Technical Subject:

Development of biocrystals using three-dimensional nanopatterned elastic substrate fabricated by two-photon initiated polymerization and their application to tissue engineering

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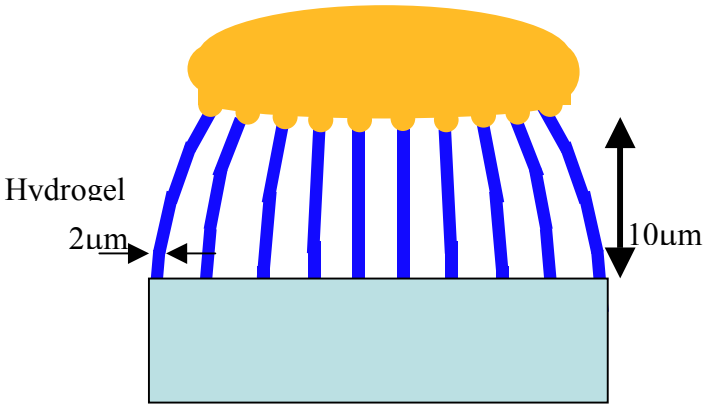

Fig.1 Elastic substrate for tissue engineering
(Cross section view)

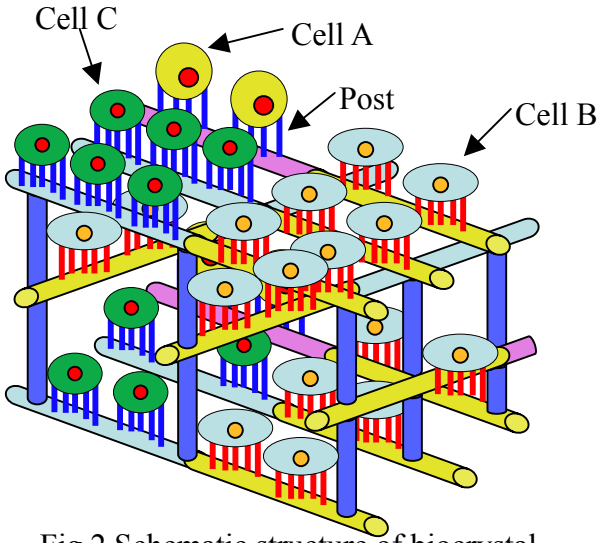

Fig.2 Schematic structure of biocrystal

Goal & Contribution to well-being for all humanity:

Goal of this project is supply an artificial organ based on biocrystals (biohybrid artificial organ) fabricated by two-photon initiated polymerization which work as substrates to culture liver, pancreas cells. This system will save the people who need transplantation of organ.

Method/Approach:

This project will be carried out by following procedure.
1) Fabrication of elastic nano posts using two-photon initiated polymerization
2) Optimization of substrate composition of hydrogel for tissue engineering
3) Culture cells on elastic micro posts
4) Measurement of force in cell using elastic posts
5) Verification of the mechanochemical and tensegrity model
6) Development of biocrystals which enable to co-culture different cells on any positions of substrate

Introduction/Position in the session:

Recently, it is recognized that force of cell plays an important role to culture tissue. We fabricated three-dimensional photonic crystal possessing 180 nm resolution by using two-photon initiated polymerization. In addition, we succeeded to produce hydrogel micro-cantilever which deflects by 45 degree under UV illumination.

In this study, we apply this micro-fabrication technique to tissue engineering and regenerative medicine. In order to analyze mechanochemical model, micro-fabricated elastic posts will be prepared as a substrate and tension to the substrate of cell will be measured as show in Fig.1. In addition, we will try to co-culture of any kinds of cells on any points of substrate as we desired to produce a biocrystal as shown in Fig. 2.

In this session, we would like to show the fabrication of micro-patterned elastic substrates which are suitable for tissue engineering and hope to discuss the application of nano-patterned structure to build biosystem devices.

Call for collaboration:

In order to develop the biocrystals, we would like to collaborate with the biologist who is interested in the interdisciplinary area. Specialists of the cell biologist and polymer chemist are welcome.