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Human embryonic stem cells: lessons from stem cell niches *in vivo*

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In vivo the stem cell niche is an essential component in controlling and maintaining the stem cells' ability to survive and respond to injury. Human embryonic stem cells (hESCs) appear to be an exception to this rule as they can be removed from their blastocytic microenvironment and maintained indefinitely *in vitro*. However, recent observations reveal the existence of an autonomously derived *in vitro* hESC niche. This provides a previously unappreciated mechanism to control hESC expansion and differentiation. Recognizing this, it may now be possible to take aspects of *in vivo* stem cell niches, namely extracellular matrices, paracrine signals and accessory cell types, and exploit them in order to gain fidelity in directed hESC differentiation. In doing so, routine customization of hESC lines and their application in regenerative therapies may be further enhanced using unique hESC niche-based approaches.

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