Joint Event

World Congress on

Tissue Engineering, Stem Cells and Regenerative Medicine

&

International Conference on
Cell and Gene Therapy

March 14-15, 2019 | London, UK

Label-free and non-invasive cell analysis in 3D tissue models and quality assurance of blood products using Raman trapping microscopy

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Raman trapping microscopy (RTM) is a non-invasive, label-free, highly sensitive analytical method for efficient and fast identification and characterization of single cells in solution or within 3D-tissue. Here, we present RTM as a novel tool for gentle yet highly precise cell analysis in three independent experiments, providing an overview about the large versatility of this method.

We could show evidence that RTM is a suitable tool to investigate if primary human tracheobronchial epithelial cells used within an engineered 3D human airway mucosa tissue model display tumour-specific characteristic. Furthermore, we could observe cellular differentiation in 3D mucosa scaffolds and monitor condition of blood products such as erythrocyte and thrombocyte concentrates. Here, we could show that both erythrocytes and thrombocytes have their own Raman profile. In addition, change of Raman spectra with time was consistent with routine quality control studies of decrease in platelet activation capacity as well as with the correlation in metabolic consumption. The identified Raman parameters could become a quality feature for tissue models, but also for blood products with regard to aging and functionality. First results also give hint that RTM can identify bacterial contamination within erythrocyte concentrates.

Increasingly there is a need to test functionality, integrity and sterility of cell-based products during manufacture and of the final product prior to transplantation. As Raman trapping microscopy works label-free and requires less than 500 cells for analysis it has the potential to become a standard for fast, efficient and highly reliable quality control of any advanced therapy medicinal product.

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