Generation of Induced pluripotent stem cells

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The ability to reprogram human somatic cells to a pluripotent embryonic stem cell-like state through the ectopic expression of a combination of embryonic transcription factors was greeted with great excitement by scientists and bioethicists. These laboratory-grown cells are pluripotent – they can make any type of cell in the body – and are called induced pluripotent stem cells or iPSC. The reprogramming technology offers the opportunity to generate patient-specific stem cells for modeling human diseases, drug development and screening, and individualized regenerative cell therapy. Indeed, over the last decade, disease and patient specific iPSC combined with genome editing have been successfully used in preclinical studies for disease modeling and cell therapies. Most work on pluripotent stem cells is taking place in established, sophisticated core facilities which are part of large research institute centers. We applied a synthetic mRNA kit for reprogramming bone marrow derived mesenchymal stromal cells in our hematopoietic stem cell processing lab with the aim to generate intergration-free iPSC lines from healthy donors and from pediatric patients with hematological diseases. We would like to present our experince in setting up a clinical relevant reprogramming method in a clinically oriented laboratory and the successful generation of iPSC lines. Furthermore, we will summarize the progress and the recent advances that have been made over the last 10 years in the iPSC field with emphasis on strategies to develop robust lineage-specific differentiation protocols to generate large quantities of purified and matured iPSC-differentiated cells. Special mention will be made to the production of germ cells from iPSCs, which can be another possible alternative for the treatment of infertility in future.