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Short Communication

Application of Induced Pluripotent Stem Cells in Domestic Animals

David Gowran*

Department of Biomedical Sciences, University of Guelph, Guelph, Canada

DESCRIPTION

Induced Pluripotent Stem Cells (iPSCs) are indistinguishable stem cells considered by the capability to differentiate into any cell type in the body. iPSCs are a comparatively new and fast developing technology in many fields of biology, containing developmental anatomy and physiology, pathology, and toxicology. These cells have high potential in research as they are self-renewing and pluripotent with slight ethical concerns. Protocols for their production have been advanced for many domestic animal species, which have since been used to further our knowledge in the development and treatment of diseases. This research is valuable both for veterinary medicine as well as for the view of translation to human medicine. Safety, cost, and feasibility are potential fences for this technology that must be considered before extensive clinical acceptance. This review will analyze the literature pertaining to iPSCs derived from numerous domestic species with a focus on iPSC production and characterization, applications for tissue and disease research, and applications for disease treatment.

iPSCs have been produced from several donor tissue, transduction systems, and reprogramming factor combinations. In domestic species, iPSCs have been resulting from fibroblasts, MSCs and other somatic cell types including epithelial and testicular cells. Tissue sources have been found from various developmental stages, namely fetal, juvenile, neonatal, and adult. For ease, this review has known any tissue sources obtained from an animal in utero as fetal and those obtained after birth as adult [1]. Originating iPSCs from adult somatic cells is normally preferable to embryonic origin due to a higher profusion of cells, easier collection of cells, and the capacity to produce autologous iPSC populations for disease treatment. Donor tissue is then cultured and reprogrammed using viral or non-viral vectors having the elected reprogramming factors. Viral vectors include lentiviruses, oncoviruses, and Sendai viruses, while non-viral vectors include cDNA vectors, minicircles and transposons. The selected reprogramming factors usually include OSKM, but other differences have also been explored. Nanog and Lin28 are frequently used in the literature in addition to OSKM, and a small number of papers report the use of other additional transcription factors, such as TERT, and Tet1. Recently, work has been carried out using microRNAs in combination with other factors to achieve pluripotency induction. MicroRNAs alone have only shown partial reprogramming skills in domestic animals [2,3].

iPSCs have the potential to be valued tools for tissue and disease modelling. *In vitro* diversity of iPSCs has allowed for study of the developmental procedures and pathologies of tissues and may allow for preclinical testing of therapeutic drugs for veterinary and human medicine. With respect to drug screening, there has been success in human and mouse iPSC research in using differentiated iPSC lines to model disease and conduct high throughput screening of small molecules for their effects on disease progression. This technique allows for testing of potential therapeutics against disease-genotype cells specific to a species or individual without the need for interspecies comparisons or excessive lab animal use. Differentiation into exact cell types has been noted many times in the literature in porcine, equine, canine, galline, and bovine models [4,5].

CONCLUSION

Although classification of these differentiation cells is demonstrated by physiological, genetic, or metabolic capacities of cell lines, the level of differentiation varies from progenitor cells. Domestic animal diseases are plentiful and contain adverse health effects for consumers of agricultural animal by-products. Unfortunately, the use of stem cells for research on livestock disease is novel and now limited in number. The prolonged self-renewing characteristic of iPSCs supports their use in the study of physiology, disease pathology, drug toxicity and vaccine development in domestic species.

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Correspondence to: David Gowran, Department of Biomedical Sciences, University of Guelph, Guelph, Canada, E-mail: Gowran_david@gmail.com

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