potential to beneficially modulate the activity of the immune system by nutritional interventions with specific metabolic compounds such as lipid mediators (resolvins, maresins) involved in the resolution of the inflammatory state using a mouse model of total parenteral nutrition (TPN). The final goal is to understand the adverse
effects underlying TPN and to ultimately improve the immunometabolic management of critically ill patients due to sepsis and organ failure.

Collaborations are always welcome and we very much support translational research contributing to the understanding of physiological changes (e.g. genetic, metabolome- or microbiome-related) in response to anesthesia and/or to surgical stress in patients.

**Selected Recent Publications**


**Dr. Brad Kerr**

**Overview.** Research in the Kerr lab is focusing on the neuro-immune contributions to chronic pain states arising from injury or disease in the nervous system. We have a primary focus on pain in auto-immune disorders such as MS. The lab employs a variety of behavioral assays to assess pain and nociception in rodents and we also use cell and molecular techniques to understand the underlying mechanisms generating chronic pain.
The Neuroimmunology and Pain Lab is located on the 5th floor of HMRC. It’s is a shared research space with the lab of Dr. Jason Plemel (Dept. of Medicine). We currently have a collaborative project examining macrophage phenotypes after peripheral nerve injury that includes contributions from the UofA Multidisciplinary Pain Clinic and Dr. Bruce Dick (Dept. of Anesthesiology). Other collaborations involve members of the Dept. of Pharmacology (Dr. Anna Taylor and Dr. Harley Kurata) as well as a project with Drexel University (Lab of Dr. John Bethea) examining TNF, ER stress and the effects on neural plasticity.

**Funding.** The lab is currently funded by a CIHR Project Grant “Understanding the contribution of the peripheral nervous system to central neuropathic pain” and an Operating Grant from the MS Society of Canada, “Examining inflammatory processes in the DRG as a driver of neuropathic pain in MS”.

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**The Neuroimmunology and Pain Lab Summer 2021**

**Selected Recent Publications**


Endoplasmic reticulum stress in the dorsal root ganglia regulates large-conductance potassium channels and contributes to pain in a model of multiple sclerosis. FASEB 34 (9): 12577-12598


Dr. Stephane Bourque

Our research program encompasses two broad areas of cardiovascular pharmacology. The first focuses on understanding how iron deficiency in pregnancy affects growth and development of the fetus, and in turn predisposes the offspring to cardiovascular disease in later life. The second focuses on understanding the mechanisms underlying the development of vasoplegia and cardiovascular collapse in sepsis in both neonates and the elderly. Within this latter research theme, we also study the consequences of neonatal sepsis on development and subsequent cardiovascular function in adulthood.

In collaboration with the National Preclinical Sepsis Platform of Sepsis Canada, over the past year we have devoted considerable time and effort to developing a standardized rodent model of neonatal sepsis. The goal of this initiative is to establish a well-characterized animal model of neonatal sepsis in the interest of harmonizing study outcomes among research centers and performing multi-center preclinical studies across Canada. Our work on sepsis was recently funded by a project grant from the Canadian Institutes of Health Research entitled “Targeting renal vascular and mitochondrial dysfunction to prevent acute kidney injury in sepsis” (2021 – 2026).

Our research is also funded by the Kidney Foundation of Canada, the Heart and Stroke Foundation of Canada, and our students are funded by studentships from Alberta Innovates as well as the Stollery Children’s Hospital Foundation and the Alberta Women’s Health Foundation through the Women and Children’s Health Research Institute.

Select Recent Publications


Recent Trainee Awards

Si Ning Liu (summer student) was awarded (i) an NSERC undergraduate Research Award; (ii) a WCHRI Summer Studentship; and (iii) Alberta Innovates Summer Research Studentship.

Olivia Sadilek-Thring (summer student) was awarded an Alberta Innovates Summer Research Studentship.

Kimberly Tworek was awarded an Alberta Innovates Summer Research Studentship.

Dr. Forough Jahandideh (postdoctoral fellow) was awarded a Women and Children's Health Research Institute (WCHRI) Postdoctoral Fellowship.