**The combined influence of substrate elasticity and surface-grafted molecules on the exvivo expansion of hematopoietic stem and progenitor cells**


## ABSTRACT

Umbilical cord blood (UCB) is an attractive source of hematopoietic stem and progenitor cells (HSPCs) for transplantation. However, the low number of HSPCs from a single UCB donor limits the direct transplantation of UCB to patients. Because little is known about the effects of the physical microenvironment on HSPC expansion, we investigated the exvivo expansion of HSPCs cultured on biomaterials with different elasticities and grafted with different nanosegments. Polyvinylalcohol-co-itaconic acid (PVA-IA)-coated dishes with different stiffnesses ranging from a 3.7kPa to 30.4kPa storage modulus were used. Fibronectin or an oligopeptide (CS1, EILDVPST) was grafted onto the PVA-IA substrates. High exvivo fold expansion of HSPCs was observed in the PVA-IA dishes grafted with fibronectin or CS1, which displayed an intermediate stiffness ranging from 12.2kPa to 30.4kPa. The fold expansion was more than 1.4 times higher than that cultured in tissue culture polystyrene dishes (TCPS, 12GPa). Furthermore, HSPCs cultured in fibronectin or CS1-grafted PVA-IA-coated dishes with a stiffness of 12.2-30.4kPa generated more pluripotent colony-forming units (CFU-GM and CFU-GEMM) than those in TCPS dishes. This result indicates that both the physical and biological properties of biomaterials affect the exvivo expansion of HSPCs.



**Keyword:** Blood; Cell proliferation; Elasticity; Fibronectin; Stem cell; Surface grafting