Di-functional Hyaluronic Acid for Tissue Engineering

UTHealth
The University of Texas Health Science Center at Houston

Hyaluronic Acid (HA) is a polysaccharide that is expressed in the extracellular matrix (ECM) of all vertebrate tissues, contributing to the development of cells in tissue. HA based hydrogels are useful tools in tissue engineering as the HA can be modified with bioactive peptides to facilitate the growth, differentiation and attachment of stem cells and other cell types. Researchers at UTHealth have developed a novel di-functional HA, which possesses two independent functional groups that can be used for crosslinking for gelation and bioactive signal tethering. This di-functional HA provides greater ability to customize the hydrogel, generating a scaffold that more closely mimics the natural microenvironment for the desired tissue engineering applications.

Due to the important role that HA plays in cell growth and development, HA has been implemented as a tool in many areas of regenerative medicine, including central nervous system repair and wound healing. The use of HA modified with a single bioactive peptide is common in tissue engineering scaffolds, but the ability to customize the scaffold is limited by the single modification site present on HA. The newly developed di-functional HA (Dif-HA) provides two unique modification sites which can be used for tethering bioactive molecules and establishing inter-hydrogel crosslinks. The ability to tether bioactive signaling molecules is necessary to develop an ECM that can best promote cell development and regeneration, such as after injury to the central nervous system.

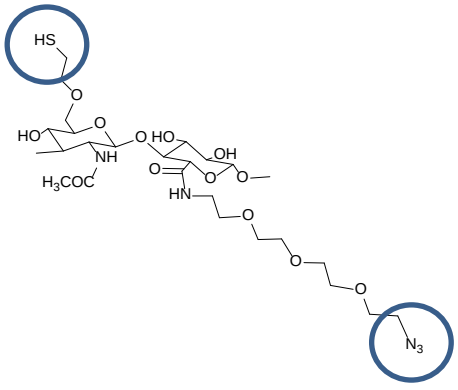

Figure 1: Chemical structure of di-functional HA. The blue circles denote the two separate functional groups, thiol and azide, where bioactive molecules can be attached or crosslinks can be formed.

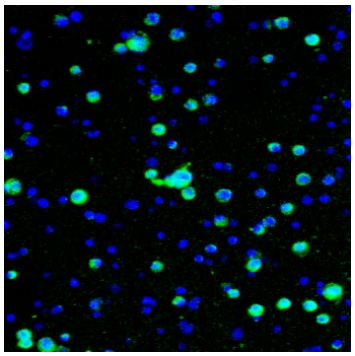

Figure 2: Staining with β -tubulin III (green) and DAPI (blue) shows that 44.51 ± 0.4 % of mouse embryonic stem cells expressed β -tubulin III, an early stage marker of neural differentiation, on day 3 of growth in a hydrogel of a 1:2 mixing ratio of monofunctional:difunctional HA.

This work was done in the laboratory of Dr. Laura Smith Callahan in the UTHealth Department of Neurosurgery & Center for Stem Cell and Regenerative Medicine.

Intellectual Property Status

- Patent application pending
- Portfolio available for licensing

Stage of Development

The Dif-HA backbone has been tested in mice and is able to support neural maturation and growth. Dif-HA has been successfully modified with bioactive peptides to promote neural differentiation, axon extension, and growth.

Publications

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For more information please contact:
Hannah M. Nelson
Sr. Technology Licensing Associate
The Office of Technology Management
P: (713) 500-3399
Hannah.M.Nelson@uth.tmc.edu