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Label-free separation of human embryonic stem cells and their cardiac derivatives using Raman spectroscopy

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Self-renewable, pluripotent human embryonic stem cells (hESCs) can be differentiated into cardiomyocytes (CMs), providing an unlimited source of cells for transplantation therapies. However, unlike certain cell lineages such as haematopoietic cells, CMs lack specific surface markers for convenient identification, physical separation, and enrichment. Identification by immunostaining of cardiac-specific proteins such as troponin requires permeabilisation, which renders the cells unviable and non-recoverable. Ectopic expression of a reporter protein under the transcriptional control of a heart-specific promoter for identifying hESC-derived CMs (hESC-CMs) is useful for research but complicates potential clinical applications. The practical detection and removal of undifferentiated hESCs in a graft, which may lead to tumours, is also critical. Here, we demonstrate a non-destructive, label-free optical method based on Raman scattering to interrogate the intrinsic biochemical signatures of individual hESCs and their cardiac derivatives, allowing cells to be identified and classified. By combination of the Raman spectroscopic data with multivariate statistical analysis, our results indicate that hESCs, human foetal left ventricular CMs, and hESC-CMs can be identified by their intrinsic biochemical characteristics with an accuracy of 96%, 98%, and 66%, respectively. The present study lays the groundwork for developing a systematic and automated method for the non-invasive and label-free sorting of (1) high-quality hESCs for expansion, and (2) ex-vivo CMs (derived from embryonic or adult stem cells) for cell-based heart therapies.

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Elevated plasma adiponectin levels in patients with chronic obstructive pulmonary disease

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Introduction: Adiponectin is an anti-inflammatory adipokine and is thought to play a role in chronic obstructive pulmonary disease (COPD) pathogenesis. This study was to investigate plasma levels of adiponectin, interleukin (IL)-8, and C-reactive protein (CRP) in ever-smokers with or without COPD.

Methods: Plasma levels of adiponectin, IL-8, and CRP were measured using commercially available kits respectively in COPD patients (n=71), healthy ever-smokers (n=62), and non-smokers (n=51). Pulmonary function test was also carried out for all subjects recruited in this study.

Results: There were significant increases in plasma adiponectin and CRP in COPD patients (median [IQR], 4.39 μg/mL [2.68-6.98 μg/mL] and 8.75 mg/L [4.26-40.63 mg/L] respectively) compared to healthy ever-smokers (1.90 μg/mL [0.86-2.86 μg/mL] and 3.71 mg/L [1.97-10.37 mg/L] respectively; P<0.001) and non-smokers (1.76 μg/mL [1.34-2.52 μg/mL] and 3.12 mg/L [2.11-5.71 mg/L] respectively; P<0.001). Patients with COPD, however, had a lower plasma IL-8 than healthy ever-smokers. Plasma adiponectin and CRP increased with COPD severity while IL-8 was reduced. Among ever-smokers with or without COPD, plasma adiponectin and CRP levels were inversely correlated with FEV_1 (% predicted) after adjustment for age, body mass index, smoking status, and pack-years smoked.

Conclusion: Plasma adiponectin levels are associated with disease severity in COPD patients, suggesting a possible role in the pathogenesis of COPD.