

# **Innovative Food and Environmental Studies Pioneered by Entomomimetic Sciences**

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Insects are the largest group of animal species on the earth. So it is often said that the earth is a planet of insects. In fact, about one million of species are described and it accounts for two third of known organisms on the earth. Every year, more than three thousands of species are described as a new species. It is said that the possible estimate of the species number is from 5 to ten millions. Like this, insects are the most flourished organisms on the earth.

Insects play important roles in the ecosystem. They have coevolved with other organisms such as flowering plants, parasitic nematodes, and insect-borne plant virus. Soil insects and termites contribute to material cycle in the ecosystem. Furthermore, they also contribute to the equilibrium of ecosystem through the complicated inter-specific relationships and the stabilization of population density.

It should be noted here that some of the insects are serious pests which damage our agricultural crops. To control insect pests, we have used a lot of insecticides in farming especially after the World War II. However, increased use of insecticides created new problems such as injury to health, environmental pollution, increased resistance to insecticides, and resurgence of insect pest population. The control of insect pests is indispensable to ensure the agricultural products as food, but it must be environmentally friendly. Here is a reason why food problems and environmental problems should be connected with each other.

The Ministry of Education, Culture, Sports, Technology and Science of Japan established a budget to launch in FY 2002 a new initiative called the 21st Century COE Program. The COE is the abbreviation of Center of Excellence. This program works to cultivate a competitive academic environment among Japanese universities by giving targeted support to the creation of world standard research and education bases in a range of study areas.

The Graduate School of Agriculture and Field Science Education and Research Center of Kyoto University have started the 21st Century COE Program entitled “Innovative Food and Environmental Studies Pioneered by Entomomimetic Sciences” from 2004. Entomomimetic Sciences are innovative entomological sciences to aim at exploring and learning from insects.

Insects are the largest group of animal species on the earth and have survived over long evolutionary history spanning 400 million years. As a result, they developed sophisticated morphology with superior functions, and constructed a complicated ecological network with other organisms such as plants in the ecosystem.

Benyus (1997) proposed a new science, Biomimicry. It is the conscious emulation of life's genius and an innovation inspired by nature. That is, its fundamental concept is "Nature as model", "Nature as measure", and "Nature mentor". She demonstrated that there are three levels of Biomimicry, Mimicking pattern, mimicking process, and mimicking ecosystem. Thus it is understood that Biomimicry is a broad science which covers from micro- to macro study areas.

We now propose a new entomological science here, i.e., Entomological Science or Entomomimetics. The concept of Entomomimetics is regarded as follows. Firstly, insects are regarded as model. That is, Entomomimetics is a science that emulates insect's designs, functions and behaviors to solve human problems such as food and environmental issues. Secondly, insects are regarded as measure. This means that Entomomimetics uses an ecological standard which has been created by insects through their long evolutionary history to judge the "rightness" of our innovations. Because insects have lived through 400 million years of violent environmental change, they would teach us, what works, what is appropriate, and what is sustainable. Thirdly, insects are regarded as mentor. Entomomimetics is a new way of viewing and valuing nature, which will lead to the desirable relationship between nature and humans.

We have set up three main subjects for Entomomimetics. The first is "Adaptability to environments". The research on this subject would contribute to the monitoring of global warming by using insects as an indicator. The second is "Communication systems". The research on this subject would lead to the development of environmentally benign insect-pest control method. The third is "Designs and functions". The research on this subject would contribute to the biomimetics, robotics, and industrial applications. The expected results of our research on these subjects would finally contribute to the solutions of food and environmental issues in the 21st Century.

## CV

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