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Letter to Editor

MicroRNA-induced pluripotent stem cells

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Dear Editor,

We read with much interest the recently published article, "Induced pluripotent stem cells in research and therapy," by Teoh *et al*.[1] The review described current methods of reprogramming and the potential of iPSC applications in medicine. This review encourages the exploration of reprogramming technology in Malaysia, and is helpful to both clinicians and stem cell researchers.

We wish to share a few facts in the methods in reprogramming related to this interesting article. Since the discovery of the first microRNA by Lee *et al.* in 1993 in C. elegans[2], over 1000 different human microRNAs have been identified and these regulate most if not all biological and pathological processes. The mir-302 microRNA gene cluster is highly expressed and specific to embryonic stem cells and downregulated after differentiation.

Recently, this cluster was used to reprogram somatic cells to iPSCs called microRNA-induced pluripotent cells (mirPS), with a remarkably high efficiency of 10%.[3] When mir-302 was co-expressed with the OSKM factors, it also enhanced their reprogramming efficiency.[3-9] (Table 1). Therefore microRNA manipulation is perhaps another valuable approach for the purpose of reprogramming.

Table 1: List of publications in somatic cell reprogramming using microRNA

No	Method	Cells	Efficiency	Authors
1	Transduction; Retrovirus 302a,b,c,d	Human melanoma cells (Colo) Human prostate cancer cells (PC3)	2-5%	Lin et al. 2008[4]
2	Transfection 291; 294; 295; 302d/ Transduction; Retrovirus OSK	Mouse embryonic fibroblasts	0.1-0.3% (294 and OSK)	Judson et al. 2009[5]
3	Transduction 302a,b,c,d	Human hair follicle cells	-	Lin et al. 2011[6]
4	Transduction; Retrovirus Cluster A: 200b, 200a, 429 Cluster B: 106a, 18b, 20b, 19b, 92a, 363 Cluster C: 302a,b,c,d, 367 OSK/OSKM	Mouse embryonic fibroblasts	Cluster B and C enhanced reprogramming by OSK/OSKM factors	Liao et al. 2011[7]
5	Transfection 302b, 372/ Transduction; Retrovirus OSK/OSKM	Human foreskin (BJ) Lung fibroblasts (MRC5)	302b and/or 372 enhanced reprogramming by OSK/OSKM factors	Subramanyam et al. 2011[8]
6	Transduction; Lentivirus 302a,b,c,d/ 302a,b,c,d,367	Mouse embryonic fibroblasts, Human dermal fibroblasts	10%	Anokye-Danso F et al. 2011[3]
7	Transfection 200c, 302a,b,c,d, 369-3p,-5p	Mouse adipose stromal cells, Human adipose stroma cells, Human dermal fibroblasts	0.0001% (mouse) 0.0002% (human)	Miyoshi et al. 2011[9]

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REFERENCES

1. Teoh HK, Cheong SK. Induced pluripotent stem cells in research and therapy. Malays J Pathol 2012;34(1):1-13.
2. Lee RC, Feinbaum RL, Ambros V. The C. elegans heterochronic gene lin-4 encodes small RNAs with antisense complementarity to lin-14. Cell 1993;75(5):843-54.
3. Anokye-Danso F, Trivedi CM, Juhr D, et al. Highly efficient miRNA-mediated reprogramming of mouse and human somatic cells to pluripotency. Cell Stem Cell 2011;8(4):376-88.
4. Lin SL, Chang DC, Chang-Lin S, Lin CH, Wu DT, Chen DT, Ying SY. Mir-302 reprograms human skin cancer cells into a pluripotent ES-cell-like state. RNA 2008;14(10):2115-24.
5. Judson RL, Babiarz JE, Venere M, Blelloch R. Embryonic stem cell-specific microRNAs promote induced pluripotency. Nat Biotechnol 2009;27(5):459-61.
6. Lin SL, Chang DC, Lin CH, Ying SY, Leu D, Wu DT. Regulation of somatic cell reprogramming through inducible mir-302 expression. Nucleic Acids Res 2011;39(3):1054-65.
7. Liao B, Bao X, Liu L, *et al*. MicroRNA cluster 302-367 enhances somatic cell reprogramming by accelerating a mesenchymal-to-epithelial transition. J Biol Chem 2011;286(19):17359-64.
8. Subramanyam D, Lamouille S, Judson RL, Liu JY, Bucay N, Derynck R, Blelloch R. Multiple targets of miR-302 and miR-372 promote reprogramming of human fibroblasts to induced pluripotent stem cells. Nat Biotechnol 2011;29(5):443-8.
9. Miyoshi N, Ishii H, Nagano H, *et al*. Reprogramming of mouse and human cells to pluripotency using mature microRNAs. Cell Stem Cell 2011;8(6):633-8.