Induced pluripotent stem cells: reprogramming platforms and applications in cell replacement therapy

ABSTRACT

The generation of induced pluripotent stem cells (iPSCs) from differentiated mature cells is one of the most promising technologies in the field of regenerative medicine. The ability to generate patient-specific iPSCs offers an invaluable reservoir of pluripotent cells, which could be genetically engineered and differentiated into target cells to treat various genetic and degenerative diseases once transplanted, hence counteracting the risk of graft versus host disease. In this context, we review the scientific research streams that lead to the emergence of iPSCs, the roles of reprogramming factors in reprogramming to pluripotency, and the reprogramming strategies. As iPSCs serve tremendous correction potentials for various diseases, we highlight the successes and challenges of iPSCs in cell replacement therapy and the synergy of iPSCs and clustered regularly interspaced short palindromic repeats (CRISPR)/Cas9 gene editing tools in therapeutics research.

Keyword: Clinical applications; Gene editing; iPSCs; OSKM; Reprogramming; Viral and nonviral vectors