Xenoestrogens Depressed Gonadotropin-Releasing Hormone Expression and Affected Embryonic Development

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Abstract

As xenoestrogens may interfere with the reproductive health of humans and wildlife, it is essential to investigate their effects and monitor their presence in the environment. Since the gonadotropin-releasing hormone (GnRH) is critical for the initiation and maintenance of the reproductive function, we developed an assay system to directly assess the effects of xenoestrogens, using a transgenic medaka (*Oryzias latipes*) in which the gene for the green fluorescent protein (GFP) was placed under the control of the *gnrh3* promoter, one of the three paralogous GnRH genes. As medaka embryos are transparent, the fluorescent expression can be easily observed *in vivo*.

We exposed newly fertilized medaka embryos to bisphenol A (BPA), nonylphenol (NP), 17β-estrodiol (E2), or a water sample from a polluted river, and observed the embryos daily. After the embryos hatched, the gene expression levels of the GnRHs, GnRH receptors, and estrogen receptors (ERs) were measured with qRT-PCR.

We found that the exposures significantly decreased the fluorescent intensity of the GnRH/GFP neurons, and slowed down the head growth and the eye development. The chemicals also lowered the heart rate, lengthened the time to hatch, suppressed the expression of the three GnRH genes, and up-regulated the ERα mRNA level. Importantly, the GnRH3 mRNA level was significantly correlated with the fluorescence intensity of the GnRH3 neurons.

We concluded that BPA, NP, and E2 had significant effects on the GnRH system and embryonic development, and the *gnrh3-GFP* transgenic medaka can be an ideal assay system for xenoestrogens and environmental water samples.