
Comparative genomics of convergent phenotypic evolution in birds

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Résumé

The avian clade displays a spectacular diversity of phenotypes. Although the body plan is overall conserved among avian species, individual bird lineages have acquired specific morphological features, some of which are related to their ecology and behavior. For example, digit orientation is associated with the mode of locomotion (1), bill shape is related to diet (2), etc. Convergent losses of ancestral traits are also widely known, the most noteworthy example being the loss of flight (3). The ecological context in which phenotypic evolution took place is often unknown, and it is unclear whether these changes were adaptive. Comparative genomics approaches, bolstered by the genomic resources available for avian species (4), can bring insights into the selective pressures and molecular mechanisms that underlie these major phenotypic changes. They enable the detection of lineage-specific shifts in selective pressures, thus helping to unveil the underlying molecular mechanisms and the genomic correlates of the phenotypic change. Here, we illustrate these comparative genomics approaches through the study of two convergent morphological evolution events: the gain of bony cranial protuberances (5) and the loss of the intromittent phallus (6). We take advantage of the public availability of hundreds of avian genomic sequences and we contribute to it by sequencing and assembling the genome of the helmeted curassow (*Pauxi pauxi*), a key species for both examples. We analyze the evolution of protein-coding genes and conserved non-coding DNA elements, searching for genomic changes that occur in parallel with phenotypic changes. While instances of positive selection are rare, we find that hundreds of protein-coding genes and non-coding elements underwent an acceleration of their rate of evolution following the phenotypic change. This indicates a relaxation of purifying selection, likely due to the loss of molecular function in elements associated with the ancestral phenotypic traits. Our results thus bring insights into the genomic consequences of these major phenotypic changes. 1. Botelho, J. F. et al. *Proc. Biol. Sci.* 281, 20140765 (2014).

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Mots-Clés: Convergent phenotypic evolution, Comparative genomics, birds.

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