Modular Miniature Microscopy System

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OTHER INFORMATION

KEYWORDS

miniature microscopy, brain imaging, behaving animals, modularity, flexibility

CATEGORIZED AS

- **Medical**
  - Devices
- **Research Tools**
  - Other
  - Screening Assays

RELATED CASES

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SUMMARY

UCLA researchers have developed a modular miniature microscopy system for brain imaging in behaving animals.

BACKGROUND

The light microscope is traditionally an instrument of substantial size and expense. Its miniaturized integration would enable many new applications based on mass-producible, tiny microscopes. Key applications include brain imaging in behaving animals for relating cellular dynamics to animal behavior.

Currently there are two commercially available miniature microscopes on the market. Both are highly limited in their capabilities in excitation source type/shape as well as lack configurability and remote focal adjustment. There is an extremely large demand of a miniature microscope system with flexibility and modularity.

INNOVATION

UCLA researchers have developed a light weight (<2g), modular, miniature (<25mm tall), single photon fluorescence microscope with remote electrical focusing. The microscopy system consists of three modules, an excitation module, an objective module, and an emission module along with a data acquisition (DAQ) system. The excitation module focuses and sends excitation light through the emission module and then out through the objective module. Excitation light emitted from the objective module illuminates a fluorescent sample and the resulting fluorescence is collected by the objective module. Fluorescent light is focused by the objective module and passed through the emission module to a photo detector where an image is formed. By switching between different module versions, one can change type of excitation light source, system magnification, and objective working distance to match each application's specific needs.

APPLICATIONS

- ▶ The primary application for this invention is to image brain activity in behaving animals, allowing for relating neuronal dynamics to animal behavior.
- ▶ The miniature microscopy system can also be used in portable, image-based diagnostics or microscope arrays for large-scale screens.

ADVANTAGES

- ▶ Compared to conventional microscopy systems, the miniature microscopy system is highly portable, cheap, and doesn't require complicated electronics. Thus it can be applied in locations inhospitable to conventional microscopy.
- ▶ Compared to other miniature microscopes on the market, the flexibility and modularity of this invention greatly extends the ease of use and imaging capabilities.
- ▶ This system has a remotely tunable lens for focal plane adjustment.

STATE OF DEVELOPMENT

Inventors have developed systems based on the device described in the Nature Methods paper, Miniaturized integration of a fluorescence microscope, and patent US 20120062723 A1. All currently available devices rely on physical focal adjustment, Gradient Index (GRIN) lenses, and a single source (LED or fiber) of wide-field excitation light. These devices have a fixed magnification, limited working distance, and a limited excitation optical pathway.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	20200166739	05/28/2020	2017-708