2P549**Millennium Green of Japanese Jewel beetle: Unexpected Variability of Color Caused by Structural Change of Organic Multilayer**

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Japanese jewel beetle (*Chrysochroa fulgidissima*) is one of beautiful beetle widely living in East Asia, called Yamato-tamamushi in Japanese. The body size is almost 4 cm x 1 cm and the color is metallic green; two dark brown strips are on the dorsal in addition. The cause of the coloring is multiple reflections, occurring by organic multilayers that cover the whole body without any dyes. This is a typical example of structural color, seen in insects, birds, fishes, worms and so on. The tamamushi elytra had been used for decoration on craft manufactures since ancient Japan, because the color is unchangeable as far as the structure is maintained. The oldest elytra for decoration are 1,300 years old. So we can call the structural color a millennium color. Meanwhile it was found that the elytra easily change the color from original green to blue or red by heating or bromoform penetration, which were almost unexpected. This variability implies that the multilayer is made of a thermoelastic porous material; it is known that the main component is chitin. Actually the color change from green to blue due to heating was accompanied with shrinkage of the elytra. Further the porous structure was determined by using a positron annihilation lifetime spectroscopy; the averaged pore radius was around 2.5 ~ 3.0 Å that almost corresponds to the size of bromoform molecule. Hereby it is shown that the color changes caused by heating and bromoform penetration come from the thermoelastic porous structure of the multilayer.

2P551**The effect of mechanical stimulation on osteogenic differentiation and calcification of cultured mesenchymal stem cells**

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It is well known that osteoblasts differentiate from pluripotent mesenchymal stem cells (MSCs) in a multistage process. On the other hand, mechanical stimulation has been known to affect a proliferating process of osteoblasts both in vitro and in vivo as well as bone homeostasis at a macroscopic level. This indicates that osteoblasts have an ability to sense and response their mechanical environments. The aim of this work was to investigate the effect of mechanical stimulation on the differentiation of osteoblasts from MSCs and to determine at what stage of the differentiation osteoblasts obtain the ability of mechanical transduction. MSCs were isolated from rat femoral bone marrow and subcultured. They were seeded in collagen gel matrix. We constructed a strain-controlled mechanical stimulator which are used under cell culturing condition. MSCs were cultured with bone morphogenetic protein-2 (BMP-2) in the stimulating equipment. Several modes of mechanical stimulation were applied during the cultivation. We intended to determine a specific gene expression responsible to osteogenetic differentiation and calcification in MSCs cultured under the mechanical stimulation. A screening of the specific genes expressed in MSCs were performed. In the presentation, the detail of the experimental result will be discussed from the standpoint of mechanotransduction of osteoblasts and bone formation.

2P550**Controlling nano-porous structures of a diatom shell.**○Kazuo Umemura¹, Xing Liao², Shigeki Mayama³, Mohammed Gad⁴¹Tokyo Institute of Technology, ²Tsinghua University, ³Tokyo Gakugei University,⁴Ain Shams University

Diatoms are one of the most common photosynthetic micro algae in nature. They exist wherever there is light and water. They have a unique box-shaped cell wall or frustules which are made of hydrated silica. The wall is decorated with ornamentations of various shapes that range from rib-like structures to well organized nano-porous holes. That is why fossil diatoms have been widely used as filters, plasters, and so on. Artificially controlling the size of the nano-porous structures of diatom shells has never been reported before. Here we describe a method for controlling the size of nanostructures of a marine pinnate diatom namely *Navicula* sp. Fresh diatoms were burnt in concentrated sulfuric acid to get rid of all the organic matter of the cell. They were washed after that with pure water. The washed frustules were chemically etched at various conditions, washed and collected by centrifugation. The etched structures were examined by optical microscopy and scanning electron microscopes. By this procedure, the pore size was well controlled from several tens nm to 300 nm. The technique can be applicable to improve function of various nanobio devices such as water filters. We thank Mr. Yasufumi Nakashima, Prof. Xin-Hui Xing, and Prof. XiaoZhong Zhang for providing instruments and supporting experiments. We also thank the Tokyo Tech-Tsinghua University joint graduate program and the Musashi Institute of Technology for providing an opportunity to carry out this research.

2P552**Reconstruction of Biomechanical Component using Insect Tissue for a Quasi-Living Actuator**○Yoshitake Akiyama¹, Kikuo Iwabuchi², Yuji Furukawa¹, Keisuke Morishima¹¹Dept. of Mechanical Systems Engineering, Tokyo Univ. of Agriculture and Technology, ²Dept. of Applied Biological Science, Tokyo Univ. of Agriculture and Technology

While previous works on cell-based devices for integrated chemical systems have focused on exploiting biochemical functions of cells, we have demonstrated the direct utilization of on-board cells as microactuators converting chemical energy into mechanical energy. The concept of biomicroactuators was demonstrated by using cardiomyocytes to drive microstructures[1-3]. Here we propose the regenerative mechanical system for a quasi-living actuator driving at room temperature. As a first step, organs and tissues extracted from silk worms were cultured. Dorsal vessels kept beating vigorously for two days and alary muscles did sluggishly more than three weeks. To regenerate them as a quasi-living machine, they have to been cultured and reconstructed after dissociation at the cell level. We succeeded in dissociating them alive by examining conditions e.g. exposure time, shaking method, and reagents. Our preliminary experimental results show the possibility of reconstruction of a regenerative microrobotic system with living components in future. The demonstrated capabilities should enable fundamental changes in the concept of actuators and cell-hybridized instrumentation.[1] K. Morishima, Y. Tanaka, et.al, Sensors and Actuators B, Chemical, in press, (2006). [2] Y. Tanaka, K. Morishima, et.al, Lab on a Chip, 6(2), 230-235 (2006). [3] Y. Tanaka, K. Morishima, et.al, Lab on a Chip, 6(3), 362 - 368(2006).