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Embryonic vs. Induced pluripotent stem cells: Considerations for clinical applications

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The technologies developed to produce human-induced pluripotent stem cells (hiPSCs), derived by epigenetic reprogramming of human fibroblasts, have provided an exciting new platform for generating dedifferentiated somatic cells— thought to be almost identical to human embryonic stem cells (hESCs) and of great promise for patient tailored regenerative medicine therapies. However, a prospect of potential tumorigenisity of iPSCs remains a concern, especially considering that reprogramming-inducing factors either can function as oncogenes or linked to cancers. We attempted a detailed comparative analysis of hESCs and iPSCs on microRNA (miRs) at the micro-karyotype level. The analysis of 365 miRs revealed 72 differentially expressed miRs, 15 of which show >10-fold difference, and 10 of these are considered cancer related. Additionally we observed that deletions of genes with tumor suppressor activity were found to arise during reprogramming, and duplications of genes with oncogenic activity to occur over long-term passage of hiPSCs. A number of differences were documented by other authors at epigenetic level include aberrant imprinting, histone modifications, DNA methylation defects at CpG islands. Most common finding is incomplete reprogramming when reprogrammed cells retain a memory of the parent tissue of origin. Aside from tumorigenisity, epigenetic background seemingly alters differentiation potential. There is increasing number of reports on limited differentiation capacities of iPSCs compare to hESCs. These data demonstrate hiPSCs technology will require further assessment and highlight the need for comprehensive genomic analysis of the cells destined for future therapies.

Biography

Galat is an Assistant professor in the Department of Pathology at Northwestern University's Feinberg School of Medicine and director of Children's Hospital of Chicago Research Center's Stem Cell Core Facility. Dr. Galat was the first to develop and introduce the hESC lines harboring the mutations specific for human diseases and and characterized a novel type of embryonic stem cells that contribute to a developing yolk sack. Consequently he has been working on establishing, molecular characterization and directed differentiation of hESCs and iPSC lines.

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