A novel analysis software to detect Ca²⁺ signaling abnormalities in cardiomyocytes

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Ca²⁺ signaling plays major role in cardiac contractility. Alterations in Ca²⁺ signaling can be seen in arrhythmogenesis associated with cardiac disorders and heart failures. By analyzing the Ca²⁺ cycling of cardiomyocytes with the help of Ca²⁺ imaging, basic cardiac functionality, cardiac disorders and drug responses can be studied more thoroughly.

We have generated spontaneously beating cardiomyocytes from induced pluripotent stem cell lines derived from patients with different cardiac disorders. Ca²⁺ cycling studies have revealed substantial defects and abnormalities in calcium signaling of these cardiomyocytes, presumably reflecting the cardiac phenotype observed in the patients. Ca²⁺ signaling abnormalities can be seen as variable frequency and amplitude and they can be categorized by their form. The analysis of these abnormalities is extremely important to study and understand different cardiac diseases and drug responses. So far this analysis has been done manually by researcher without any generally accepted analysis criteria's. However this way of analysis is subjective and slow and repeatability of analysis may be poor. To overcome these issues, we have developed Ca²⁺ data analysis software based on interactive visualization. The Ca²⁺ data analysis software allows to explore and distinguish different Ca²⁺ signal patterns from recordings and categorize the abnormalities objectively. It will speed up the analysis of cardiomyocyte Ca²⁺ signals and provide a specific analysis criteria’s to analyze Ca²⁺ abnormalities in cardiomyocytes. This analysis software can be exploited to study basic disease pathology, to screen drugs, and to optimize drug therapy in a patient-specific manner.