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Sex ratio in newborn Common marmosets *(Callithrix jacchus)*: no indication for a functional germ cell chimerism

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The compilation of marmoset and tamarin breeding data from several different sources shows a deviation from the expected 1:1 sex ratio in favour of males (e.g. Ford and Evans 1977; citation of unpublished data from different colonies; Gengozian 1971; Gengozian et al. 1980; Hampton 1970; for additional references and discussion see Rothe et al. 1991).

The question was asked whether a skewing of the sex ratio in marmosets and tamarins could be due to germ cell chimerism, i.e. in the case of an excess of males due to XY oocytes, in the case of an excess of females due to XX spermatocytes (detailed discussion see Ford and Evans 1977; Gengozian 1971; Gengozian et al. 1980; Hampton 1970; Hampton 1973). Different opinions exist, however, whether germ cell chimerism in callitrichids is functional or not (detailed discussion in Gengozian et al. 1980). According to Gengozian et al. (1980) germ cell chimerism in callitrichids is a very rare event. Furthermore, these authors observed a balanced sex ratio in known heterosexual chimeras, and they could not identify unequivocally XX or XY cells at diakinesis-metaphase in the primary spermatocytes or oocytes, respectively, of *Saguinus oedipus* and *Saguinus fuscicollis* chimeras. These results provide presumptive evidence against functional germ cell chimerism (at least) in these species.

One major problem in analysing the reasons of a skewed sex ratio are not only lacking data on the frequency of known chimeras in the respective breeding colony, but often also an insufficient number of offspring born to each breeding pair and of the entire colony.

The composition and size of 114 litters (= 297 infants) were analysed. Litters of unknown size and/or sex ratio were excluded from the investigation. The breeding males (n = 30) and the breeding females (n = 30) were all born in captivity (filial generation F_1 to F_6) and were grouped into two categories: a. males/females that were born in isosexual litters and b. males/females that were born in heterosexual litters. Accordingly, the breeding pairs were grouped into four categories: A. both parents were born in isosexual litters; B. the father was born in an isosexual, the mother in a heterosexual litter; C. the father was born in a heterosexual, the mother in an isosexual litter; D. both parents were born in heterosexual litters (see Table).

Housing and feeding of our marmoset colony have already been described elsewhere in detail (Rothe et al. 1991).

Chi^2-test was used to test differences between expected and observed frequencies of newborn males and females (Siegel and Castellan 1988).

The table shows the number of litters and infants according to litter-size, litter-composition and origin of the parents (categories A to D). Except for category C (χ^2 = 5.76; df = 1; $P < 0.05$) there were no significant differences in the sex ratio of newborn

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marmosets (see also ROTHE et al. 1991) and further, no indication of a secondary sex-ratio manipulation due to germ cell chimerism in either the males or the females was found, i.e. groups with a parent that was born in a heterosexual litter did not show a shift in the sex ratio to either males (category B) or females (category C).

Thus, our data do not provide a basis for the assumption that one or the other breeding male deviated from the 1:1 ratio of X- or Y-containing sperm cells, or that one or the other female produced Y-containing ova. The data suggest that germ cell chimerism in the common marmoset is a rare event which generally seems to have no impact on the overall sex-ratio of the population. However, due to the rather small sample size, expecially concerning the number of litters of each female, we cannot exclude that germ cell chimerism occurs in some males and females and hence might be of some importance for the sex ratio of their offspring. This aspect needs further investigation.

Number of litters and infants according to litter-size, litter-composition and origin of the parents

	Litter-size and -composition	Categories A	B	C	D	Σ litters	Σ infants
Singletons	m	0	1	0	2	3	3
	f	0	0	0	4	4	4
Twins	mm	2	1	2	3	8	16
	mf	6	4	4	8	22	44
	ff	1	3	2	1	7	14
Triplets	mmm	1	0	5	5	11	33
	mmf	5	3	4	14	26	78
	mff	3	1	7	13	24	72
	fff	0	0	0	3	3	9
Quadruplets	mmmm	0	0	0	1	1	4
	mmmf	0	0	0	0	0	0
	mmff	0	0	1	1	2	8
	mfff	0	0	0	2	2	8
	ffff	0	0	0	1	1	4
	Σ litters	18	13	25	58	114	—
	Σ infants	45	29	68	155	—	297
	sex-ratio (m:f)	1.34:1.0	0.93:1.0	1.43:1.0	1.07:1.0	—	1.17:1.0

m = male; f = female; m:f = ratio of males to females; category A: both parents were born in isosexual litters; category B: father was born in an isosexual litter, mother in a heterosexual; category C: father was born in a heterosexual litter, mother in an isosexual; category D: both parents were born in heterosexual litters.

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