Bioengineers 'pump' life into post-heart attack therapies

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(PhysOrg.com) -- Bioengineers at UC San Diego are one step closer to improving therapies for heart attack victims.

A paper recently published in *Biomaterials* called “Hydrogels with time-dependent material properties enhance cardiomyocyte differentiation in vitro,” describes how the researchers measured the increase in stiffness that occurs in heart muscle as it develops and then mimicked that change in a modified version of a biological material called hyaluronic acid. Pre-cardiac cells grown on these materials were found to mature into adult heart cells better than when grown on materials that did not stiffen. This process occurred despite not having the proper chemical signals around them and shows how important stiffness can be to cells.

This is why their finding is important: Stem cells are often injected into the scar tissue that results from a heart attack (called “myocardial infarction”) in a treatment called cellular cardiomyoplasty. This scar tissue is three-to-four-times stiffer than normal muscle. Since cells are normally responsive to stiffness, the stiff scar helps to block their ability to become muscle. Instead, they turn into immature bone.

“Our hypothesis for this latest effort was that we need to develop a material which we can inject that stiffens as the heart does naturally during development,” said Adam J. Engler, an assistant bioengineering professor at UC San Diego and co-author of the paper. “By placing pre-cardiac cells onto this material and allowing it to stiffen from a soft material to one that resembled normal muscle (and not the stiff scar), we

can better ‘program’ the cells to become mature cardiac muscle. What we observed was that this is indeed the case.”

The bioengineers will follow this up with studies with animal experiments to see if the combination of stem cells and their material helps regenerate muscle rather than have the injected cells become immature bone as which often occurs with cellular cardiomyoplast Jennifer Young, co-author of the paper and a UC San Diego bioengineering Ph.D. student, is excited about theclinical application of her research – the potential to help improve the quality of life of patients who suffer from acute myocardial infarction (heart attack).

“It is always a very satisfying feeling to solve a challenging problem,” said Young, who chose the field of bioengineering because of its promise, cutting-edge nature and countless interesting applications. “It is rewarding to make a contribution to the field, and to see your hard work pay off. However, in a way, the most satisfying part of a breakthrough is identifying the next obstacle that needs to be overcome.”

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