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Pieczarka, J. C. 1995. A Natureza e a Variabilidade de Heterocromatina Constitutiva em Primatas Sul-Americanas. Unpublished Doctoral Thesis, Universidade Federal do Rio Grande do Sul, Porto Alegre. 202pp.

Chromosomal Relations and Phylogenetic and Phenetic Analyses in the Callitrichidae

In March 1995, Cleusa Yoshiko Nagamachi defended her thesis on chromosomal relations and the phylogeny of the Family Callitrichidae. It formed part of the requirements for a doctoral degree in Genetics and Molecular Biology at the Federal University of Rio Grande do Sul, Porto Alegre, Brazil. The study was supervised by Dr. Margarete Suñe Mattevi, and supported by the Universidade Federal do Pará (UFPA), the Universidade Federal do Rio Grande do Norte (UFRGS), the Fundação de Amparo à Pesquisa do Rio Grande do Sul (FAPERGS), the Financiadora de Estudos e Projetos (FINEP), the Brazil Science Council (CNPq), the Brazilian Higher Education Authority (CAPES), and Eletronorte (Centrais Eléctricas do Norte SA). The following is a summary of the thesis.

This study comprised the first broad inter- and intrageneric cytogenetic (G, C, G/C and NOR banding) and cytotaxonomic study of the family Callitrichidae, including representatives of all four genera: *Cebuella pygmaea*; *Callithrix argentata* group (*C. argentata*, *C. emiliae*, *C. chrysoleuca*, *C. humeralifera*, and *C. mauesi*); *Callithrix jacchus* group (*C. aurita*, *C. geoffroyi*, *C. jacchus*, *C. kuhli*, and *C. penicillata*); *Leontopithecus* (*L. chrysomelas*, *L. rosalia*); and *Saguinus* (*S. midas midas*, *S. m. niger*). The aim was to characterize each species, group, and genus in terms of their chromosomes, as well as to determine the types of chromosomal rearrangements that have occurred in the karyotypic differentiation of the members of the family. The results were converted to numeric data and submitted to phenetic and cladistic analyses to determine phylogenetic relationships and clusters among the callitrichids. The phenetic analysis was performed using the NTSYS-pc program (UPGMA method) and the cladistic analysis with the NTSYS-pc (NJ method) and PAUP programs. *Cebus apella* was used as an outgroup in the cladistic analysis. The results obtained allow for the following conclusions.

1) Callitrichids share nearly all the euchromatic chromosome segments.

2) Considering only the euchromatic portion, within species groups and genera were all found to be homosequential, with no chromosome rearrangement differentiating their karyotypes.

3) Chromosomal rearrangements were found which differentiated groups and genera, with five distinct karyotypes as follows: a) a reciprocal translocation differentiates *Cebuella* (2n = 44) from the *Callithrix argentata* group (2n = 44); b) a centric fusion/fission rearrangement and a paracentric inversion differentiate both *Cebuella* and the *C. argentata* group from the *Callithrix jacchus* group (2n = 46): c) a reciprocal translocation and a paracentric inversion differentiate *Leontopithecus* (2n = 46) and *Saguinus* (2n = 46) from the *C. jacchus* group; and d) *Saguinus* diverges from all others by a paracentric inversion and pericentric inversions in at least three pairs of acrocentric autosomes.

4) The variations in the content of chromosomal material are due to differences in the amount of noncentromeric constitutive heterochromatin, the distribution patterns of which are characteristic in each group or genus. This suggests that the accumulation mechanisms of these constitutive heterochromatins might have occurred after the differentiation of the distinct group comprising the callitrichids.

5) The phenetic and cladistic analyses separate the genus *Cebus* from the callitrichids, which form a clade. In the callitrichids, the results show that the marmosets (*Cebuella* and *Callithrix*) form a subclade: *Cebuella* and the *C. argentata* group being more closely related to each other than to the *C. jacchus* group. *Leontopithecus* and *Saguinus* are also very closely related, indicating that, if not derived from each other, they share a close common ancestor. *Leontopithecus* are karyotypically closer to the marmosets (*C. jacchus* group) than is *Saguinus*.

6) On the basis of information obtained from chromosomes, and taking into account the evolutionary pathways, it was possible to suggest the karyotype of an ancestor, as well as proposals for the origin, differentiation and dispersion of the callitrichids. If evolution occurred in the direction of a body size increase (primitive hypothesis), the ancestral form would have a karyotype similar to those of marmosets. If, on the other hand, evolution was in the direction of a body size decrease (phyletic dwarfism), the karyotype of the ancestor would be similar to those of tamarins. Both are chromosomally plausible. However, when taking into account the current distributions of the callitrichids, the proposal involving phyletic dwarf-

ism is the more probable.

Cleusa Yoshiko Nagamachi, Departamento de Genética, Centro de Ciências Biológicas, Universidade Federal do Pará, Campus do Guamá, 66075-110 Belém, Pará, Brazil.

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Nagamachi, C. Y. 1995. Relações Cromossômicas e Análises Filogenética e de Agrupamento na Família Callitrichidae (Platyrrhini, Primates). Unpublished Doctoral Thesis, Universidade Federal do Rio Grande do Sul, Porto Alegre. 181pp.

Cytogenetics, Chromosomal Evolution, Radiation and Speciation in Spider Monkeys

In 1994, Manuel Alfredo Araujo Medeiros completed his Master's thesis on cytogenetics, chromosomal evolution, radiation and speciation in *Ateles*, for the Postgraduate Course in Biological Sciences (specialization in Genetics) of the Federal University of Pará and the Emilio Goeldi Museum, Belém, Pará, Brazil. It was supervised by Dr. Regina Maria de Souza Barros, and supported by the Brazil Science Council (CNPq), the Brazilian Higher Education Authority (CAPES), and the Universidad Autonoma de Barcelona (UAB), Spain. The Emílio Goeldi Museum, Belém, The Center for Forest Warfare Instruction (CIGS), Manaus, the National Primate Center, Belém, the Teresina Zoo, Piauí, and the Barcelona Zoo, Spain, kindly provided material for the cytogenetic study of the spider monkeys. The following is a summary of the thesis.

The karyotypes were studied of 22 spider monkeys of four subspecies: *Ateles paniscus paniscus*, *A. p. chamek*, *A. belzebuth hybridus*, and *A. b. marginatus* (following the taxonomy of Kellogg and Goldman, 1944). Four cytogenetic techniques were used: conventional staining, G and C banding, and NOR staining. The data obtained concerning karyotype structure and chromosomal variation were compared to that available in the literature. The results of the analyses, and in particular the geographic variation in chromosomes 6, 7, and 4/12, indicate that *A. p. chamek* represents the most primitive form of the genus, which would have originated in the southwestern Amazon basin and spread eastwards, founding the ancestral population of *A. b. marginatus*, and northwest, giving rise to *A. b. belzebuth*. The taxa found to the west of the Andes would in this case have been derived from the ancestral populations of *A. b. belzebuth*. *A. p. paniscus* is almost certainly derived from the ancestral populations of *A. b. hybridus*.

The peripheral radiation of *Ateles* in the Amazon basin can be partially accounted for by a number of different models of biogeographic evolution, although the relative distribution of the northernmost taxa and the phylogenetic relationships between them, based on cytogenetic data, indicate that significant changes occurred in the distribution of forests during the Pleistocene.

It was not possible to define the taxonomic status of the *Ateles* forms studied here, although *A. p. paniscus* appears to be a monotypic and reproductively isolated from all other populations. The results of this study nevertheless confirm the need for a taxonomic revision of the genus, given that at least four karyotypically distinct groups were identified: 1) *A. geoffroyi* and *A. belzebuth hybridus*; 2) *A. fusciceps rufiventris* and possibly *A. f. fusciceps*; 3) *A. belzebuth belzebuth*, *A. paniscus chamek*, and *A. belzebuth marginatus*; and 4) *A. paniscus paniscus*.

Manuel Alfredo A. Medeiros, Departamento de Biologia, Universidade Federal do Maranhão, Largo dos Amores 21, Centro, 65020-240 São Luis, Maranhão, Brazil.

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Medeiros, M. A. A. 1994. Citogenética, Evolução Cromossômica, Radiação e Especiação dos Macacos-Aranha (*Ateles*, Primates). Unpubl. Master's Thesis, Universidade Federal do Pará, Museu Paraense Emílio Goeldi, Belém, Pará. 137pp.

Putting Primates in the Classroom

The Primates, a four-part slide set that takes full advantage of young people's interest in monkeys, apes, and the environment, is available for teachers to use in their classrooms. Drawing on the library and resources of the Wisconsin Regional Primate Research Center, this set introduces the topics of primate behavior, primate conservation, primate taxonomy, and field work. Accurate and accessible, each part contains 72 slides with accompanying annotated script, suggestions for classroom activities, bibliographies and other supporting materials. *The Primates* has been tested in schools and revised at the suggestion of middle and high school teachers. The set is also easily adaptable for use in introductory classes at the