Project Title	A microscope that sees electricity: development of an optical imaging pipeline to evaluate cancer cell aggressiveness through electrical and morphological dynamics
Supervisor(s)	Professor Chris Bakal Dr Amanda Foust
Project Description	Metastasis is responsible for ~90% of cancer patient deaths. The available treatments have limited efficacy against cancer cells, and new methods are urgently needed to both detect and inhibit metastasis. The goal of this project is to develop an imaging platform for simultaneously measuring cellular membrane voltage and morphology, two properties that change with metastasis. Cells are electrically active, using membrane potential and ion fluxes to orchestrate, among many other processes, changes in cell shape. Relative to normal cells, cancer cells possess a depolarized membrane potential (equivalent to a huge force of 10,000,000 V/m), owing to a dramatic increase in voltage-gated sodium channels occurring especially in strongly metastatic cells. However, the mechanisms by which electrical hyper-excitability can drive metastasis are largely unknown. In this project the student will contribute to the development of a first-of-its kind dual electrical and mechanical image acquisition pipeline, a microscope that "sees electricity". This pipeline, to be applied in both 2D and 3D models, has the potential to reveal how electrical and morphological properties interact and modulate during metastasis. The project will integrate training and expertise in cancer bioelectricity (Djamgoz) and voltage imaging (Foust) with quantitative single-cell imaging and analysis algorithms in spheroid cultures (Bakal).