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FOCUS

PROJECT

Sex Chromosomes and the Genetic Basis of Sexual Dimorphism

In addition to fundamental differences in reproduction, males and females show profound differences in a range of somatic phenotypes, including metabolism, disease incidence, life history, and behavior. These complex phenotypes are encoded by thousands of genes, yet the sexes differ very little in genomic content. To illustrate, X and Z chromosomes in vertebrates generally constitute 5-10% of the coding content of a genome. The sex-limited chromosomes contain even fewer genes, with just 27 unique genes on the mammalian Y chromosome and less than 50 genes on the avian W chromosome.

Because the sex chromosomes are the only region of the genome that differs between females and males, they are thought to be the key to sexual dimorphisms. Clear and strong theoretical predictions link sexually dimorphic phenotypes to the sex chromosomes in a variety of ways. Additionally, the evolutionary study of sex-biased gene expression has recently emerged as a powerful method to understand the genetic basis of complex dimorphisms. This approach has been used to test predictions related to sexual conflict, and gene expression data suggests that the sex chromosomes do indeed play an important role in sexual dimorphism.

This consistent pattern has not been observed in field studies in natural systems seeking to link sexual dimorphisms to sex chromosomes. Although some studies have shown an association, these appear to be the exception, many others have not. Why is there a disconnect between laboratory and molecular studies that show that the sex chromosomes have sex-specific expression that should lead to dimorphism, on the one hand, and phenotypic studies in the field, where the evidence is mixed at best, on the other?

Recommended Reading

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PUBLICATIONS FROM THE FELLOW LIBRARY

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How to make a sex chromosome : Alison E. Wright, Rebecca Dean, Fabian Zimmer & Judith E. Mank

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Conflict on the sex chromosomes : cause, effect, and complexity

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The role of sex chromosomes in sexual dimorphism : discordance between molecular and phenotypic data

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The evolution of gene expression and the transcriptome–phenotype relationship

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Battle of the sexes: conflict over dosage-sensitive genes and the origin of X chromosome inactivation

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