

Bioengineering study on manufacturing process of human cultured tissues available for transplantation

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Tissue engineering including a broad spectrum of technology platforms is defined as an integrated field based on the principles and methodologies of engineering and life sciences toward fundamental understanding of structure-function relationships in normal and pathological mammalian tissues, and the development of biological substitutes to restore, maintain, or improve tissue function. This is an emerging interdisciplinary area of research and technology development that permit to revolutionize our health care systems. Some products are already in use clinically and their examples will assuredly increase rapidly in the future with dramatic improvement in the quality of life. Biochemical Engineers have potentials concerning the designs of culture operation (manufacturing process) and vessels (bioreactor), and their evaluation for quality control of products.

The *in vitro* cultures of human tissues have attracted a great deal of medical attention as a promising technique for repairing defective tissues *in vivo*. In the last decade, many companies have been established for supplying the regenerated grafts by means of tissue cultures of skin, cartilage, bone and so on. From a viewpoint of biochemical engineering, however, the culture systems for these tissues are not so sophisticated nor so programmed as the submerged culture systems developed for microorganisms. In manufacturing skin grafts, for instance, the raw materials of cells harvested from patients are heterogeneous, and the products of cultured tissues vary in the required size for individual epithelial sheets. Therefore, a reliable and robust process is desired for the production of cultured tissues with high reproducibility and quality. This presentation will focus on the strategies for developing the culture processes of keratinocytes targeting the epithelial sheet production, including (i) the introduction of culture techniques for keratinocyte cells and survey of skin graft production as it is, (ii) construction of kinetic model of cell growth, (iii) evaluation of cell properties based on image-analyzing techniques, and (iv) design of bioreactor system.