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Scientists develop an engineered cardiac tissue model to study the human heart

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When it comes to finding cures for heart disease scientists are working to their own beat. That's because they may have finally developed a tissue model for the human heart that can bridge the gap between animal models and human patients. These models exist for other organs, but for the heart, this has been elusive. Specifically, the researchers generated the tissue from human embryonic stem cells with the resulting muscle having significant similarities to human heart muscle. This research was published in the February 2014 issue of *The FASEB Journal*.

"We hope that our human engineered cardiac tissues will serve as a platform for developing reliable models of the human heart for routine laboratory use," said Kevin D. Costa, Ph.D., a researcher involved in the work from the Cardiovascular Cell and Tissue Engineering Laboratory, Cardiovascular Research Center, Icahn School of Medicine at Mt. Sinai, in New York, NY. "This could help revolutionize cardiology research by improving the ability to efficiently discover, design, develop and deliver new therapies for the treatment of heart disease, and by providing more efficient screening tools to identify and prevent cardiac side effects, ultimately leading to safer and more effective treatments for patients suffering from heart disease."

To make this advance, Costa and colleagues cultured human engineered cardiac tissue, or hECTs, for 7-10 days and they self-assembled into a long thin heart muscle strip that pulled on the end-posts and caused them to bend with each heart beat, effectively exercising the tissue throughout the culture process. These hECTs displayed spontaneous contractile

activity in a rhythmic pattern of 70 beats per minute on average, similar to the human heart. They also responded to electrical stimulation. During functional analysis, some of the responses known to occur in the natural adult human heart were also elicited in hECTs through electrical and pharmacological interventions, while some paradoxical responses of hECTs more closely mimicked the immature or newborn human heart. They also found that these human engineered heart tissues were able to incorporate new genetic information carried by adenovirus.

"We've come a long way in our understanding of the human heart," said Gerald Weissmann, M.D., Editor-in-Chief of *The FASEB Journal*, "but we still lack an adequate tissue model which can be used to test promising therapies and model deadly diseases. This advance, if it proves successful over time, will beat anything that's currently available."

More information: Irene C. Turnbull, Ioannis Karakikes, Gregory W. Serrao, Peter Backeris, Jia-Jye Lee, Chaoqin Xie, Grant Senyei, Ronald E. Gordon, Ronald A. Li, Fadi G. Akar, Roger J. Hajjar, Jean-Sébastien Hulot, and Kevin D. Costa. Advancing functional engineered cardiac tissues toward a preclinical model of human myocardium. *FASEB J.* February 2014 28:644-654; DOI: 10.1096/fj.13-228007