New Imaging Device and Innovative Technology Target Brain Tumors

During brain tumor surgery, precision is key. But brain tumor tissue can be hard to distinguish from normal brain tissue during surgery. Removing healthy tissue can cause neurologic deficits, while leaving tumor behind can allow cancer to spread and treatment to fail. Currently, neurosurgeons have no way of visualizing the margins of a brain tumor and, therefore, cannot ensure optimal results for their patients.

The Solution

University of Michigan researcher Dan Orringer, M.D., has collaborated with industry partner Invenio Imaging Inc., to develop the first portable Stimulated Raman Scattering (SRS) microscope for use in the operating room, which is now being tested at the U-M Health System.

Much like MRI, SRS microscopy relies on intrinsic chemical properties of biological tissue images without the need for removing or processing tissue. However, unlike MRI, SRS microscopy can rapidly generate high-resolution tissue images on a microscopic level, revealing tumor that would otherwise be invisible to the surgeon.

Dr. Orringer’s work has shown that SRS microscopic images can now be used both to guide surgery and to differentiate between different types of brain tumors. In the future, Orringer hopes to partner with other surgeons, pathologists and industry partners to leverage SRS microscopy to advance the care for brain tumor patients across the country.

The project was funded by the Michigan Translational Research and Commercialization (MTRAC) for Life Sciences Innovation Hub. MTRAC works to “fast forward” projects that have a high potential for commercial success, with the ultimate goal of positively impacting human health. MTRAC has been made possible by the Michigan Economic Development Corporation, the Michigan Institute for Clinical and Health Research, and the generosity of friends of the University of Michigan.
**Innovative technology and a new imaging device**

let doctors see brain tissue at a microscopic level to distinguish between tumor and normal brain.

**Significant Need**
Currently, surgeons have to wait a half hour or more for tissue samples to be frozen, sectioned, stained, and interpreted by expert pathologists trained to spot the difference between cancerous and healthy brain tissue.

**Compelling Science**
The Stimulated Raman Scattering (SRS) microscope rapidly generates microscopic images of fresh human tissue in the operating room. It eliminates the need for tissue sectioning, processing, or dyeing to visualize tissue architecture. When deployed, SRS microscopes will dramatically reduce the turnaround time for microscopic imaging of tissues during surgery.

**Competitive Advantage**
The ability to detect tumor margins without having to send samples out of the OR for frozen sectioning could increase patient safety and improve outcomes by shortening the length of surgeries and reducing the number of cases where cancer cells are left behind.

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**MTRAC Project Key Milestones**

- Design fiber laser capable of generating microscopic SRS images with a laboratory-style microscope
- Design optical probe capable of performing SRS imaging with the resolution and field of view of a laboratory-style microscope
- Build and test fiber laser - acquire SRS images with fiber laser and standard laboratory-style microscope
- Build handheld optical probe – acquire SRS images with fiber laser and handheld optical probe
- Test fiber laser and handheld optical probe – demonstrate intraclass correlation coefficient (ICC) >0.8 reflecting substantial agreement between SRS and H&E for microscopic diagnosis

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**Overall Commercialization**

- Closed $1M seed round including private and institutional investors and secured $2M in NIH funding to support commercialization.
- New IP generated during MTRAC builds on existing patent portfolio.
- The MTRAC funding we received was central to the creation of the first clinical SRS microscope, which has now been used in our operating room to image tissue from over 275 cancer patients.

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**Commercialization Strategy**

- Product to be manufactured, marketed, and sold through a partnership between Invenio and established medical device partners.
- Completed 513(g) classification by FDA.