

IBEHS Thesis Page - Comprehensive Project Summaries

2021-2022

<p>Computational neuroscience Supervisor: Dr. Suzanna Becker</p> <p>This project explored the computational modeling of brain circuits and computational neuroscience as part of the research performed at McMaster's Neurotechnology and Neuroplasticity lab.</p>	<p>Identifying barriers for community services in vulnerable Families Supervisor: Dr. Andrea Gonzalez</p> <p>This student assisted with a research project involving understanding the barriers to engagement at an individual family level by performing field research.</p>	<p>Impact and revenue generation for sustainability Supervisor: Sarrah Lal</p> <p>This thesis involved literature reviews, meetings with professionals, and using the help of advisors to create a plan for novel revenue generation and commercialization strategies for Education Technology products.</p>
<p>Evaluating and addressing patient no-shows through a biomedical engineering lens Supervisor: Dr. Greg Curnew</p> <p>The goal of this project was to create a solution to improve the quality of care for patients at a clinic through the development of an app and leading patient-centred workshops.</p>	<p>Use of machine learning for Emergency Department workload prediction Supervisor: Dr. Quynh Doan</p> <p>This project involved the theoretical design of workload intensity predictive model to predict emergency department workload and evaluate the market demand and future prospects of the model.</p>	<p>Clinical tools to enhance diagnoses of osteoporosis and fracture risk Supervisor: Dr. Cheryl Quenneville</p> <p>For this project, a prototype program was developed to analyze osteoporosis data through machine learning techniques to improve healthcare.</p>
<p>Optimization of biofilm cell reactor Supervisor: Dr. Zeinab Hosseinidoust</p> <p>This student optimized flow cell bioreactors to develop consistent and reliable biofilm formations to develop novel cell therapies.</p>	<p>The regulation of O-GlcNAc modification in YAP/TAZ mechanotransduction Supervisor: Dr. Fei Geng</p> <p>The project aims to characterize the mechanism underlying the regulation of O-GlcNAc modification in YAP/TAZ mechanotransduction in metastatic breast cancer cells.</p>	<p>Change initiatives in healthcare: towards an integrated decision-making framework Supervisor: Sarrah Lal</p> <p>This project investigated existing healthcare decision-making frameworks to identify common and divergent practices and develop a new decision-making tool to assist with streamlining of clinical initiatives to achieve the Quadruple Aim.</p>
<p>Developing an electrochemical biosensor Supervisor: Dr. Leyla Soleymani</p> <p>The objective of this project was to develop an electrical biosensor for analyzing cancer biomarkers through the design of a miniaturized electrochemical cell.</p>	<p>Fluorescence-based detection of cytokines using lubricant-infused surface technology Supervisor: Dr. Tohid Didar</p> <p>This project's goal was to optimize antibody and cytokine detection methods, such as fluorescence-based ELISA assay, for the detection of cytokines at very low levels.</p>	<p>Proteomic analysis of sera and nasal swab samples from COVID-19 patients Supervisor: Dr. Fei Geng</p> <p>The project aims to design and implement the proteomic and interactomic profiling of biomarkers in sera and nasal swab samples from COVID-19 patients using mass spectrometry.</p>
<p>Cost-benefit evaluation tools to support the adoption of new health technologies Supervisor: Sarrah Lal</p> <p>This thesis aims to develop a platform/tool that evaluates technologies from start-up companies against the Quadruple Aim, strategic priorities, and other important metrics.</p>	<p>Gamification of a business learning module Supervisor: Dr. Kenneth Owen</p> <p>This student explored the potential use and effectiveness of a game to deliver knowledge in the field of business through research, prototype building and testing, as well as market-related analysis.</p>	<p>Learning-based approach to genomic and metabolic analysis for biosynthesis navigation Supervisor: Dr. Nathan Magarvey</p> <p>Use deep learning (DL) and reinforcement learning (RL) techniques in combination with bioinformatics, metabolomics and genomics to elucidate and learn biologically relevant and active biosynthesis pathways.</p>

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<p>Systematic review of non-pharmacological modalities for postoperative pain management in women having elective Cesarean section Supervisor: Dr. Harsha Shanthanna</p> <p>This thesis was a systematic review of non-pharmacological modalities and their contribution to postoperative pain management in women having C-sections to evaluate non-pharmacological techniques/modalities.</p>	<p>The Innovators Compass: Guiding entrepreneurs through Canada's complex healthcare ecosystem Supervisor: Dr. Kenneth Owen</p> <p>The aim of this project was to build on existing research to facilitate the adoption of new impactful technologies in healthcare settings.</p>	<p>A systematic review of availability of neonatal pharmacokinetic and pharmacodynamic information for ionotropic drugs in neonates Supervisor: Dr. Samira Samiee-Zafarghandy</p> <p>This project involved completing a systematic review investigating the availability of pharmacokinetic and pharmacodynamic information for ionotropic drugs in preterm and term neonates by looking at 5 drugs.</p>
<p>How screentime affects sleep in children Supervisor: Dr. Alex Drossos</p> <p>Studies have found that heavy screen use can impact sleep quality. This thesis explored the relationship between screen time and sleep hygiene and was applied to policy recommendations in this thesis.</p>	<p>Validation of new software tool for surgical planning and 3D printing implantable devices Supervisor: Dr. Greg Wohl</p> <p>The proposed project is to test the software by running validation steps to quantify the precision of the rendering of a 3D printed object and to test the sensitivity of the software processing to different imaging settings to improve its robustness.</p>	<p>EEG and EMG for biofeedback in controls and neurological conditions Supervisor: Dr. Aimee Nelson</p> <p>This project involved recording and processing biological signals related to brain and muscle activity. Machine learning and statistical analysis was used to model and represent the data.</p>
<p>Assessing physical activity levels in gait patterns through wearable accelerometers Supervisor: Dr. Dylan Kobsar</p> <p>This student explored novel methods to acquire physical activity levels and built foundations to measure physical activity levels in osteoarthritis patients with wearable devices.</p>	<p>Quantification of bone changes in joints of genetic mouse model of osteoarthritis Supervisor: Dr. Greg Wohl</p> <p>The purpose of this project is to assess the changes in bone shape and structure in the joints of hind limbs in a genetic knockout mouse model that develops osteoarthritis. 3D analysis to quantify bones changes was also explored.</p>	<p>Biosynthesis of nanoparticles and application in nanomedicine Supervisor: Dr. Faiez Alani</p> <p>This project examined and evaluated nanoparticles as a novel method to solve problems in nanomedicine such as drug delivery, cancer therapies, and tissue engineering.</p>
<p>Optimization of bioink formulations for lung tissue biomimetics Supervisor: Dr. Jeremy Hirota</p> <p>This project involved research and experiments to develop an elastic and compliant bioink that recapitulates the mechanical properties of the lung to facilitate lung survival and growth.</p>	<p>Sacrificial molding: A novel technique for the microfabrication of 3D channel networks Supervisor: Dr. Ravi Selvaganapathy</p> <p>The purpose of this project was to fabricate an expandable catheter for neonatal applications using microfabrication techniques.</p>	<p>Smart dietary tracking for GI diseases, diagnoses, and management Supervisor: Dr. Qiyin Fang</p> <p>This project aims to refine the scope of DiTrack solution by refining its business model, target population etc. and build a backend database to assist in clinically relevant dietary information collection about the patients.</p>
Naturopathic medicine extended	Designing for clinician and patient	Developing an electrochemical

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<p>care application Supervisor: Sarrah Lal</p> <p>This project focused on developing a method to track a patient's adherence to instructions given after appointments. The goal is to sell this portal to every naturopathic doctor to help improve their patient's outcomes.</p>	<p>experiences within developmental pediatric clinics Supervisor: Dr. Sean Park</p> <p>This student reviewed a scope of issues that might be seen in a developmental behavioural pediatrician clinic. They then presented their findings and solutions to these problems on a large scale.</p>	<p>biosensor for cancer biomarker detection Supervisor: Dr. Leyla Soleymani</p> <p>The objective of this project was to develop an electrical biosensor for detecting a multiplex of prostate cancer biomarkers directly in body fluids.</p>
<p>Assessing how cell media respond to electrical currents for experiments of cell stimulation Supervisor: Dr. Greg Wohl</p> <p>The purpose of this project is to perform experiments to evaluate how cell medium responds to electrical current as part of a larger goal of exploring the effects of electrical stimulation on bone adaptation.</p>	<p>The use of biomedical technologies to aid and monitor the elderly population in North America Supervisor: Dr. Julija Kelecevic</p> <p>The goal of this thesis project is to conduct a scoping review on the use of biomedical technologies to aid and monitor the elderly population in North America.</p>	<p>Understanding barriers for public transport utilization among the visually impaired Supervisor: Dr. Kenneth Owen</p> <p>For this project, the student explored existing barriers to accessible public transportation for the visually impaired, conducted market research into existing interventions, and researched usability, consumer attitudes and strategies for successful interventions</p>
<p>Assesment of health related quality of life in patients undergoing GI cancer surgery Supervisor: Dr. Pablo Serrano Aybar</p> <p>The purpose of this study is to shed some light on the poorly studied area of post-surgical quality of life (QoL) outcomes by prospectively analyzing health-related QoL in patients undergoing GI surgery for cancer at baseline, 1, and 3 months post-operatively through widely used questionnaires.</p>	<p>Stable Kaiso overexpression impacts in colorectal cancer cells using CRISPR/Cas9 Supervisor: Dr. Juliet Daniel</p> <p>This project will investigate how CRISPR/Cas9 can be applied in a lab to develop cancer cells that can stably overexpress the transcription factor Kaiso without inducing cell death, potentially creating the first model of its kind in the context of Kaiso. This would open many doors for further research in this lab.</p>	<p>Investigating AAV9-MANF as a protective factor against the amphetamine model of MANF Supervisor: Dr. Ram Mishra</p> <p>This project will determine if increasing MANF expression in the brain through either gene or protein therapy will provide neuroprotection and/or neurorestoration against amphetamine-induced behavioural abnormalities and neuronal ER stress.</p>
<p>High tibial osteotomy motion capture study Supervisor: Dr. Kim Madden</p> <p>This study involved comparing 3D kinematic gait data for patients before and after high tibial osteotomy. Motion capture data from patients was used and compared to subjective patient-reported outcome measures.</p>	<p>Assessing the spread and burden of wound infections in a single burn unit Supervisor: Dr. Christopher Coroneos</p> <p>This thesis project focused on learning how to extract and collate patient-specific data, including demographics, infection (e.g. sputum, blood, urine), reintervention, length of stay, mortality, costs.</p>	<p>YAP mechanotransduction in breast cancer metastasis Supervisor: Dr. Fei Geng</p> <p>The project aims to investigate the molecular and cellular mechanism (YAP and beta-catenin pathways) of cancer mechanotransduction using a set of immunological, biochemical, proteomic and interactomic approaches.</p>

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<p>The Cancer Risk from Deep Learning Study (CANDLE) Supervisor: Dr. Robert Grant</p> <p>The purpose of this study is to determine whether we can use administrative data to develop a risk prediction model for cancer. The objectives involve the creation of a model to predict the risk of cancer, with an aim to improve clinician decision making and increase subsequent efficacy for all patients.</p>	<p>Silence and genetics: intergenerational transmission of trauma among McMaster students Supervisor: Dr. Aytak Akbari-Dibavar</p> <p>This project aims to provide an opportunity for the student to engage in comprehensive research on the impact of political trauma intergenerationally in Palestinian and Kashmiri students</p>	<p>Anaphylaxis: a retrospective analysis of emergency room visits Supervisor: Dr.Derek Chu</p> <p>This student investigated anaphylaxis and reviewed its definition, epidemiology, etiology, prognosis, differential diagnoses, complications, and treatments through a retrospective observational study.</p>
<p>3D printable dialysis membranes Supervisor: Dr.Ravi Selvaganapathy</p> <p>This thesis project exposed the student to the field of 3D printing and fabrication of membranes. The focus was on dialysis devices.</p>	<p>How ankle posture affects injury risk in frontal car crashes Supervisor: Dr. Cheryl Quenneville</p> <p>The goal of this research is to determine if more comprehensive injury criteria are needed to better assess safety of the ankle region during car crashes.</p>	<p>Pattern of approach to treatment of a hemodynamically significant patent ductus arteriosus (hsPDA) Supervisor: Dr. Samira Samiee-Zafarghandy</p> <p>This project involves conducting a retrospective study on the efficacy of high vs. low dosing of ibuprofen in neonates with hsPDA.</p>
<p>Investigating the immune environment of helminth infected mouse intestines through mucosal immune response Supervisor: Dr. Joshua Koenig</p> <p>This project involved using laboratory and imaging techniques such as Swiss rolling, cryosectioning, antibody staining, confocal microscopy and post-acquisition analysis to study helminth-infected mouse intestines.</p>	<p>Electrochemical sensing of substance P in saliva Supervisor: Dr. Matiar Howlader</p> <p>In this research project, the student will develop electrochemical sensor to measure substance P levels in the saliva of healthy volunteers and chronic pain sufferers.</p>	<p>Automation of muscle fibre typing and size estimates using machine learning Supervisor: Dr. Stuart Phillips</p> <p>This project will be to operationalize and establish the Myovision software and test it on a large sample of histological sections from older persons who have undergone resistance training.</p>
<p>Development of an AI based OSPE App Supervisor: Dr. Bruce Wainman</p> <p>This project aims to develop an application that allows students to engage in virtual OSPE practice sessions, with AI responsible for evaluating their performance.</p>	<p>Development of real time food monitoring sensors using DNA-zyme based sensors Supervisor: Dr. Tohid Didar</p> <p>This project aims to develop an on-site, colourimetric sensor for the detection of E. coli contamination in water.</p>	<p>The effects of Staphylococcus aureus on Pseudomonas aeruginosa biofilms in patients with cystic fibrosis Supervisor: Dr. Valerie Waters</p> <p>This project aims to examine the role of Pseudomonas aeruginosa and Staphylococcus aureus co-infection by investigating the effect of Psl-SpA interaction on antimicrobial resistance in chronic PA infections.</p>

<p>Quantification of bone changes in joints of genetic mouse model of osteoarthritis Supervisor: Dr. Greg Wohl</p> <p>The purpose of this project is to assess the changes in bone shape and structure in the joints of hind limbs in a genetic knockout mouse model that develops osteoarthritis. 3D analysis to quantify bones changes was also explored.</p>	<p>A comprehensive approach to Odontogenic Keratocyst (OKC) management Supervisor: Dr. Balraj Kang</p> <p>This thesis project followed the recovery of an OKC patient in a case report that was planned to be published in the Journal of Maxillofacial and Oral Surgery to serve as a reference for other oral & maxillofacial surgeons.</p>	<p>Human AI-partnership for medical application Supervisor: Dr. Thomas E. Doyle</p> <p>This project is focused on research ideation and early hypothesis modelling in the area of human-AI partnership for medical application.</p>
<p>A study of how the ecology of relationship, connection and intimacy affects health Supervisor: Dr. Adrienne Xavier</p> <p>This student explored land-based skills, activities, and learning as valuable ways to engage in community and build meaningful and grounded interactions.</p>	<p>Expansion microscopy methods applied to 3D printed hydrogels Supervisor: Dr. Jose Moran Mirabel</p> <p>This project explored the use of expansion microscopy techniques in 3D bioprinted constructs to optimize and establish a protocol that effectively expands the polymers.</p>	<p>3D X-ray tomography characterization of biomineralizing tissues in health and disease Supervisor: Dr. Tengten Tang</p> <p>The purpose of this project was to understand advanced tools and methods used in skeletal research, particularly with regards to X-ray imaging and bone morphometry assessments.</p>
<p>Mobile applications for biosensing data acquisition Supervisor: Dr. Leyla Soleymani</p> <p>In this project, the student will be developing a mobile app for wearable biosensors. The student will also design embedded systems solutions to integrate bioassays into a wearable/portable format.</p>	<p>Mucoadhesive degradable microgels for ophthalmic drug delivery Supervisor: Dr. Todd Hoare</p> <p>This project involved the synthesis and characterization of phenylboronic acid (PBA) functionalized self-assembled poly(oligoethylene glycol methacrylate) (POEGMA) nanoparticles.</p>	<p>3D vascularized placental barrier model from human blastocyst-derived stem cells Supervisor: Dr. Boyang Zhang</p> <p>The purpose of this project was to gain insight as to what antibody types and concentrations in maternal blood are optimal to achieve immune transfer in newborn babies, thus informing developmental studies of prenatal vaccines.</p>
<p>The SEAL study: Size and Effect of Anatomical Learning in VR Supervisor: Dr. Bruce Wainman</p> <p>This thesis project aimed to better understand the influence of model size on short-term recall (as a proxy for learning) of anatomical landmarks to inform the development of learning adjuncts in the anatomy lab.</p>		