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System integration for industrialization of regenerative medicine: Creation of organ factory

Tissue and Organ Fabrication Using Cell Sheet Engineering: Japan's Challenge in Spreading World-First Novel Regenerative Medicine

Medicine and engineering joining forces to treat patients around the world

Recently, regenerative medicine is widely regarded as an effective method of achieving radical treatments that overcome the limits of treatments, and has been attracting worldwide attention. To establish this visionary treatment method, fundamental studies using embryonic stem (ES) and induced pluripotent stem (iPS) cells have been carried out actively, and tissue engineering therapies are also becoming increasingly important for aim at clinical application.

Our team has succeeded in developing a novel treatment method in regenerative medicine using a unique tissue engineering approach known as cell sheet engineering. Cell sheet engineering is already being used in clinical treatment of the cornea, heart, and esophagus. Our currently achievements, treating diseases which could not be cured completely with conventional methods, have drawn global attention and hope for future developments.

We are attempting to build automated fabrication systems to produce large quantities of cell sheets and thick tissues or organs by combining biomedical and engineering technologies. We hope to link these systems based on the production procedure and establish an infrastructure for the industrialization of regenerative medicine.

Profile

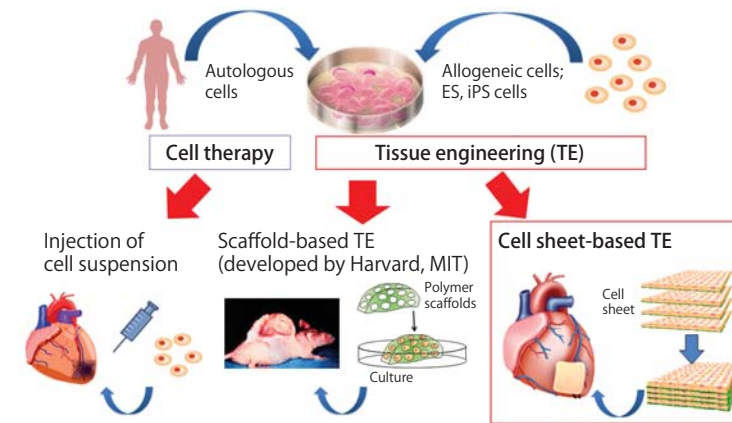
Born on March 21, 1949. From Tokyo

Interests

History, golf

Cell sheets that enable the efficient transplantation of cells

The main treatment method that had been developed from the past in regenerative medicine are cell therapy or scaffold-based tissue engineering. These methods use scaffold made of biodegradable polymers or the injection of cell suspension, but have various flaws. Cell sheets are made of cell and extracellular matrix of cells and do not contain foreign substances, thereby allowing them to overcome the flaws existing in the conventional methods, enabling efficient transplantation of cells. We believe that cell sheets will be a useful means of fabricating and transplanting high-dimensional tissue and organs in the future.



21st century medical innovation:
Combining medical and engineering technologies to create cell sheet manipulation, tissue-forming, and transplantation technologies, thereby saving patients with intractable diseases.

Latest topics in research outcome

By 2011, we completed all the devices that make up the automated system, and commenced reviews for practical application using animal cells and tissue. We have also acquired the Japanese patent rights, as a start, to the basic concept of the automated system. Furthermore, we have established a mass culture method and differentiation induction method for human iPS cells, and succeeded in obtaining a large number of human cardiomyocytes. As a result, we attained success in fabricating the world's first pulsing cell sheets from human cardiomyocytes.

FIRST PROGRAM

Toward the materialization of Tissue Factory and Organ Factory

In order to provide support for regenerative medicine, we are engaged in the development of Tissue Factory equipped with automated systems that are able to supply large quantities of stable, high quality cell sheets, and where processes ranging from the treating of collected tissue to the fabrication of cell sheets are automated. At the same time, through the mass culture of stem cells and the development of vascular network creation technology, we have also built up basal technologies for Organ Factory that fabricate regenerated organs to replace the use of donor organs. We aim to contribute to the international community by saving the lives of many patients around the world through the dissemination and industrialization of regenerative medical treatment using cell sheet engineering.

