that of *Spermophilus*[7]. Paleontological data provide evidence that *Cynomys* originated during the late Pliocene or Pleistocene and is, therefore, one of the most recently evolved genera of North American Sciuridae[7].

The chromosomes of *Cynomys* are also distinctive because they represent the highest *2n* yet found among the Sciuridae (Table). Because acrocentric autosomes are lacking, the number of chromosome arms (fundamental number (FN)[10]) is 96, the highest FN seen within the family.

Cynomys is of theoretical interest to cytotaxonomists because the complete lack of correlation between high *2n* and numerous acrocentrics contrasts sharply with data from primates[6] and other rodents[11]. Furthermore, *Cynomys* is an exception to the current concept of mammalian cytotaxonomy, which postulates that among related taxa the more specialized and recently evolved species are characterized by a lower *2n*, fewer acrocentric and more metacentric chromosomes[6]. This view is based upon the frequent observation that karyotypes appear to evolve from high to low *2n* by a series of Robertsonian centric fusions; the absence of acrocentrics and high *2n* of *Cynomys* are arguments against centric fusion as the explanation for intergeneric karyotype divergence.

Evolution from low to high *2n* may result from dissociation or fragmentation of metacentric chromosomes. *Cynomys* could have evolved from a *Spermophilus*-like ancestral stock with lower *2n* by dissociation, provided the acrocentric chromosomes produced by this process were later converted to metacentrics by a series of pericentric inversions. Proof of this hypothesis cannot be obtained because of the striking degree of karyotypic divergence seen between *Cynomys* and *Spermophilus*, and chromosomes alone do not support a close intergeneric affinity. Nevertheless, the dissociation-pericentric inversion sequence is compatible with the taxonomic opinion, based on several reliable lines of evidence, that the 2 genera are closely related[7,8]. If correct, *Cynomys* is one of the few examples of chromosome dissociation observed in mammals, although it has been previously postulated by MATTHEY[11].

Analysis of chromosomes from the other 4 species of *Cynomys* may provide greater insight into chromosome evolution of this genus[12].

Chromosomal characteristics of representative species of Sciuridae

Species	*2n*	Fundamental No.
Spermophilus beldingi[1]	30	56
Sp. columbianus[1]	32	60
Sp. undulatus[1]	34	64
Sp. richardsoni[1]	34, 36	64
Sp. townsendi[1]	36, 38, 46	68, 66, 66
Sp. lateralis[8]	42	78
Sp. beecheyi[8]	38	72
Marmota broweri[5]	36	62
M. caliqata[5]	42	62
Eutamias minimus[2]	38	58
Glaucomys sabrinus[9]	48	74
Sciurus carolinensis[9]	40	76
Cynomys ludovicianus	50	96

Zusammenfassung. Die Analyse der mitotischen Chromosomen bei *Cynomys ludovicianus* ergibt die diploide Zahl 50 und einen Karyotypen mit nur metazentrischen und submetazentrischen Autosomen. Der Fall *Cynomys* ist einzigartig unter den Sciuridae: hohe *2n* Zahl und Fehlen acrozentrischer Chromosomen.

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Department of Medicine, Northwestern University Medical School, Chicago (Illinois 60611, USA), October 4, 1966.

[9] C. F. NADLER, in preparation.
[10] R. MATTHEY, Experientia *7*, 50, 78 (1945).
[11] R. MATTHEY, Rev. suisse Zool. *64*, 39 (1957).
[12] Supported by National Science Foundation Grant No. GB 3251.

On Reproduction Studies and the Occurrence of Cataracts in Rats after Long-Term Feeding of the Insecticide Heptachlor

The widespread use of pesticides has led to many cases of poisoning in animals, both acute and chronic. As yet, few experiments on the chronic effects of pesticides on animals have been carried out. It is especially essential to investigate the toxicity of those pesticides, such as DDT and other chlorinated hydrocarbons (of the cyclodienic compound type), that are not eliminated for a long time and can accumulate in the body fat. Their presence suggests a potential hazard to human health.

To evaluate the significance of accumulation of these insecticides in the body, we studied the effect of heptachlor (1, 4, 5, 6, 7, 10, 10-heptachloro-4, 7, 8, 9-tetrahydro-4, 7-methyleneindene) on the fertility of rats. The experiments showed firstly that low dosages of heptachlor administered with food result in a marked diminishing of litter size, both in several litters of one generation as well as in successive generations. Secondly they showed that the life span of the sucklings is significantly shortened, the death rate being highest in the first 24–48 h (Table). The applied dose of standard heptachlor, purity 98.1%, was 6 mg/kg body weight, and did not cause any clinical toxicological signs in all the investigation time (18 months). Function studies of the parenchymatous organs (Quick test, BSP clearance, concentration and dilution tests of the Kidneys, and the elimination of phenol red) did not show disturbances, with the exception of the liver tests which approached the limit of significance in the female rats[1].

[1] M. MESTITZOVÁ, Prac. Lék. *18*/4, 153 (1966).

Birth, growth and death rate of litters in chronic heptachlor intoxication

Group	Frequency of litters Absorption	%	Mean litter size	Mean weight after 1 week, g	1 month, g	Increase g	% mortality within 1st week	1st month
$F_{1/1}$[a]	9/12[b]	75	5.6	15.7	52.6	36.9	47.1	54.9
	(7/9)	(77.7)	(6.7)	(14.2)	(54.4)	(40.2)	(12.0)	(17.0)
$F_{1/2}$	6/11	54.5	6.1	15.9	62.0	46.1	37.5	59.4
	(6/11)	(54.5)	(10.5)	(22.6)	(83.7)	(61.1)	(23.8)	(23.8)
$F_{1/3}$	2/9	22.2	8.0	18.6	60.0	41.4	50.0	50.0
	(3/8)	(37.5)	(7.7)	(15.2)	(70.2)	(55.0)	(4.3)	(4.3)
$F_{2/1}$	12/14	85.7	6.7	16.7	63.5	46.8	50.6	61.7
	(13/13)	(100)	(9.7)	(18.3)	(58.1)	(39.8)	(6.0)	(10.3)

[a] The first number represents the sequence of offspring, the second number the sequence of litters. [b] The first number represents the number of rats which produced litters, the second number is the number of mated females. Numbers in brackets are the values for the control animals.

An additional result of the long-term feeding of heptachlor is the development of cataracts of the lens both in offspring and in the parent rats. Prolonged feeding increased the chance of occurrence of cataracts in the parents; in the offspring they were observed shortly after their eyes opened (Figures 1, 2 and 3). Otherwise the eyes were normal.

The sequel of occurrence of cataracts excludes the possibility of recessive genetic traits, nor can a vitamin B deficiency be made responsible for their development. In experiments on rats on low riboflavin diet, DAY et al.[2,3] found cataracts, however, accompanied by the other typical deficiency characteristics. In our control animals fed on the same diet without heptachlor we could not note such findings or other signs of vitamin B deficiency. This may not exclude a possible interference of heptachlor with vitamin B which could prevent normal utilization. It is more likely to be the manifestation of a disturbed metabolic pathway due to toxicosis. To draw any biological conclusions from these results needs further investigation. A detailed report of the studies referred to here will be published elsewhere.

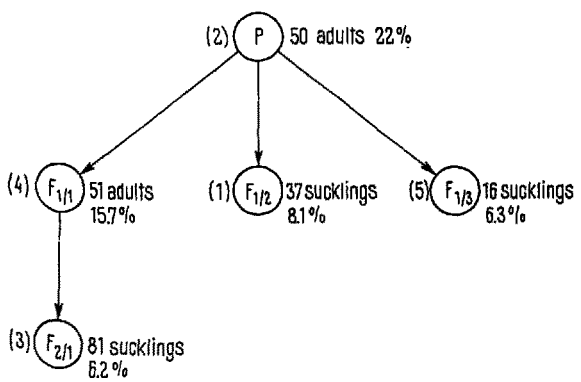

Fig. 1. Incidence of cataracts. The figures represent the occurrence of cataracts. Their onset being with adults after 4.5–9.5 months of feeding and with sucklings 19–21 days after birth. Numbers in brackets show the number of investigated animals and % of cataract occurrence. In the control animals there was complete absence of cataracts.

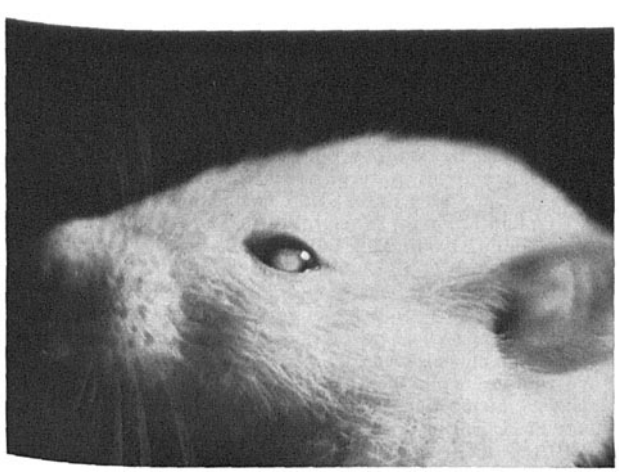

Fig. 2. Cataract in a suckling of 19 days age.

Fig. 3. Cataract of a parent rat of 7.5 months age.

Zusammenfassung. In langfristigen Fütterungsversuchen über die Wirkung von Heptachlor auf Ratten wurde eine Beeinträchtigung der Reproduktionsfunktion, der Lebensfähigkeit der Nachkommen und das Auftreten von Katarakten beobachtet.

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[2] DAY, LANGSTON, and O'BRIEN, Am. J. Ophthalmol. *14*, 1005 (1931).
[3] DAY, DARBY, and LANGSTON, J. Nutrition *13*, 389 (1937).