Research Centers for the BEANS Project (Part I)

1. Life BEANS Center (the University of Tokyo)

The MEMS devices that are expected to become essential in the fields of health, medical care, and the environment will be implantable medical devices for around-the-clock health management, ultra-high-sensitivity on-site prevention and diagnostic devices, on-site environmental control devices for improving and preserving the environment, and energy harvesting devices for the effective utilization of natural energy.

However, in order to manufacture such devices, it is necessary to develop processes for fusing the desirable functions possessed by biomaterials and organic matter (biomolecules, cells, tissues, microbes, and synthetic organic molecules) with conventional materials used in current MEMS.

In addition to the members involved in MEMS fields, our research center has assembled researchers from health care businesses, researchers active in biotechnology fields for studying regenerative medicine and proteins, for example, and doctors from university hospitals, all of who work day and night on research for fusing heterogeneous fields.

These efforts have continuously produced research findings that are fascinating enough to be covered by the news media, such as a cell doll and fluorescent gel beads, even though we have been conducting research under the BEANS Project for less than one year. While we have plans to continue upgrades on the research facilities, the center is steadily conducting studies on seeds needed to produce even more fascinating results in the future.

As we have plans to add more people to the staff in October, you can expect that the Life BEANS Center will continue to grow stronger.

R&D conducted at the Life BEANS Center

(1) Process technologies for nano-interface fusion

The Life BEANS Center is developing interface control processes for controlling the orientation of materials and achieving selective placement, immobilization, and high-density coating of materials in order to utilize functions like biocompatibility, specific molecular recognition, high-efficiency multi-stage reactions, and high-efficiency energy harvesting. We are also conducting R&D on processes for forming biomaterials with long-term stability, such as hydrogels and artificial lipid bilayers with high biocompatibility.

(2) Structuring of bio/organic materials

The center will establish processes for expressing advanced cell functions through the structuring of bio/organic materials and will acquire technical guidelines for reproducibility and uniformity of process technologies such as processes for producing 3D heterostructures of cells using their capacity for self-assembly.

2. 3D BEANS Center (the University of Tokyo)

The 3D BEANS Center comprises seven companies, four universities, and one research institute and may be distinguished from the other research centers by the large number of members–more than half of the staff–who are dispatched from companies. It may be accurate to say that these employees gradually became acclimated to the lifestyle and culture at the university over a period of about one year, since they were forced into a lifestyle quite different from the corporate environment and culture to which they had become accustomed. During last year, the inaugural year of the BEANS Project, most of our duties were far removed from research, such as outfitting the laboratory that included construction of the clean room and setting up equipment. On many occasion it seemed that we would never reach our intended purpose of conducting research. However, things have now settled down, and we have sufficient equipment installed for performing our own work. Although overdue, we are now progressing slowly but surely and will have much more to show for our efforts in the near future.

We have already begun implementing joint research projects with other research centers in the BEANS Project that have greater needs, since the 3D BEANS Center primarily studies etching, film formation, and other technologies rooted in semiconductor processes, and it is likely that our collaborations will continue to increase. For example, we have begun fusing our low-damage dry etching and supercritical fluid deposition (SCFD) technique with the organic film formation technologies practiced at the Life BEANS Kyushu Center. By utilizing our low-damage dry etching in the Kyushu center's organic film deposition, we have been able to form 3D structures never before seen, indicating that this could lead to a new processing method. In order to accelerate our research, we plan to install special equipment for etching organic films at the Life BEANS Kyushu Center in the near future. Some of the researchers at the 3D BEANS Center will be traveling to Kyushu to help set up the equipment. We are also making steady progress on a study for deposition of the unique organic films at Life BEANS Kyushu using our supercritical fluid deposition (SCFD) technique. Further, while in fields other than research we have worked with the Life BEANS Center, with which we share a lounge at the University of Tokyo, this year joint research projects between the two centers have been proposed as we gradually get on track to achieve the primary BEANS objective of fusing dissimilar fields. Hereafter, the 3D BEANS Center will continue in its efforts to serve as a bridge for the fusion of heterogeneous fields.