Fishy Behavior

Persistent effects of early-life exposure to 17α-ethinylestradiol

av

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Akademisk avhandling

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Abstract

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The synthetic estrogen 17α-ethinylestradiol (EE_2) is an endocrine disrupting chemical (EDC) of concern due to its persistent nature and widespread presence in the aquatic environment. In mammals, effects of developmental EDC exposure on reproduction and behavior not only persist to adulthood after discontinued exposure, but are also inherited by several consecutive unexposed generations. The results presented in this thesis demonstrate that non-reproductive behavior in fish is highly sensitive to the influence of EE_2 during development and the effects do not appear to be restored after a long recovery period in clean water. We have shown that exposure to low doses of EE_2 during development results in increased anxiety in two fish species (zebrafish and guppy) and their offspring. We have also demonstrated that the effects of EE_2 on anxiety are apparent in both sexes and are transgenerationally transmitted to two consecutive generations of unexposed offspring in the guppy. In order to investigate the possible biological mechanisms of the observed persistent effects on non-reproductive behavior, we also performed an RNA sequencing analysis of the whole-brain transcriptome in developmentally exposed zebrafish after remediation in clean water until adulthood. Differential expression of 33 genes in males and 62 genes in females were observed as a result of EE_2 exposure, with only one gene affected in both sexes. Functional analysis revealed cholesterol biosynthesis and circadian rhythm to be the top two affected pathways in males and females, respectively. Both pathways have previously been implicated in anxiety behavior and represent possible candidates connecting the transcriptome alterations to the observed behavioral phenotype. The study represents an initial survey of the fish brain transcriptome by means of RNA sequencing after long-term recovery from developmental exposure to an estrogenic compound.

Keywords: Endocrine disruptors, anxiety, stress behavior, transgenerational effects, 17α-ethinylestradiol, developmental exposure, social behavior, fish.

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