

Use Of Non-Ionic Copolypeptide Hydrogels For Cell Suspension And Cell And Molecule Delivery

Tech ID: 30435 / UC Case 2015-124-0

SUMMARY

UCLA researchers in the Departments of Bioengineering, Chemistry and Biochemistry, and Neurobiology have developed novel copolypeptide hydrogel formulations for the delivery of cells and molecules to locations throughout the body, including the central nervous system.

BACKGROUND

Central nervous system (CNS) disorders, commonly caused by trauma, stroke, and degeneration, are debilitating chronic health conditions impacting the quality of life for millions of patients. Currently, there is a shortage of good treatment options available for these patients, partly due to the many challenges associated with treating CNS conditions through systemic delivery. Recently, polymer-based biomaterials have been investigated as potential vehicles for the site-specific delivery of drugs and cells into the CNS. Although many of the materials have shown promise in the early studies, they suffer from several limitations such as suboptimal mechanical properties, heterogeneity, immunogenicity, cytotoxicity, and high cost. Therefore, there is a strong need for biocompatible, injectable, and cost-effective materials that can deliver locally to the CNS for both therapeutic applications and neuroscience research.

INNOVATION

UCLA researchers have developed novel formulations of non-ionic diblock copolypeptide hydrogels (DCH) that exhibit major improvements in various criteria compared to other DCH and non-DCH materials. Whereas ionic DCH were found to be toxic to suspended murine mesenchymal stem cells, the non-ionic DCH showed minimal cytotoxicity and supported the long-term survival of the suspended cells. Furthermore, these non-ionic DCH feature tunable physical properties that enable reversible thermoresponsive behavior at room temperature vs. body temperature. These characteristics make the non-ionic DCH attractive candidates for delivering cells or molecules to the CNS. The non-ionic DCH may also be used to deliver cells to other locations in the body, including to damaged cardiac tissue after myocardial infraction.

In vivo studies in mice conducted by the researchers demonstrated that thermoresponsive DCH carrying suspended neural stem cells (NSC) were easily injected into the brain or spinal cord as a liquid, and subsequently self-assembled into hydrogels with a stiffness tuned to that of the CNS tissue. The results from these studies revealed that DCH increased the survival of grafted NSC by three-fold; moreover the NSC integrated with neural cells at lesion sites and supported the regrowth of host nerve fibers.

APPLICATIONS

- ▶ Drug and cell delivery to the CNS and other locations in the body
- ▶ Neuroscience research, i.e. the development, function, and repair of the CNS

ADVANTAGES

- ▶ Cytocompatibility
- ▶ Tunable stiffness & viscosity
- ▶ Injectability
- ▶ Thermoresponsiveness
- ▶ Low cost

STATE OF DEVELOPMENT

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OTHER INFORMATION

KEYWORDS

biomaterials, copolypeptide hydrogel, injectable, nonionic, thermoresponsive, self-assembly, tunable stiffness, drug delivery, cell transplantation, neural stem cells, central nervous system, spinal cord injury, neural repair

CATEGORIZED AS

- ▶ **Materials & Chemicals**
 - ▶ Biological
 - ▶ Polymers
- ▶ **Medical**
 - ▶ Delivery Systems
 - ▶ Disease: Central Nervous System
 - ▶ Therapeutics
- ▶ **Nanotechnology**
 - ▶ Materials

RELATED CASES

2015-124-0

This invention has been developed and tested in mice.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,298,424	04/12/2022	2015-124

RELATED MATERIALS

- ▶ Zhang, S. et al. ACS Biomater. Sci. Eng. 2015, 1, 705–717.
- ▶ Zhang, S. et al. Biomacromolecules 2015, 16, 1331–1340.

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ Preparation Of Functional Homocysteine Residues In Polypeptides And Peptides
- ▶ Compositions Of Polyion Complex Polypeptide Hydrogels
- ▶ Chemoselective Side-Chain Modifications Of Methionine-Containing Elastin-Like Polypeptides

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