Enhanced iPSC-derived Cardiomyocytes Adhesion and Maturation Using Protein-Polyelectrolyte Complex/Polyacrylamide Hydrogel

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Significance

Current cardiac tissue engineering cannot generate tissue that is sufficiently mature to be used as a therapeutic for heart disease patients.



Innovation and Approach

Previous studies have used culture scaffolds that mimic either the compositional or the mechanical properties of the cardiac ECM, but few have used both aspects in tandem. We hypothesized that semi-synthetic hydrogel that supports integrin adhesion and of a tissue-like stiffness will improve iPSC-CM maturation



Results







A) When iPSC-derived cardiomyocytes were seed onto the hydrogel, spontaneous formation of contractile multicellular spheroids was observed B) Within 5 days, the spheroids became more compact and organized. C) After 9 days of culture, the spheroids

began to loosely adhere to the surface of the hydrogel, as seen by the formation projections on the edges of the spheroids

Conclusions and Future Work

 Spheroid formation is possibly caused by the surface of the PPC-PAM hydrogel being low-adhesive, likely due to the bioinert PAM

 Culture of cardiomyocytes on the PPC-PAM can preserve and synchronize the contraction of the cells.

 The apparent adhesion of the spheroids to the hydrogel is likely due to integrin-ligand interaction between the cardiomyocytes and the PPCs.

 Future work includes conducting cardiac maturity biomarkers studies on the cells culture on the PPC-PAM hydrogel, contraction studies, and increasing adhesive property of the hydrogel.