

An ancestral link between genetic and environmental sex determination

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Researchers from Osaka University and the National Institute for Basic Biology, Japan, have found a highly significant connection between the molecular mechanisms underlying genetic and environmental sex determination. The scientists report in the open-access journal *PLoS Genetics* the identification of a gene responsible for the production of males during environmental sex determination in the crustacean *Daphnia*.

Ways in which an individual organism's sex is determined are diverse among animal lineages and can be broadly divided into two major categories: genetic and environmental. In genetic sex determination (GSD), sex-specific differentiation results from intrinsic genetic differences between males and females, whereas environmental sex determination (ESD) relies upon environmental signals to induce male or female sex determination. In contrast to GSD models, the genetics of ESD organisms are poorly understood.

The researchers cloned Doublesex (Dsx) genes from *Daphnia magna*, a freshwater brachiopod crustacean that clones itself to produce males in response to certain environmental cues. The Dsx genes play an important role in controlling sexual differences in organisms using GSD such as nematodes, insects, and <u>vertebrates</u>. Knocking out one particular Dsx gene, DapmaDsx1, in male embryos resulted in the production of female traits including ovarian maturation, whereas ectopic expression of DapmaDsx1 in female embryos resulted in the development of male-like phenotypes.



The researchers infer that there is an ancient, previously unidentified link between genetic and environmental sex determination. This study was confined only to the role of Dsx in ESD, so it would be highly desirable to establish the link between the environmental signal and Dsx expression. However, this work lends support to the "Doublesex hypothesis" of sex determination, in which many different sorts of upstream regulatory pathways could converge on Dsx-family genes, which would serve as the basis of sexual differentiation mechanisms across the animal kingdom.

More information: Kato Y, Kobayashi K, Watanabe H, Iguchi T (2011) Environmental Sex Determination in the Branchiopod Crustacean Daphnia magna: Deep Conservation of a Doublesex Gene in the Sex-Determining Pathway. PLoS Genet 7(3): e1001345. doi:10.1371/journal.pgen.1001345

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