Stories starting from AhR activation triggered by dioxin

Heidi Qunhui XIE
State Key Laboratory of Environmental Chemistry and Ecotoxicology, China Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, 18 Shuangqing Road, Haidian District, Beijing, 100085, China
E-mail: qhxie@rcees.ac.cn

Acetylcholinesterase (AChE, EC3.1.1.7) plays important roles in the cholinergic neurotransmission, which has been widely recognized as a biomarker for monitoring pollutions of organophosphate and carbamate pesticides. Emerging evidence suggests a broad spectrum of environmental toxic substances is able to decrease AChE activity in various species. Dioxins are amongst these emerging environmental AChE disruptors, which are persistent organic pollutants with multiple toxic effects on the nervous system. By using enzyme-based and cell-based methods, we have demonstrated that dioxin decreased AChE activity by suppressing the gene expression via aryl hydrocarbon receptor (AhR) in human derived neuroblastoma cells. Both transcriptional and posttranscriptional regulations were involved in the AhR-mediated mechanisms. On the other hand, AChE activity was also decreased by dioxin treatment during myogenic differentiation of mouse C2C12 cells. The gene expression and the enzymatic activity were both significantly suppressed, however, via non-AhR-dependent mechanisms. The dioxin-induced inhibition of AChE expression has different mechanisms of action among different species. This difference may be due to differences in the position and number of consensus sequences of dioxin response elements on the promoters of human and mouse ACHE genes.

Keywords: Acetylcholinesterase; Dioxin; Aryl hydrocarbon receptor; Transcriptional regulation; Posttranscriptional regulation

Heidi Qunhui Xie is an associate professor at the Research Center for Eco-Environmental Sciences (RCEES), Chinese Academy of Sciences, in Beijing, China. She was graduated at the Health Science Center of Peking University and got her Bachlor and Master degrees of Clinical Medicine, and later on was graduated from the Hong Kong University of Science and Technology and received PhD degree at the department of Biology. For postdoctoral study, she was trained at the Department of Biology, École normale supérieure, Paris, France supervised by Prof. Jean Massoulié. Her research is focused on acetylcholinesterase (AChE), an important enzyme in the nervous system. In the past decade, she have been working on the effects and action mechanisms of dioxins, typical organic persistent pollutants. She and her colleagues have done a systemetic work on the mutiple mechanisms for the regulation of AChE by dioxins.