

# Evolution of sex chromosomes and karyotypes in iguanas (Squamata: Pleurodonta)

*PhD Thesis*

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## Abstract

This PhD thesis is composed of five published articles and one manuscript, and is focused on the evolution of the sex chromosomes and karyotype of the iguanas (Pleurodonta). Based on our primary research of available data, only male heterogamety (XX/XY) with ancestral karyotype  $2n = 36$  chromosomes was recorded in iguanas. However, in many species sex chromosomes have not been uncovered by classical cytogenetics, probably due to their homomorphy. The partially-known X chromosome content of *Anolis carolinensis* allowed us to compare the relative gene doses of X-specific genes between male and female of representatives of all iguana families, and to reveal homologous and well-differentiated sex chromosomes across all iguanas, with the exception of basilisks. Thus, due to the comparable age with sex chromosomes of mammals and birds, the results put into question the importance of endothermy for the formation of stable sex chromosomes. The striking feature of the iguanas is the relatively frequent occurrence of multiple sex chromosomes in their karyotypes. Using the ancestral state analysis of the type of sex chromosomes, it has been found that these multiple sex chromosomes developed at least twelve times independently, and some of these origins are probably associated with other karyotype rearrangements. In comparison, in birds (ZZ/ZW) there is no single occurrence of this derived type of sex chromosome. Therefore the possible influence of the heterogamety on evolution of this type of sex chromosome and their fixation in the karyotype of amniotic vertebrates is discussed in this thesis and supported by statistics. A deep molecular cytogenetic examination of the Madagascan iguanas (Opluridae), revealed that despite the geographical distance, this family shares most of the cytogenetic traits with the New-World iguanas. Additionally in this family, the nature of the Y chromosome indicated the possible limitations of comparative genomic hybridization, the technique commonly used for detection of sex chromosomes. Our examination of the representatives of 17 families of squamate reptiles for the presence of interstitial telomeric sequences (ITS) in the karyotype and comparison with already available data revealed frequent occurrence of ITS in this group. Due to the relatively conserved karyotype in this group, this suggests possible cryptic chromosomal rearrangements or telomere sequence distribution in genomes through the activity of mobile elements. The publications included in this thesis develop the studied subjects by experimental and theoretical outcomes, helping to assess the general validity of hypotheses about the evolution of sex chromosomes and the basic genome organization even in the broader context.