Congratulations
Health and Bio Research
Grant Recipients

Every year, the Children’s Hospital Colorado (CHCO) and Colorado School of Mines (Mines) collaborate to award grants for research that is health and bio related. This year’s winners are Cecilia Diniz Behn (Mines) and Kristen Nadeau (CHCO) for “Innovating Methods to Assess Tissue-Specific Insulin Sensitivity in Type 1 Diabetes” and Judith Klein (Mines), Andrea Bischoff (CHCO) and Steven Moulton (CHCO), for their project entitled “Enema Device for Children with Spina Bifida”. Read more about these two exciting joint Mines and Children’s Hospital Colorado research projects in this week’s issue.
2020 Research Grant Projects
In Collaboration with Colorado School of Mines & Children’s Hospital Colorado

Enema Device for Children with Spina Bifida

Spina bifida is a birth defect of the neural tube that hampers the development of the brain and spinal cord, resulting in several malformations including abnormal growth and spinal column deformations, paraplegia, and bowel and bladder problems. The incidence of spina bifida in the United States is estimated at 1-2 cases per 1000 population. Most of these patients suffer from a neurogenic bowel and bladder. Patients with a neurogenic bowel require a daily enema to evacuate stool, so that the patient remains clean during the day. Patients with a neurogenic bladder require bladder catheterization several times per day, with or without medication and bladder augmentation, to stay dry for urine. Social continence is an important factor that can significantly impact the quality of life for these patients. Initiated and advised by Mines alum, Damian Friend, the goal of this project is to improve the quality of life for children and adults with fecal incontinence by developing an enema administration device that improves upon current methods. 2019-20 academic year. A first prototype of the device was developed by the CO-Pls (Bischoff and Moulton (CHCO) and Klein (Mines) and five Mines students (Rachel McManus, Ryan Croghan, Mary King, Gabriel Muehlbauer, James McNamara) in a Capstone Design @ Mines project advised by Donna Bodeau. Design@Mines (https://capstone.mines.edu/showcase/) students spend their senior year working with clients on projects in mechanical, electrical, civil, and environmental engineering disciplines. Project funds will be used to finalize design and material selection, resulting in a truly functional prototype. A torso model will be used to test and optimize the prototype device. Then, we will produce devices for clinical testing. Patients who are eligible for the study will be enrolled at Children’s Hospital Colorado and the devices will be used at home. The results of the clinical trial will be collated and presented at a major pediatric surgery conference.

Innovating Methods to Assess Tissue-Specific Insulin Sensitivity in Type 1 Diabetes

Dr. Kristen Nadeau (CHCO) and Dr. Cecilia Diniz Behn (Mines) were awarded a Children’s Hospital/Mines Collaboration grant to develop novel methods to quantify whole-body and adipose insulin resistance (IR) in youth with type 1 diabetes (T1D). Increasing evidence implicates IR in the pathophysiology of other conditions including cardiovascular disease and diabetic kidney disease in T1D, but the absence of endogenous insulin secretion in these patients negates most common methods of assessing IR. Furthermore, IR in T1D presents in a different phenotype compared to type 2 diabetes, requiring a better understanding of the mechanisms of IR in T1D in order to treat it. Nadeau and Diniz Behn will develop a validated mathematical modeling-based approach that estimates whole-body and adipose IR in T1D using glucose, insulin, and free fatty acid concentration data collected before and after an oral glucose load. In addition to providing reliable quantification of IR in T1D, this physiologic methodology will enable assessment of new therapeutics that involve stimulation of the gut-pancreas axis.

Newsletter Issue 2, May 4, 2020
Call for Action in Response to COVID-19

In response to COVID-19, Mines has moved to a fully online learning model. But what about research? Is Colorado School of Mines doing anything to flatten the curve? Yes! A number of projects are currently ongoing. Here are two example projects. For more details on these and additional projects, and for a resource on COVID-19, please visit our webpage at: https://catalyst.mines.edu/call-for-action-covid-19/

PROJECT 3: AI FOR DRUG AND TARGET DISCOVERY AND DIAGNOSTICS DEVELOPMENT

Machine learning (ML) and simulations are integral tools for AI. Large amounts of clinical, epidemiological, sequence and molecular data has been collected as evidenced by more than 1000 scientific articles relating to the novel coronavirus and a number of dedicated databases and websites disseminating these large data. We will leverage ML and simulations for drug and biomarker discovery for treatment and diagnostics in a collaboration with specialists in computational biology of host-pathogen interaction networks.

PROJECT 4: AI FOR HOSPITAL CLINICAL OPERATIONS

As hospitals assess their clinical operations and readiness both now and for the duration of the pandemic, operations research tools are needed to help them ensure that their facilities have the necessary expertise, equipment, and personnel in place to provide optimal care while also protecting their staff. Prior to the coronavirus pandemic, there was already a strain on scarce nursing resources, and while we’ve seen nurses and other medical personnel selflessly and courageously jumping into the fray to help areas of greatest need, we are reminded that this will be a marathon and not a sprint. Until adequate PPE supplies exist, we can reasonably expect our providers to become ill and exit the workforce at an accelerated rate. As of last week, 2,629 Italian health care workers (8.3% of overall cases) had experienced a COVID-19 infection, with infections attributed to inadequate equipment and asymptomatic exposures. Thus, hospitals are assessing how to manage their resources for the whole curve, not just for the immediate influx, but for the duration. We are working with emergency departments (ED) in Chicago and NYC to help them appropriately allocate resources across short and longer term horizons. The proposed technology develops a new predictive analytics engine grounded in optimization modeling for emergency department use under short-term and medium term covid conditions. A simulation component will be introduced to allow ED leaders to consider and compare operational strategies generated via a predictive analytics engine grounded in optimization modeling. Seeking: operations research expertise, python, statistics,
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If you have any comments, suggestions or question, or would like your bio and/or health related
project featured on the catalyst HTI website and/or in the newsletter, of if you have any news of
relevance to bio and health, please contact judithklein@mines.edu