Docket #: S24-288

A miniature optoencephalography microscope with active modulation capabilities

Mental health disorders can disrupt the dynamic characteristics of neural circuitry across the brain. To study how disease manifests these disruptions, the use of animal models are necessary, along with tools that enable the readout of brain-wide activity and tools that can make deliberate perturbations. Such tools will enable hypothesis testing of methods which characterize the disease as well as explore therapeutic restoration of brain dynamics and behavioral phenotypes.

The Deisseroth Lab at Stanford has developed a miniature optical microscope that enables both spatially-selective control of perturbations and recording, allowing it to be used on freely behaving small animal subjects. This invention consists of MEMS scanning mirror(s) for raster-scanning across the sample volume to create an image serially. Fluorescence from the sample can be collected by either a fiber coupled to one or more MHz-bandwidth photodetectors or a photodetector directly mounted to the collection side of the microscope. The area sampled by the microscope can reach up to 10x10mm with the lens prescriptions. The nature of the lens prescriptions is unique in that they are optimized to provide a convenient working distance by being largely-invariant to the distance from the microscope to the sample. The invention enables a dynamic readout and modulation of neuronal activity across a large volume of brain tissue while maintaining a miniaturized package which allows for subjects to be freely exploring within their natural environment.

Applications

- -Neuroscience Research
- -Microscopy Devices

- -Optical microscopy for rodent brain imaging

Advantages

- -Spatial-selective brain modulation
- -Light-weight and miniature
- -No existing methods have yet paired an optical imaging modality with a spatially-selective perturbation modality.
- -Removes the restriction of maintaining a light source and detectors at the microscope body via fiber-coupling of the associated radiation.

Publications

- Sean Quirin, et al. Freely moving optoencephalography with random-access optogenetic control. *Proceedings of SPIE* (2026).

Innovators

- Sean Quirin
- Alex White
- Karl Deisseroth

Licensing Contact

Evan Elder

Associate Director, Licensing and Strategic Alliances, Physica

Email