

New evolutionary insights into the early development of songbirds

December 2 2019



A first-year Penn State College of Information Sciences and Technology doctoral student spent four months observing birds in an effort to learn what it would mean to design technologies from a more-than-human perspective. Her autoethnographic study contributes to addressing the challenging research problem of how to operationalize posthuman concepts into practice for human-computer interaction. House finchnigel. Credit: Wikimedia Commons

An international team led by Alexander Suh at Uppsala University has sequenced a chromosome in zebra finches called the germline-restricted chromosome (GRC). This chromosome is only found in germline cells, the cells that hold genetic information which is passed on to the next generation. The researchers found that the GRC is tens of millions of years old and plays a key role in songbird biology, having collected genes used for embryonic development.

The ability to reproduce is a fundamental trait of all life. How reproduction has evolved and how it functions on a genetic level is therefore of great interest to [evolutionary biologists](#). During the early development of an animal embryo, cells are divided into two major types, germline and [somatic cells](#). Germline cells are present in the reproductive organs and hold [genetic information](#) which is passed on to the next generation, whereas somatic cells are the cells which make up the rest of the organism. Biologists have discovered that in some organisms, certain genes and repetitive DNA-sequences are eliminated when cells become either somatic or germline, which means that not all cells in an organism contain the same genome.

In certain species, entire chromosomes are specific to the germline. One such chromosome in [zebra finches](#) is called the germline restricted chromosome (GRC). For the first time, an international team led by Alexander Suh at the Department of Ecology and Genetics at Uppsala University has performed a comprehensive genomic, transcriptomic, and proteomic analysis of the GRC in zebra finches. The GRC is the largest chromosome in the zebra finch genome and constitutes more than 10 percent of the genome.

"The GRC is a very strange chromosome. We found that some of its genes are repeated tens or even hundreds of times, whereas the somatic cells have only one gene copy." says Cormac Kinsella, one of the first authors of the study.

By identifying [specific genes](#) and comparing them with genomic data from other species, the scientists could unravel the evolutionary history of the GRC. The results showed that the GRC is tens of millions of years old and likely present across all songbird species, which represent half of all bird species. The scientists also think that the GRC became an important factor in bird development because many genes associated with early [embryonic development](#) are found there. Because the GRC is not present in somatic cells, expression of its genes only affects [germline cells](#) thereby protecting somatic cells from possible negative effects.

"Because we found GRC expression on the RNA and protein level, we expect our evidence for selection acting on the GRC to become the starting point of further exciting discoveries." says Francisco Ruiz-Ruano, the other first author of the study.

More information: Cormac M. Kinsella et al. Programmed DNA elimination of germline development genes in songbirds, *Nature Communications* (2019). [DOI: 10.1038/s41467-019-13427-4](https://doi.org/10.1038/s41467-019-13427-4)

Provided by Uppsala University

Citation: New evolutionary insights into the early development of songbirds (2019, December 2) retrieved 19 April 2024 from <https://phys.org/news/2019-12-evolutionary-insights-early-songbirds.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.