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Multi-color Three Dimensional Imaging Using Multi-focus Microscopy

Tech ID: 23832 / UC Case 2012-220-0

INVENTION NOVELTY

This technology identifies an advanced imaging technique of biomicroscopy using an innovative type of a wide-field multi-focus microscope to enable fast, high-resolution 3D imaging.

ADVANTAGES

This technology provides the following advantages:

- ▶ Powerful tool for fast and sensitive 3D fluorescence microscopy of live samples
- ▶ Simultaneous acquisition of all focal planes on a single camera
- ▶ Light efficiency of the imaging path is better than 50 percent
- ▶ Current design allows imaging of a volume of 33x33x18 microns at 31Hz

TECHNOLOGY DESCRIPTION

Today, many three-dimensional (3D) biological specimens and processes are studied in two-dimensions (2D) due to the slow speed of the light microscope in recording a 3D image. This technology advances imaging techniques of biomicroscopy using an innovative type of a wide-field Multi-Focus microscope to enable fast, high-resolution 3D imaging. The system includes a novel grating design and chromatic correction scheme that is appended to the camera port of a high-resolution epifluorescence microscope to produce an instant focal stack of high-resolution 2D images simultaneously displayed on a single camera. The 3D microscope is designed to minimize photobleaching and phototoxicity while enabling high-speed imaging of weak fluorescent samples such as single fluorophores and to acquire multiple focal planes without aberrations to avoid loss in resolution and contrast.

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OTHER INFORMATION

KEYWORDS

Multi-color, Multi-Focus,

Microscopy, 3D,

biomicroscopy,

Fluorescence, Single Particle

CATEGORIZED AS

- ▶ **Imaging**
 - ▶ 3D/Immersive
 - ▶ Molecular
- ▶ **Medical**
 - ▶ Imaging

RELATED CASES

2012-220-0

The concept of Multi-Focus imaging uses optical manipulation to produce an entire focal series instantaneously. The Multi-Focus system developed is based on a phase-only diffractive grating placed in the Fourier plane in the emission path. The grating pattern is specially designed to split up the emission light from the sample into a set of simultaneous images and to focus shift diffraction orders. Each diffraction order forms a separate image of the sample, and the resulting series of images is recorded as a 2D array on a single, large-chip electron multiplying charge couple device camera.

APPLICATION

- ▶ Basic life science research
- ▶ Fluorescence biomicroscopy
- ▶ Single particle tracking in live cells
- ▶ Neuronal imaging
- ▶ Development imaging of small organisms

RELATED MATERIALS

- ▶ [Abrahamsson, S., et al, Fast multicolor 3D imaging using aberration-corrected multifocus microscopy. Nature Methods, 10: 60-63 \(2013\)](#)

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,477,091	10/25/2016	2012-220
European Patent Office	Published Application	2802861	11/19/2014	2012-220

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