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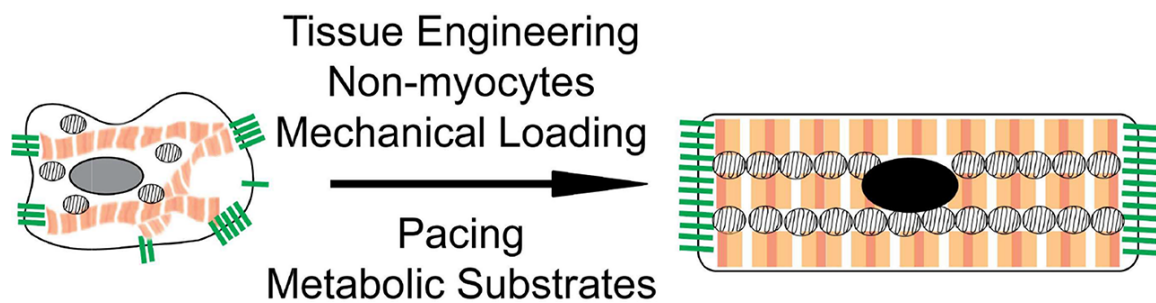
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How close are we to growing a human heart from stem cells?

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According to review, we can now grow tissues analogous to heart muscle in utero using stem cells. The next step is to mimic the conditions that cause tissues to mature as they would in full adults.



While new advances in generating heart tissue using human pluripotent stem cells (hPSCs) have led to leaps forward in understanding fundamental biology, disease modeling and drug development, researchers still haven't produced a fully mature heart muscle cell, known as a cardiomyocyte.

In the new review, Mills and Hudson assess how close the research community is to generating mature human cardiomyocytes from pluripotent stem cells. They state that in order to understand how cardiomyocytes mature one must adequately understand the environment heart cells grow in, in particular after the person is born. This includes mechanical loading and how and when the cells receive metabolic substrates.

The authors have noted that changes in the postnatal effects of increased oxygen availability might help drive maturation, as might the adaptations brought on by the shift from carbohydrate-derived energy in utero to fatty acid metabolism that predominates when a newborn breastfeeds, among many other things.

"There has also been big progress in making different cardiomyocyte subtypes," said James Hudson, an author on the paper. "Traditionally protocols primarily make ventricular cardiomyocytes, but more recent protocols have been developed to also make atrial or pacemaker cardiomyocytes."

Built on previous research, direct differentiation techniques in the last 15 years have allowed researchers to create cardiomyocytes from hPSCs with yields of greater than 95 percent.

However, further research in this area is still needed to better understand how the heart matures and increases its function. By answering these questions, Hudson said he hopes the community will be able to make existing models even closer to the human adult heart.

Source: "Bioengineering adult human heart tissue: How close are we?," by Richard J. Mills and James Hudson, *APL Bioengineering* (2019). The article can be accessed at <https://doi.org/10.1063/1.5070106>.

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