

Accepted Manuscript

Title: Polycations and Their Biomedical Applications

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PII: S0079-6700(16)30024-7
DOI: <http://dx.doi.org/doi:10.1016/j.progpolymsci.2016.05.004>
Reference: JPPS 983

To appear in: *Progress in Polymer Science*

Received date: 8-1-2015
Revised date: 1-3-2016
Accepted date: 16-5-2016

Please cite this article as: Kim K, Chen WCW, Heo Y, Wang Y, Polycations and Their Biomedical Applications, *Progress in Polymer Science* (2016), <http://dx.doi.org/10.1016/j.progpolymsci.2016.05.004>

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Polycations and Their Biomedical Applications

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Short Title: Biocompatible polycations

Key Words: Polycation, Growth Factor Delivery, Gene Therapy, Tissue Engineering, Coacervate

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Abstract

Polycations are useful delivery vehicles for nucleic acids and proteins. Physicochemical properties, safety, and cost are important design parameters for polycation-enabled controlled release methods. Improvements in the design and biocompatibility of synthetic polycations and complexes thereof are necessary for clinical applications. This review focuses on breakthroughs in the development of biocompatible polycations and their biomedical applications in the past 10 years. First, we summarize current strategies to develop naturally derived and synthetic polycations and describe the most commonly used polycations. Second, we discuss polycation-mediated non-viral gene delivery systems used for tissue engineering and regenerative medicine. Third, we review the development of polycation-mediated self-assembled systems for the delivery of heparin-binding proteins, with an emphasis on translational potential. Finally, we introduce platforms for fabricating polycation-based complexes, including layer-by-layer assembly, polymeric vesicles, polycation-containing microspheres, and approaches to improve the functionality of delivery complexes. With improvements in polycation design, safety, and efficacy, polycation-based controlled delivery is expected to contribute significantly to tissue repair and regeneration applications.

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