

Development of Technology to Manipulate the Biological Functions of Stem cells for Cell therapy of Next Generation

Yasuhiko Tabata

(Kyoto University, Institute for Frontier Medical Sciences, Professor)

【Outline of survey】

There are two approaches to realize the therapy of regenerative medicine : tissue regeneration and repairing by cell transplantation and tissue engineering where the proliferation and differentiation of cells are promoted by biomaterials and biomedical technologies to induce the regeneration and repairing of tissues. The objective of this project is to develop the technology of tissue engineering for enhancement of the biological functions of stem cells aiming at promoted efficacy of cell therapy. Biomaterials of gene transfection for stem cells and the technologies of cell culture are both developed to manipulate and enhance the biological functions of cells. The functions of stem cells genetically manipulated by efficient combination of transfection biomaterials and culture technologies are investigated in vitro and in vivo. The results obtained are indispensable for the future development of tissue regenerative therapy. This is because the results are practically applicable for the basic research of stem cells biology and medicine as well as their therapeutic applications. In this project, the biomaterials of non-viral gene transfection for stem cells are investigated and developed as the viral system cannot be clinically applied. In addition, the improvement of cell culture substrates and technology/methodology is actively carried out to provide stem cells with good culture conditions which greatly affect the efficiency of gene transfection. Efficient manipulation of stem cells for their biological activation can be achieved by the substantial research integration of gene transfection and cell culture technologies.

【Expected results】

Even if stem cells can be obtained accompanied with the recent advance of cells researches, it is practically impossible to enhance the therapeutic efficacy of cell transplantation without the improvement and development of technology and methodology to increase the grafting rate of cells transplanted. The achievement of this project will result in the increased grafting rate of cells transplanted and the consequent enhancement of their therapeutic efficacy, which is one of the large and important steps to realize the cell therapy of next generation. The technology of cells manipulation developed can be applied for stem cells which are practically difficult to genetically engineer their biological functions. In addition, the technology is also useful to clarify the mechanism of cells differentiation and achieve the differentiation regulation as well as the research for the design and creation of drugs.

【References by the principal investigator】

- Y. Tabata. Current status of regenerative medical therapy based on drug delivery technology. Regenerative BioMedicine Online, 16(1), 70-80(2008)
- M. Yamamoto and Y. Tabata. Tissue engineering by modulated gene delivery. Advanced Drug Delivery Reviews, 58, 535-554 (2006)

【Term of project】 FY2008—2012

【Budget allocation】

129,400,000 yen (direct cost)

【Homepage address】

<http://www.frontier.kyoto-u.ac.jp/te02/index-j.php3>