Label-free identification of subcellular organelles and distribution of molecular targeted agent in cancer cells

Samir F. El-Mashtoly, D. Niedieker, D. Petersen, H. K. Yosef, S. Krauß, E. Freier, A. Mosig, C. Kötting, and K. Gerwert

Department of Biophysics, Ruhr-University Bochum, 44801 Bochum, Germany

Coherent anti-Stokes Raman scattering (CARS) is an emerging biophotonics tool for label-free imaging of cells and tissues. Here, we present CARS hyperspectral images of MIA PaCa-2 pancreatic cancer cells generated via hierarchical cluster analysis (HCA). We also demonstrate the feasibility of using CARS coupled with HCA to colocalize the cellular components by comparing the index color images of HCA with those obtained using immunofluorescence staining. With these data a supervised learning algorithm based on random forest as a classifier, was trained and used to identify simultaneously the nucleus, nucleolus, lipid droplets, and endoplasmic reticulum in an automated way (1). Random forest also can differentiate between endoplasmic reticulum, Golgi apparatus, and mitochondria. In addition, the trained classifier was also applied successfully on different human cancer cell-lines.

Furthermore, we have shown the distribution of a molecular targeted agent erlotinib in colon cancer cells by Raman microscopy, where erlotinib is a tyrosine kinase inhibitor. Raman results indicated that erlotinib has strong C≡C stretching vibration, which is located in a Raman silent region of cells (2). Thus, it can be used as a label-free marker band for erlotinib. The Raman results also indicated that the drug is metabolized to desmethyl-erlotinib in cells.

References

(1) El-Mashtoly, S.F., Niedieker, D., Petersen, D., Kruß, S., Freier, E., Mosig, A., Kötting, Hahn, S., and Gerwert, K. *Biophysical J*. In press.

(2) El-Mashtoly, S.F., Petersen, D., Yosef, H.K., Mosig, A., Reinacher-Schick, A., Kötting,C., and Gerwert, K. *Analyst*, 2014, 139, 1155-1161.