Stem cells and AI team up to predict cardiac arrhythmias in patients

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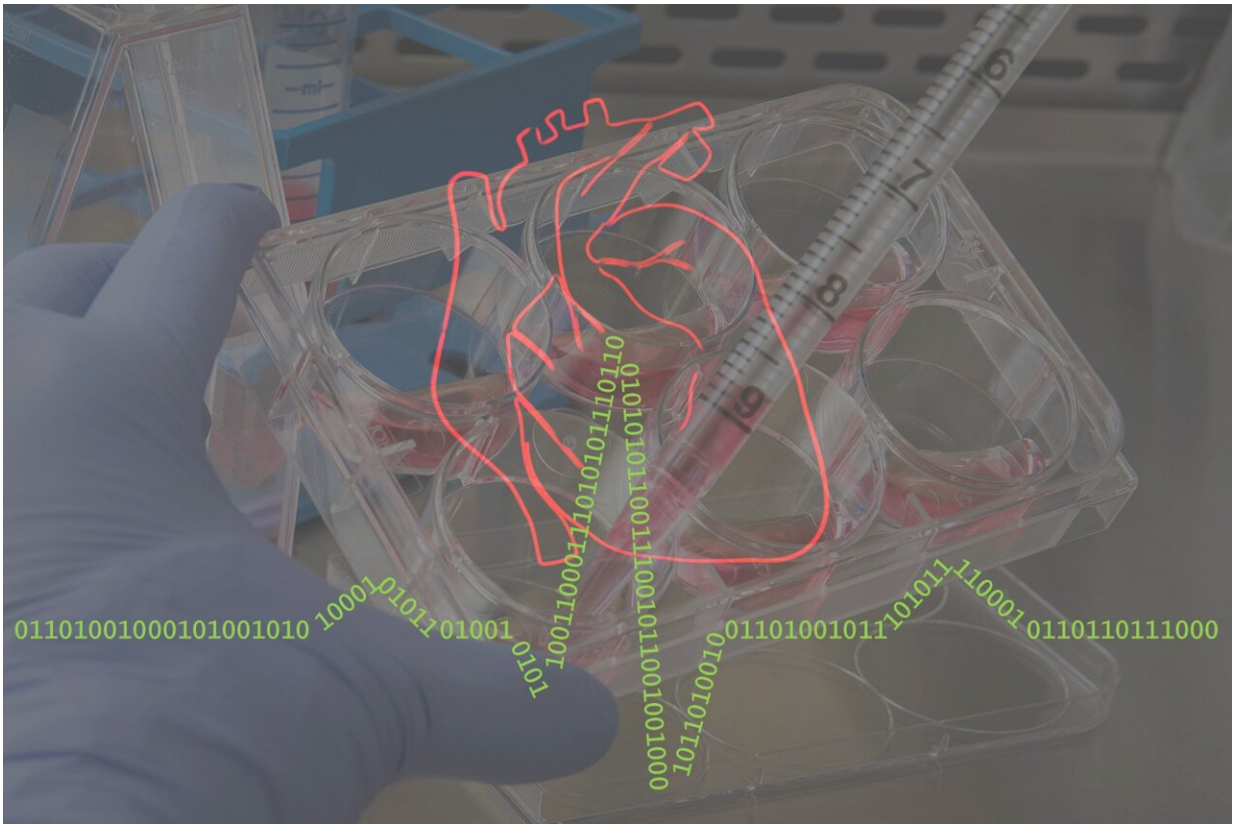

Screening cultured stem cell-derived cardiomyocytes for arrhythmias using machine learning. Credit: Institute of Molecular and Cell Biology, Singapore

Cardiac arrhythmias are a major risk factor for sudden cardiac death, which accounts for 15% to 20% of all deaths worldwide. Causes for

arrhythmias are diverse and include genetic factors, patients' physical and mental condition, and certain medications. Onset and severity of arrhythmic events in patients are notoriously unpredictable, particularly in younger and patients with no history of cardiac disease.

To address this issue, Boon-Seng Soh, Jeremy Kah Sheng Pang and colleagues from the Institute of Molecular and Cell Biology, Singapore combined stem cell technology with machine learning, which enabled them to predict with a high degree of accuracy arrhythmias in the lab. The results of the research were recently published in the journal *Stem Cell Reports*.

In their research, the team used human heart muscle cells, so-called cardiomyocytes, which were made from pluripotent stem cells in the lab. The different cardiomyocyte cultures used in this study had varying propensities to arrhythmias due to genetic mutations or drug treatment.

Using video data from more than 3,000 "healthy" and arrhythmia-prone cardiomyocytes, the researchers trained a machine learning program on the specific beating behavior of the cultures, using a visible indicator of changes in calcium concentrations within the cells, as a measure of heart function. Using this system, the computer algorithms achieved over 90% accuracy in predicting the occurrence of drug- or genetically-induced arrhythmias and identified distinct patterns predictive of arrhythmias.

This research lays the foundation for machine learning-based patient risk profiling and drug toxicity testing in patient-derived cardiomyocytes, which could help to generate safer and more effective medicines.

More information: Boon-Seng Soh, Characterizing arrhythmia using machine learning analysis of Ca2+ cycling in human cardiomyocytes, *Stem Cell Reports* (2022). DOI: 10.1016/j.stemcr.2022.06.005. www.cell.com/stem-cell-reports … 2213-6711(22)00321-6

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