

Genetic Studies of Neotropical Primates at the Extremes of Their Natural Distributions

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**GENETIC STUDIES OF NEOTROPICAL PRIMATES
AT THE EXTREMES OF THEIR NATURAL
DISTRIBUTIONS**

Researchers at the Universidad Veracruzana (UV), Universidad de Buenos Aires (UBA) and the University of Michigan (UM) are conducting a collaborative project on the genetics of Neotropical primates at the northern and southern edges of their distributions. The main aim of this project is to combine expertise in ecological, genetic and behavioral approaches to understand the taxonomy and evolution of primates in these regions.

This complementary effort started in 2001, when Marta D. Mudry visited field sites in Mexico with members of the UV primate research group, collecting samples from *Alouatta palliata* and *Ateles geoffroyi* as part of a cytogenetic project on atelid taxonomy. Dr. Mudry described the karyotypes of these species and identified the presence of different patterns in sex chromosomes from the samples obtained during this trip (Mudry *et al.*, 2001; Nieves and Mudry, 2001; Nieves, 2003; Nieves *et al.*, 2005; Solari and Rahn, 2005). At the same time, Liliana Cortés-Ortiz was using molecular data to examine the phylogenetic relationships and biogeography of the genus *Alouatta* (Cortés-Ortiz *et al.*, 2003), as well as characterizing the hybridization between Mexican howler monkey species and studying the phylogeography of *A. palliata* in Mesoamerica (Cortés-Ortiz, 2003). In addition, Ernesto Rodríguez-Luna, Domingo Canales-Espinosa, and Francisco García-Orduña had initiated a long-term study to understand the current distributions of Mexican primates, as well as the sympatry of *A. palliata* and *A. pigra* in the state of Tabasco, Mexico (García-Orduña *et al.*, 1999, 2005; Rodríguez-Luna *et al.*, 2001).

For over 25 years, researchers at UV have studied the ecology, physiology and behavior of Mexican primates, including *A. palliata mexicana* (see Appendix I), *A. pigra* (*e.g.*, García-Orduña *et al.*, 1999, 2005; Rodríguez-Luna *et al.*, 2001) and *Ateles geoffroyi* (see Appendix II), and have developed and implemented strategies for their conservation (see Appendix III). Over approximately the same period, researchers of GIBE (Grupo de Investigación en Biología Evolutiva) of UBA have analyzed the cytogenetics of several Neotropical primates, including *Alouatta caraya*, *Aotus azarae*, *Ateles* spp., *Callithrix jacchus*, *Cebus apella*, and *Saimiri boliviensis* (see Appendix IV for a complete listing by species). The GIBE team has used heterochromatic patterns and chromosome rearrangements to elucidate the taxonomy of New World primates (see Appendix IV). More recently, researchers at GIBE have also used biochemical electrophoresis (Szapkievich *et al.*, 1998; Szapkievich, 2000; Szapkievich and Mudry, 2003) and other molecular techniques to characterize populations and to explore the phylogenetic relationships of some of these taxa (Ascunce *et al.*, 2002, 2003a, 2003b). Finally, Liliana Cortés-Ortiz,

formerly part of the UV group and now affiliated with UM, is continuing her studies on the systematics and phylogeography of Mesoamerican primates, the genetic characterization of a hybrid zone between *A. palliata* and *A. pigra*, the evolution of reproductive isolation in howler monkeys, and the application of molecular approaches to the understanding of primate behavior.

These researchers from UV, UBA and UM are now joining efforts to study the taxonomy and evolution of Neotropical primates using molecular, cytogenetic, ecological and behavioral approaches. Through this collaboration, researchers are currently investigating the heterochromatic pattern and sex chromosome system of *A. pigra* — the only species of *Alouatta* whose karyotype has never been studied. This cytogenetic work will be complemented by morphological and molecular characterizations of each sampled individual to verify their identification to species.

These molecular and cytogenetic studies will improve our understanding of the origin and evolution of the exceptionally diverse chromosomal arrangements that occur in howler monkeys (see for example, Ma *et al.*, 1975; Lima and Seuánez, 1991; Consigliere *et al.*, 1996; Rahn *et al.*, 1996; Mudry *et al.*, 2001; Oliveira *et al.*, 2002; Rahn and Solari, 2005). In addition, the cytogenetic study of *A. pigra* will provide a foundation for the comparison of karyotypes of hybrid and backcrossed *A. palliata* / *A. pigra* individuals against the typical karyotype of each parental species.

We expect that this multidisciplinary approach will contribute to the understanding of primate evolution in the Neotropics, as well as establishing a basis for primate conservation in this region. Furthermore, this collaborative project can be a model for combining efforts, expertise, and resources to study primates and other organisms in Latin America.

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Appendix I: Universidad Veracruzana studies on *Alouatta palliata mexicana*.

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Appendix II: Universidad Veracruzana studies on *Ateles geoffroyi*.

Cortés-Ortiz and Rodríguez-Luna, 1997; García-Orduña *et al.*, 1993, 2002; Hernández-Salazar *et al.*, 2001, 2003; Laska *et al.*, 1996, 2000a, 2000b, 2003; Rodas *et al.*, 2002; Rodríguez-Luna, 1991; Rodríguez-Luna *et al.*, 1996; Silva-López *et al.*, 1986, 1988.

Appendix III: Universidad Veracruzana studies on primate conservation.

Canales-Espinosa, 1997; Cortés-Ortiz *et al.*, 1996; García-Orduña *et al.*, 1987; Rodríguez-Luna *et al.*, 1987a, 1987b, 1993a, 1993b, 1996a, 1996b, 1996c; Rodríguez-Luna and Cortés-Ortiz, 1994, 1995a, 1995b; Rodríguez-Luna and Domínguez-Domínguez, 2002; Rylands and Rodríguez-Luna, 2000.

Appendix IV: Universidad de Buenos Aires cytogenetic studies on Neotropical primates.

Alouatta caraya: Fundia *et al.*, 2000; Mudry, 1983; Mudry *et al.*, 1992, 1994, 1998; *Aotus azarae*: Mudry, 1983; Mudry *et al.*, 1982c, 1984, 1990; Mudry and Galliari, 1985; *Ateles* spp.: Nieves, 2003; Nieves *et al.*, 2003, 2005; *Callithrix jacchus*: Mudry *et al.*, 1981, 1982a, 1990; *Cebus apella*: Fundia *et al.*, 1987; Mantecón *et al.*, 1984; Martínez, 2003; Martínez *et al.*, 2002, 2004; Mudry, 1983, 1990; Mudry *et al.*, 1984, 1985, 1990; Mudry and Slavutsky, 1987; Mudry and Vinuesa, 1988; Ponsá Fontanals *et al.*, 1995; and *Saimiri boliviensis*: Fundia *et al.*, 2000; García *et al.*, 1995; Mudry *et al.*, 1982b, 1990; Slavutsky and Mudry, 1990; Steinberg *et al.*, 2003, 2004, 2005.