SEXUALLY DIMORPHIC EXPRESSION OF AROMATASE IN THE MEDAKA BRAIN

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Introduction:

Male and female vertebrates, including teleost fishes, exhibit differences in a variety of behavioral and physiological traits, including reproductive behavior, aggression, and endocrine secretion patterns. Several types of neuroanatomical and neurochemical sex differences have been identified in mammals and birds that could underlie these functional differences [3, 5]. In contrast, very little is known about sex differences in the brain of teleosts. Teleosts should, however, provide unique models for the study of sex differences and sexual differentiation of the brain in that their brains exhibit a considerable degree of sexual plasticity throughout their lifetime [7]. To uncover the molecular basis of sex differences in the teleost brain, we examined sex differences in the expression of the brain-predominant form of aromatase, the rate-limiting enzyme in the conversion of androgen to estrogen [2, 4, 6, 8], in the brain of medaka *Oryzias latipes*.

Methods:

We searched for genes exhibiting sexually dimorphic patterns of expression in the medaka brain, and identified the aromatase gene as being predominantly expressed in females. Sex differences in its expression were examined in relation to several factors, including reproductive stages, genetic sex, phenotypic sex, and gonadal steroids. We also determined which brain area and cell type were the source of the sex difference in aromatase expression.

Results:

A series of analyses revealed that aromatase expression in the medaka brain was not under the direct control of sex chromosome genes, but increased secretion of estrogen from the ovary, but not from the testis, after the onset of puberty led to higher expression of aromatase in the female than male brain in a reversible and transient manner. The medaka aromatase was expressed throughout the ventricular zones in the brain, where, in most regions, females have a greater degree of expression compared to males. The most prominent sex difference was observed in the optic tectum, where expression was almost specific to females only. We also found that contrary to what is known in other teleost species, radial glial cells was not the source of aromatase expression in the medaka brain.

Conclusion:

Since it is widely accepted, although not proven in teleosts, that aromatase in the brain plays an important role in sex differences and sexual differentiation of the vertebrate brain [1, 6, 9], the reversible and transient regulatory system for aromatase expression in medaka may be able to account for the conspicuous sexual plasticity of the teleost brain. Further studies are needed to understand what determines the unique cell specificity of aromatase expression in the medaka brain and what physiological significance this will lead to.

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