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Stem cell sources for building vasculature in microfluidic systems

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Embryonic stem cells (ESCs) and induced pluripotent stem (iPS) cells are attractive in vitro models of vascular development, therapeutic angiogenesis and tissue engineering. Although a number of biochemical signals have been identified for directing endothelial fate, many of these factors activate redundant pathways, and the minimal combinatorial signals directing vascular fate have yet to be elucidated. Using our stage-specific chemically-defined derivation methodology, we examined multiple combinatorial factors for directing vascular smooth muscle cells (SMCs), pericytes, sprouting endothelial cells (ECs) and non-sprouting ECs. While all ECs express vascular endothelial (VE-cadherin), the sprouting ECs express low levels of Flt-1 while non-sprouting ECs expressing high levels of Flt-1. These cell populations were then examined for their unique potential to generate perfusable vasculature in vitro compared with human umbilical vein endothelial cells (HUVECs) and normal human lung fibroblasts. Results indicate that, the stem cell-derived populations are more dynamic compared with HUVECs - forming vasculature very early in just 1-2 days but lack longer-term stability. Further exploration is required for enhancing longer-term stability of vascular networks in vitro.

Biography

Kara E McCloskey is an Associate and Founding Professor in the School of Engineering at the University of California, Merced. She has received her BS in Chemical Engineering from The Ohio State University and her PhD through a joint Biomedical Engineering Program with The Cleveland Clinic Foundation. She has completed her Post-doctoral training with Dr. Robert Nerem at the Georgia Institute of Technology. Her research is in the field of Cardiovascular Tissue Engineering with a specific focus on deriving functional cell products from stem cells.

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