Comprehensive Research Experience for Medical Students (CREMS)
2022 Supervisor and Project Information Form

Please complete and return via email ONLY to crems.programs@utoronto.ca by February 18, 2022.

Supervisor Information
NOTE: CREMS will not support pre-determined pairings of students and supervisors. Supervisors must agree to open their projects to all students and interview all that are interested.

Name: Andrew Dimitrijevic
Email: Andrew.dimitrijevic@sunnybrook.ca

Department: Otolaryngology
Hospital/Research Institution: Sunnybrook

SGS Department(s) (if applicable):
Institute of Medical Science; Physiology

ORCID ID (see https://orcid.org/ - If you do not have an ORCID ID we encourage you to sign up for one):
https://orcid.org/0000-0003-1170-3484

Location of Work:
Sunnybrook Health Sciences Centre

Field of Research (up to 4 keywords):
Hearing, cochlear implants, electroencephalography, neuroimaging, speech perception

Student contact time (number of hours per week YOU are available to the student for any concerns or to review progress):
10 hrs
**Project Information**

*NOTE: If this project is selected, this information will be posted on CREMS website for interested student applicants to view research opportunities.*

**PROJECT TITLE:**

Predicting patient outcome after cochlear implant surgery using electroencephalography.

**PROJECT DESCRIPTION:**

Including background, aim(s), method(s) and significance of the project. *Maximum 300 words.*

**Background:** Although cochlear implant surgery can restore hearing in deaf individuals. There is tremendous variability in outcome ranging from 0 to 100% speech perception. Numerous meta-analysis reports suggest that medical factors such as age, duration of deafness, or degree of hearing loss only account for approximately 30% of the modelled variability. One explanation for the variable outcome is that different patients have different degrees of brain plasticity associated hearing restoration with the cochlear implant. Our electroencephalography (EEG) data in existing cochlear implant patients suggests that cross-modal plasticity (auditory cortex recruitment arising from visual input) is beneficial when the patient is performing a language task (visual lipreading). It is hypothesized that pre-surgical EEG measurements of cross-modal plasticity arising from deafness will be related to patient speech perception outcome after surgery.

**Aims:** To develop a presurgical biomarker of cochlear implant outcome.

**Methods:** The prospective student will analyze an existing dataset. We have collected EEG recording in patients prior to cochlear implant surgery while performing a lip-reading task of a muted video. All patients are now post one year surgery and have clinical measures of speech perception as part of standard clinical care. Models of brain activity will be assessed using freely available neuroimaging software. The relationship between neural activity in pre-defined regions of interest (e.g., auditory cortex) and surgical outcome will be assessed using multiple linear regression.

**Significance:** Understanding the neural mechanisms of cross-modal neural plasticity and its relationship to surgical outcome can help transform the current standard of practice. For example, if cross-modal plasticity is positively associated with outcome, patients can practise audio-visual integration prior to surgery. The wait time for cochlear implant surgery in Ontario is approximately one year. This time frame will give ample time for pre-surgical training strategies to optimized patient outcomes.

**Is this project remote-capable (in case of new restrictions) or have an alternative remote option?**

☒ Yes, remote capable ☐ No

☐ Yes, alternate remote option. Please specify (100 words max): Click or tap here to enter text.

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

☒ Yes ☐ No ☐ Not Applicable

**If yes, please list the application submission date:**
Do you expect this work will be published?
☑ Yes        ☐ No        ☐ Uncertain / Other
**Research Environment and Student Roles and Responsibilities**

Please be specific as possible. Please describe the research environment, including availability of required facilities/equipment/expertise, supervisor’s experience and mentorship plans. Please clearly outline the student role(s) and responsibilities related to the project, potential educational value, and indicate who will serve as the student’s direct report for daily oversight (PI, PHD student, technician, etc.). **Maximum 300 words.**

**Research Environment:** Dedicated lab space with workstation computers in the Otolaryngology clinic at Sunnybrook. Extra cubicle space with computers available at the K-wing common research area.

One full time, two part time research assistants, and two graduate students are onsite, available and have the necessary expertise to aid in EEG neuroimaging data analysis.

The PI (Andrew Dimitrijevic) has no clinical duties and has an office directly above the lab. He will be available for guidance on a daily basis.

The cochlear implant lab has weekly lab meetings where daily lab activities and progress are discussed.

Students are encouraged to participate in ongoing studies and will learn how to conduct EEG and psychophysical measurements. They will also learn the necessary software needed to analyze neuroimaging data.

The student will report to the PI directly on a weekly basis.

**Student roles and responsibilities:**

- Process existing EEG data using Brainstorm
- Access the clinical database of cochlear implant users
- Use R Studio to perform multiple linear regression between EEG and clinical speech perception data.
- Write up a draft/outline manuscript.

**Mentorship plan:**

Weekly meetings with the PI and will discuss the field of Otolaryngology and cochlear implants, how to write a scientific paper, research opportunities for clinician scientists.