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Mapping Ciliary Activity Using Phase Resolved Spectrally Encoded Interferometric Microscopy

Tech ID: 32102 / UC Case 2019-651-0

BRIEF DESCRIPTION

Researchers at UCI have developed an imaging technique that can monitor and measure small mobile structures called cilia in our airways and in the oviduct. This invention will serve as a stepping stone for study of respiratory diseases, oviduct ciliary colonoscopy and future clinical translations.

SUGGESTED USES

- Endoscopic medical imaging devices
- Cellular imaging

FEATURES/BENEFITS

- High resolution (micron-scale resolution, picometer displacement sensitivity)
- High scan speeds, real-time imaging
- Non-invasive
- Larger field of view
- Obtain more comprehensive view of cilia activity

TECHNOLOGY DESCRIPTION

Our bodies use a variety of defense mechanisms to prevent, trap, or remove foreign particles from the body. The airway, for example, is lined with small hair-like flexible structures called cilia, which help transport mucus trapped with unwanted particles away from the lungs and out of the body. The unique mobility of these structures is a key aspect of their ability to transport or “clear” the mucus. In individuals with damaged cilia, this clearance is impaired and unfortunately leads to lung damage and respiratory problems. Additionally, ciliary activity generates the primary driving force for oviduct tubal transport, which is an essential physiological process for successful pregnancies. Malfunction of the cilium in the fallopian tube, or oviduct, may increase the risk of infertility and tubal pregnancy that can result in maternal death. In order to better understand the ciliary activity, doctors and scientists take samples of ciliated tissue and image samples with high speed digital cameras and optical microscopes. However, there is a need for an in vivo imaging method capable of providing a real-time, comprehensive view of cilia structure, movement, and patterns for better understanding of their functions.

A team of scientists and engineers at UCI have designed a system capable of overcoming these aforementioned limitations. Previously, the group developed a phase resolved doppler optical coherence tomography (PRD-OCT) system that was able to obtain lateral cross-sectional images of cilia and cilia movement in real-time. The inventors realized the need to observe the surface dynamics of cilia over time and spatially and thus developed a spectrally encoded interferometric microscopy (SEIM) system with PRD technology. As a result, fast, high resolution enface images can be captured and processed in real-time.

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INVENTORS

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OTHER INFORMATION

CATEGORIZED AS

- » **Optics and Photonics**
 - » All Optics and Photonics
- » **Imaging**
 - » Medical
- » **Medical**
 - » Devices
 - » Disease: Respiratory and Pulmonary System
 - » Disease: Women's Health
 - » Imaging

Additionally, the integration of PRD-OCT with PRD-SEIM provides a multidimensional view of cilia. Furthermore, a hand-held, non-invasive probe with this optical technology will allow doctors and scientists to better monitor, image, and measure cilia activity in vivo and in real-time in patients with respiratory conditions. This invention will serve as a stepping stone for study of respiratory diseases, oviduct ciliary colonoscopy and future clinical translations.

» [Research Tools](#)

» [Sensors & Instrumentation](#)

» [Medical](#)

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,445,941	09/20/2022	2019-651

RELATED CASES

2019-651-0

STATE OF DEVELOPMENT

- Constructed PRD-SS-SEIM for real-time enface imaging of ciliated tissue; performed experiments with ex vivo rabbit trachea and porcine oviduct samples under varying conditions (temperature and drug applications)
- Additional in vivo rabbit models, then clinical trials

RELATED MATERIALS

- » [Spatial Mapping of Tracheal Ciliary Beat Frequency Using Real Time Phase-Resolved Doppler Spectrally Encoded Interferometric Microscopy - 12/03/2019](#)
- » [Characterization of oviduct ciliary beat frequency using real time phase resolved Doppler spectrally encoded interferometric microscopy - 10/11/2019](#)
- » [Visualization and Detection of Ciliary Beating Pattern and Frequency in the Upper Airway using Phase Resolved Doppler Optical Coherence Tomography - 08/17/2017](#)

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ [Polarization-Sensitive Optical Coherence Tomography Using a Polarization-Insensitive Detector](#)

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