

Fall 2020 Grant Awards ^[1]

Fall 2020 AB Nexus Grant Awards

New Collaboration (\$50,000)

Control-theoretic design of data-driven policies for containing transmission of infectious diseases

Andrea Buchwald (CU Anschutz; CSPH, Innovative Design and Analysis)

Emiliano Dall'Anese (CU Boulder; Electrical, Computer, and Energy Engineering)

The goal of this project is to develop a unified framework that explains the spread of a pandemic based on the mobility patterns between regions, states, or countries, and leverages control-theoretic tools to develop coordinated regional interventions to limit or prevent future outbreaks. The project will first investigate a networked SEIR model that can effectively capture mobility patterns between connected communities; based on this new model, the project will then leverage the latest advances in data-driven control and online optimization to design adaptive control policies that incorporate societal objectives while ensuring that infection spread can be contained.

Identification of an embryonic cell-intrinsic cancer checkpoint: studying differential transcriptional effects of the proto-oncogene MLL1 versus MLL-ENL in an embryonic system

Patricia Ernst (CU Anschutz; Pediatrics, Pharmacology, Hematology/Oncology)

Mary Allen (CU Boulder; BioFrontiers)

This collaborative proposal will identify a barrier to neoplastic transformation that prevents leukemia in embryonic blood-forming tissues. Understanding this developmental barrier will provide insights into treating leukemia in children versus adults.

Next-Generation Imaging Biomarkers for Rheumatoid Arthritis

Larry Moreland (CU Anschutz; Medicine, Rheumatology)

Corey Neu (CU Boulder; Mechanical Engineering)

This project aims to establish a method for in vivo, functional assessment of cartilage in rheumatoid arthritis, and support a new paradigm targeting cartilage biomechanics and structure as specific indicators of joint damage and repair. This work will provide research communities with: (1) a clinical tool to functionally study emerging and already available biological therapies for inflammatory diseases of the joint, and that predict treatment response, (2) new imaging biomarkers to evaluate the efficacy of repair in animal and human trials in vivo, and (3) foundational data for structure-function relationships in healthy and

diseased cartilage.

Patient-specific On-demand Pre-surgical Planning Models via 3D Printing

Nicholas Jacobson (CU Anschutz; Engineering, Design, and Computation/Inworks)
Robert MacCurdy (CU Boulder; Mechanical Engineering)

The goal of this project is to advance autonomous fabrication and generative design to enable personalized medicine via 3D-printed pre-surgical planning models. These models will provide surgeons with mechanically-realistic patient-specific visualization and interaction templates, enabling superior outcomes.

Stroke Risk Assessment for Improved Left Ventricle Assist Device Therapy in Heart Failure Patients

Jay Pal (CU Anschutz; Surgery, Cardiothoracic)
Debanjan Mukherjee (CU Boulder; Mechanical Engineering)

Stroke remains the most dreaded complication of Left Ventricle Assist Device (LVAD) therapy, with cases reported in 11-47% of patients receiving an LVAD for heart failure. This new collaboration will enable pre-surgery investigations on factors that determine post-surgery stroke in LVAD patients, thereby significantly improving LVAD surgical planning, reducing stroke risks, and benefitting patient health and treatment outcomes.

Existing Collaboration (\$125,000)

Associative Threat Learning: Measuring Mechanisms for Treating Threat-based Psychopathologies

Joel Stoddard (CU Anschutz; Psychiatry)
Matt Jones (CU Boulder; Psychology)

Exposure therapy is an effective intervention for anxiety and threat-based psychological disorders. This project combines behavioral experiments, neuroimaging, and computational modeling to study how exposure therapy works and how it might be improved or personalized.

Biophysical Cues Governing Growth Plate Organization: A Computational & Experimental Approach

Karin Payne (CU Anschutz; Medicine, Orthopedics)
Stephanie Bryant (CU Boulder; Chemical and Biological Engineering)

This project will develop the first growth plate organoid with the ability to recapitulate the columnar organization of cells, a key structural determinant that is required for normal growth in children. This organoid will allow for deeper study of bone growth and genetic diseases affecting growth plate development, and will have regenerative medicine relevance in children with growth plate injuries and growth disorders.

Novel Extracellular Vesicle-Based Nanoparticles for Drug Delivery

Dmitri Simberg (CU Anschutz; Pharmaceutical Sciences)

Jingshi Shen (CU Boulder; Molecular, Cellular, Developmental Biology)

This collaborative project focuses on mechanistic understanding of extracellular vesicle (EV) release and development of indocarbocyanine lipid-loaded EVs as drug delivery systems. If successful, this work will improve specificity and efficacy of EVs for treatment of various diseases including cancer.

Groups audience:

AB Nexus

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