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Lecture Title: Novel Nano- and Micro- Fabrication Technique of Polymer Materials Based on Self-Organization

**Abstract:**

We have found that micro porous polymer films were cast from water-immiscible solvent under humid casting condition. Condensation of water due to evaporation cooling was occurred on the polymer solutions during casting. Self-packed surface monolayer of mono-dispersed water droplets formed on the solution surface act as a temporary template of micro-pores. Hexagonally packed regular sized micro-pores like in “honeycomb” were formed in the polymer film after evaporation of solvent and water. Pore size can be widely regulated from several decade microns to a few hundred nanometers by changing evaporation time or humidity, and so on. Biomedical application is an emerging requirement for the honeycomb-patterned polymer films, especially of biodegradable polymers. The honeycomb-patterned and normal cast films of  $\epsilon$ -caprolactone were used as a liver cell (Wister rat hepatocytes) culture substrate, respectively. Liver cells cultured on normal cast film with no structure tend to flatten and do not express proper liver functionality, e.g. albumin secretion and urea synthesis. Conversely, liver cells cultured on the honeycomb-patterned film take on a spherical shape (hepatocytes spheroid) and are functional. The shapes and functions of liver cells can be altered, depending on the size and shape of the pores and the materials used in preparing the honeycomb-patterned film. Spheroid formation of neural cells (hippocampus neural stem cells) was also found on the honeycomb-patterned film.

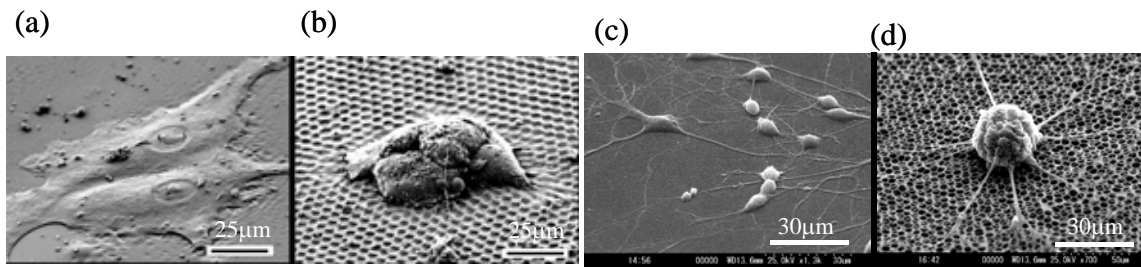


Figure 1. Effect of surface patterns of substrates on cultured cells. Hepatocytes (a) (b), and hippocampus neural cells (c) (d) on flat and patterned substrates, respectively.

**These results indicate that the honeycomb patterned polymer films prepared by self-organization processes have a large potential as novel biomedical materials for tissue engineering and regeneration medicine.**

**References :**

- M.Shimomura, “Dissipative Structures and Dynamic Processes for Mesoscopic Polymer Patterning” in “Nanocrystals Forming Mesoscopic Structures” ed. by M.P.Pileni, Wiley-VCH, pp157-171 (2005).**