# POSTDOCOTORAL FELLOW POSITION

## NATURE-INSPIRED APPROACH FOR NON-INVASIVE MULTISCALE CHARACTERIZATIONS OF SOFT TISSUES

**POSITION SUMMARY:**

We are looking for a highly motivated **domestic postdoctoral fellow** to work on an interdisciplinary research project involving computational biomechanics, multi-scale modeling of materials, ultrasonic wave propagation in complex materials, and bio-fabrication.

The project funded will be conducted in close collaboration between the University of Montreal, Research Center of Sainte Justine Hospital, Montréal TransMedTech Institute (Prof. Houman Savoji), Polytechnique Montréal (Prof. Pooneh Maghoul), and McGill University (Prof. Dieter Reinhardt). Successful candidates are expected to participate in writing research proposals, reports, presentations, and publications, as well as market assessment and commercialization of our technology.

**QUALIFICATIONS:**

- A strong background and track-record in **wave propagation in porous materials**, **ultrasound**, and **vibration analysis**.
- PhD in computational mechanics, biomedical engineering, mechanical engineering, civil engineering, materials science, or a related discipline.
- Must demonstrate theoretical and practical knowledge within the fields of computational mechanics, materials science, and bioengineering.
- Having knowledge in tissue engineering, 3D (bio)printing, and cell biology is an asset.
- Experience with in vitro assays including cell viability, toxicity, etc. is as asset.
- Scientific track record demonstrating well-organized design and execution of research.
- Ability to work independently and in a collaborative team.
- Strong communication skills.

Please send your application as a single PDF file including a **complete CV**, **cover letter** describing research interests and goals, **full list of publications**, as well as the names and contact information of **three references**. Applications should be sent to Prof. Houman Savoji (houman.savoji@umontreal.ca) and Prof. Pooneh Maghoul (pooneh.maghoul@polymtl.ca) using the subject line "**PDF Application – Characterization of Soft Tissues**".

**PROJECT DESCRIPTION:**

The physical and mechanical properties of soft tissues have been traditionally studied by employing destructive and invasive macroscale techniques that cannot discriminate microscale heterogeneity in tissues and matrix, nor can they provide insight into interior architectures. Our general objective is to develop a ground-breaking biomimetic technology to non-invasively characterize 3D bioprinted soft tissues (e.g., heart) using ultrasonic techniques. Inspired by the response of geomaterials, including soil and rocks, to vibration and stress waves, we aim to develop a small, portable Quantitative Ultrasound (QUS) Device to non-invasively determine a set of physical and mechanical properties of soft tissues (e.g., 3D bioprinted healthy and diseased heart tissues). The ultrasound units can be small enough to be carried by a practitioner to remote areas (e.g., in rural areas on earth or beyond earth in space). This will provide a new technique for both the clinical/experimental approaches and has the potential to revolutionize disease modelling and diagnostics. Clinically, a better understanding of how specific and intersecting mechanisms lead to specific outcomes will allow earlier diagnosis and a reduction in disease progression, or maybe even prevention, thereby significantly improving patients' lives and reducing health care costs. The outcomes of this project have high potential since it will not only provide a robust non-invasive technique to measure physical and mechanical properties of soft tissues (e.g., heart, among others) but can also be used as a diagnostic tool to reveal microscale changes in the tissue matrix (i.e., cellular microenvironment/extracellular matrix) to provide information about disease mechanisms. The deliverables of this proposal are as follows: 1) we will build upon our prior experience in characterizing the geomaterials a new technique to implement an ultrasound to non-invasively measure the physical and mechanical properties of soft tissues; 2) we will test and validate ultrasonic technique on 3D bioprinted soft tissues (e.g., healthy and diseased cardiac tissues); 3) we will provide validation of our computational predictions in a 3D bioprinted heart tissue. 4) we will investigate matrix biology changes in 3D bioprinted healthy and diseased tissues over time to shed light on the underlying pathological mechanism of disease (e.g., fibrosis, heart muscle mass loss, etc.). Insights from these models will additionally provide real-time feedback to our computational modelling in our first objective, thereby completing the circle from computational modelling to identify disease mechanisms, to experimental validation, and back to refining predicted disease mechanisms. The proposed research will result in improving health in Quebec and Canada, especially in remote areas. It will also offer new perspectives for clinicians to understand diseases and improve therapies.

**EQUAL ACCESS EMPLOYMENT PROGRAM**

Our institutes are strongly committed to fostering diversity and inclusion. Through its Equal Access Employment Program, our institutes invite women, Aboriginal people, visible and ethnical minorities, as well as persons with disabilities to send their application. We will confidentially adapt our recruitment mechanisms to the specific needs of people with disabilities who request it. We also welcome applications from candidates of all orientations and sexual identities.