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Personal history

Education: 1994–1997, Faculty of Agriculture, Kyushu University, Fukuoka, Japan, Received Bachelor Degree in Agriculture; 1997–2000, Laboratory of Fisheries Environmental Science, Graduate School, Kyushu University, Received Masters Degree in Agriculture; 2000–2003, Laboratory of Fisheries Environmental Science, Division of Bioresource and Bioenvironmental Sciences, Graduate School, Kyushu University, Received Ph. D Degree in Agriculture. **Overseas Training:** Apr. 1997–Feb. 1998, Skidaway Institute of Oceanography, Savannah, GA, USA; Sep.–Nov. 2000, Michigan State University, East Lansing, MI, USA.

Employment History: 2003–2005, Research Fellow, CMES, Ehime University, Matsuyama, Japan; 2005–2006, Research Fellow, Area of Excellence at The Centre for Marine Environmental Research and Innovative Technology (MERIT), Department of Biology and Chemistry, City University of Hong Kong, Kowloon, Hong Kong SAR. 2006–present, Assistant Professor, CMES, Ehime University.

Biological Responses against Multiple Environmental Stressors

The number of anthropogenic chemicals in the environment has dramatically increased with industrial development. Organisms inhabiting polluted areas are exposed to complex mixtures of these chemicals, not single chemicals. Additionally, they are also affected by other environmental stressors, such as changes in temperature or oxygen levels, interaction with other organisms, etc. Generally, the risks of chemicals are evaluated by exposing the experimental animals to a single chemical. However, this method is not enough to understand the environmental risks of chemical pollutants on wild animals to multiple chemicals. Therefore, to understand the real risk of environmental contaminants, it is quite important to analyze the effects of multiple environmental stressors.

Mixture toxicity is one of the important issues of multiple stressors. We have been studying the effects of mixtures of tributyltin (TBT) and polychlorinated biphenyls (PCBs) on the reproduction of Japanese medaka (*Oryzias latipes*). We have found that the developmental toxicity of TBT was enhanced by co-exposure to PCBs, even when their exposure levels were below the no-observed-effect concentrations of the individual chemicals. In another study, we found that perfluorinated compounds (PFCs) might have the potential to amplify cytochrome P4501A induction by dioxin-like compounds in the liver of wild common cormorant (*Phalacrocorax carbo*), which leads to a possible hypothesis that PFCs could enhance the toxicity of dioxins.

Furthermore, we have been working on the toxicity evaluation of the physical and biological parameters such as hypoxia and infectious diseases, respectively, in fish, and evaluated how these effects interact with chemical pollutants.

Once organisms are exposed to such environmental stressors, they respond to them, showing adverse effects, adaptation, or resistance. To understand these biological responses, we are now evaluating the global gene expression profiles by microarray technology, known as "Toxicogenomics". We have constructed microarray platforms for medaka, cormorant, and Japanese flounder (*Paralichthys olivaceus*). Using these platforms, we have identified TBT- or PCB-responsive genes in the brain of medaka, and studied the association between persistent organic pollutant levels and gene expression profiles in the liver of cormorant. Additionally, we investigated the effects of heavy oil on immune system-related genes in flounder and analyzed the relationship between transcriptomic changes and phenotypic effects.

In future, we will continue to conduct both lab exposure tests and field researches to understand and explain the mechanisms of biological responses to environmental stresses, and to apply microarray technique to field research.

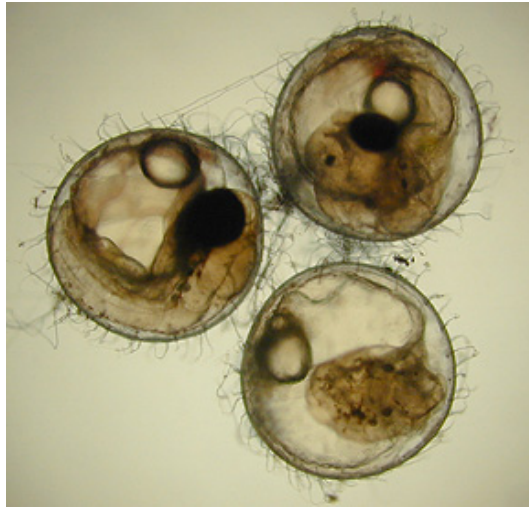


Figure 1. Abnormal development of eyes in medaka embryos exposed to a mixture of TBT and PCBs.

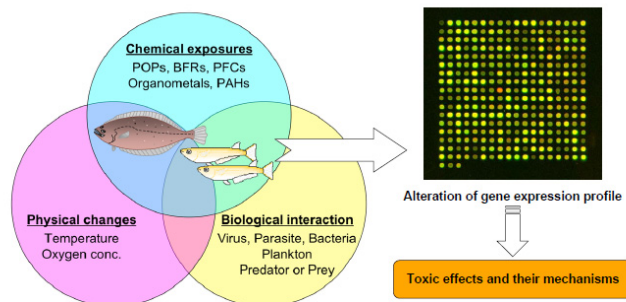


Figure 2. Application of microarray technology to evaluate the toxic effects of multiple environmental stressors.