Interferometric Microscopy and Nanoscopy in Live Biological Cells and Tissues

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Name of Fellow
Institution
Funder

European Commission FP7-Seventh Framework Programme

Contact information of fellow
Country

EC

Title of project/programme

Interferometric Microscopy and Nanoscopy in Live Biological Cells and Tissues

Source of funding information

European Commission FP7-Seventh Framework Programme

Total sum awarded (Euro)

€ 100,000

Start date of award

01/04/12

Total duration of award in years

4.0

The project/programme is most relevant to:

Alzheimer's disease & other dementias

Keywords

Biomedical Imaging | Interferometry | Spectroscopy | Optical Microscopy | Nanoscopy | Nanoparticles | Optical coherence tomography | Biological cells | Alzheimer's disease | Cancer | Red blood cells

Research Abstract
The current research proposes new optical spectroscopic and interferometric microscopy and nanoscopy techniques for accurate measurements and visualization of biological cell structure,

organization, stiffness and dynamics by recording the cell spatial, temporal, and refractive-index structure on sub-wavelength and sub-Hertz scales. The following objectives are proposed:
(a) Novel optical-mechanical signatures of cancer cells measured by wide-field digital interferometry: I propose to establish multi-disciplinary cancer biomarker using the stiffness signatures of cancer cells measured in a noncontact, quantitative and label-free manner by wide-field digital interferometry (WFDI).
(b) Interferometric and spectroscopic diagnosis of red blood cell diseases: I propose to measure mechanical and morphological properties of live red blood cells (RBCs) with extremely high sensitivity in a non-destructive, noncontact and label-free manner, as a mean to learn about the biomechanical properties of the RBC membrane and as a novel diagnosis tool for diseases that change morphology and mechanical properties of RBCs.
(c) Developing plasmonic-nanoparticle-based interferometric methods for Alzheimer's disease research: I propose to develop new nano-sensing and imaging modalities as a means to monitor degradation of neuronal function due to Alzheimer's disease. I will use photothermal optical coherence tomography with nanoparticles bound to amyloid beta to detect the degeneration in neuronal activity. This system will be combined with a low-coherence WFDI system for quantitative phase imaging of rapid dynamic neuronal phenomena.
The proposed objectives are highly interdisciplinary, involving optical engineering, sensing in biological systems, biophysics, nanoscience, neurobiology, and disease research, and have a great potential of providing new means for diagnosis and monitoring of diseases in the sub-cellular level, as well as aiding in identifying new avenues for therapy.

Types:
Fellowships

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N/A

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Alzheimer's disease & other dementias

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