Supervisor & Project Information Form

Please complete and return via email ONLY to gdip.hres@utoronto.ca by ***Monday September 30, 2019***

Supervisor Information

MUST have unrestricted SGS appointment (appointment to supervise graduate students)

Name: **Alain Dabdoub**	**Email:** **Alain.Dabdoub@sri.utoronto.ca**
SGS Department: **Laboratory Medicine and Pathobiology**	**Field of Research:** **Inner ear development and regeneration**
Research Institution affiliation (if applicable): **Sunnybrook Research Institute**	**Location of Work:** **Sunnybrook**
Student contact time (number of hours per week YOU are available to the student for any concerns or to review progress:	**1 - 2 hours during academic year** **2 hours during summers**

Project Information (will be posted on GDipHR website for student access)

TITLE:

Novel Diagnostic Approaches for Detection of Inner Ear Biomarkers

DESCRIPTION (MAX 500 WORDS):

According to the World Health Organization, there are 500 million people suffering from debilitating hearing loss worldwide including three million Canadians. Furthermore, there are 6 million Canadians affected by balance disequilibrium. Both of these disorders significantly affect the geriatric population and with the expected doubling of this population in the next 25 years, hearing and balance disorders will reach epidemic proportions and have profound impact on the quality of life, affecting mobility and independence, and economic cost for elder care.

Although inner ear function can be measured by a set of physical and neurological examinations such as audiograms (for hearing), these measurements fail to indicate the specific sites of degeneration in the inner ear responsible for the impairment. Thus, the need for a new diagnostic approach based on the detection of inner ear biomarkers is unmet for the diagnosis of the cellular damages. Effective biomarkers are quantifiable indicators of the presence or severity of a disease state. They can be detected and measured in easily accessible body fluids, like whole blood. They need to be specific to either an organ or to a disease process that can be objectively measured and evaluated as the indicators of health, pathogenesis, or responsiveness to a treatment. Biomarkers can be specific cells, proteins, genes, or antibodies. Currently, there are no blood biomarkers available to report on the health or disease state of the inner ear.

Our endeavor aims to discover and elucidate unique and promising biomarkers for inner ear disorders such as hearing loss, tinnitus and Meniere's disease. The identification of biomarkers to monitor inner ear health is necessary for better diagnostics as well as improved assessment of treatment efficacy. In this project, we aim to develop a technology for the rapid detection and sensitive quantification of a wide range of inner ear biomarkers at the point-of-care. As a testbed for the development of our technology, we will initially focus on the detection of proteins through the development of an electrochemical biosensing device. The biosensor platform must display sensitivity and specificity that is clinically relevant and working in unprocessed whole blood while providing the diagnosis of multiple target biomarkers simultaneously.

More accurate diagnostics will help identify the site of lesion in the inner ear – sensory hair cells, auditory neurons, synapses, stria vascularis, or central auditory pathway. Furthermore, this

project, by the development of a rapid lab-on-a-chip biosensing device for simultaneous multiplexing detection of biomarkers, will provide the ability to predict and monitor the progression of the disorder and efficacy of treatment.

If human subjects are involved, have the appropriate Research Ethics Board approvals been obtained?

☐Yes ☐No ☐Application Submitted (Date: _____)

Do you expect this work will be published within the 20 months?

☒Yes ☐No ☐Uncertain / Other

Student Roles & Responsibilities (*please be as specific as possible****)***

Please indicate who will serve as the student's direct report for daily oversight (PI, PhD student, technician, etc…)

Student role and responsibilities:

The student will study the synthesis of nanostructured materials on paper substrates using fabrication methods, including electrodeposition, drop-casting, and/or printing techniques. The electroanalytical characterization approaches will be performed to control the morphology and surface roughness. The paper-substrates having nanostructured electrodes will be implemented with printed electronics that further provide addressable electrodes and readout. The electrodes' surface roughness and morphology will be investigated using Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM). The student will implement an assay with a proper recognition strategy to develop biosensor paper-based devices.

The student will also be involved with the biomarker discovery process, which is being done alongside the biosensor development.

Student's supervision:

The lead in my group is research associate Dr. Sahar Mahshid, a material science engineer. Dr. Mahshid was an NSERC postdoctoral fellow first in Dr. Alexis Vallee-Belisle's lab at the University

of Montreal and before joining my laboratory summer 2018, she was in Dr. Shana O. Kelley's lab here at the University of Toronto. She has extensive experience in biomarker detection and building rapid sensitive biosensing platforms including over twenty impactful publications on the subject in addition to two patents.