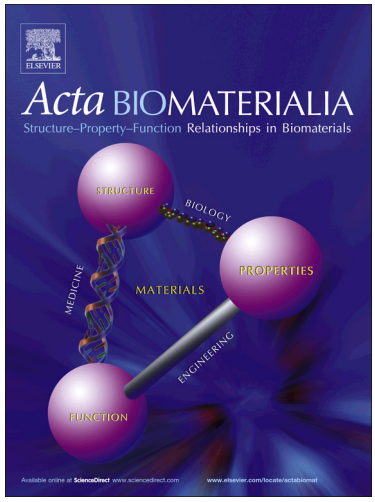

Review article

Current Approaches in Biomaterial-Based Hematopoietic Stem Cell Niches

Alvin Bacero Bello, Hansoo Park, Soohong Lee

PII: S1742-7061(18)30148-X
DOI: https://doi.org/10.1016/j.actbio.2018.03.028
Reference: ACTBIO 5370

To appear in: *Acta Biomaterialia*

Received Date: 26 September 2017
Revised Date: 7 February 2018
Accepted Date: 14 March 2018

Please cite this article as: Bello, A.B., Park, H., Lee, S., Current Approaches in Biomaterial-Based Hematopoietic Stem Cell Niches, *Acta Biomaterialia* (2018), doi: https://doi.org/10.1016/j.actbio.2018.03.028

Current Approaches in Biomaterial-Based Hematopoietic Stem Cell Niches

Alvin Bacero Bello[1,2], Hansoo Park[1*], and Soohong Lee[2*]

[1]*School of Integrative Engineering, Chung-Ang University, Seoul 06911, Korea; abacerobello@gmail.com*
[2]*Department of Biomedical Science, CHA University, Seongnam-Si 13488, Korea*

**Correspondence: heyshoo@cau.ac.kr (Tel.: +82-2-820-5804, Fax: +82-2-813-8159); soohong@cha.ac.kr (Tel.: +82-031-881-7243, Fax: +82-31-881-7249)*

Abstract

Hematopoietic stem cells (HSCs) are multipotent progenitor cells that can differentiate and replenish blood and immune cells. While there is a growing demand for autologous and allogeneic HSC transplantation owing to the increasing incidence of hereditary and hematologic diseases, the low population of HSCs in cord-blood and bone marrow (the main source of HSCs) hinders their medical applicability. Several cytokine and growth factor-based methods have been developed to expand the HSCs *in vitro*; however, the expansion rate is low, or the expanded cells fail to survive upon engraftment. This is at least in part because the overly simplistic polystyrene culture substrates fail to fully replicate the microenvironments or niches where these stem cells live. Bone marrow niches are multi-dimensional, complex systems that involve both biochemical (cells, growth factors, and cytokines) and physiochemical (stiffness, O_2 concentration, and extracellular matrix presentation) factors that regulate the quiescence, proliferation, activation, and differentiation of the HSCs. Although several studies have been conducted on *in vitro* HSC expansion via 2D and 3D biomaterial-based platforms, additional work is required to engineer an effective biomaterial platform that mimics bone marrow niches. In this study, the factors that regulate the HSC *in vivo* were explained and their applications in the engineering of a bone marrow biomaterial-based platform were discussed. In addition, current approaches, challenges, and the future direction of a biomaterial-based culture and expansion of the HSC were examined.