

Neurobiochemical Analysis of Abnormal Fish Behavior
Caused by Copper Toxicity

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The goal of this study is to develop a biomarker used in monitoring abnormal behaviors of Japanese medaka (*Oryzias latipes*) as a model organism caused by hazardous chemicals. Japanese medaka was treated under appropriate sublethal concentrations of copper and the fish were subjected to copper treatment after starvation for 48 hr. The untreated individuals showed common behavioral characteristics (*i.e.*, smooth and linear movements with small curvatures) in the movement behaviors. Locomotive activity of the fish was monitored using Image Processing and Automatic Data Acquisition Systems. When treated with copper (100 ppb), the fish showed shaking patterns more frequently. As concentration of copper was increased to 1000 ppb, activity was decreased, and the fish showed an erratic movement. Fish were exposed to copper at various concentrations (0, 100, and 1,000 ppb) for 24 hrs, and AChE (acetylcholine esterase) activity was observed. There was no significant decrease or increase in the enzyme activity of head and body portions depending on

the concentrations. Expressions of TH (tyrosine hydroxylase) protein in the different organs from both head (brain) and body (kidney) portions were comparatively analyzed using an immunohistochemical technique. Five organs of the fish (olfactory bulb, hypothalamus, optic lobe, pons and myelencephalon regions) showed a relatively strong TH protein expression in the control experiment. A differential expression of TH, however, was observed in the treatment (100 ppb and 1,000 ppb). The treatment (1,000 ppb) significantly suppressed TH protein production in the brain regions. In kidney, however, the higher concentration of copper (1,000 ppb) caused little suppression compared with the control. Copper appeared to be less effective in suppression of TH than diazinon.