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Nanotechnology to Aid in Correction of Heart Defects

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Previous Status Quo

Current approaches to correcting heart defects require multiple surgeries and have complications due to inactive polymer patches

By adding single walled carbon nanotubes to heart patches, we improved heart cell electrical communication, and through use of liquid crystal elastomers, we can stretch developing patches.

Project Details

- Amniotic fluid contains a population of multi-potent stem cells that can be rapidly expanded, differentiate into multiple cell types, and can be used to vascularize an implantable matrix.
- Cell alignment, stretch conditioning, and scaffold resistance to contraction all affect cardiomyocyte maturation, force generation, and electrophysiology. Liquid crystal elastomer scaffolds are a controllable and scalable method of controlling these parameters.
- A heart patch incorporating CNT demonstrated improved conduction velocity and is feasible as a full thickness defect myocardial patch

Challenges

Need *in vivo* testing of any toxicity and clearing of carbon nanotubes

Next Steps

Plans to test heart patches in a rat model. Next steps are a large animal model and clinical trials.

