Roundtable: Embryonic or adult stem cells: scientific and ethical considerations

The technology of human embryonic stem cells

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The first embryonic stem cell lines from mouse were first derived in 1981 and have allowed a remarkable progress in biomedical research. They enabled the making of so-called knock-out mice and allowed the study of gene function in a more targeted way. Many disease mechanisms have been elucidated thanks to these mice. Soon it became clear that the pluripotent embryonic stem cells could be used to derive differentiated cells of all 3 germ layers and be used for regeneration in vivo. Accordingly, researchers attempted to derive embryonic stem cells from human blastocysts. After several fruitless efforts to establish stable human embryonic cell lines the break-through happened in 1998 with the derivation of several cell lines. Since then, the stem cell field has exploded, over 500 lines have been derived from human blastocysts produced during IVF treatment and would have been discarded otherwise. The potential applications of human embryonic stem cells have evolved far beyond regenerative medicine. For the first time in history, researchers have the capabilities to establish robust models for human diseases, and have abundant human cells in culture that are karyotypically normal, which will allow to characterize cellular functions in the different human organs. It is now even possible to model early human embryonic development, until now a black box. It is expected that human embryonic stem cell technology will have an enormous impact on society and day-to-day life in the next 1-2 decades.

Keywords: hESC lines, karyotypically normal human cells, in vitro fertilization, blastocyst, human embryonic development, human disease models, regenerative medicine