UNIVERSITY OF SASKATCHEWAN

Faculty Areas of Research
ACB 401.6 Honours Research Project

BIOMEDICAL IMAGING

L. Dean Chapman (dean.chapman@usask.ca): 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 that 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.

David Cooper (dml.cooper@usask.ca): 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.

CELL BIOLOGY

Helen Nichol (h.nichol@usask.ca): Our laboratory uses a novel cross-disciplinary approach to study how cells store and detoxify excess metals and metalloids with a focus on their roles in neurodegeneration. Synchrotron technologies like X-ray absorption spectroscopy (XAS) are used to localize and speciate metals in organelles, cells and even whole organisms. These experiments are conducted at the Canadian Light Source and the Stanford Synchrotron Radiation Laboratories in California. We combine XAS with molecular biology, biochemistry and genetics tools to address various questions related to metal metabolism. Our model systems range from human cells (Friedreich's ataxia) to Drosophila (Alzheimer's, Parkinson's and PKAN). The longterm goal of our research is to develop therapies that slow neurodegeneration.

Nick Ovsenek (nick.ovsenek@usask.ca)**:** 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.

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DEVELOPMENTAL BIOLOGY

Julia Boughner (julia.boughner@gmail.com)**:** 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.

Brian Eames (b.frank@usask.ca)**:** 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.

William M. Kulyk (william.kulyk@usask.ca)**:** 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 anlaysis, reverse transcriptase PCR, recombinant gene transfection, immunocytochemistry, and in situ hybridization.

NEUROBIOLOGY

Jennifer Chlan (jmc134@mail.usask.ca): 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.

Adel Mohamed (adel.mohamed@usask.ca): 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.

Bogdan Popescu (bfp180@mail.usask.ca): Research areas include brain metabolism; multiple sclerosis and other neuroimmunological diseases; pathogenesis and disease treatment.

Valerie M.K. Verge (valerie.verge@usask.ca): 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.

ASSOCIATE FACULTY MEMBERS:

Terra Arnason, Department of Medicine (terra.arnason@usask.ca): Research areas include cancer biology, cellular metabolism, diabetes, endocrinology, and yeast genetics.

Andrew Freywald, Department of Pathology & Laboratory Medicine (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.

Michael Kelly, Department of Surgery (m.kelly@usask.ca). Research areas include cardiovascular disease, stroke, and vascular tissue engineering.

Michael Levin, Department of Medicine (phone 306-655-8350): Research areas include multiple sclerosis, neuroimmunology, neurovirology, autoimmunity and RNA binding proteins.
(website: *https://research-groups.usask.ca/skms-office/ms-research-centre/research-positions.php*)

Troy Harkness, Department of Biochemistry, Microbiology and Immunology (troy.harkness@usask.ca): Research is focused on the molecular genetics regulating chromatin assembly and aging in yeast.

IMPORTANT NOTE:
The Department of Anatomy & Cell Biology recently merged with the Department of Physiology and the Department of Pharmacology, forming the new *Department of Anatomy, Physiology and Pharmacology*.

Due to this merger, any full-time faculty member in the former Department of Physiology or the former Department of Pharmacology is also potentially qualified to supervise an ACB BSc program student in an ACB 401.6 Undergraduate Research Project. The names of these faculty members are currently listed on the following sites:
https://medicine.usask.ca/profiles/physiology/index.php