

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

Science and Engineering (Interdisciplinary Science and Engineering)



Title of Project : **Establishment of Cell Fiber Engineering For Next Generation of 3D Tissue Culture**

Shoji Takeuchi
(The University of Tokyo, Institution of Industrial Science, Professor)

Research Project Number : 16H06329 Researcher Number : 90343110

Research Area : Science and Engineering (Interdisciplinary Science and Engineering)

Keyword : Nano micro biosystem

【Purpose and Background of the Research】

3D tissue construction *in vitro* is important not only for medical use but for many other applications including environmental monitoring, bio actuators and cultured meat. However, long-term culture of 3D tissues has been difficult so far due to the lack of nutrition in the central area of the tissue, which triggers cell death.

In this project, we develop a “cell fiber technology” that enables us to construct 3D tissue and to culture it for a long time, by understanding the mechanism to form cell fibers and analyzing details of constructed tissue properties. Also we verify the availability of this technology in various application fields, resulting in the establishment of a research platform of the cell fiber engineering.

【Research Methods】

We aim to achieve the following three points:

1. Understand the mechanism of production, control and handling of cell fibers to make it commodity technology.

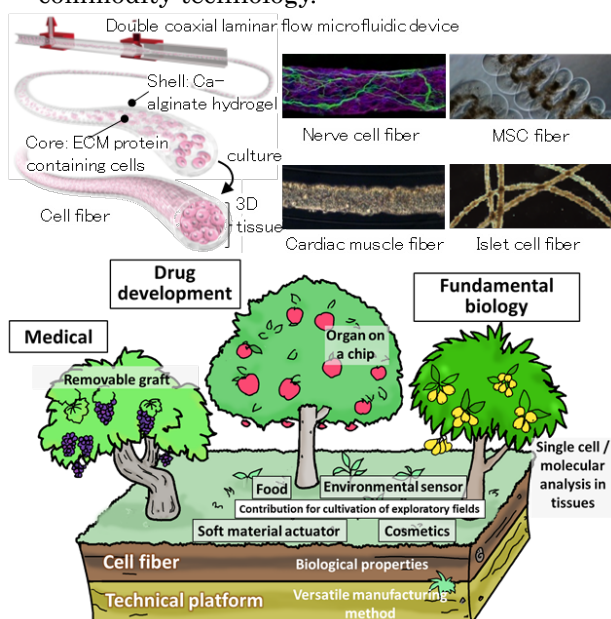


Fig.1 (Upper-left) Schematic illustration of cell fiber production. (Upper-right) cell fibers with various kinds of cells. (Lower) cell fiber engineering achieved through this project and expected effects.

2. Make “cell fiber database” that provides

optimized culture conditions for various kind of cells as practical technical platform.

3. Show the possibility of cell fiber in basic biology (single cell/molecular analysis), pharmacology (drug testing, disease model) and medical fields (transplantation of tissue.).

We will make a team of researchers specializing in engineering, biology and medicine. Moreover, we will cooperate with the specialists of application fields to drive the project forward.

【Expected Research Achievements and Scientific Significance】

Cell fiber technology enables us to introduce appropriate ECM in the core of the fibers with cells, cells can be cultured in environment similar to *in vivo*. Additionally, cell fibers can be combined with larger scale tissue engineering technology such as bio-printing. We believe the cell fiber technology will be the world standard technical platform for next generation once we commodify this technique.

Through this project, we hope that cell fiber technology will change the conventional method of 3D tissue cultivation dramatically, providing various breakthroughs in basic biology, drug testing and medical treatment.

【Publications Relevant to the Project】

- H. Onoe, T. Okitsu, A. Itou, M. Kato-Negishi, R. Gojo, D. Kiriya, K. Sato, S. Miua, S. Iwanaga, K. Kuribayashi-Shigetomi, Y. Matsunaga, Y. Shimoyama, S. Takeuchi: Metre-long Cellular Microfibres Exhibit Tissue Morphologies and Functions, **Nature Materials**, vol. 12, pp. 584–590, 2013
- H. Onoe and S. Takeuchi: Cell-laden microfibers for bottom-up tissue engineering, **Drug Discovery Today**, vol. 20(2), pp. 236–246, 2015

【Term of Project】 FY2016-2020

【Budget Allocation】 144,900 Thousand Yen

【Homepage Address and Other Contact Information】

<http://www.hybrid.iis.u-tokyo.ac.jp/en/>