Docket #: S24-107

Robotic Microscopy Platform for Imaging and Manipulating Biological Samples

Imaging methods that can visualize biological samples with high and temporal resolution are critical for modern biomedical research and clinical practice. Unfortunately, advanced microscopes that can provide superior spatiotemporal resolution are typically bulky and mechanically inflexible. For example, in cancer removal surgery, it would be extremely advantageous to determine in situ whether the tissue under examination is pathological using state-of-the-art microscopy methods. However, due to the lack of a suitable in situ imaging system, surgeons must first excise the tissue under investigation from the patient, then transfer and wait for the diagnostic result before they can proceed with the surgery. These additional steps add extra delays to the procedure, as well as introduce potential sources of errors.

To address the need for a high-resolution imaging system that is mechanically dexterous, the Schnitzer Lab at Stanford has created a novel microscopy platform using state-of-the-art micro-optics and robotic design. In contrast to existing endoscopic systems, the inventors' imaging platform was designed from the ground-up to accommodate multiple laser scanning microscopy techniques, such as confocal imaging, two-photon microscopy, and stimulated Raman scattering microscopy. In addition to imaging, the microscopy platform can also perform manipulations of the sample via laser surgery or optogenetics, in many cases concurrently with live imaging of the sample. Due to its unique optical and mechanical capabilities, the robotic microscopy platform opens up new applications of high-resolution imaging in many fields. The inventors have successfully utilized this robotic microscopy platform to visualize and control neural activity in multiple spatially distributed brain areas at the same time in a behaving animal. The invention provides a powerful new tool for basic neuroscientists and researchers to

engage in pharmaceutical research.

Stage of Development
Research - in vivo

Applications

- Surgical tool
- Research tool
- Microscopy
- Multi-tissue imaging

Advantages

- There is no currently existing commercially available product that allows for high-resolution optical imaging in a highly dexterous and a miniaturized form factor
- Can provide in situ tissue diagnostic, reducing time and cost during surgical procedures
- Compatible with currently existing microscopy and imaging platforms and enables seamless integration

Publications

- Kim, T. H., & Schnitzer, M. J. (2022). "Fluorescence imaging of large-scale neural ensemble dynamics." *Cell*, 185(1), 9-41.

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