Non-invasive Chamber-Specific Identification of Cardiomyocytes in Differentiating Pluripotent Stem Cells.

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Public Summary:
A major obstacle to the application of stem cell-derived cardiomyocytes (CMs) for disease modeling and clinical therapies is the inability to identify the developmental stage of these cells without the need for genetic manipulation or utilization of exogenous markers that negates their clinical utility. We demonstrate that Raman microspectroscopy can non-invasively identify embryonic stem cell (ESC)-derived chamber-specific CMs and monitor cell maturation in a marker-free approach. This real-time identification and characterization of cardiomyocytes non-invasively will allow potential clinical application without need for genetic manipulation to identify them.

Scientific Abstract:
One major obstacle to the application of stem cell-derived cardiomyocytes (CMs) for disease modeling and clinical therapies is the inability to identify the developmental stage of these cells without the need for genetic manipulation or utilization of exogenous markers. In this study, we demonstrate that Raman microspectroscopy can non-invasively identify embryonic stem cell (ESC)-derived chamber-specific CMs and monitor cell maturation. Using this marker-free approach, Raman peaks were identified for atrial and ventricular CMs, ESCs were successfully discriminated from their cardiac derivatives, a distinct phenotypic spectrum for ESC-derived CMs was confirmed, and unique spectral differences between fetal versus adult CMs were detected. The real-time identification and characterization of CMs, their progenitors, and subpopulations by Raman microspectroscopy strongly correlated to the phenotypical features of these cells. Due to its high molecular resolution, Raman microspectroscopy offers distinct analytical characterization for differentiating cardiovascular cell populations.