Quality control by automation and specification of cell culture process

Design of bioprocess, Development of bioreactors, Evaluation and specification of cells and tissues

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1 Design of a culture process for in vitro production of cells and tissues

We will design culture containers (bioreactors) and a culture procedure (process) for production of cultured tissues for transplantation, and monitor the culture conditions by imaging (image processing) to collect information and feedback the information to the bioprocess for complete automation of the culture process. Automated culture will reduce labor for tissue production and human errors, and lead to quality improvement of products.

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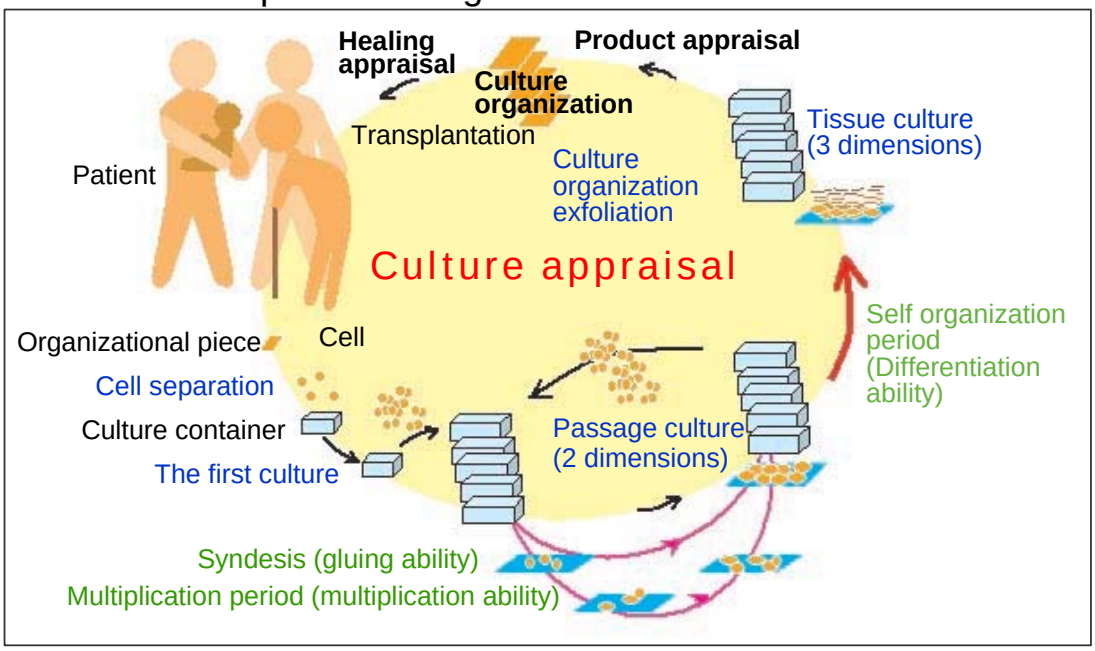
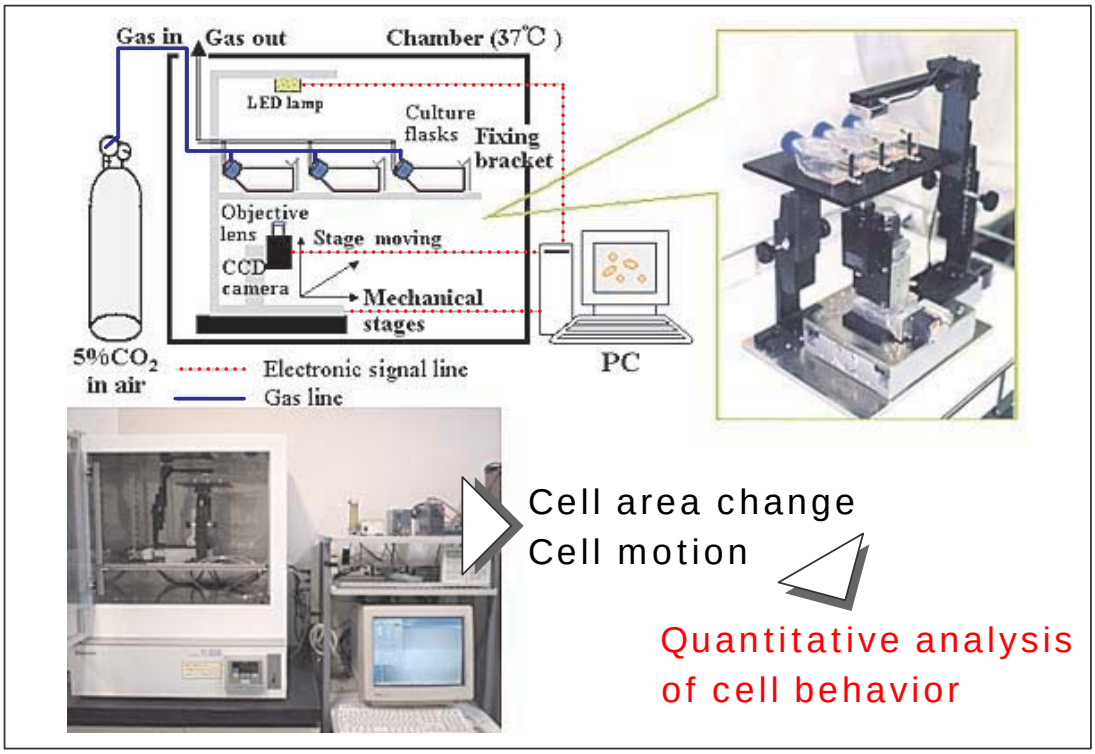
2 Development of a culture simulator for specification of the culture process

We are performing computer simulation of proliferation of cells, substance production, and differentiation in tissue culture to develop tools for prediction of culture process (scheduling) and quality evaluation of cultured tissues (quality control). The ultimate goal is construction of a virtual factory in which the production process and quality evaluation of cultured tissues as products can be predicted by evaluation of raw material cells using this simulator.

Cell culture process figure



Individual cell behavior observation device



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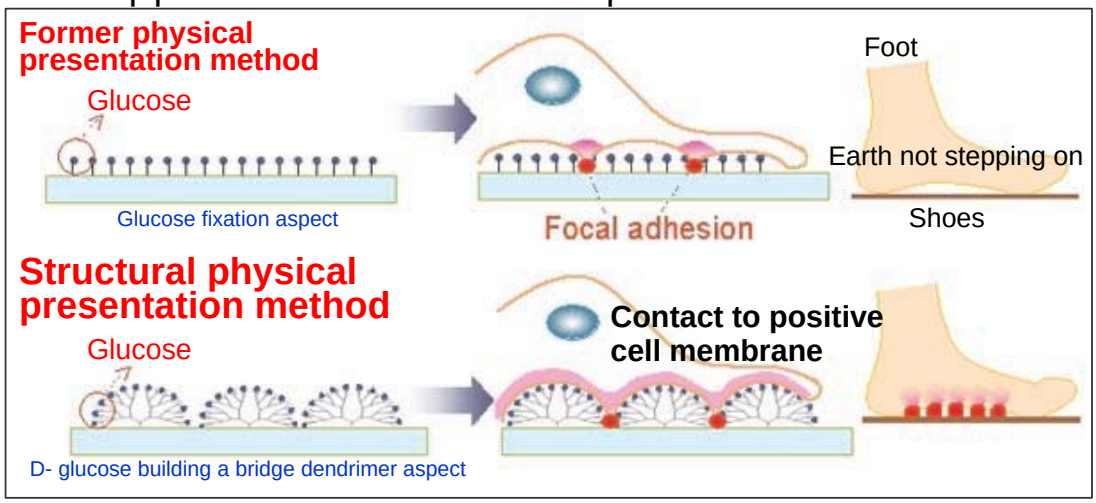
3 Design of a culture surface capable of controlling cell differentiation

We are designing culture surfaces that can control cell morphology and transmit stimulation. Particularly, dendrimer culture surfaces presenting ligands such as glucose allow immobilization of cells through transporters present in the surface layer of the cells, morphology control, and highly efficient transmission of stimulation to cells through nano-scale uneven shapes, which may stabilize quality of proliferating cells (inhibition of dedifferentiation, stabilization of orientation of differentiation).

Cell appraisal in cell fixed aspect



Other study contents of Taya laboratory

- In vivo elucidation and utilization of defense mechanism against oxidative stress
- Development and specification of an antibacterial/antiviral process
- Construction of a stable production system of superior plant species
- Biofilm as a place for natural transformation and its inhibition