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Novel serum-free 2D human cardiac organ-on-a-chip platform assesses contractile output *in vitro* for predictive pharmacology

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Promising pharmaceuticals frequently fail clinical trials due to cardiotoxicity or a decline in heart function not shown in pre-clinical animal models and live-dead assays on human cell lines. The development of low cost, high-throughput, and reliable in vitro human models remains a priority for pharmaceuticals to avoid costly dead ends in clinical trials. Organ-on-a-chip systems allow the creation of a functional, human tissue test bed that leverages the benefits of miniaturization and the availability of differentiable human stem cells. We report the development of a 2D cardiac platform that allows the functional interrogation of human induced pluripotent stem cell (iPSCs) derived cardiomyocytes (CM). The platform uses a laser reflected off silicon cantilevers with adhered CMs to monitor contractile force and beat frequency. Long-term cardiomyocyte culture conditions and a gravity-driven micro fluidic housing construct allow the daily and non-invasive interrogation of the cantilevers. Chips with up to 32 cantilevers can be rapidly scanned by the automated stages and cardiac output measured by a high speed detector. This enables acute and chronic drug studies with arrhythmogenic and ionotropic compounds to predict *in vivo* cardiac output.

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