



Title of Project : Innovative Materials Engineering Based on Biological Diversity

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【Purpose of the Research Project】

Biological diversity is the result of a long evolutionary process for adaptation to various environments. This diversity has been acquired by “biological processes and techniques” including “production processes” “operation principles” and “operation systems”, all of which differ from “human technology”.

“Sub-cellular structures” that are often observed on the surface of insects and plants possess characteristic functions. The study of the “biological processes and techniques” yielding these characteristic structures and functions will help to solve urgent issues involving the environment, resources, and energy, and will lead to a paradigm shift in human technology, known as biomimetic engineering.

This project, a interdisciplinary project based on the study of natural history, biology, agriculture, materials science, mechanical engineering, and environmental science, will open the door to a new system through the combination of lessons learnt from both “biological diversity” and “human wisdom”, and from the viewpoints of environmental policy and comprehensive technical governance. Through the design and fabrication of materials and devices based on knowledge obtained from biological diversity and a biological process, we aim to make a platform for innovation and new industry to develop a “biomimetics database” as well as train a new generation of talented scientists with expertise in biology and engineering.

【Content of the Research Project】

Our research area consists of three branches. In group A01, “Biomimetics database”, we aim to build a “biomimetics database” that will become the basis for an initial innovation platform based on the compilation of biological diversity. The other aim of this project is to train a new generation of scientists with expertise in biology and engineering.

In group B01, “Biomimetics design”, we will disclose the functions and formation processes of biological “sub-cellular structures”. Based on these biological systems, we will design and make innovative materials and devices.

In group C01, “Biomimetics sociology”, we will systematize engineering based on biological diversity as a new field of science and technology from the viewpoint of the social implications of environmental policy, and with the aim of contributing to the realization of and further innovation toward a sustainability society.

【Expected Research Achievements and Scientific Significance】

The cooperation between biology, engineering and social science are necessary will produce new research areas and contribute to the training of personnel to lead the next generation. Furthermore, for the creation of new industries to contribute to sustainability, the biomimetic-based technology must be accepted by society. A paradigm shift in innovation toward a sustainable society will be realized through biomimetic-based technology. Specifically, by focusing on the “movements,” “structures,” and “system operations” in nature, we will be able to develop new materials and systems that support low energy consumption, renewable energy, effective energy use and conversion and the use of non-rare elements. In addition, we will pursue the international standardization of biomimetics and contribute to the international competitiveness of our country.

【Key Words】

Biomimetics: The design and engineering of materials mimicking biological systems. For example, nylon is a synthetic polymer mimicking natural silk.

Self-assembly: Formation of ordered structures with various patterns or rhythms. Organs and tissues are sophisticated self-assembled structures.

【Term of Project】 FY2012-2016

【Budget Allocation】 1,076,500 Thousand Yen

【Homepage Address and Other Contact Information】

<http://biomimetics.es.hokudai.ac.jp>