

# The evolution of bird-of-paradise sex chromosomes revealed

April 2 2019

---



Many species are named after the European royal members who once had exclusive access to the plumage. For example, *Paradisaea rudolphi* (blue bird-of-paradise) is named after the Crown Prince Rudolf of Austria, and has become a vulnerable species partially because of the plumage hunting. Credit: Ellis Rowan

(c1847-1922) [Public domain], via Wikimedia Commons

Birds-of-paradise are a group of songbird species, and are known for their magnificent male plumage and bewildering sexual display. Now, an international collaborative study involving the University of Vienna, Zhejiang University of China and the Swedish Museum of Natural History has analyzed the genomes of 11 songbird species, including those of five bird-of-paradise species, and reconstructed the evolutionary history of their sex chromosomes.

Birds have opposite sex [chromosomes](#) to those of mammals. That is, females have one Z chromosome and one female-specific W chromosome, while males have two Z chromosomes. The W chromosome is much smaller and gene-poor, similar to the Y chromosome of humans. By sequencing the female [songbird](#) genomes, the researchers have uncovered the details of how Z and W chromosomes became separated for their evolutionary trajectories, and which factors dictate the fates of the genes on the W chromosome.

## **Junk DNA facilitated the separation of sex chromosomes**

Sex chromosomes are not supposed to have genetic exchange with each other for most regions. That is, they evolve along separate evolutionary trajectories so that sex-determining genes will not be recombined from one sex chromosome to the other, then appear in the opposite sex. The researchers showed that such suppression of recombination has occurred at four time points between the songbird sex chromosomes.

This has reshaped four consecutive sex-linked regions to form a gradient

of time-associated divergence pattern, termed "evolutionary strata." Despite the dramatically diverse phenotypes of all extant 5,000 songbird species, all of them seem to share the same evolutionary history of these recombination suppression events. Notably, one family of repetitive elements (called CR1 transposon), presumably non-functional DNA sequences, have massively accumulated at a mutation hotspot located between the two neighboring evolutionary strata. The researchers hypothesize that junk DNA may have triggered the loss of recombination between sex chromosomes and subjected them to separate evolution paths.

## Only dosage-sensitive genes survived on the W chromosome

Once recombination is lost on the W chromosome (Z chromosomes can still recombine only in males), genes cannot resist the invasion of deleterious mutations, as normally, they can be effectively purged by [recombination](#). This is the price of sex that the sex chromosome (the mammal Y or the bird W) has to pay. Now, only a handful of genes are retained and functional on the songbird W chromosomes due to this long-term genetic erosion. The researchers found the retained genes tend to be more broadly or highly expressed than any other genes that have become lost in non-avian species in which both sets of genes still exist. This indicates that the retained genes have more important functions than others, and losing them, even when the Z-linked gene still exists in female, is too costly for the [species](#) to bear a reduced dosage.

**More information:** Luohao Xu et al. Dynamic evolutionary history and gene content of sex chromosomes across diverse songbirds, *Nature Ecology & Evolution* (2019). [DOI: 10.1038/s41559-019-0850-1](https://doi.org/10.1038/s41559-019-0850-1)

Provided by University of Vienna

Citation: The evolution of bird-of-paradise sex chromosomes revealed (2019, April 2) retrieved 10 April 2024 from

<https://phys.org/news/2019-04-evolution-bird-of-paradise-sex-chromosomes-revealed.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.