

High-throughput characterization of metabolic changes in cells

Achim Kohler^{a,b}, Heidi Najbjerg^c, and Nils Kristian Afseth^b

^aCIGENE – Center for Integrative Genetics, Department of Mathematical Sciences and Technology (IMT), Norwegian University of Life Sciences, 1432 Ås, Norway

^bNofima, Osloveien 1, 1430 Ås, Norway

^c Dept. of Food Science, Aarhus University, Foulum, Denmark

In biosciences, cell-model systems are used to investigate metabolic and structural cellular responses upon environmental changes and exposure to chemical components. For example, human cells are exposed *in vitro* to various beneficial or detrimental food components in order to investigate cellular responses upon uptake and metabolism of nutrients in a controlled manner. In order to be able to study cellular responses under many different conditions, fast and high-throughput biochemical screening techniques are urgently needed. In a recent study¹, we investigated the cellular responses of HepG2 cells upon fatty acid exposure of four different fatty acids frequently found in biological samples (oleic acid, elaidic acid, vaccenic acid and palmitic acid) by high-throughput FTIR spectroscopy. FTIR measurements were obtained on dried films of cell suspensions on multi-well plates. A clear distinction between the fatty acid exposures could be seen from the spectra, and especially the changes in double bond configurations related to cis/trans isomers and conjugation of the fatty acid chains could be studied in detail. The high-throughput characteristics of FTIR spectroscopy allow multiple conditions and even combinations of fatty acids to be investigated in a short time frame. To demonstrate this we used an experimental mixture design involving both pure fatty acids and combinations of fatty acids². The obtained results revealed both additive and non-additive effects of individual fatty acids when combined in mixtures.

References

- [1] Heidi Najbjerg, Nils Kristian Afseth, Jette F. Young, Hanne C. Bertram, Mona E. Pedersen, Stine Grimmer, Gjermund Vogt and Achim Kohler, Monitoring cellular responses upon fatty acid exposure by Fourier transform infrared spectroscopy and Raman spectroscopy, *Analyst* **136**, 1649–1658 (2011).
- [2] Heidi Najbjerg, Jette F. Young, Hanne C. Bertram, Nils Kristian Afseth, V. Høst, and Achim Kohler. 2011. High-throughput FTIR spectroscopy of intact HepG2 cells reveals additive and non-additive effects of individual C18:1 fatty acids when given as mixtures. *Submitted*.