【Grant-in-Aid for Scientific Research (S)】

Science and Engineering (Engineering)

Title of Project： Cell Exercise toward Elastic Cellular Tissue

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Research Area：　Intelligent Machine and Mechanical System
Keyword：　Mechatronics, Cellular Tissue Engineering, Cell Exercise

【Purpose and Background of the Research】

When we impart periodic mechanical stress to cell continuously, it eventually loses its deformability. This test is called “Cell Stress Test”. On the other hand, when we reduce the stress level to the cell, the situation eventually results in the “Exercise” instead of “Stress” mode. As a result, we can expect cellular tissue with highly elasticity. This is what we call “Cell Exercise”.

Through our preliminary experiments, it was found that we obtain cellular tissue with even bigger size and with much more gene expression concerning with muscle fiber under “Cell Exercise” than those under atmospheric pressure.

By considering these facts, the goal of this research is to obtain an optimum parameters in term with the most elastic cellular tissue by monitoring both elasticity and gene expression of cellular tissue during “Cell Exercise”.

【Research Methods】

We first develop the multifunctional incubator capable of freely changing the pressure pattern and of continuously monitoring the behavior of cell in dish, so that we can make clear the difference of cell behaviors between normal and “Cell Exercise” modes, respectively. Especially, how the interaction between cells start with respect to time and how they affect the cellular tissue construction. A set of optimum parameters for the most elastic cellular tissue can be searched by monitoring both elasticity and gene expression of cellular tissue during “Cell Exercise”.

【Expected Research Achievements and Scientific Significance】

The proposed “Cell Exercise” can be applied to all conventional cell culturing methods. Thus, we can expect additional effects, such as a short-term culturing, and an increase of elasticity of cellular tissues. Since “Cell Exercise” does not need any chemical, the cellular tissue under “Cell Exercise” should be good for human body in regenerative medicine. We believe that this is a great advantage expected from this research.

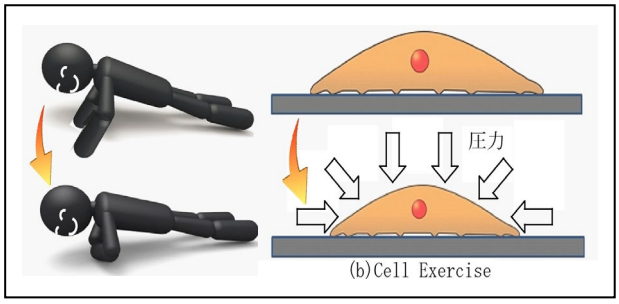

Figure 1 Conceptual Image of Cell Exercise

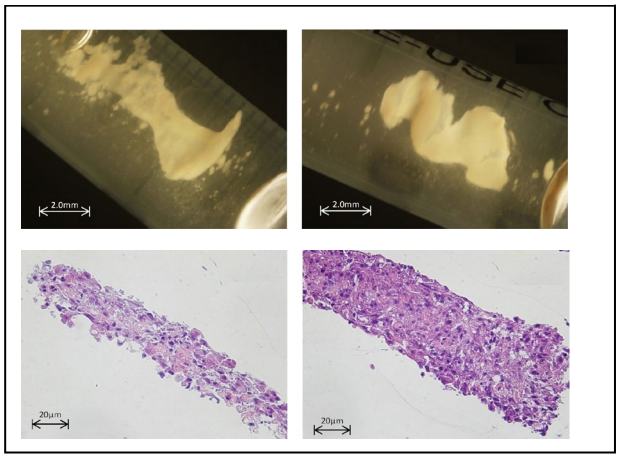

Figure 2 Under Atmospheric Pressure (left) and Cell Exercise (right)

【Publications Relevant to the Project】

S. Sakuma, K. Kuroda, C. Tsai, W. Fukui, F. Arai and M. Kaneko, Red Blood Cell Fatigue Evaluation Based on the Close-encountering Point between Extensibility and Recoverability, Lab on a Chip, vol.14, nn.6, 1135-1141, 2014.

【Term of Project】 FY2015-2018

【Budget Allocation】 114,100 Thousand Yen

【Homepage Address and Other Contact Information】

http://www-hh.mech.eng.osaka-u.ac.jp/~mk/Index-j.html.jp