# BIOENGINEERING & BIOMEDICAL ENGINEERING

# RESEARCH SEMINAR

## LABEL-FREE IMAGING OF THICK SPECIMENS USING GRADIENT LIGHT INTERFERENCE MICROSCOPY (GLIM)


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ABSTRACT

Light scattering limits the quality of optical imaging of unlabeled specimens: too little scattering and the sample is transparent, exhibiting low contrast and too much scattering washes the structure information altogether. As a result, current instruments, target specifically either the thin (low-scattering) specimens or the optically thick (multiply scattering) samples. We developed gradient light interference microcopy (GLIM) to extract 3D information from both thin and thick unlabeled specimens. GLIM exploits the principle of low-coherence interferometry to extract phase information, which in turn yields strong, intrinsic contrast of transparent samples, such as single cells. Because it combines multiple intensity images that correspond to controlled phase shifts between two interfering waves, GLIM is capable of suppressing the incoherent background due to multiple scattering. Due to the specific, common path interferometric geometry used, the two interfering fields are affected identically by multiple scattering and remain comparable in power even in deep tissue, thus, allowing them to interfere with great contrast. Thus, GLIM yields real-time tomography of optically thick samples via full field imaging. These results indicate that GLIM can become a valuable label-free analysis tool for in-vitro fertilization, where contrast agents and fluorophores may impact the viability of the embryo. We demonstrate the use of GLIM to image various samples, including standard micron size beads, single cells, cell populations, and thick bovine embryos. GLIM operates as an add-on to a conventional microscope and overlays seamlessly with the existing channels (e.g., epi-fluorescence).


BIO

Gabriel Popescu is a Professor in Electrical and Computer Engineering, University of Illinois at Urbana-Champaign. He received his Ph.D. in Optics in 2002 from the School of Optics/ CREOL (now the College of Optics and Photonics), University of Central Florida. He continued his training with Michael Feld at M.I.T., working as a postdoctoral associate. He joined Illinois in August 2007 where he directs the Quantitative Light Imaging Laboratory (QLI Lab) at the Beckman Institute for Advanced Science and Technology. Dr. Popescu served as Associate Editor of Optics Express and Biomedical Optics Express, Editorial Board Member for Journal of Biomedical Optics and Scientific Reports. He authored a book, edited another book, authored 150 journal publications, 200 conference presentations, 32 patents, gave 190 lecture/plenary/invited talks. He founded Phi Optics, Inc., a start-up company that commercializes quantitative phase imaging technology. He is OSA Fellow and SPIE Fellow.

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