Update from the Labs

Dr Micheal 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:

• 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.

• 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

• Novel Strategies to Prevent Total Parenteral Nutrition-Induced Gut and Liver Inflammation, and Adverse Metabolic Outcomes. Mol Nutr Food Res. 2021; 65(5):e1901270. PMID: 32359213


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. In 2018, the Neuroimmunology and Pain Lab at the University of Alberta (UofA) was opened with Dr. Jason Plemel (Dept. Medicine) and Dr. Bradley Kerr (Dept. of Anesthesiology) as co-directors. The Neuroimmunology and Pain lab is located on the 5th floor of the Heritage Medical Research Centre and it represents a hub for neuroimmunology research within the Neuroscience and Mental Health Institute (NMHI) at the UofA.

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”.

Recent Publications


Dr Stephane Bourque

Research Highlights

My research group has a longstanding interest in iron deficiency (ID) during pregnancy, and how it affects fetal and placental growth1. In addition to increasing the risk of adverse pregnancy outcomes, prenatal ID (like many prenatal insults) can predispose the offspring to a lifetime of health complications2. Though our past work in this area has been largely preclinical, our recent publications highlight a concerted effort to translate these findings to the clinical realm.

Iron deficiency (ID) is a pervasive global health issue, and represents one of the most treatable and preventable causes of daily adjusted life-years lost. Yet a worldwide prevalence of ~25%, with a sizeable majority of this burden shouldered by young women and children, underscores the challenges that impede effective treatment. Accurate assessments of maternal and fetal/neonatal iron status and hematological indices are critical for pre- and post-natal interventions to maximize health benefits and minimize adverse outcomes. Although direct sampling of fetal/neonatal blood is possible, it is rarely done. Instead, maternal haematological and iron status indices are used to guide intervention in pregnancy and the neonatal period. However, the prevailing notion that maternal iron status and
severity of anemia is a useful surrogate of fetal iron status has not been validated. In fact, our recent clinical study3 and systematic review4 challenges this assumption. A discordance between maternal and fetal indices could have implications for fetal and neonatal health, since ID in pregnancy is associated with adverse pregnancy outcomes (e.g. preterm birth, fetal growth restriction, congenital defects). Moreover, ID during gestation may deprive the neonate of critical iron stores needed for optimal growth and development in early postnatal life. Thus, there is an urgent need for better diagnostic methods to diagnose fetal/neonatal ID and anemia to guide intervention strategies during this critical period of life.


**Trainee Scholarships and Awards**

Lastly, like many laboratories across Canada and abroad, the COVID-19 pandemic has had a dramatic impact on our research progress, and has been an ongoing source of consternation for students and staff alike. Our trainees’ resilience and resolve to forge ahead in their programs of study, despite the challenges they continue to face on a daily basis, is a credit to them. Below is a list of student accomplishments in the past two months:

- Claudia Holody was awarded a Motyl Graduate Studentship in Cardiac Sciences and a WCHRI Graduate Scholarship.
- Dr. Forough Jahandideh (postdoctoral fellow) was awarded a Women and Children’s Health Research Institute (WCHRI) Postdoctoral Fellowship.
- Richard Mah was awarded an Alberta Innovates Summer Research Studentship and a WCHRI Summer Studentship.
- Mark Nie was awarded an Alberta Innovates Summer Research Studentship and an NSERC Undergraduate Student Research Award.
- Si Ning Li was awarded an Alberta Innovates Summer Research Studentship.
- Kimberly Tworek (working with Dr. Kimberly Macala) was awarded WCHRI Summer Studentship.