

## ***Blood Plasma Fourier Transform Infrared and Raman Spectroscopy for Non-invasive Detection of Ovarian Cancer***

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**Background** In spite of numerous advances in omics research, robust diagnosis of ovarian cancer with blood based analysis remains a challenge. A novel metabolomic approach is to use biospectroscopy of blood plasma or serum, which carries the potential to characterise biomolecular alterations of the diseased states [1,2]. Raman and attenuated total reflection Fourier transform infrared (*ATR-FTIR*) spectroscopy with multivariate analysis is used to identify the spectral biomarkers and classification methods were used to ascertain class accuracy.

**Methods** Blood samples were obtained from ovarian cancers ( $n=30$ ) and controls ( $n=30$ ) following which plasma and serum were isolated using standardized procedures. To obtain Infrared spectra, serum and plasma samples were mounted on low-e glass slides and were interrogated with *ATR-FTIR* spectroscopy. Raman spectra were obtained after mounting blood plasma ( $n=8$ ) on aluminium stubs, drying and analyzing with *InVia Renishaw* Raman spectrometer (Renishaw PLC, UK).

The spectra were processed using MATLAB R2010a software with the IRootLab toolbox (<http://irootlab.googlecode.com>). For the analysis of Raman spectra of ovarian cancer vs. non-cancer controls ( $n=400$ ), we applied principle component analysis followed by linear discriminant analysis. For ATR spectra ( $n=2,400$ ) linear discrimination analysis was used. The support vector machine classifier was employed to obtain classification accuracy rate (average between sensitivity and specificity).

**Results** Statistically significant difference was observed between spectra of ovarian cancer versus control for Raman and ATR-FTIR spectroscopy ( $p<0.001$ ). Support vector machine classifier showed classification accuracy of 74 % for Raman spectra while the accuracy was 93.3 % IR spectra of blood plasma. The spectral biomarkers responsible for segregation were vibrations of proteins, lipids and DNA.

**Conclusions** This proof of concept study provides evidence in support of *ATR-FTIR* spectroscopy of blood plasma/serum for accurate diagnosis of ovarian cancer.

### References:

- [1] J. Trevisan, P.P. Angelov, A.D. Scott, P.L. Carmichael, F.L. Martin, *Bioinformatics* 29(8), 1095-1097 (2013)
- [2] K. Gajjar, J. Trevisan, G. Owens, P.J. Keating, N.J. Wood, H. F. Stringfellow, P. L. Martin-Hirsch, F. L. Martin, *Analyst* Jan 17 (2013)