FTIR Spectral Signature of Anticancer Drugs Effect on PC-3 Prostate Cancer Cells: Is there any Influence of the Cell Cycle?

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FTIR spectroscopy was recently demonstrated to be a useful tool to obtain a unique fingerprint of several anticancer drugs. While cell responses to anticancer drug are related to their "mode of action", it is obvious that some of the drugs used in these previous studies affect the cell cycle. For example, antimicrotubules disable the mitotic apparatus by disrupting the formation or the depolymerisation of microtubules. Cells are thus mostly blocked in the G2/M phase. On the other hand, it has been suggested that the changes observed in the cell spectra due to treatments could be related to the cell cycle. The aim of the present study is to examine this hypothesis and to investigate whether spectral variations induced by a treatment reflect the cell cycle behaviour or the metabolic perturbations induced by the drug. To answer this question, a method was developed that allows an unambiguous identification of the cell cycle phase for each individual cell. This method is based on the superimposition of three types of images: visible, infrared and propidium iodide fluorescence images. Propidium iodide intercalates the bases of the DNA. As the DNA amount in a cell is correlated with the cell cycle phase, the exact phase of each individual cell could be identified. On IR images, mean spectra corresponding to single cells were calculated and associated with the cycle stage defined using fluorescence images. Statistical analyses were applied on these IR spectra, first in order to compare spectra of cells from different stage of the cycle and second, to investigate to what extent the modifications related to the cell cycle contribute to the spectral variations due to paclitaxel treatment. Results demonstrate that the FTIR cell cycle signature is very small with respect to the changes induced by the paclitaxel.

References

A. Derenne, A. Mignolet, E. Goormaghtigh, Analyst 138, 3998-4005 (2013).