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Project Title:  Understanding Brain Tumour Growth, and Improving Brain Tumour Treatment, Using Advanced Imaging Techniques Inside and Outside of the Operating Room

Project Description – include background, hypothesis, proposed methodology, and expected outcomes (one page maximum; you may attach a page to this form):
See attached page

Research Environment - Description of the number of research personnel, size of lab, etc.:
The principal investigators office is on the 10th Floor of the London Health Sciences Centre – University Hospital. The imaging research laboratory is within the laboratories of Drs. Terry Peters and Ali Khan at the Robarts Research Institute. This laboratory consists of 10-15 research personnel including graduate students, post-doctoral students and research associates with expertise in surgical planning and clinical image analysis. The student will have the opportunity to work with a senior neurosurgical resident / PhD candidate who is working on a similar project. A senior medical student with knowledge of the project may also be available to assist the student. There is also work space on the 4th Floor of the Dental Sciences Building.

Expected Objectives/Accomplishments for Student for Year 1:  The student will review the pertinent literature on brain tumors to gain a better understanding of the disease. The student will review the pertinent literature on image analysis to gain a fundamental understanding of image registration and segmentation as well as functional imaging paradigms and analysis. The student will begin to gather data. This will involve segmentation of existing images and correlation with clinical patient data.

Expected Objectives/Accomplishments for Student for Year 2:  The student will continue to gather data. The student will statistically analyze the data and present it. The student will prepare abstracts of the work and possibly a manuscript.
Certifications - if this project will require any certification approvals from one or more of the following offices, please check the appropriate box below. If you know the protocol information, please enter it into the text box provided (or enter the status of the approval in the text box):

- x □ Human Ethics REB Number 105542
- □ Animal Use Subcommittee
- □ Biohazard

Note: Certification approval should be obtained prior to the start of summer. Projects without this approval will not be a priority for funding.

Project Description

Background: Brain tumours constitute a diverse group of intracranial abnormalities (1,2). A highly malignant brain tumour such as glioblastoma multiforme may cause premature disability and death (1). A non-malignant brain tumour such as a meningioma may produce serious symptoms based on its size and location, though sometimes it may be effectively treated and the patient cured (1). Usually the first step in the treatment of a patient with a brain tumour is surgical resection (1). The goal is to achieve maximal surgical resection while minimizing patient morbidity. Intraoperative image guidance allows the surgeon to anatomically localize a brain tumour and assess the extent of resection during the operation. Pre-operative advanced imaging techniques such as functional magnetic resonance imaging (fMRI) and tumour segmentation can help assess patient suitability for surgical resection. The incorporation of these advanced imaging techniques into the operating room may further improve the extent and safety of brain tumour resection (3,4,5,6,7). They may also lead to an improved understanding of brain tumour growth (9,10,12).

Hypothesis: The use of advanced imaging techniques inside and outside of the operating room can lead to the improved treatment of brain tumours and a better understanding of tumour growth.

Proposed methodology: The principal investigator is a neurosurgeon who has performed over 1000 brain tumour operations, most using anatomical image guidance technology (8,11). Approximately 60 of these patients have undergone advanced pre-operative imaging including functional MRI and/or tumour segmentation (6,7,10). The student will 1) analyze the imaging data on these patients to determine indications for performing advanced imaging in the operating room and to gain a better understanding of brain tumour growth, and 2) help develop ways to incorporate the advanced imaging into the operating room (7,10).

Expected outcomes: It is expected that the student will develop indications for the use of advanced imaging techniques to help perform optimal brain tumour surgery. It is expected that the student will perform work to help incorporate advanced imaging techniques into the operating room and to gain a better understanding of brain tumour growth.
References: