

## Engineering the stem cell microenvironment

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**H**uman embryonic stem cells (hESC) represent a promising source of human cells for cell transplantation and engineered tissue constructs. Unlike any other stem cell, hESC have the combined ability to proliferate, self renew for long periods, differentiate into all specialized cells of the body and more importantly can organize into complex multi-cell type structures during their embryonic-like differentiation. However, to unlock the full therapeutic potential of these cells it is necessary to develop approaches to control their in vitro growth and differentiation to useful specific sub types. To this aim we have developed two different approaches: 1) Engineering stem cell microenvironments via extrinsic signaling. We developed smart scaffolds that sequence the presentation of chemical cues for hESC differentiation into vascularized tissue. In-vivo transplantation of these scaffolds in mice that underwent ischemic hind limb surgery salvaged the limb from necrosis development. 2) Engineering the stem cells themselves via intrinsic genetic programming by 3D delivery of siRNA, silencing gene known to participate in the process of hESC differentiation. By knockdown a single gene (KDR) we were able to block hESC differentiation towards the endoderm lineage as evident by 60-90% down regulation of genes representative of endoderm differentiation. An understanding of both materials science and stem cell biology allows the recreation of 3D microenvironments favorable of specific tissue. These 3D tissue environments can then serves as platform for fundamental research in organ development, studies of disease or testing of drugs.

### Biography

Zoldan is an expert in stem cell engineering and material science. She received her Masters and Phd degrees in the Technion's department of Materials Engineering specializing in polymer science. In her postdoctorate research, she expanded her research base and entered the growing field of tissue engineering. Currently, she is heading stem cell tissue engineering research at the Langer Lab.

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