

# 3D TRACKING OF NANO-CARRIERS ON LIVING CELLS IN BRIGHT-FIELD IMAGES

Chau-Hwang Lee,<sup>1,2</sup> Feng-Ching Tsai,<sup>1</sup> Chun-Chieh Wang,<sup>1</sup> and Chia-Pin Liang<sup>2</sup>

<sup>1</sup>Research Center for Applied Sciences, Academia Sinica, Taipei 11529, Taiwan

<sup>2</sup>Institute of Biophotonics, National Yang-Ming University, Taipei 11221, Taiwan

E-mail: clee@gate.sinica.edu.tw

**KEY WORDS:** Wide-field optical profilometry, Membrane topography, Nanometer positioning accuracy.

## ABSTRACT

Nanoparticles and liposomes of nanometer diameters have been considered as useful vehicles for the therapies of various diseases including cancers [1,2]. A very important issue in the therapeutical applications of these nano-carriers is to estimate the intake process and efficiency after the nano-carriers binding on the cell membranes. In addition, three-dimensional (3D) tracking of a nano-carrier can provide information about how a cell digests and expels the carrier.

In this work we will present the 3D tracking of nanoparticles and liposomes on living cells by the combination of the non-interferometric wide-field optical profilometry (NIWOP) technique [3] and the polynomial-fit Gaussian weight (PFGW) tracking method [4]. These two optical techniques achieve 20-nm 3D positioning accuracy for scattering particles in

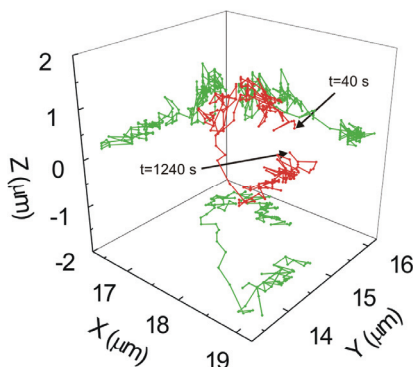
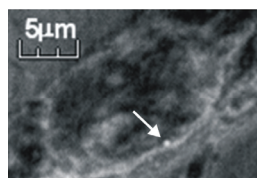


Figure: Left: a bright-field reflection image of a fibroblast. The arrow indicates a liposome containing AuNPs bound on the membrane. Right: Bright-field 3D tracks of a FGF-liposome moving in a living cell.

bright-field images. We will show 3D tracks of gold nanoparticles (AuNPs) coated with transferrins on the membranes of fibroblasts. The intake efficiency of these AuNPs is estimated based on the comparison of particle positions and membrane heights. We will also show the motion of 200-nm liposomes containing 5 nm AuNPs and tagged with fibroblast growth factor (FGF) in a living cell. The temporal analyses of the liposome motion are used to identify active transportation and diffusion processes of these liposomes.

## REFERENCE

- [1]. M. E. Davis, Z. Chen, and D. M. Shin, "Nanoparticle therapeutics: an emerging treatment modality for cancer," *Nat. Rev. Drug. Discov.* **7**, 771-782 (2008).
- [2]. D. B. Fenske and P. R. Cullis, "Liposomal nanomedicines," *Expert Opin. Drug Deliv.* **5**, 25-44 (2008).
- [3]. C.-H. Lee, H.-Y. Mong, and W.-C. Lin, "Non-interferometric wide-field optical profilometry with nanometer depth resolution," *Opt. Lett.* **27**, 1773-1775 (2002).
- [4]. S. S. Rogers, T. A. Waigh, X. B. Zhao, and J. R. Lu, "Precise particle tracking against a complicated background: polynomial fitting with Gaussian weight," *Phys. Biol.* **4**, 220-227 (2007).