Mitochondrial Transplantation to alter energy metabolism

Tech ID: 32084 / UC Case 2018-234-0

BRIEF DESCRIPTION

Mitochondrial cardiomyopathy occurs when cardiomyocytes possess defective mitochondrial DNA. There is no cure and current treatment involves providing patients various dietary supplements. A novel biotherapy in which healthy mitochondria are transplanted directly into cells can help pave the way for treating mitochondrial-related diseases.

SUGGESTED USES

- Method does not necessitate the removal of diseased tissues or defective cells
- pH dependent method of determining successful mitochondrial determination is sensitive/specific

Uses:
Treatment of diseases related to mitochondrial impairment

FEATURES/BENEFITS

- Method does not necessitate the removal of diseased tissues or defective cells
- pH dependent method of determining successful mitochondrial determination is sensitive/specific

Uses:
Treatment of diseases related to mitochondrial impairment

FULL DESCRIPTION

The mitochondria, an organelle found inside an individual cell, is responsible for providing cellular energy. Improper function of the mitochondria can lead to organ dysfunction due to an insufficient energy supply. Patients suffering from mitochondrial impairment can present symptoms at any age with almost any affected body organ/system. In particular, mitochondrial cardiomyopathy, a heart disorder characterized by abnormal myocardial structure and/or function, may occur due to defected mitochondrial DNA. In severe cases of mitochondrial cardiomyopathy, patients can suffer from arrhythmias, heart failures, or even sudden cardiac deaths. Currently, patients suffering from mitochondrial cardiomyopathy receive a mitochondrial cocktail, which contains a variety of vitamins and supplements, to manage this condition. Currently, there are no ways to correct mitochondrial myopathy.

The treatment proposed by UCI researchers features mitochondrial transplantation by administering isolated mitochondria into recipient cells (Figure 1). The proposed treatment delineates the potential of mitochondrial transplantation for clinical application in settings where there is an acute stress that would benefit from a boost in cellular bioenergetics.

Feasibility of such a technique was demonstrated in cardiomyocyte-like cells derived from rat embryonic hearts. Mitochondrial DNA were isolated using commercially available kits followed by staining with a pH dependent stain that fluoresces only after successful uptake and internalization by another cell. Native mitochondrial are labeled with a separate dye to distinguish the two types of mitochondria. It was observed that uptake can occur as early as 4 hours and internalized mitochondria remain in the new host cells for up to 28 hours. Furthermore, the internalized mitochondria are intact and believed to be viable.

Overall, this treatment is attractive because it does not require the removal of existing cells. Instead, this technique focuses on repairing existing cells by replacing defective mitochondria. As a result of the healthy mitochondrial uptake, cellular function can be restored and/or enhanced.
STATE OF DEVELOPMENT

Inventors have successfully observed the internalization of isolated mitochondria into cells.

PATENT STATUS

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- Growth-Accommodating Transcatheter Pulmonary Valve System
- Mitochondrial Transplantation for Treating Mitochondrial Cardiomyopathy
- Method for Synchronizing a Pulsatile Cardiac Assist Device with the Heart
- Automated Histological Image Processing tool for Identifying and Quantifying Tissue Calcification
- Simple, User-friendly Irrigator Device for Cleaning the Upper Aerodigestive Tract and Neighboring Areas
- Automated 3D Reconstruction of the Cardiac Chambers From MRI of Ultrasound
- Minimally Invasive Percutaneous Delivery System for a Whole-Heart Assist Device