Innovations
UNIVERSITY OF COLORADO
ANSCHUTZ MEDICAL CAMPUS

Injectable Scaffold for Cardiac Tissue Engineering

Category
Medical Devices - Materials

Problem
Cardiomyocytes do not regenerate after injury and current regenerative methods have serious limitations

Technology Overview
Reverse Thermal Gel functionalized with Carbon nanotubes promote cell proliferation

IP Status
- Patents Pending.
- Available for Exclusive or Non-Exclusive Licensing

Value Proposition
- CNT scaffold boosts proliferation and viability of cardiomyocytes
- Minimally invasive delivery system and requires no additional step for activation

Market Attractions
- Heart failure market expected to reach $11.5B by 2025
- Approximately 422.7 million cardiovascular disease cases diagnosed globally each year

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Problem: Cardiovascular disease is the leading cause of death in the United States, accounting for one in every three deaths. Many types of heart failure are caused by the degeneration of cardiomyocytes, specialized muscle cells composing 75-80% of the heart. The adult heart has difficulty regenerating these cells, leading those with injuries to seek transplants. However, the availability of heart transplants is limited and those who are unable to receive such treatment have scarce options and poor prognoses. Regenerative medicine, including surgical implants and injection of exogenous or stem cells, have been explored as a standard of care, but many require invasive surgery and the cells tend to have short lifespans and low retention in the area of need.

Technical Solution and Key Value Propositions: Researchers at the University of Colorado have shown the value of carbon nanotubes (CNTs) in cardiac regenerative medicine and have incorporated the material into an injectable reverse thermal gel as a delivery system of new cells. The carbon nanotube functionalized gel exists as a solution at room temperature and forms into a 3D gel shortly after reaching body temperature. This design allows for a minimally invasive delivery system of stem cells and does not require any additional step for activation, like UV light, as the increase in temperature alone will form the scaffold. The CNTs have been demonstrated to provide stability to the gel, as well as increasing the proliferation, viability, and function of injected cardiomyocytes as shown in Figure 1. This technology has the potential to be an alternative treatment for those with heart failure. Initial studies have shown the CNT scaffold to provide better development of cells than traditional 2D gelatin matrices and a biocompatibility in mice yielded good tolerance and low toxicity.

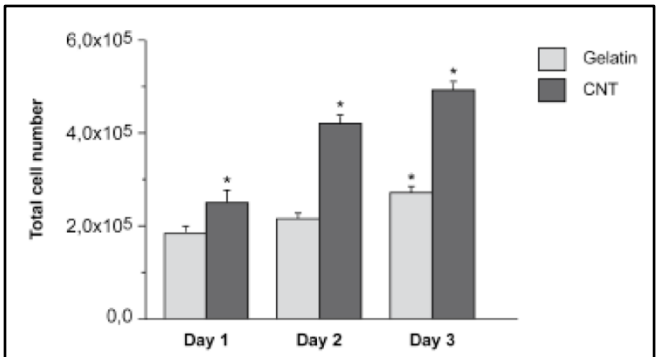

Fig. 1: Cardiomyocytes double in number when grown on a carbon-nanotubes (CNT) substrate

Key Documents and Sources:

- Patent applications: “Carbon-Nanotube Modulation of Myocyte Cells” (Publication number 2017/0145384, filing date of 3/14/2011) and “Carbon nanotube-functionalized reverse thermal gel and methods of forming and using the same” (Publication number 2019/060456, filed 9/20/2017)
- “Injectable Carbon Nanotube-Functionalized Reverse Thermal Gel Promotes Cardiomyocytes Survival and Maturation” doi: 10.1021/acsami.7b11438.

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About CU Innovations

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