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Intracellular Microlenses by Biophotonics

Bethany Joy*

Department of Biomedical sciences, Beijing University, China

Brief Report

A new fascinating concept in biophotonics is the use of a single biological constituent as a photonic component with well-defined properties. We show here that endogenous lipid droplets in mature adipose cells can function as totally biocompatible microlenses to improve microscopic imaging and detection of intracellular and external signals. Enhanced fluorescent imaging of the cytoskeleton, lysosomes, and adenoviruses has been obtained with the help of biolenses constructed of lipid droplets. Simultaneously, we showed that the needed excitation power can be lowered by as much as 73%. Optical tweezers are used to finely control lipidic microlenses in order to address targets and perform real-time imaging inside cells [1].

The lipid droplets' concentrating action on incident light allowed for an efficient detection of cancer cells' fluorescence signal in extracellular fluid. The exciting route for a multipurpose biocompatible optics tool for biosensing, endoscopic imaging, and single-cell diagnostics is opened by lipid droplets acting as endogenous intracellular microlenses. Biophotonic imaging is fast gaining traction as a method for microscopic and macroscopic clinical assessment of breast cancer. Optical biopsy is an intraoperative procedure that uses near-infrared (NIR) light to examine tumour margins and lymph nodes with micron-scale resolution. Optical mammography is a noninvasive technique that uses near-infrared light to get spectroscopic information and three-dimensional pictures of complete breast tissues [2].

Optical techniques are used in biophotonics to probe tissue structure. Endoscopy has used a variety of procedures, although the majority of research has focused on optical biopsy (i.e., ascertaining whether lesions are neoplastic or benign). Several organisations have developed a variety of approaches to analyse the micro- and nanostructures within the cell and quantify disruptions. The Backman group has been in the forefront of developing new tools to investigate various structural aspects of field carcinogenesis [3]. While colon carcinogenesis is heterogeneous (i.e., there are four separate consensus molecular subtypes, distinct epigenetic routes, etc.,), structural elements (chromatin nano-architecture, microvascular blood content, stroma, and so on) appear to be consistent across neoplasia.

Because of the complexity of the underlying pathophysiological reactions, chronic wounds in diabetics are a considerable healthcare burden. Biological and biophysical agents, as well as other innovative methods, are being extensively investigated to help diabetic wound treatment [4]. Photobiomodulation (PBM) therapy, a type of low-dose biophotonics treatment, has been shown to be useful in promoting acute and chronic wound healing. The utilisation of this noninvasive, nonionizing source of low-dose light to aid wound healing is an appealing clinical approach. The precise molecular pathways mediating its therapeutic efficacy, which include mitochondrial cytochrome C oxidase, photosensitive cell membrane receptors and transport channels, and extracellular activation of latent TGF-1, have received substantial mechanistic insights in the last decade.

Since the unintentional discovery of sunlight killing paramecia after exposure to a chemical substance, photodynamic-based techniques have come a long way. Underlying optical biophysics biomedical engineering of specialised instruments for therapy, diagnostics, and therapeutic guidance development of novel photosensitizers (including activatable molecular beacons, nanoparticle-based agents, and molecularly targeted delivery systems); understanding of the photobiology of PDT at the cellular, tissue, and whole-organism (e.g., immunological) levels translation into clinical trials; and financing of clinical trials [5].

- **PGS (polarization-gated spectroscopy):** This is aimed at improving mucosal microcirculation. Hemoglobin has a pathognomonic light absorption characteristic, making it an appealing target. By studying the distinctive absorption/reflection spectra of red blood cells, quantifiable information about the microvasculature in tissue samples can be obtained (RBCs). The co-polarization versus cross-polarization signals can be used for depth selectivity because single scattering events retain polarisation while multiple events do not. PGS can tell you how much haemoglobin is in your blood, how much oxygen is in your blood, and how big your blood vessels are.
- **Enhanced backscattering spectroscopy:** Enhanced backscattering is an optical phenomena that can provide quantitative information on the epithelium's nanoscale composition. Intensified backscattering, also known as coherent backscattering, is a result of light travelling in biological tissues self-interfering, resulting in an enhanced scattering peak in the backward direction (i.e., direction opposite to that of the light beam incident on the tissue surface). The milieu of epithelial cells and the mucosal/submucosal tissue microenvironment is studied in LEBS by scattering light over the intestinal mucosa. LEBS detects macromolecules (such as DNA and collagen) and small organelles in the intestinal lamina propria to produce a noticeable scattering signal, allowing subcellular scale identification not achievable with traditional light microscopy.
- **PWS (partial-wave spectroscopic microscopy):** This technique uses one-dimensional propagating waves in different sections of a cell to extract information. PWS calculates the intracellular architecture's disorder strength (Ld), which is proportional to the variance and correlation length (e.g., the effective size of intracellular nanostructures) of local mass density spatial variations. PWS collects data on individual cells by splitting them into 60,000 pixels and analysing the refractive index fluctuation from pixel to pixel. This can be layered on cell visualisations to investigate the state of individual cell compartments.

References

1. Wang, Feifei, Lianqing Liu, Haibo Yu, and Yangdong Wen, et al. "Scanning superlens microscopy for non-invasive large field-of-view visible light nanoscale imaging." *Nat Commun* 7 (2016): 1-10.
2. Chen, Xixi, Tianli Wu, Zhiyong Gong, and Jinghui Guo et al. "Lipid droplets as endogenous intracellular microlenses." *Light Sci Appl* 10 (2021): 1-11.
3. Miccio, Lisa, Pasquale Memmolo, Francesco Merola,and Martina Mugnano, et al. "Optobiology: live cells in optics and photonics." *JPhys photonics* 3 (2020): 012003.
4. Miccio, L., P. Memmolo, F. Merola, and P. A. Netti et al. "Red blood cell as an adaptive optofluidic microlens." *Nat Commun* 6 (2015): 1-7.
5. Merola, Francesco, Álvaro Barroso, Lisa Miccio,and Pasquale Memmolo et al. "Biolens behavior of RBCs under optically-induced mechanical stress." *Cytometry A* 91 (2017): 527-533.

***Address for Correspondence:** Bethany Joy, Department of Biomedical sciences, Beijing University, China, E-mail:bethonyjoy@gmail.com*

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