

A Framework for the Development of a Prediction System for Determining the Effects of Exposure to Environmental Chemicals on Children's Health

Authors: Hideko Sone¹, Hiroko Zaha¹, Wataru Fujibuchi², Takeaki Taniguchi³, Seiichiroh Osako⁴, Junzo Yonemoto¹, Hiroaki Siraishi¹

¹National Institute for Environmental Studies/Research Center for Environmental Risk, Japan

²National Institute of Advanced Industrial Science and Technology/Computational Biology Research Center, Japan

³Mitsubishi Research Institute/Research Center for Advanced Science and Technology, Japan

⁴The University of Tokyo/Division of Environmental Health Sciences, Japan

Keywords: prediction, system, children, health, gene expression

A great concern has been raised that exposure to low doses of environmental chemicals during fetal and newborn development may result in a predisposition to various disorders such as cancer, learning disabilities, and allergies later in life. The way in which chemicals with such potential effects are identified is thought to be one of the most important issues in human health risk management. To solve this problem, genomics analysis using multiple types of information, such as toxicity, epidemiological, and clinical information, is necessary. The development of prediction systems is already being pursued. We are also trying to develop a system which can be used to predict the effects of chemicals at early stages of contamination. The system we are constructing has three components. The first component is a data acquisition system which can handle large quantities of data (a ChemToxGen system); it is capable of extracting multiple types of information based on the chemical's name or CAS number from the toxic information database TOXNET/PubMed and the gene expression database Gene Expression Omnibus (NCBI, USA). The second component is a system (pCEC, profiles of Chemical Effects on Cells) that categorizes chemicals based on their effects using gene-expression and toxicological information. We demonstrated that it can categorize 102 J&J hepatotoxicants based on their molecular mechanisms, toxicological data, and microarray data. The third component is a system for multi-profiling chemicals. In this report, we describe the framework of our complete system and its process of categorization and classification of toxic influences and their relationship with molecular mechanisms. To give an example of its effectiveness, 158 chemicals out of those included in Speed98 and ExTEND2005 (lists of chemicals compiled by the Japanese Ministry of the Environment) and in the IARC (International Agency for Research Cancer) list of carcinogenic materials were successfully classified in terms of their toxicity based on their gene expression data.

Point of Contact:

Hideko Sone

Senior Researcher

National Institute for Environmental Studies

16-2 Onogawa

Tsukuba, Ibaraki, Japan 305-8506,

81-298-50-2464

hsone@nies.go.jp