FIRH
Firestone Institute for Respiratory Health

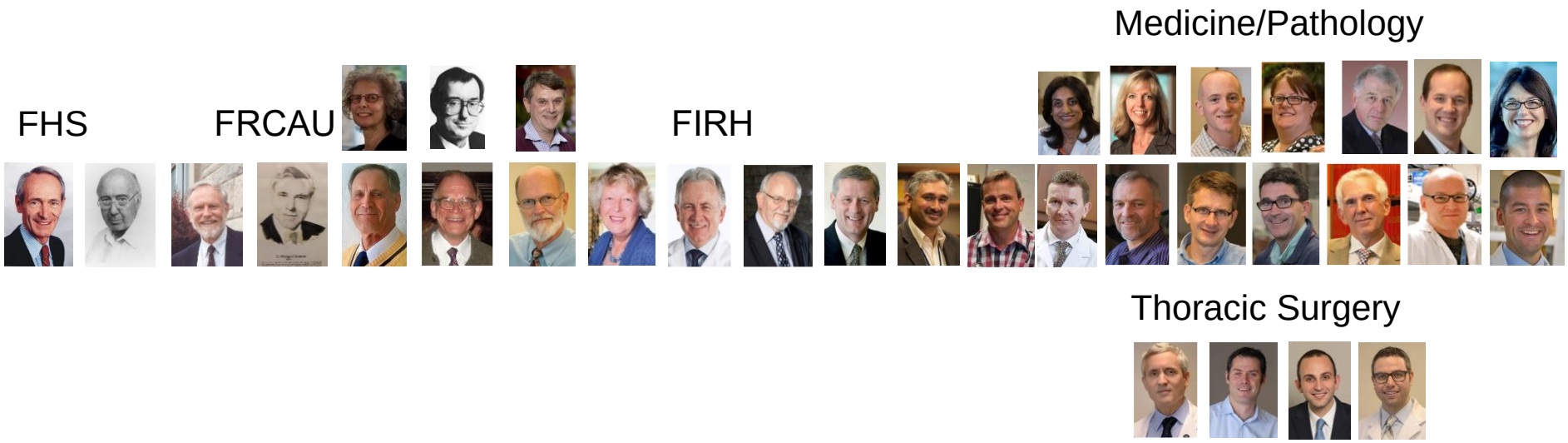
McMaster University

Making Interdisciplinary Research a Reality at the Firestone Institute for Respiratory Health

September 28, 2020

Jeremy Hirota PhD
Canada Research Chair in Respiratory Mucosal Immunology
Assistant Professor of Medicine and Biomedical Engineering – McMaster University
Affiliate Professor of Medicine – University of British Columbia
Adjunct Professor of Biology – University of Waterloo
CEO and Co-Founder - Infinotype
@jeremyhirota
hirotaja@mcmaster.ca

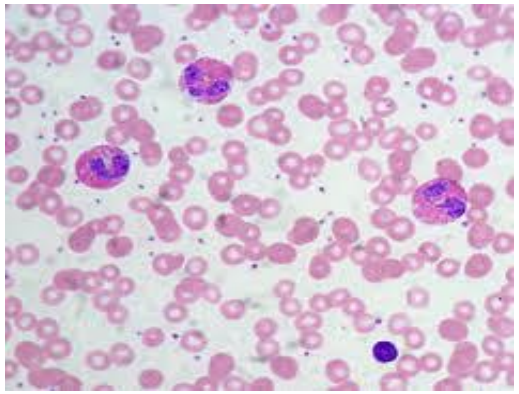
History of the Firestone Institute for Respiratory Health



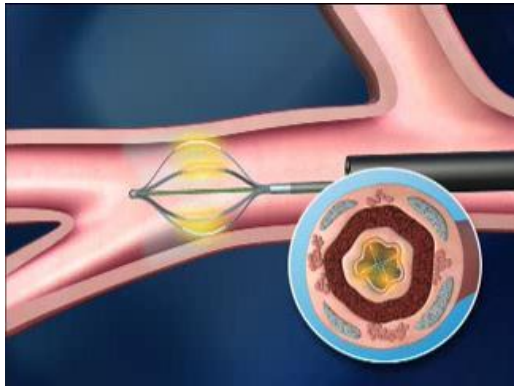
Inman

Firestone Institute for Respiratory Heath
Interdisciplinary Market Innovations










What will fuel the next generation of innovations?

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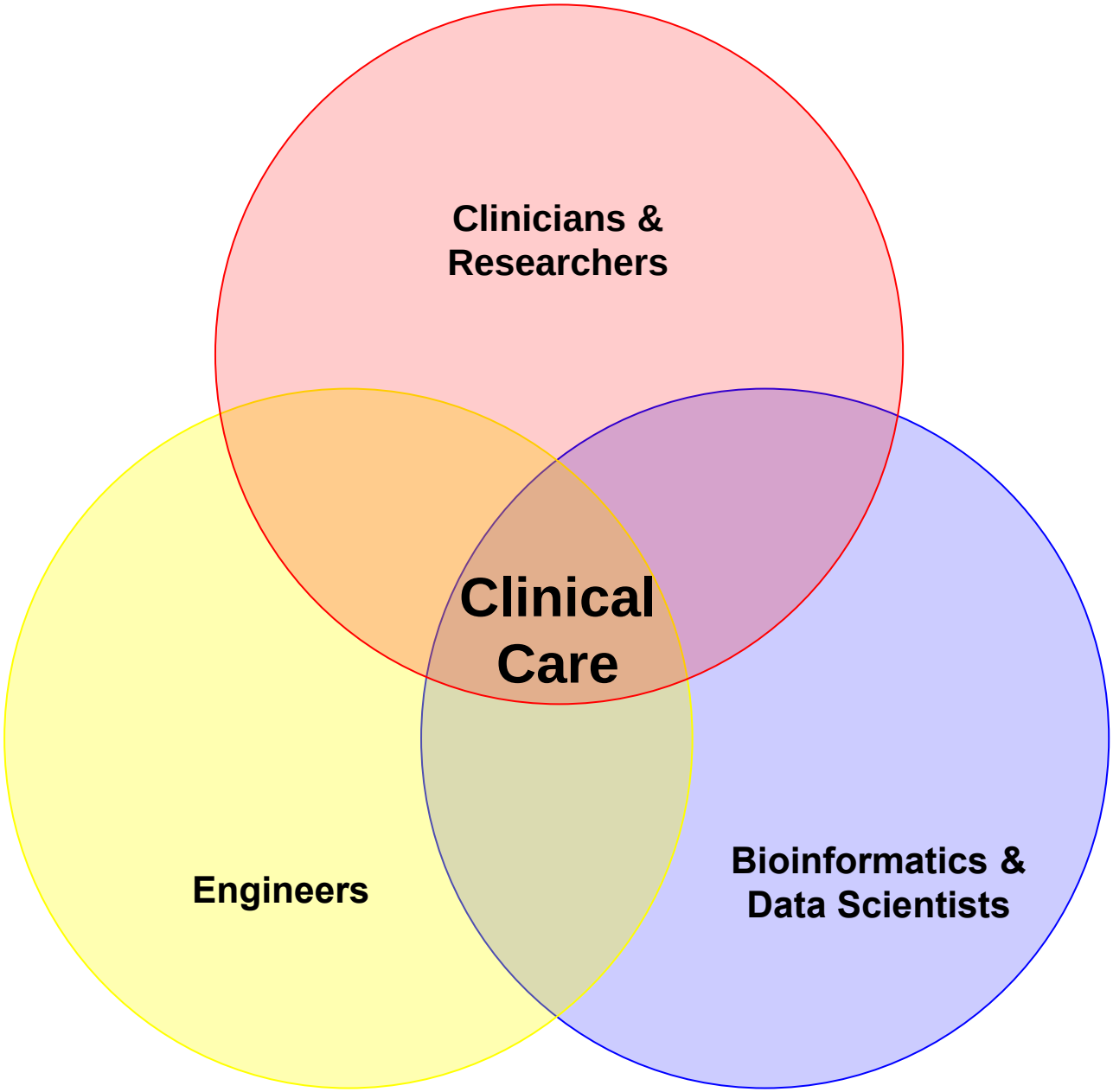


Integration with a new generation of engineers: Creating solutions for clinical and research problems

Engineers

3D printing

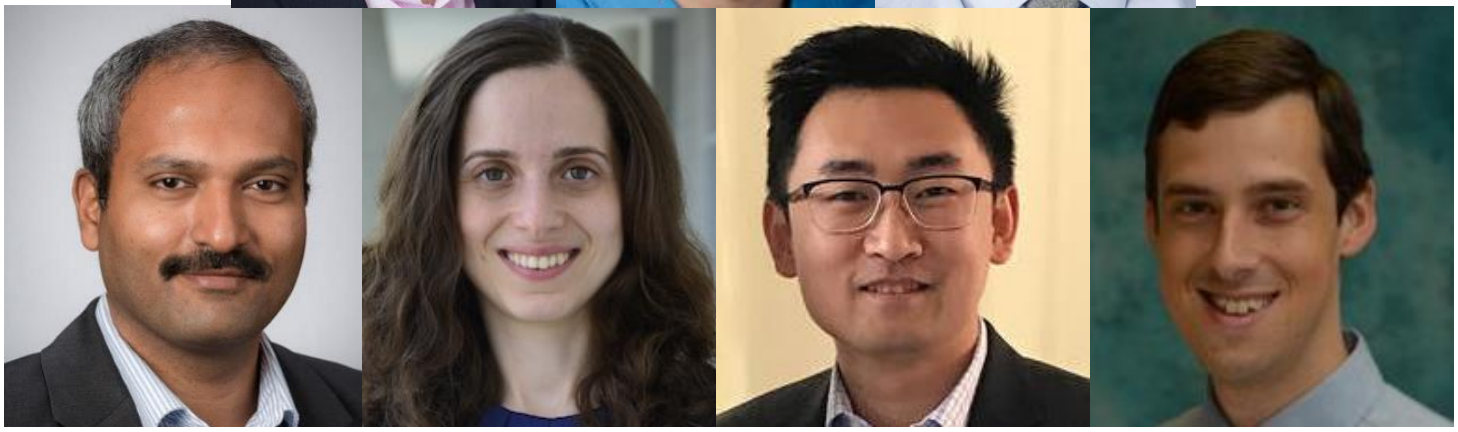
Remote Sensors

Drug Delivery

Microfluidics

Materials Engineering

Biosensors



Imaging

Regenerative Medicine

Point of Care Diagnostics

Tissue Engineering

Smart Materials

Engineers

Integration with a new generation of engineers: Creating solutions for clinical and research problems

Ravi Selvaganapathy
Mechanical Engineering

Microfluidics
Biosensors

Leyla Soleymani
Engineering Physics

Point of Care
Diagnostics

Boyang Zhang
Chemical Engineering

Organ-on-Chip
Tissue Engineering
Regenerative Medicine

Todd Hoare
Chemical Engineering

Hydrogels
Smart Materials

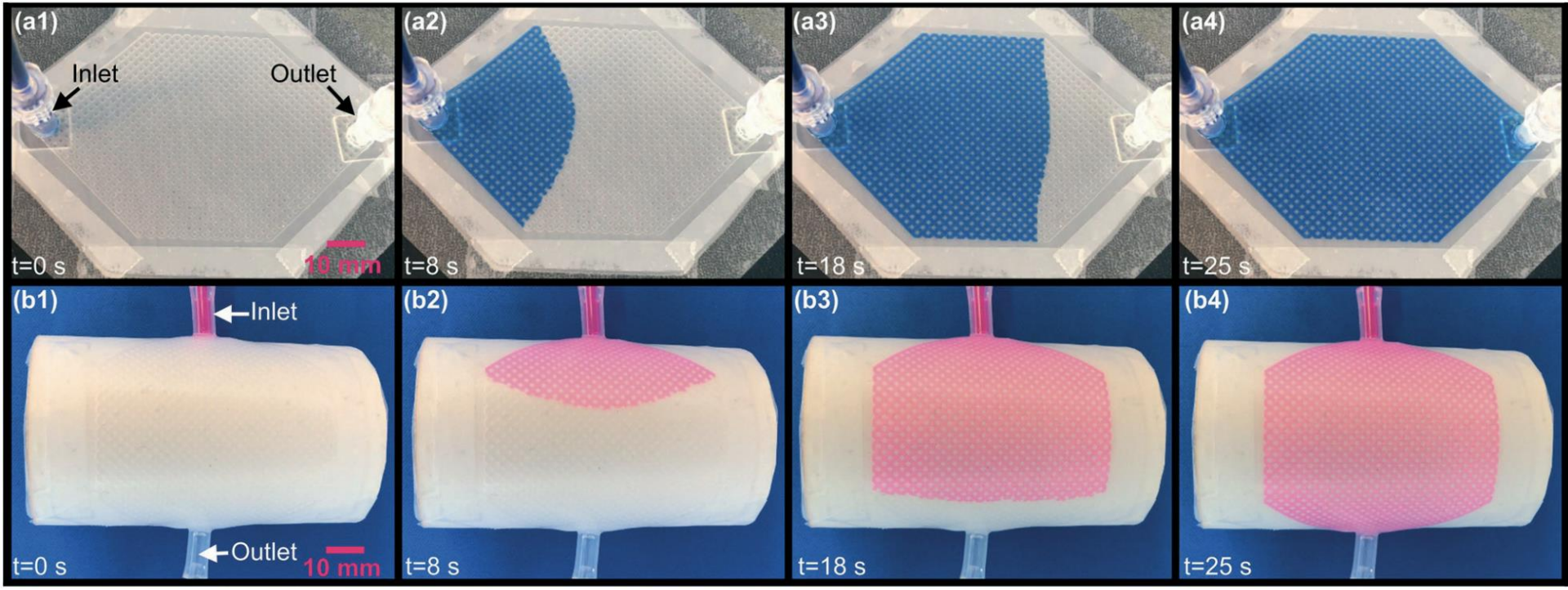
Engineers

Dr. Ravi Selvaganapathy – McMaster

Artificial Placenta

Problem: Preterm neonates with immature lungs require a lung assist device to maintain oxygen saturation at normal levels, while also having low blood volumes.

Solution: An ultra-thin, flexible, two-sided, low volume, blood oxygenator that increases oxygen saturation by greater than 30% relative to existing commercial products



Engineers

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Dr. Leyla Solyemani – McMaster
Engineering Physics

Goal

Point of care analyte detection using disposable diagnostic chips

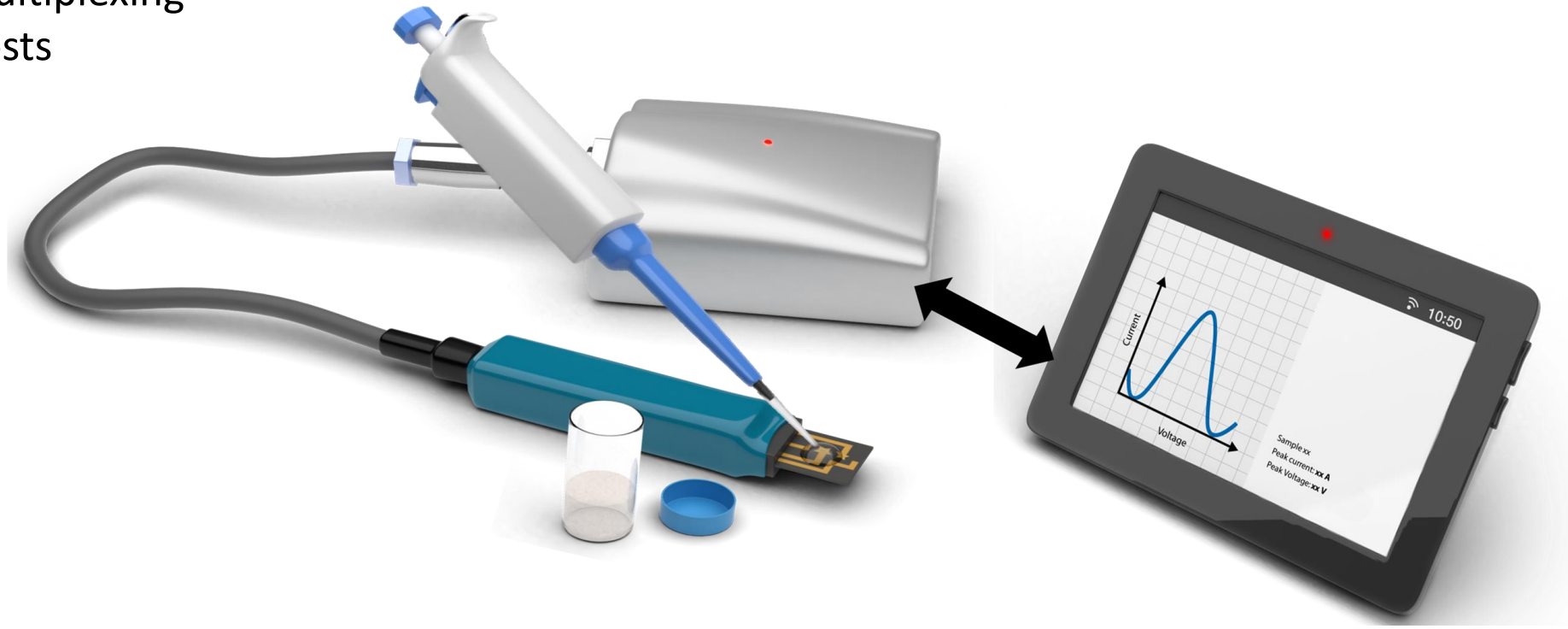
Problems being solved

Integrated sample preparation

Enhanced sensitivity

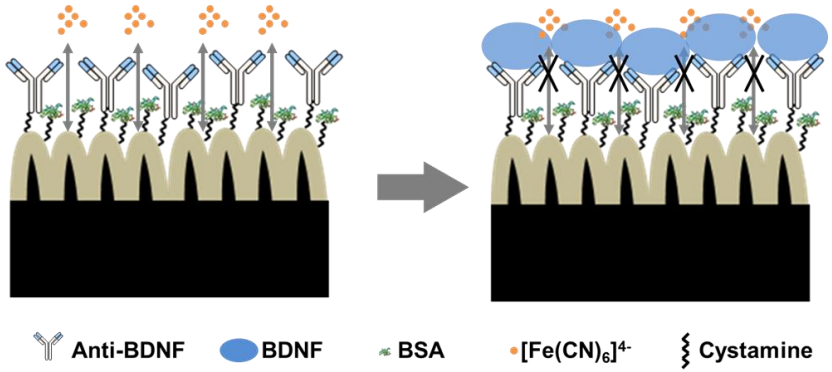
Multiplexing

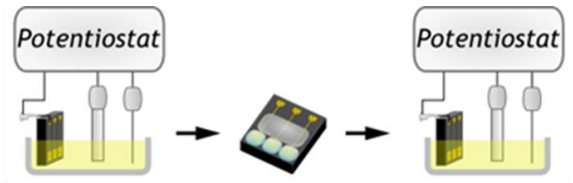
Costs

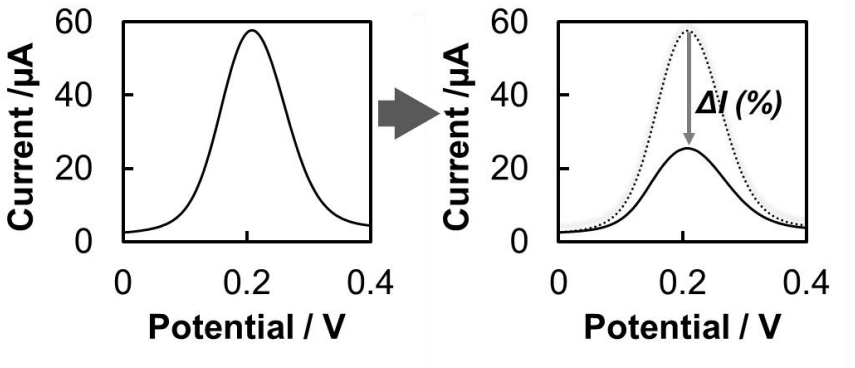


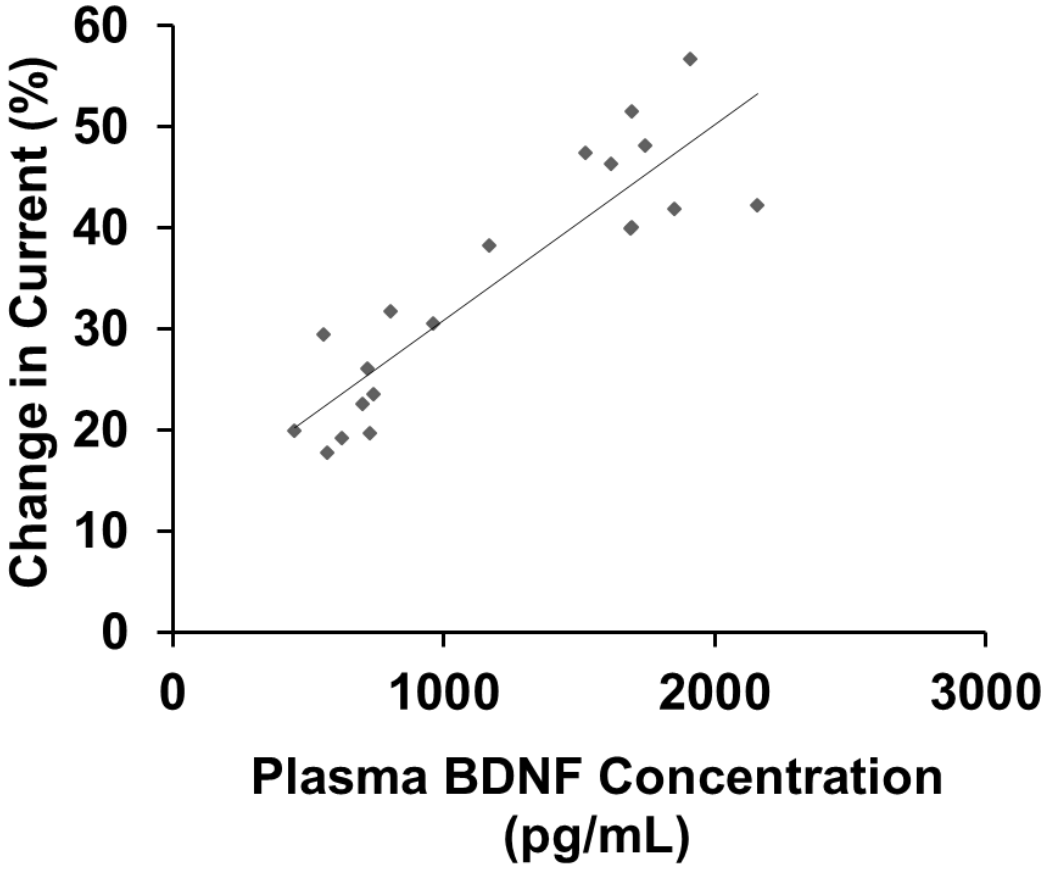
Engineers

Dr. Leyla Solyemani – McMaster
Engineering Physics









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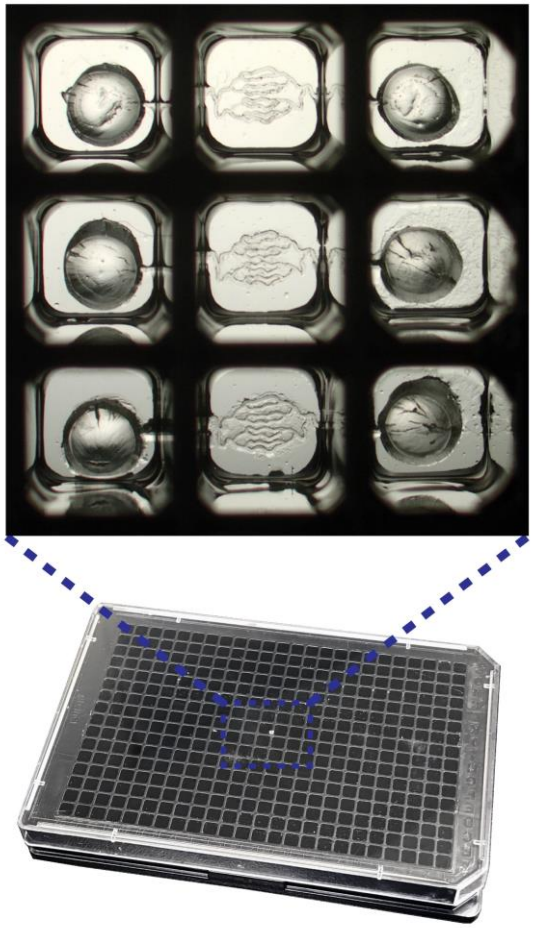
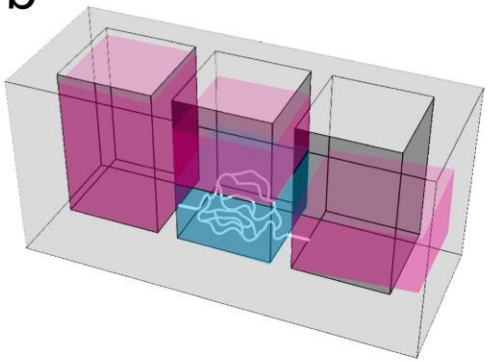
Tissue Engineering of Blood Vessels and Lung

Problem: Recapitulating vascular interfaces of different organs in three dimensions is critical in both organ-on-a-chip and tissue engineering applications

a

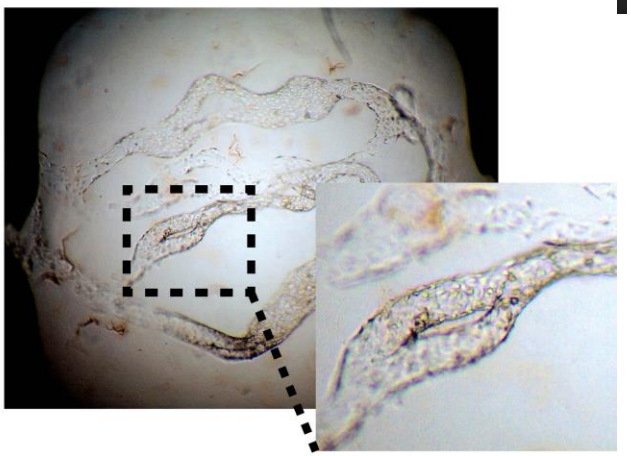


b



Formation of perfusable vascular network

c



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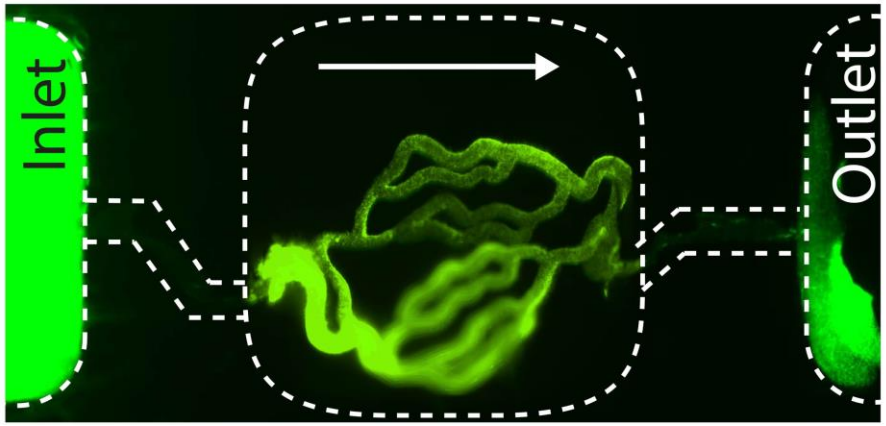
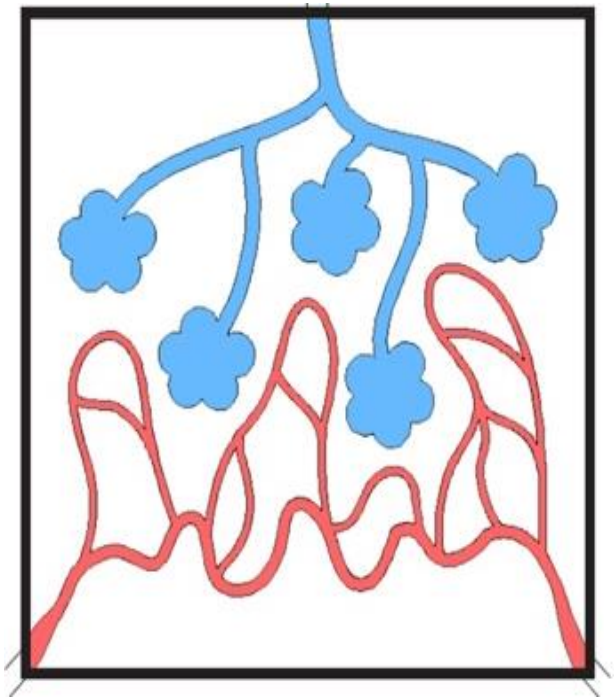


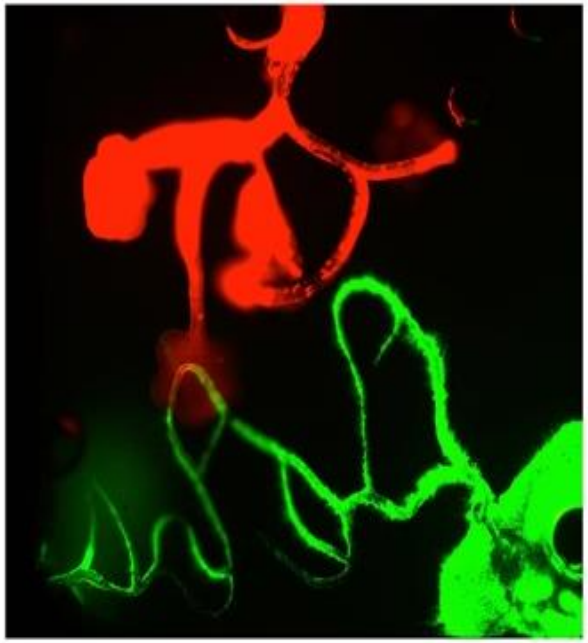
Engineers

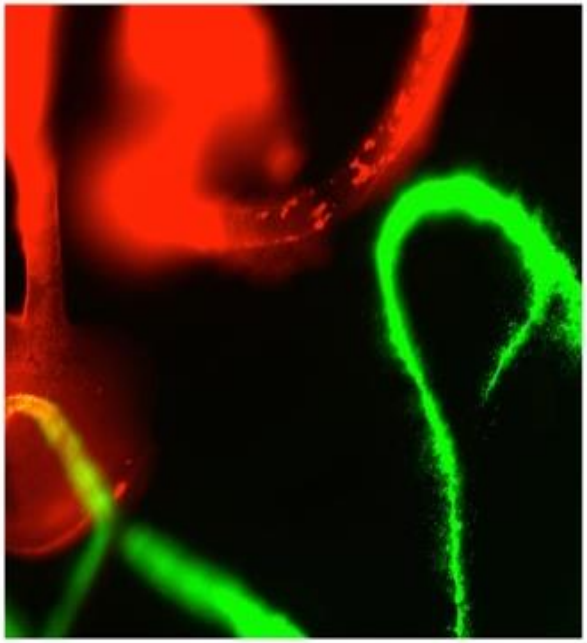
Dr. Boyang Zhang – McMaster

Tissue Engineering of Blood Vessels and Lung

Lung Model







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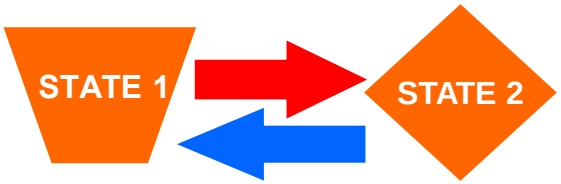
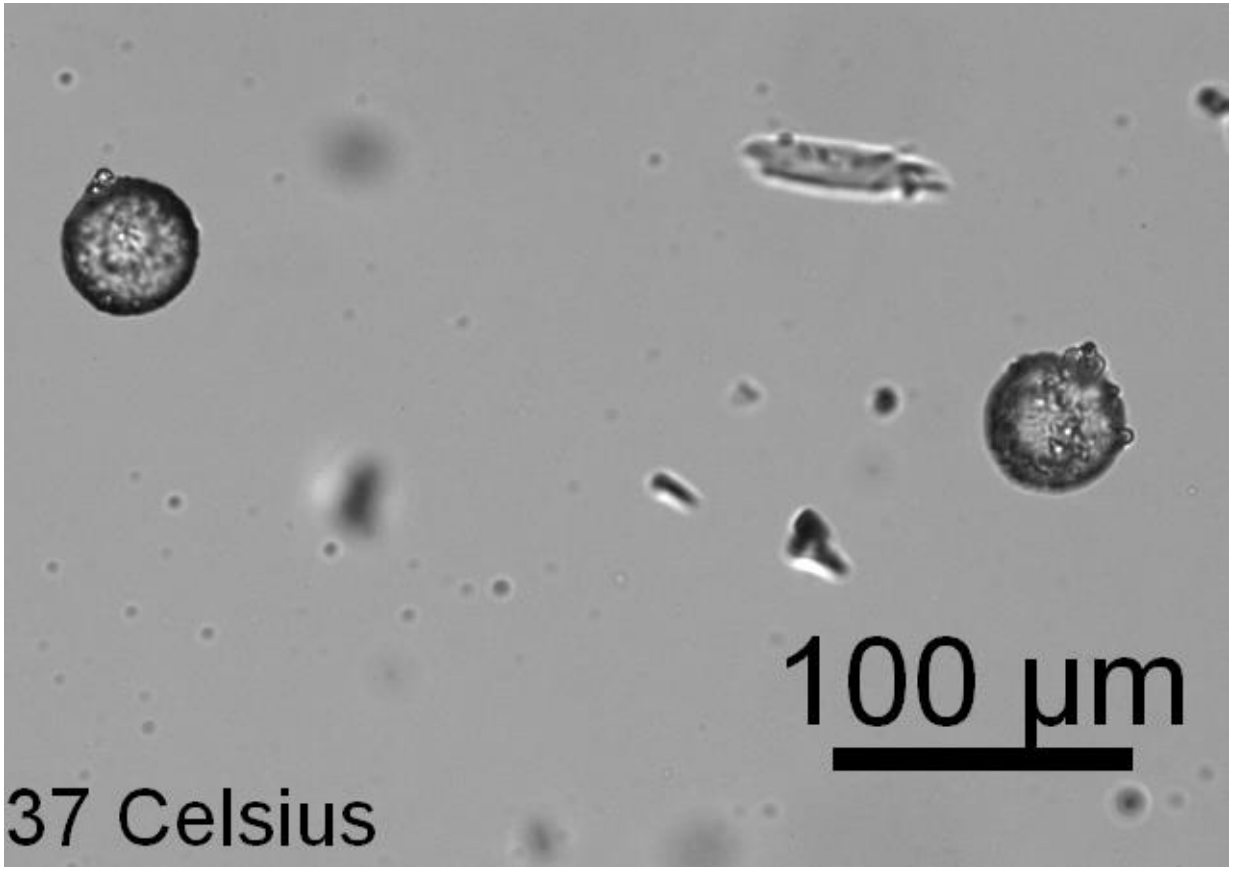
Dr. Todd Hoare – McMaster

Hydrogels: Tissue Engineering, Diagnostics & Drug Delivery

Stimuli-Responsive Smart Materials



Temperature
pH
Chemical concentration
Light
Shear
Magnetic field



Bioinformatics
&
Data Scientists

Data Driven Strategies:
From Discovery to Personalized Care

Andrew Doxey
Computer Science
Biology

Computational Models
Protein Prediction
Transcriptomics

Brendan McConkey
Biology

Protein Prediction
Data Mining
Microbial Genetics

Brian Ingalls
Applied Math

Systems Biology
Mathematical Models
Synthetic Biology

Anna Dvorkin
Pathology & Molecular Medicine

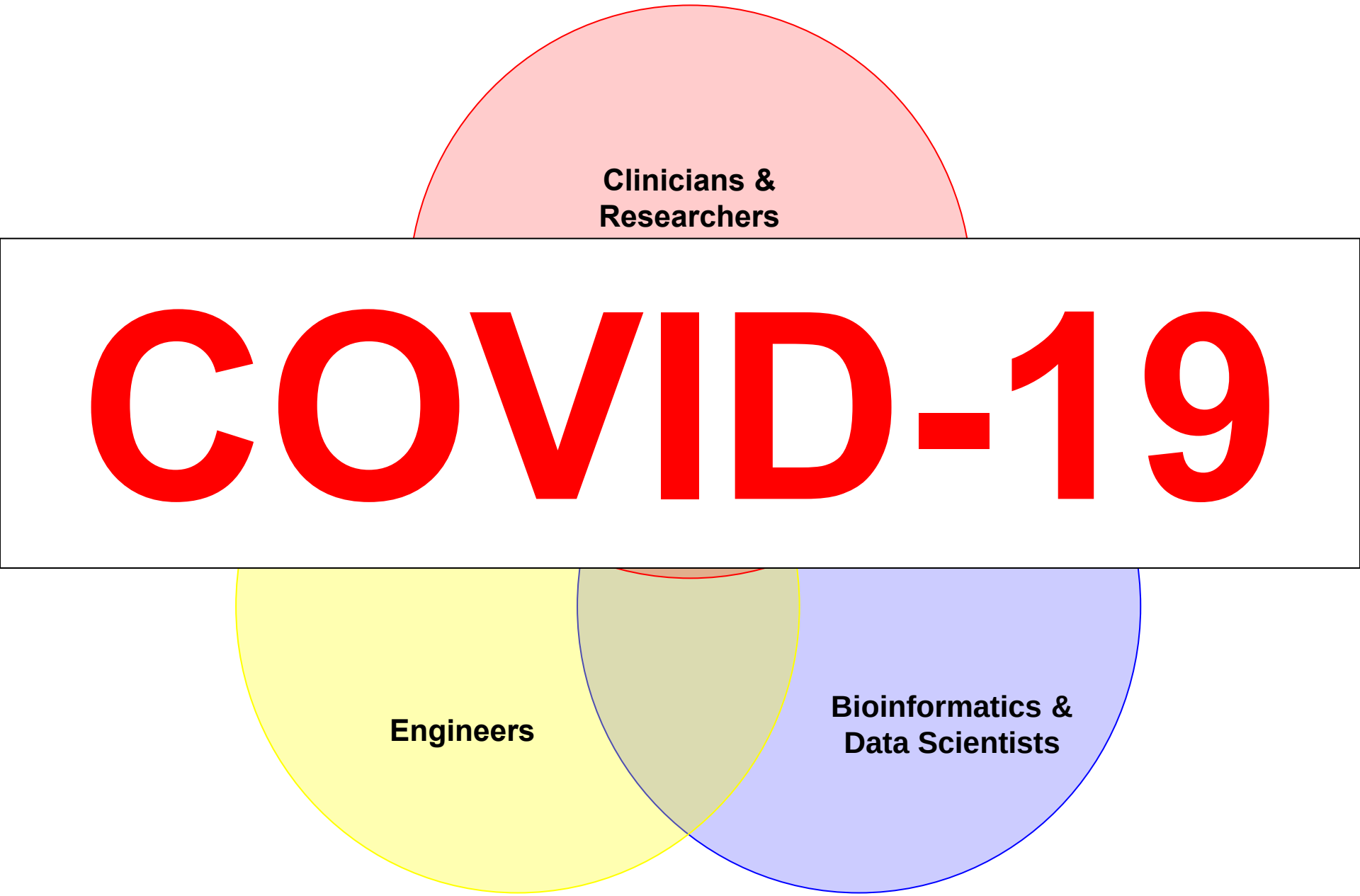
Transcriptomics
Data Mining

Milica Vukmirovic
Medicine

Bioinformatics of Lung Disease
Entrepreneurial Training

UNIVERSITY OF WATERLOO

What will fuel the next generation of innovations?



McMaster opens Centre of Excellence to advance personal protective equipment in Canada

June 29, 2020
Jessie Park

The Centre of Excellence in Protective Equipment and Materials is a network of engineers, clinicians, manufacturers and companies dedicated to improving personal protective equipment products and supply chains in Canada.

McMaster University is now home to an established network of engineers, clinicians, local manufacturers and companies dedicated to advancing personal protective equipment products in Canada.

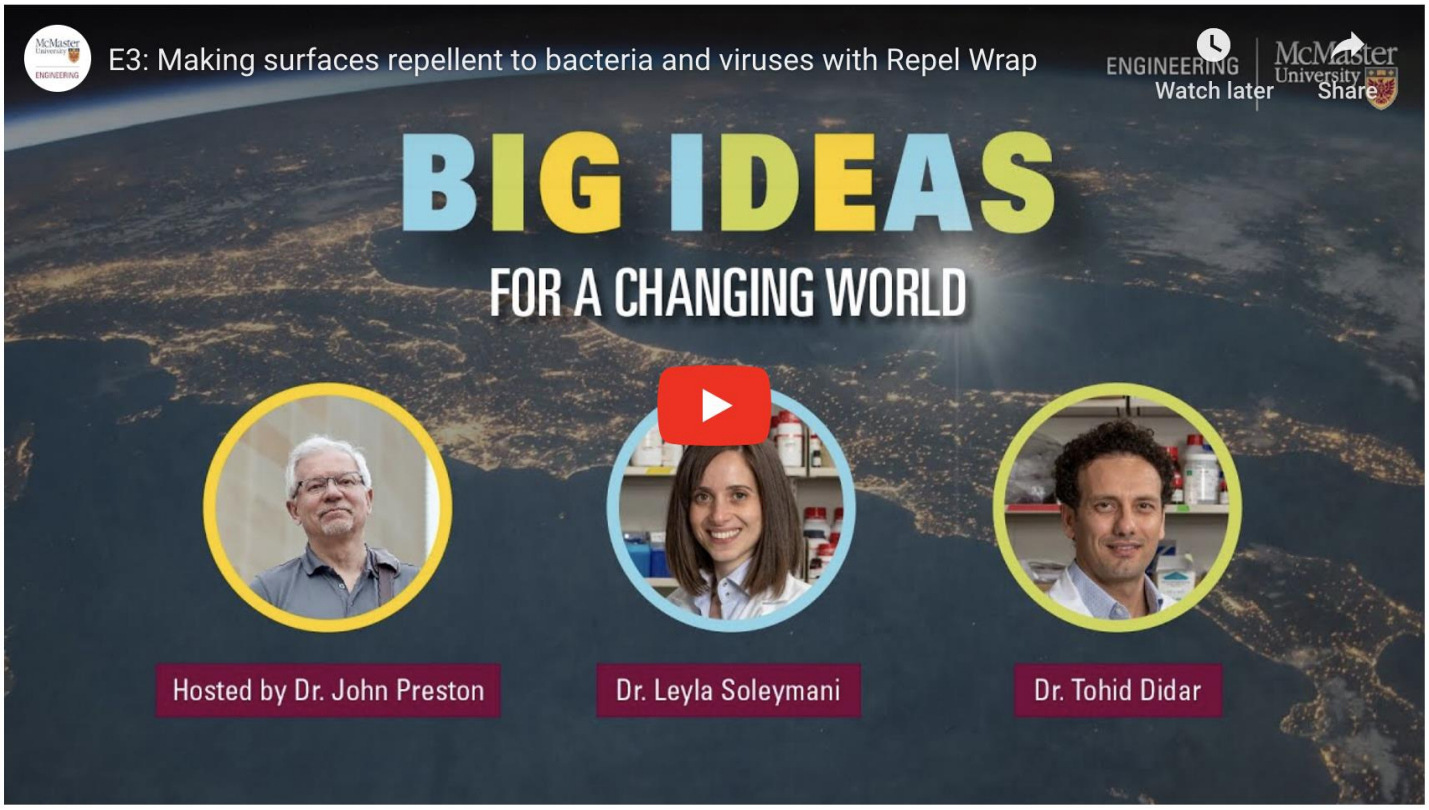
Related Faculty:

P. Ravi Selvaganapathy

Professor and Canada Research Chair in Biomicrofluidics
Department of Mechanical Engineering

John Preston

Associate Dean, Research and External Relations



Making surfaces repellent to bacteria and viruses with Repel Wrap

August 12, 2020
Jessie Park

In Episode 3 of the Big Ideas for a Changing World podcast, Leyla Soleymani and Tohid Didar share the latest on their bacteria and virus repellent plastic wrap and its potential use during the pandemic.

What if frequently touched surfaces like food packaging, door handles and bus railings could be coated with a plastic that repels bacteria and viruses?

Related Faculty:

Tohid Didar

Assistant Professor
Department of Mechanical Engineering

Leyla Soleymani

Associate Professor and Canada Research Chair in Miniaturized Biomedical Devices
Department of Engineering Physics

McMaster engineers bringing to market at-home test to detect COVID-19 antibodies and 3D cell printing technology

July 21, 2020
Jessie Park

Since March, a team of researchers have developed and advanced two novel technologies which have applications during the COVID-19 pandemic and beyond. Ishwar Puri and Rakesh Sahu speak about these products in the latest Big Ideas for a Changing World podcast episode.

Related Faculty:

Ishwar K. Puri

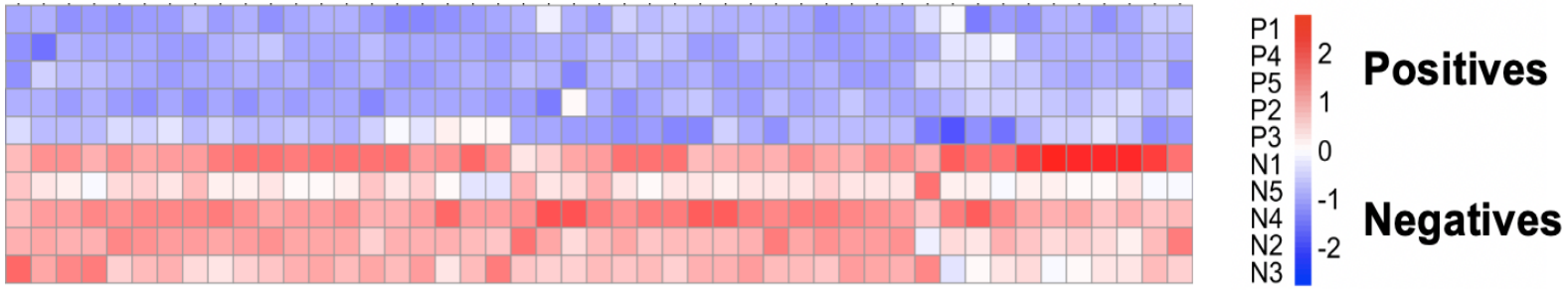
Dean of Engineering

Rakesh Sahu

Research Associate
Department of Materials Science and Engineering

An optimized clinical lab COVID-19 diagnostic test incorporating host responses for predicting disease course and healthcare system utilization

Funding:
FastGrants.org - $70K
Roche Canada - $100K
Ontario Government - $329K
Natural Sciences and Engineering Research Council (NSERC) - $50K



Biotechnology company focused on bringing personalized point of care diagnostics into your home – COVID and beyond

infinotype.com

∞infinotype

Home

Our Vision

Our Team

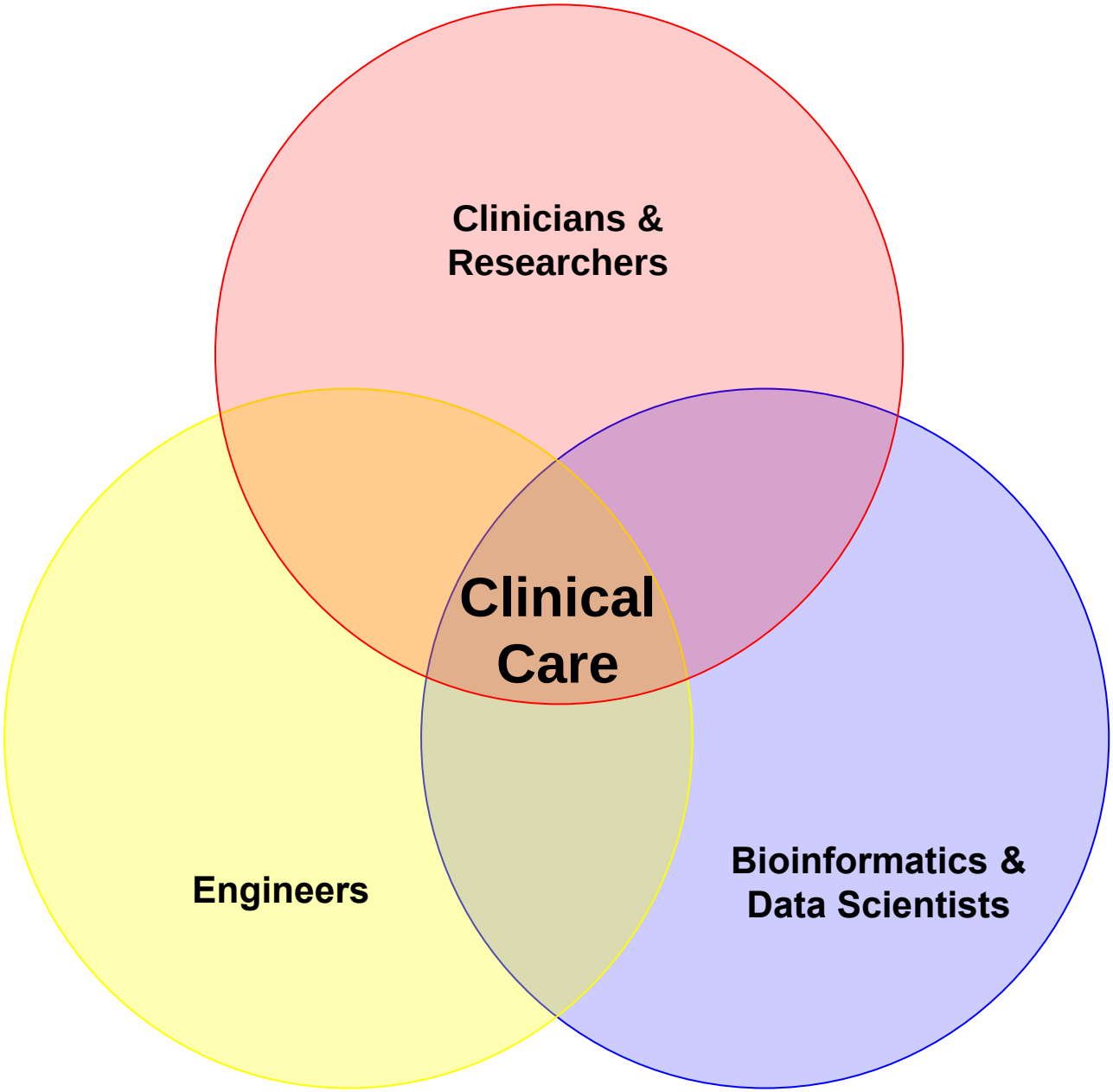
Our Technology

Information

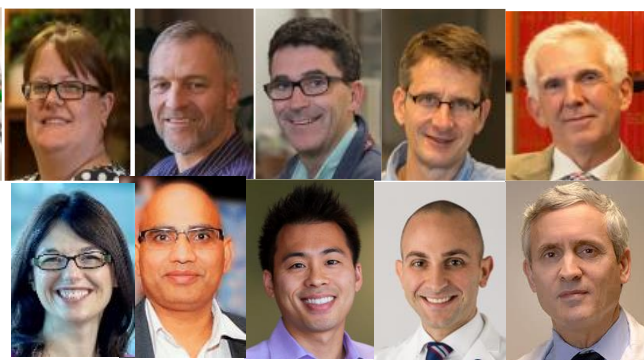
Your health Infinite possibilities

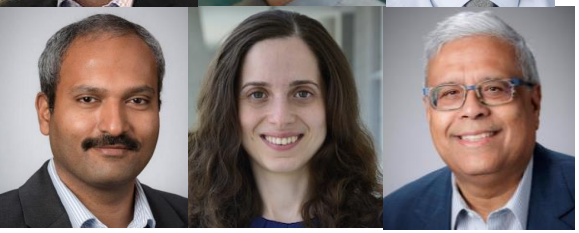
Developing a solution for you

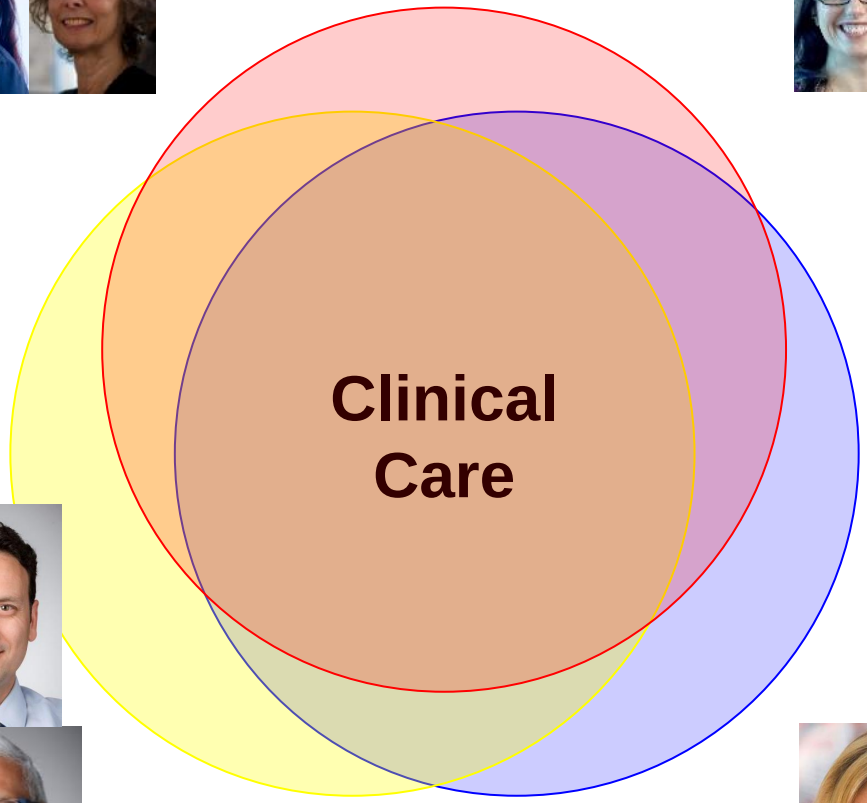
What will fuel the next generation of innovations?

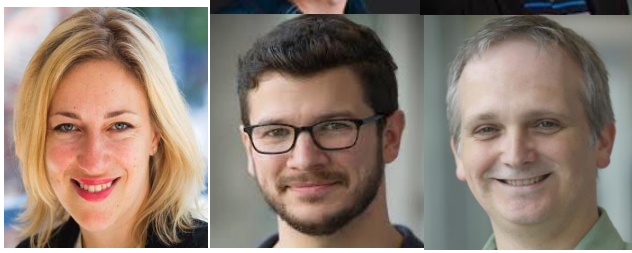


Firestone Institute for Respiratory Health





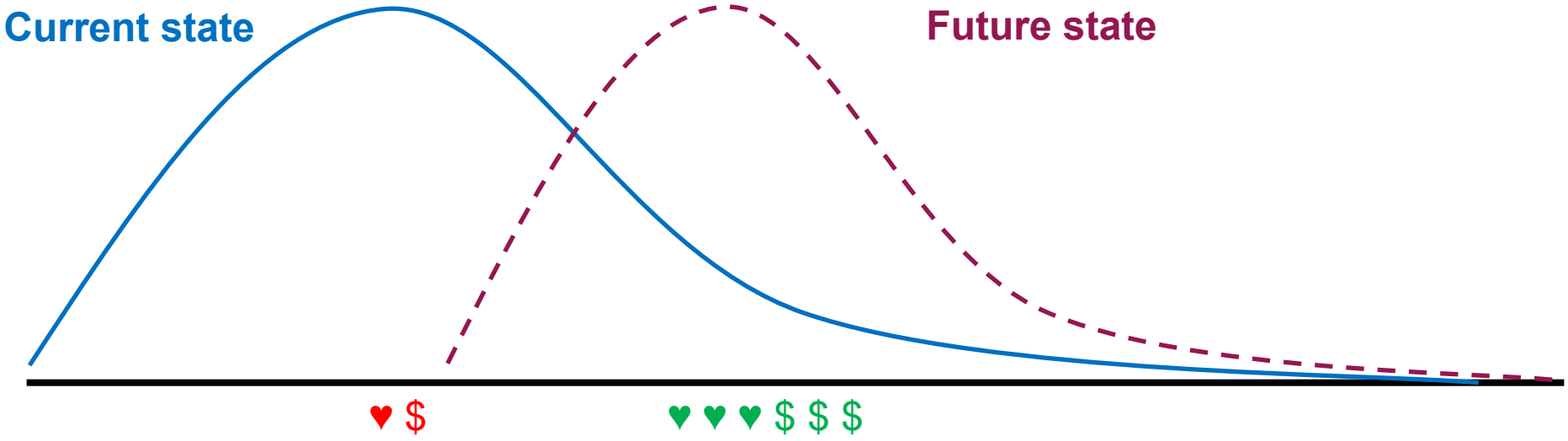




Faculty of Engineering

Bioinformatics & Data Scientists

What if we **enhance how we build human capacity at the Firestone Institute for Respiratory Health?**



Overarching Hypothesis:

Enhancing interdisciplinary interactions will fuel the next generation of innovations from the Firestone Institute for Respiratory Health

Thanks to All that have come before

Inman

Looking Outward - PARTNERSHIPS

MEDTEQ+: Centre of Excellence for Commercialization of Research (CECR)
Mission: Through collaborative, industry led projects, accelerate innovation and position, on a global scale, products and services developed by the Canadian medical technologies industry

MEDTEQ+ L'INNOVATION POUR LA SANTÉ / INNOVATION FOR HEALTH

ABOUT MEMBERS PROGRAMS ACHIEVEMENTS NEWS & EVENTS CONTACT FR

MEDTEQ IMPACT / Boehringer Ingelheim

Dates

Launch of the Call: September 18, 2020 at noon.
Closing of the Call: October 2, 2020 at noon.

Contact

Sylvie Lau,
Advisor, Integration of Innovation

CONTACT

Partner

Boehringer Ingelheim

Call for solution description

Objectives

Boehringer Ingelheim Canada and MEDTEQ+ wish to issue a call for technological solutions to Canadian industrial, clinical and academic networks to propose solutions to the identified needs in the management of progressive fibrosing interstitial lung diseases (PF-ILD). The most promising proposals will be selected for funding and co-development with our expert partners – the Research Institute of the McGill University Health Centre (RI-MUHC) and the Firestone Clinic (St-Joseph's Healthcare Hamilton).

Eligibility

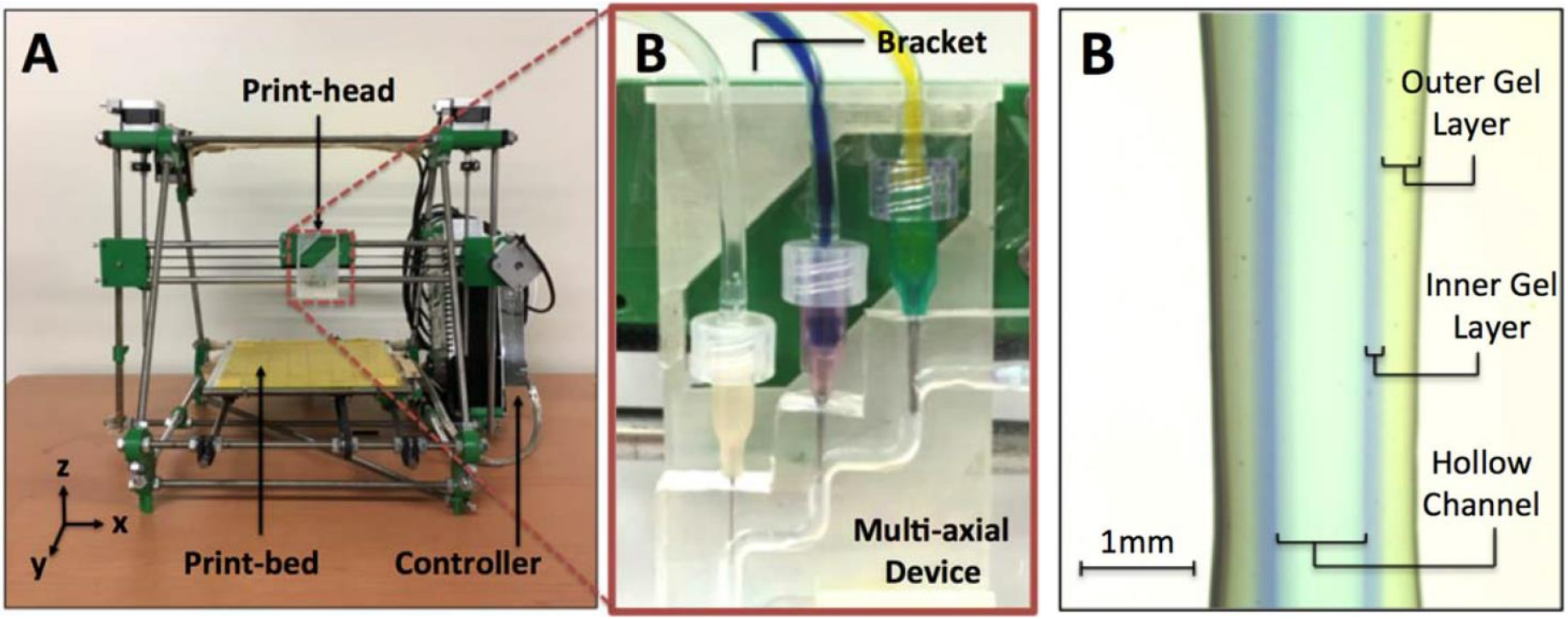
- The proposed solutions must be **digital technologies or technologies with digital integration capacity** (advanced diagnostics, health IT, decision support, patient follow-up, patient-practitioner communications, care trajectories, etc.)
- The project leader must be a company incorporated in Canada and carrying out local R&D and/or manufacturing activities in Canada
- The project will be a collaboration between the industrial community and the RI-MUHC and/or the Firestone Clinic; therefore, the applicant will be required to submit a collaborative project or describe its ability to collaborate with the institutions
- Solutions with a technological readiness level 6 (TRL 6) will be preferred, i.e. solutions at a stage of validation of the impact in real care environment (patient trajectory, cost of care, clinical-economic impacts…). Lower TRL solutions may be considered if TRL 6 can be achieved by the beginning of the project or quickly during the course of the project
- The duration of the projects will be between 12 and 18 months

Engineers

Dr. Ravi Selvaganapathy – McMaster
Tissue Engineering

Problem: The size and scale of tissues created with bioprinters has been limited by challenges with integrating vasculature structures for perfusion.

Solution: Design, develop, and validate a multi-axial print head design suitable for generating concentric ring structures amenable to perfusion and maintaining cell viability



Attala et al. Biofabrication. 2019

Engineers

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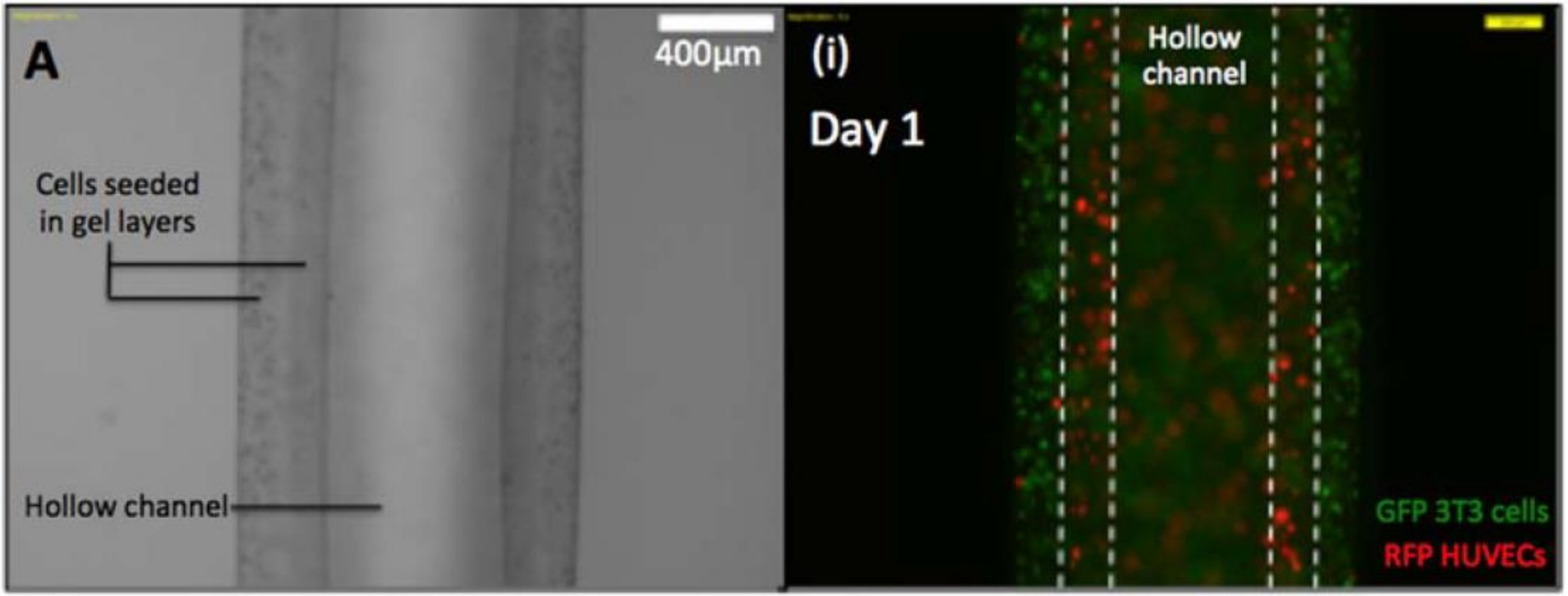
Tissue Engineering



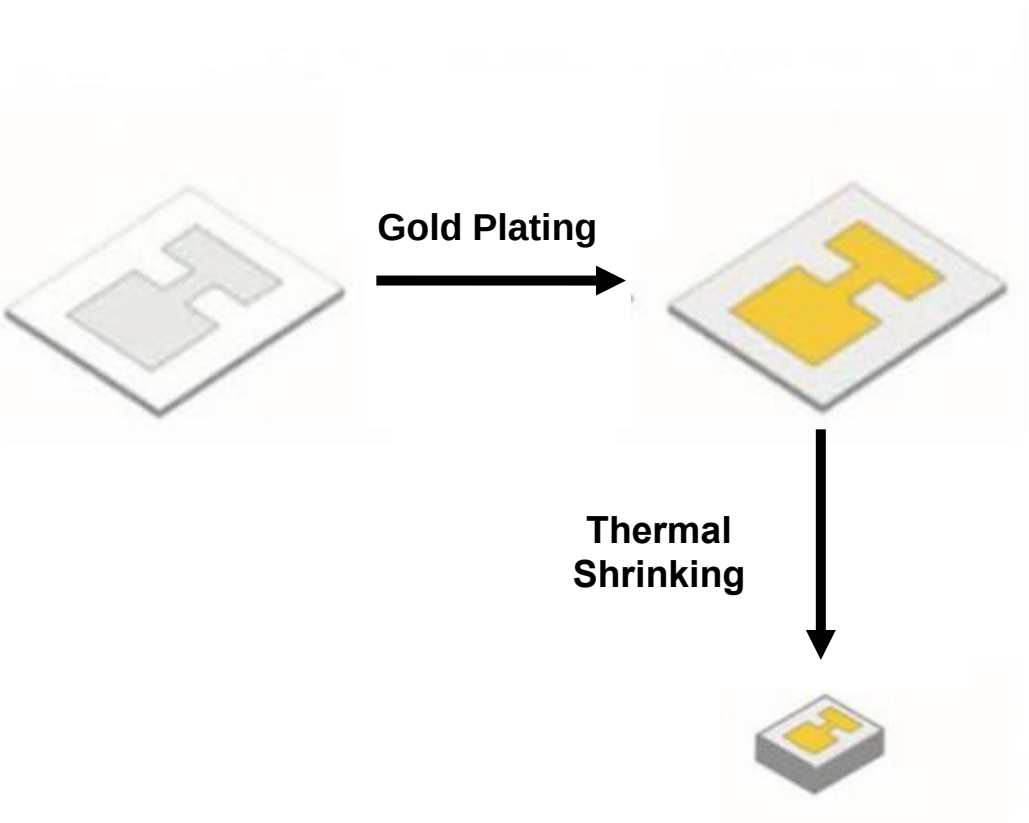
Attala et al. Biofabrication. 2019

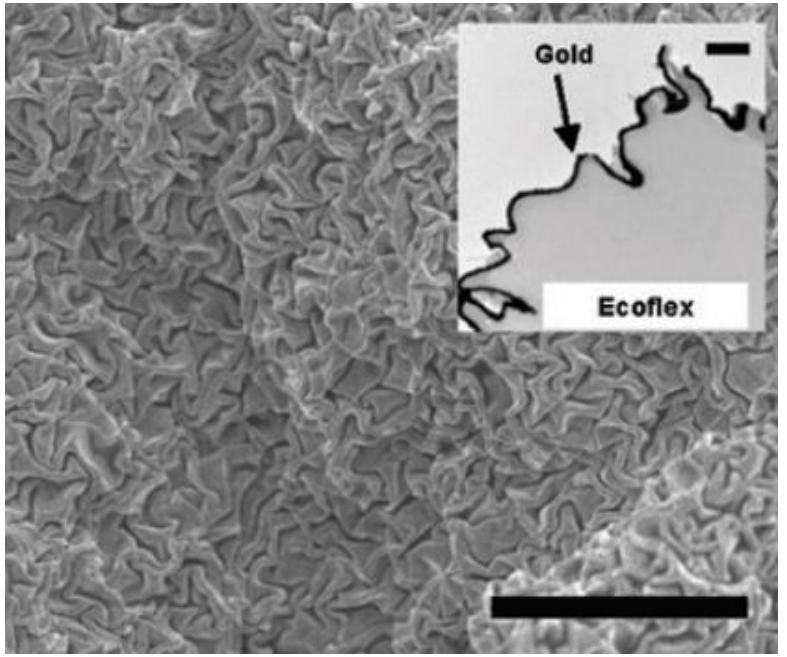
Engineers

Dr. Leyla Solyemani – McMaster Engineering Physics

Problem: Biosensors rely on conductors of electrical current. Conductors that retain their conductivity under strain are an essential building block of wearable biosensor systems.

Solution: Design, develop, and validate stretchable electrochemical biosensors using solution processed wrinkled gold electrodes that increase simultaneously increase surface area and tolerance to strain

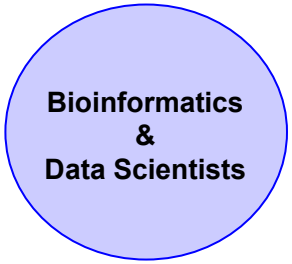


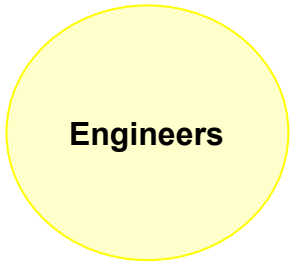


Chan et al. Analytica. 2019

Designing Highly Porous Drug-Impregnated Polymer Scaffolds Using Pressurized Gas Expanded Liquids for the Treatment of Lung Fibrosis

(Collaborative Health Research Project – Funded 2019-2022)





Kjetil Ask
Medicine

Nathan Hambly
Medicine

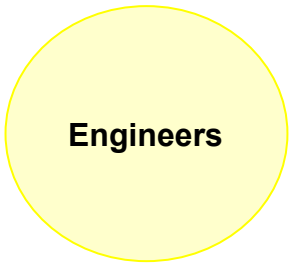
Martin Kolb
Medicine

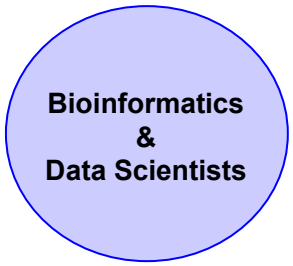
Anna Dvorkin
Pathology

Todd Hoare
Chemical
Engineering

SynoPlate™ – Human Physiology on Demand

(CIHR Project – Funded 2019-2023)





Yaron Shargall
Surgery

Jay Hirota
Medicine

Boyang Zhang
Engineering

Andrew Doxey
Biology

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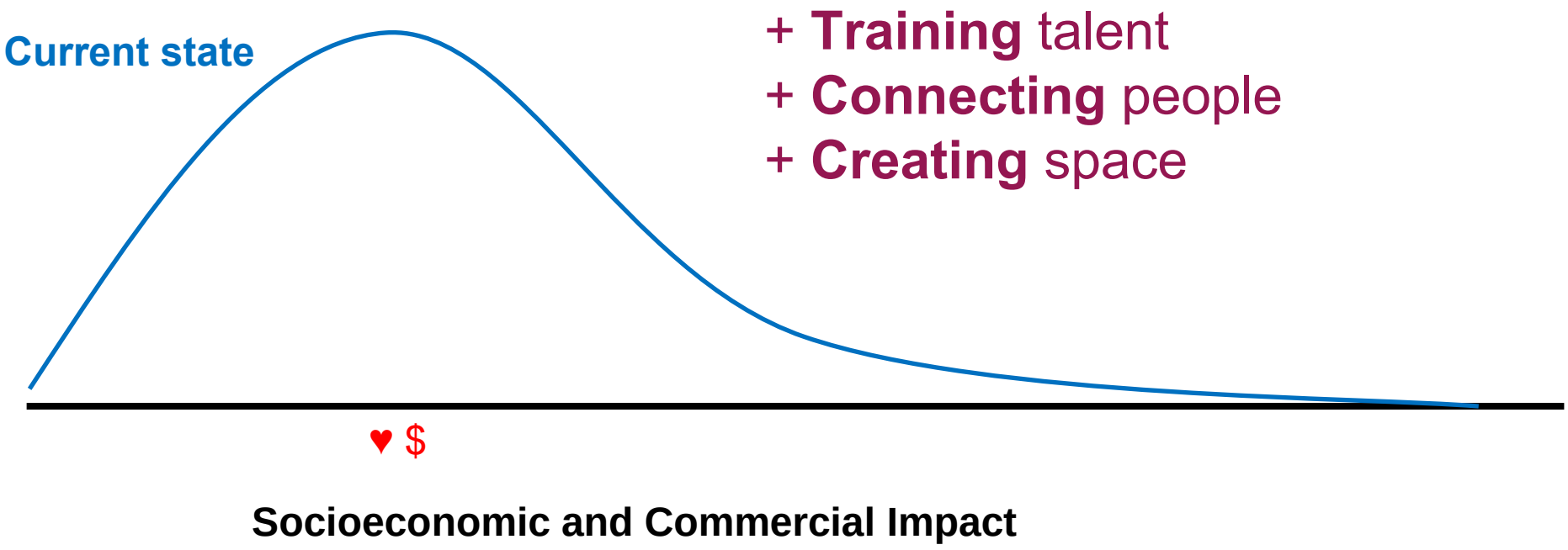

What will fuel the next generation of innovations?

Engineers

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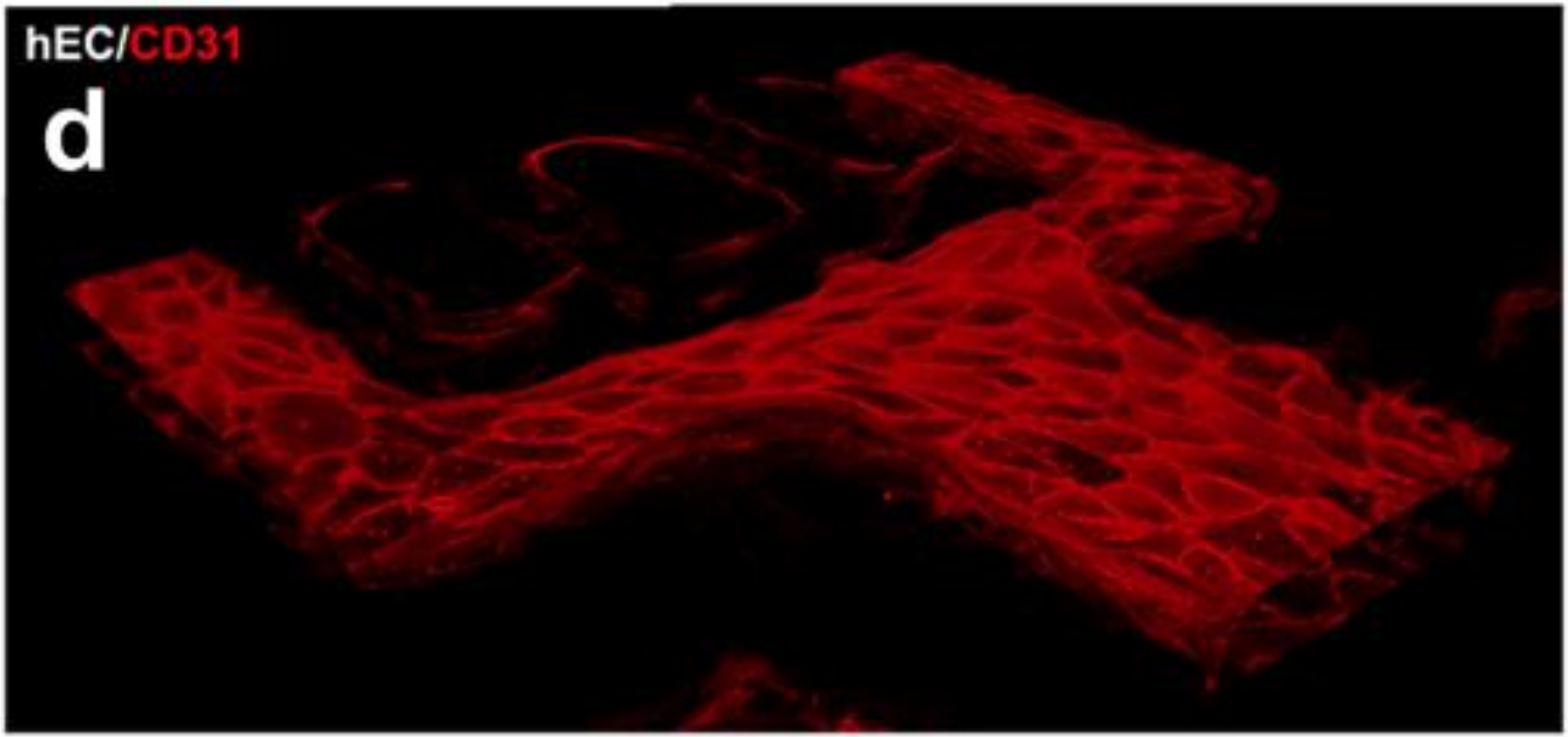
Tissue Engineering of Blood Vessels and Lung

Problem: Recapitulating vascular interfaces of different organs in three dimensions is critical in both organ-on-a-chip and tissue engineering applications

Solution: AngioChip™, a stable biodegradable scaffold with a built-in branching microchannel network that is flexible and porous enabling integration of *in vivo*



Zhang et al. Nature Methods 2016

Engineers

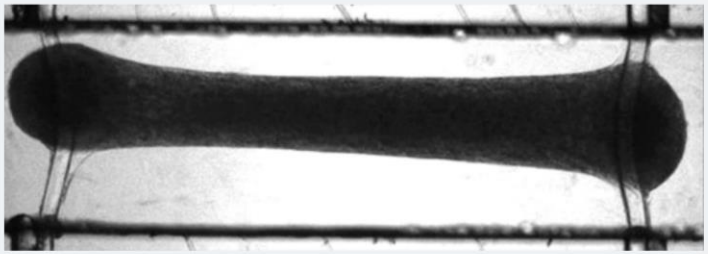
TARA

VISION PLATFORM PRODUCT MARKETS TEAM CONTACT NEWS

Cardiotype.Fo

TARA's *in vitro* contractility analysis

Cardiotype is TARA's 3D model of mature cardiac tissue. It embodies the physiological hallmarks of the human heart and provides a picture of key cardiac functions. Cardiotype.Fo provides a complete and direct analysis of cardiac contractility, including the amplitude, duration and rate of force generation.



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NEWS

September 27, 2018

TARA Launches Cardiotype.Fo, Best-In-Class Assay for Assessment of Cardiac Contractility

September 25, 2018

Frost & Sullivan Recognizes TARA With 2018 North American Technology Innovation Award

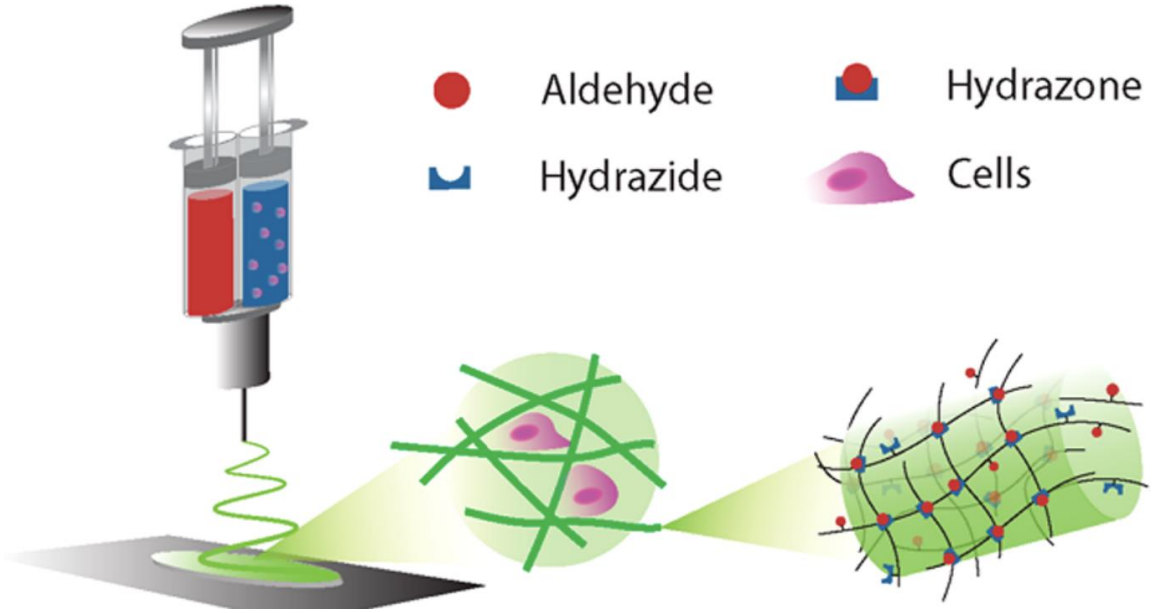
May 30, 2018

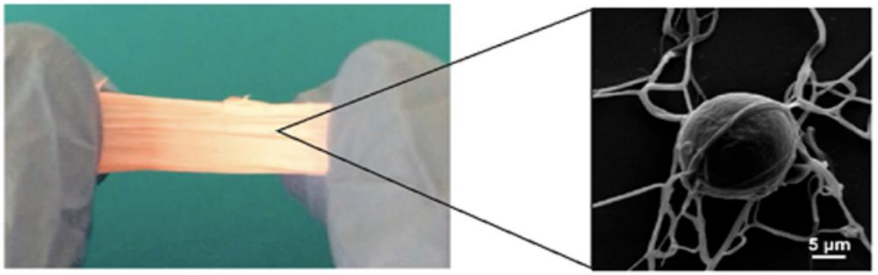
TARA CEO Misti Ushio Named to Fast Company's 100 Most Creative People in Business

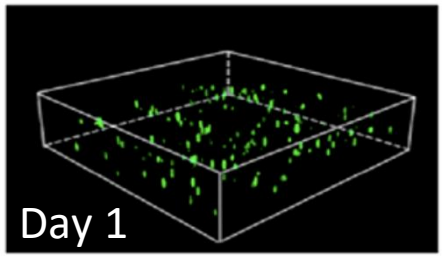
Engineers

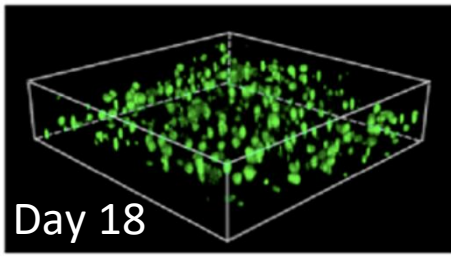
Dr. Todd Hoare – McMaster

Hydrogels: Tissue Engineering, Diagnostics & Drug Delivery









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