Evaluation of a Raman Spectroscopy Probe in the Diagnosis of Brain Tumors

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As the percentage of brain tumor that is resected increases, a patient's life expectancy drastically increases. Thus, neurosurgeons need to be able to differentiate between healthy brain tissue and tumors in real-time during surgery, and more easily make an intraoperative decision as to which part of the brain to resect. Raman Spectroscopy is a unique type of measurement of inelastic light spectra that can be used to determine the spectral fingerprint of molecules, and identify and differentiate molecules of any substance. In this project, a wand utilizing Raman spectroscopy was used to take 1066 spectra from 225 brain tissue samples from brain surgeries. In the operating room, I used the wand to assess the spectra of the brain tissues. I then compared these spectra against the pathology reports of the same tissues, to judge the efficacy of the Raman wand in identifying normal brain tissue vs. the various brain tumors. Finally, I split the data into two groups: a training subset to teach an algorithm to differentiate between the groups, and a testing subset to judge the efficacy of the machine learning program on actual specimens. The result is that the Spectroscopic wand was 94% accurate in differentiating between healthy and tumor tissues, with 100% specificity and 100% sensitivity between the various types of tissues. Ultimately, with this new Raman technology that has only recently been tested on living human tissue, we can hopefully help patients with the dreaded disease of malignant brain tumors live longer.