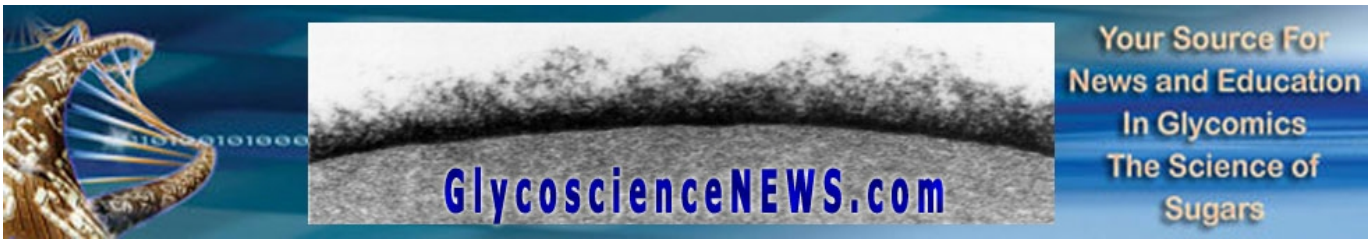

The Sugar Trehalose Researched for Tissue Regeneration

Could be the future of diabetic chronic wound treatment

Glycoscience Lesson #7

by JC Spencer

Diabetic patients are at increasing risk of developing chronic wounds and the numbers are expected to dramatically grow as diabetes increases.

Wounds are healed as blood vessels are able to bring more oxygen and micronutrients to the area. It is quite logical that forming additional blood vessels will increase the capacity for transporting more blood flow. This arrangement of blood vessels could initiate a robust growth program that would induce formation of mature, stable vasculature system.

The delivering a sufficient amount of siRNA* to cells is an extremely difficult task that has previously prevented this therapy from being adopted clinically for wound healing.

A team of researchers led by an NIBIB grantee at Vanderbilt University has created a biodegradable scaffold that enables sustained, local delivery of gene-silencing factors called siRNA to promote tissue regeneration. They recently used the scaffold to deliver siRNA to mice in order to locally silence a gene normally responsible for inhibiting blood vessel formation.

Trehalose

To achieve sustained delivery, the researchers first packaged siRNA into nanoparticles, which protect siRNA from being degraded by enzymes found in the extracellular environment. They then combined these nanoparticles with varying amounts of the sugar Trehalose. This Nanoparticle-Trehalose combination was then embedded into a biodegradable tissue scaffold, which they implanted under the skin of a mouse. Trehalose acts as a porogen, meaning it creates pores in the tissue scaffold. As a result, the rate at which nanoparticles are released from the scaffold is directly influenced by the amount of Trehalose added. Based on the quantity of Trehalose, the system can be tuned to release the nanoparticles to the surrounding cells immediately or time released over a period of several weeks.

The new platform technology could provide a new approach for the treatment of chronic wounds, which afflict over six million patients in the U.S. and cost an estimated $25 billion dollars per year to treat.

Christine A. Kelley, Ph.D., a Division Director at the National Institute of Biomedical Imaging and Bioengineering (NIBIB), praised the development saying, "*This innovative approach and effective method for local siRNA delivery could have wide applications including diabetic wound healing, a significant and growing problem across the globe*."

Trehalose is a bioactive sugar that can be used in tissue engineering. Trehalose is known to protect human cells from stress as the sugar strengthens cell membrane and assists the proper folding of proteins.

* Small interfering RNA (siRNA) are small pieces of double-stranded RNA, that can "interfere" with the translation of proteins by binding to and promoting the degradation of messenger RNA (mRNA) at specific sequences. In doing so, they prevent the production of specific proteins based on the nucleotide sequences of their corresponding mRNA.

Source and References:

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