# AN ATLAS OF MAMMALIAN CHROMOSOMES

VOLUME 1

**T. C. HSU**
Section of Cytology, Department of Biology, The University of Texas M. D. Anderson Hospital and Tumor Institute, Houston, Texas

**KURT BENIRSCHKE**
Department of Pathology, Dartmouth Medical School, Hanover, New Hampshire

SPRINGER-VERLAG
BERLIN • HEIDELBERG • NEW YORK 1967

## INSTRUCTIONS

## READ CAREFULLY BEFORE UNPACKING

An annual edition with new plates of this atlas is planned. To make this atlas most useful it will be necessary to collate the new editions with the old ones according to taxonomic principles, i.e., orders and families. Instruction sheets will be supplied with every new edition, as well as a complete index.

It will be easiest to place the pages into a ring folder (supplied by Springer-Verlag at $2.00). Thus, after a few years, folder 1 may contain the Monotremata, Marsupialia and Insectivora; folder 2 may contain Lagomorpha, Carnivora, Primates, etc., depending on how quickly the information is gathered for various orders. This will insure maximum usefulness for this compendium.

---

Springer-Verlag will supply special ring-binders for use in this series. Please indicate your interest by filling out this form and mailing it to the Publisher.

SPRINGER-VERLAG NEW YORK INC.
175 Fifth Avenue
New York, N.Y. 10010

Name_____

Institution_____

Street_____ City_____ State_____ Zip_____

# AN ATLAS OF MAMMALIAN CHROMOSOMES

VOLUME 1

# Contents

# AN ATLAS OF MAMMALIAN CHROMOSOMES

VOLUME 1

T. C. HSU
Section of Cytology, Department of Biology, The University of Texas M. D. Anderson Hospital and Tumor Institute, Houston, Texas

KURT BENIRSCHKE
Department of Pathology, Dartmouth Medical School, Hanover, New Hampshire

SPRINGER-VERLAG
BERLIN • HEIDELBERG • NEW YORK 1967

Library of Congress Catalog Card Number 67-19307
Printed in the United States of America


Title No. 3961

# Introduction

In recent years, because of advances in karyological techniques, we have witnessed a remarkable renewal of interest in studies of mammalian chromosomes. These techniques, generally involving the use of tissue culture, colchicine and hypotonic solution pretreatments, allow for a much clearer display of metaphase chromosomes of mammalian cells than the classic direct squash or tissue section methods. Consequently, what was known about the chromosome complement of most mammals must be revised. The most astonishing revision, of course, was that made by Tjio and Levan in 1956, who demonstrated that the diploid number of man is 46, not 48 as previously believed. Similar revisions will have to be made for many other mammalian species, either in number or in karyotype structure. Many animals are being examined cytologically for the first time.

The findings are now extensive and scattered; they appear in numerous periodicals and newsletters, or they are kept in cytologists' file drawers without being published. It is difficult to have access to pertinent data for comparison among related species or for evaluation of various karyological characteristics within a karyotype. Such evaluations can be done only when reasonably uniform material is collected and placed side by side for comparison, accompanied by relative references. We considered that probably an *Atlas of Mammalian Chromosomes* would fulfill such a need.

Needless to say, it is impossible to present karyotypes of all mammalian species at one time. Many species have not yet been analyzed cytologically. Even if such data become available, they would be too bulky to be printed in a single volume. Thus, we decided to present, in consecutive volumes, approximately 50 species each year in this relatively uniform format for eventual collation into taxonomic groupings. In so doing, it was decided to print the atlas in a loose-leaf form, so that each unit (the karyotype and its descriptions) can be rearranged in order to facilitate the addition of new units.

The selection of species for each volume is somewhat arbitrary. Availability is, of course, the most important factor. We have included in the first volume a number of laboratory animals as well as domestic animals because karyological information on these species is keenly desired. We included also several wild species distributed in various orders and families.

With a few exceptions, the material presented in the first volume comes from our own files. In the future, it will be necessary to solicit contributions from colleagues who may have a collection of karyotypes of mammalian species that we do not have. Such contributions are and will be individually acknowledged.

It is not always easy to obtain karyotypes of both sexes of the same species for presentation. However, this is done whenever possible. Some cytologists arrange all morphologically similar chromosomes in one row. Perhaps this is scientifically correct, but our method of constructing karyotypes is to pair the chromosomes according to their morphological characteristics. The pairs are then arranged in groups (length as well as position of the centromere), similar to the suggested procedure for human and cat karyotypes. However, without idiogram analysis, although this is done with the best effort from good preparations, ambiguous situations occur repeatedly and errors in pair matching are unavoidable. With a few well-known cases as exceptions, we make no attempts to propose nomenclature of the chromosome pairs of any karyotype. Those working on the idiogram of one species or a group of species should confer and publish a suggested nomenclature system for others to follow. However, we try to identify the sex chromosomes whenever we can do so. In some cases, such as the cattle and the Syrian hamster, identification of the X chromosome is unequivocal, because the X is morphologically unique among the chromosomes of the complement. The Y chromosome is generally the smallest or one of the smallest of the complement, but exceptions occur. When it is the smallest or morphologically unique, its identification is also unequivocal. Autoradiography with tritiated thymidine may be used to match pairs and to identify the sex elements, but this has been done in only a few cases.

The diploid number of each species is indicated in all cases for instant and convenient reference. It must be emphasized that, although the diploid number appears stable in a number of species or even genera (*e.g., Myotis*), variation in diploid number has already been found (*e.g., Spilogale putorius*). In rodents and probably in other groups, a species may possess a constant diploid number, but shows extensive karyotypic polymorphism among populations. It is imperative, therefore, to present the collection record and indicate the deposition of the specimen whenever such information is available, even though this cannot be done at all times. Specimens purchased from animal dealers usually have a vague locality of collection, and study skins and skulls are not always obtainable from expensive animals, where even a small skin biopsy is a precious gift.

The references are directed principally to publications of karyotype analysis in which modern techniques have been employed. They are not necessarily complete, although in most instances an attempt has been made to be inclusive. The index refers to familiar names as well as scientific names. In subsequent volumes all species published in previous volumes will be cross-indexed.

We would like to express our sincere thanks to Mr. R. Lindemann and Dr. H. Heck of the Catskill Game Farm, Mr. John Werler and Dr. George F. Luquette of the Houston Zoological Garden, Drs. Doris H. Wurster, Margaret M. Sullivan and Frances E. Arrighi; Messrs. R. Low, John D. Carnes, Miss Ella Young and Miss Mary Bea Cline for their assistance in many ways.

T. C. Hsu
Kurt Benirschke

# Order: MARSUPIALIA

## Family: MACROPODIDAE

***Potorous tridactylus apicalis*** (Rat kangaroo)

$2n = 13♂, 12♀$

Volume 1, Folio 1, 1967

Order: MARSUPIALIA Family: MACROPODIDAE

Potorous tridactylus apicalis (Rat kangaroo)

2n=13♂,12♀

AUTOSOMES: 10 Metacentrics, submetacentrics or subtelocentrics

SEX CHROMOSOMES: X Submetacentric
$Y_1$ Medium-sized acrocentric
$Y_2$ Small acrocentric

All chromosome pairs are morphologically distinguishable. The X chromosome has a deep secondary constriction on the long arm near the centromere.

The karyotypes shown here are gifts of Dr. Margery W. Shaw, University of Michigan, Ann Arbor, Michigan, USA. Lymphocyte cultures.

REFERENCES:


1) Sharman, G.B.: The mitotic chromosomes of marsupials and their bearing on taxonomy and phylogeny. Australian J. Zool. 9:38, 1961.

2) Walen, K.H. and Brown, S.W.: Chromosomes in a marsupial (Potorous tridactylis) tissue culture. Nature 194:406, 1962.

3) Shaw, M.W. and Krooth, R.S.: The chromosomes of the Tasmanian rat-kangaroo (Potorous tridactylis apicalis). Cytogenetics 3:19, 1964.

4) Moore, R. A biometric analysis of the chromosomes of the marsupials – Marcopus major, Marcopus rufus and Potorous tridactylis. Cytogenetics 4: 145, 1965.

5) Hayman, D.L. and Martin, P.G.: An autoradiographic study of DNA synthesis in the sex chromosomes of two marsupials with an $XX/XY_1Y_2$ sex chromosome mechanism. Cytogenetics 4:209, 1965.



Order: MARSUPIALIA Family: MACROPODIDAE

Potorous tridactylus apicalis (Rat kangaroo)

2n=13♂,12♀


# Order: CHIROPTERA

## Family: DESMODONTIDAE

***Desmodus rotundus murinus*** (Vampire bat)

Volume 1, Folio 2, 1967

Order: CHIROPTERA Family: DESMODONTIDAE

Desmodus rotundus murinus (Vampire bat)

2n=28

AUTOSOMES: 26 Metacentrics and submetacentrics

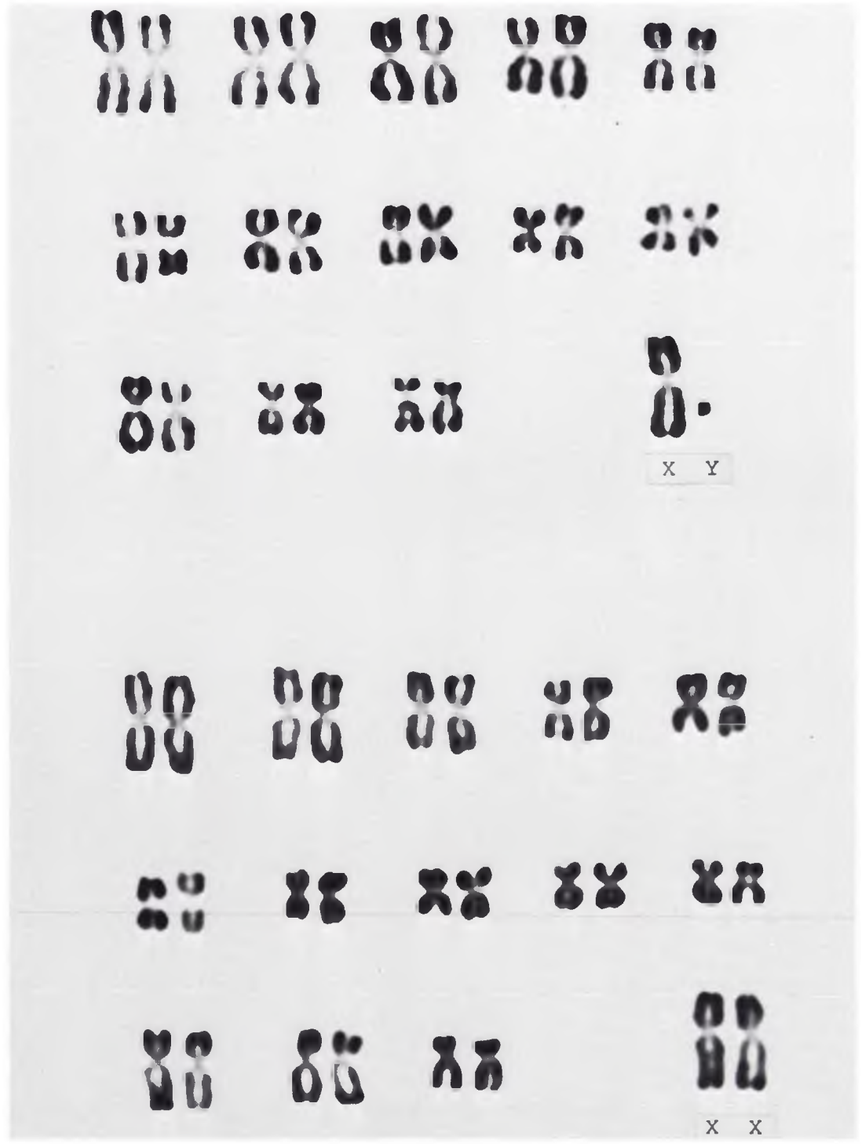
SEX CHROMOSOMES: X Large submetacentric
Y Minute telocentric

The specimens (one male and one female) were collected in Vera Cruz, Mexico by Mr. Robert Dooley, Houston Zoological Garden, Houston, Texas, USA. Lung cultures were used for karyological studies.

Order: CHIROPTERA Family: DESMODONTIDAE

Desmodus rotundus murinus (Vampire bat)

2n=28



# Order: CHIROPTERA

## Family: VESPERTILIONIDAE

***Myotis velifer incautus*** (Cave bat)

2n = 44

Volume 1, Folio 3, 1967

Order: CHIROPTERA Family: VESPERTILIONIDAE

Myotis velifer incautus (Cave bat)

2n=44

AUTOSOMES: 6 Large metacentrics and submetacentrics
2 Small submetacentrics
34 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Medium-sized submetacentric
Y Minute

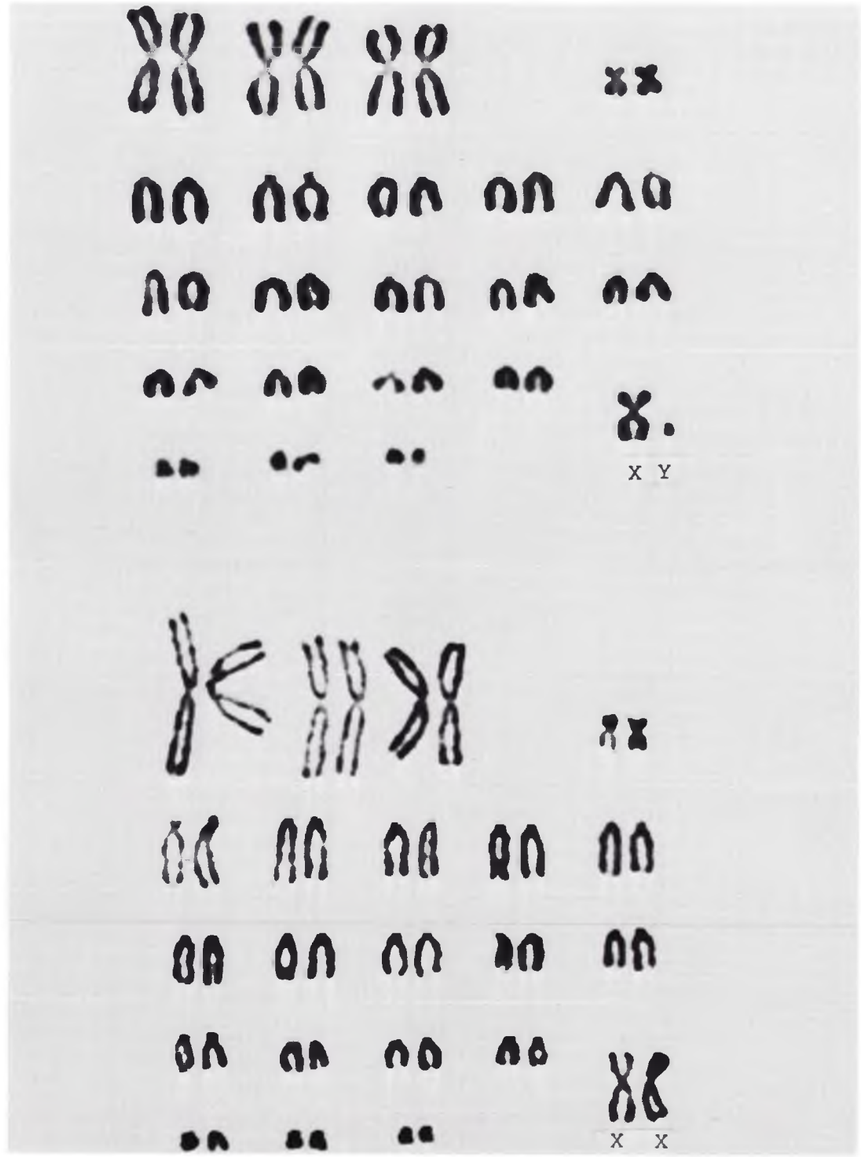
Three pairs of the acrocentric autosomes are distinctly smaller than other chromosomes.

Specimens were collected by Dr. Bryan P. Glass from the State of Oklahoma. Lung cultures were initiated for karyological studies.

Order: CHIROPTERA Family: VESPERTILIONIDAE

Myotis velifer incautus (Cave bat)

2n=44



# Order: CHIROPTERA

## Family: VESPERTILIONIDAE

***Pipistrellus subflavus subflavus*** (Eastern pipistrelle)

2n = 30

Volume 1, Folio 4, 1967

Order: CHIROPTERA Family: VESPERTILIONIDAE

Pipistrellus subflavus subflavus (Eastern pipistrelle)

2n=30

AUTOSOMES: 20 Large or medium-sized metacentrics or submetacentrics
2 Relatively small submetacentrics
6 Small subtelocentrics

SEX CHROMOSOMES: X Medium-sized metacentric
Y Small submetacentric

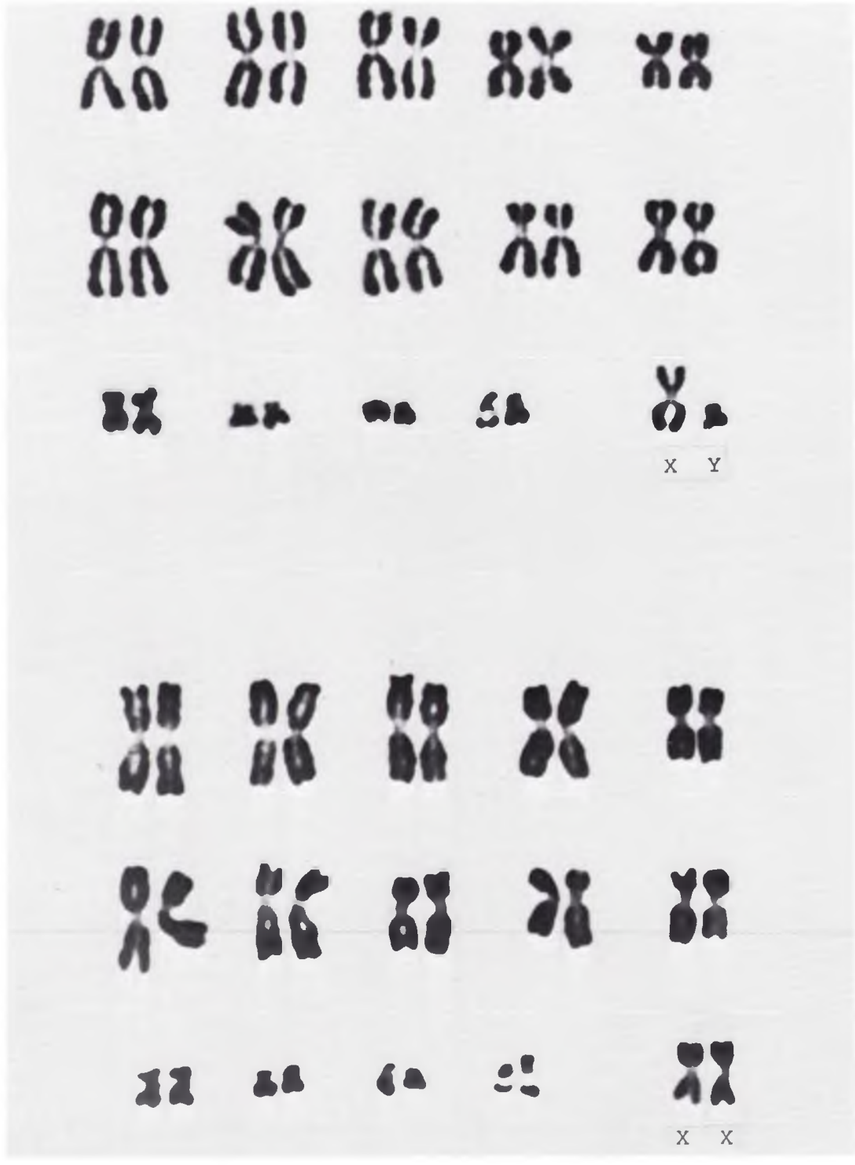
One pair of the small subtelocentric autosomes bears a secondary constriction on the long arm. The identification of the X is equivocal, since one or two pairs of autosomes show similar morphology.

Two male and one female specimens were collected by Dr. Bryan P. Glass, Department of Zoology, Oklahoma State University, Stillwater, Oklahoma, USA. Lung cultures were used for karyological studies.

Order: CHIROPTERA Family: VESPERTILIONIDAE

Pipistrellus subflavus subflavus (Eastern pipistrelle)

2n=30



# Order: EDENTATA

## Family: DASYPODIDAE

***Dasypus novemcinctus*** (Nine-banded armadillo)

2n = 64

Volume 1, Folio 5, 1967

Order: EDENTATA Family: DASYPODIDAE

Dasypus novemcinctus (Nine-banded armadillo)

2n=64

AUTOSOMES: 18 Metacentrics, submetacentrics or subtelocentrics
44 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Acrocentric

The last autosome shown, a small submetacentric element, has always large satellites, often bent back over the main portion of this chromosome.

Numerous animals have been studied from two locations in Texas, USA. Lymphocyte, kidney (shown), skin, and embryo cultures have identical features.

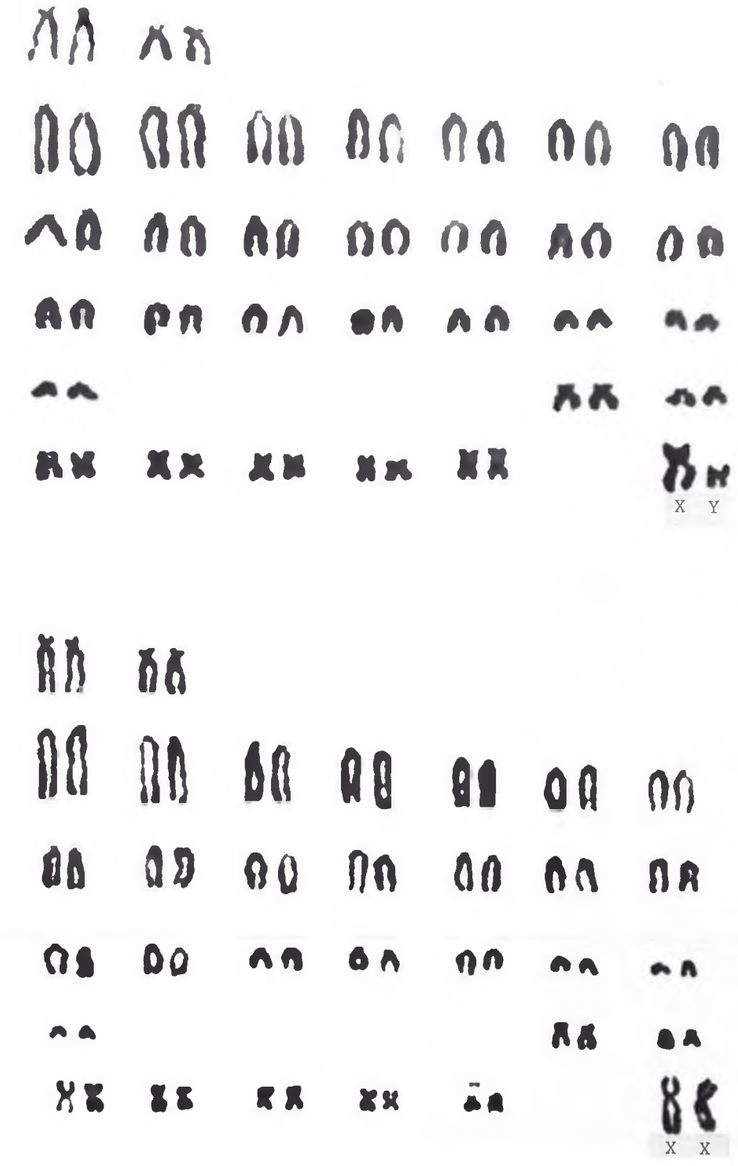
REFERENCES:

Beath, M.M., Benirschke, K. and Brownhill, L.E.: The chromosomes of the nine-banded armadillo, Dasypus novemcinctus. Chromosoma 13:27, 1962.

Order: EDENTATA Family: DASYPODIDAE

Dasypus novemcinctus (Nine-banded armadillo)

2n=64



# Order: LAGOMORPHA

## Family: LEPORIDAE

***Lepus alleni alleni*** (Antelope jack rabbit)
2n = 48

Volume 1, Folio 6, 1967

Order: LAGOMORPHA Family: LEPORIDAE

Lepus alleni alleni (Antelope jack rabbit)

2n=48

AUTOSOMES: 42 Metacentrics, submetacentrics or subtelocentric
4 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Acrocentric

The specimens were collected in Tucson area, by Mr. David Hinds, University of Arizona, Tucson, Arizona, USA. Muscle tissues were used to initiate cell cultures for karyological studies.

Order: LAGOMORPHA Family: LEPORIDAE

Lepus alleni alleni (Antelope jack rabbit)

2n=48

# Order: LAGOMORPHA

## Family: LEPORIDAE

***Lepus californicus eremicus*** (Black-tailed jack rabbit)

2n = 48

Order: LAGOMORPHA Family: LEPORIDAE

Lepus californicus eremicus (Black-tailed jack rabbit)

2n=48

AUTOSOMES: 42 Metacentrics, submetacentrics or subtelocentrics
4 Acrocentrics

SEX CHROMOSOMES: X Large submetacentric
Y Small acrocentric

The specimens were collected by Mr. David Hinds in Tucson, Arizona, USA. Muscles were used to initiate cultures for karyological studies.

REFERENCES:

Worthington, D.H. and Sutton, D.A.: Chromosome numbers and analysis in three species of Leporidae. Mammalian Chromosomes Newsletter No. 22:194, 1966.

Order: LAGOMORPHA Family: LEPORIDAE

Lepus californicus eremicus (Black-tailed jack rabbit)

2n=48

# Order: LAGOMORPHA

## Family: LEPORIDAE

***Oryctolagus cuniculus*** (Laboratory rabbit)

2n = 44

Oryctolagus cuniculus (Laboratory rabbit)

2n=44

AUTOSOMES: 34 Metacentrics, submetacentrics or subtelocentrics
8 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Submetacentric

Karyotypes were obtained from kidney cultures of male and female domestic white rabbits.

REFERENCES:

1) Melander, Y.: The chromosome complement of the rabbit. Hereditas 42: 432, 1956.

2) Sarkar, P., Basu, P.K. and Miller, I.: Karyologic studies on cells from rabbit cornea and other tissues grown in vitro. Invest. Ophthal. 1:33, 1962.

3) Teplitz, R. and Ohno, S.: Postnatal induction of ovogenesis in the rabbit (Oryctolagus cuniculus). Exp. Cell Res. 31:183, 1963.

4) Sharma, G.P., Parshad, R. and Ghuman, S.K.: On the meiotic and somatic chromosomes of the rabbit. Oryctolagus cuniculus. Res. Bull. (N.S.) Panjab Univ. 14:171, 1963.

5) McMichael, H., Wagner, J.E., Nowell, P.C. and Hungerford, D.A.: Chromosome studies of virus-induced rabbit papillomas and derived primary carcinomas. J. Nat. Cancer Inst. 31:1197, 1963.

6) Pruniéras, M., Jacquemont, C., and Mathivon, M.F.: Etudes sur les relations virus-chromosomes. V. - Le caryotype du lapin domestique. Ann. L'Inst. Pasteur 109:465, 1965.

7) Nichols, W.W., Levan, A., Hansen-Melander, E. and Melander, Y.: The idiogram of the rabbit. Hereditas 53:63, 1965.

8) Dave, M.J., Takagi, N., Oishi, H. and Kikuchi, Y.: Chromosome studies on the hare and the rabbit. Proc. Jap. Acad. 41:244, 1965.

9) Ray, M. and Williams, T.W.: Karyotype of rabbit chromosomes from leucocyte cultures. Canad. J. Genet.& Cytol. 8:393, 1966.

Order: LAGOMORPHA Family: LEPORIDAE

Oryctolagus cuniculus (Laboratory rabbit)

2n=44

# Order: RODENTIA

## Family: SCIURIDAE

***Marmota monax*** (Northeastern American woodchuck)

2n = 38

Volume 1, Folio 9, 1967

Order: RODENTIA Family: SCIURIDAE

Marmota monax (Northeastern American woodchuck)

2n=38

AUTOSOMES: 24 or 26 Metacentrics, submetacentrics or subtelocentrics
10 or 12 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Metacentric
Y Acrocentric

The classification of the element here placed as No. 11 is difficult. In some preprations (top) it appears acrocentric, in others (bottom) it is more subtelocentric.

Five specimens captured in central Vermont, USA and New Hampshire, USA were studied with lymphocyte culture, kidney and fibrous tissue preparations. All had similar results. The karyotypes shown were prepared from primary kidney cultures.

REFERENCES:

Couser, W., Sargent, P., Brownhill, L.E. and Benirschke, K.: The somatic chromosomes of the Northeastern American Woodchuck, Marmota monax. Cytologia 28:108, 1963.

Order: RODENTIA Family: SCIURIDAE

Marmota monax (Northeastern American woodchuck)

2n=38

# Order: RODENTIA

## Family: SCIURIDAE

***Tamiasciurus hudsonicus streatori*** (Red squirrel)

2n = 46

Order: RODENTIA Family: SCIURIDAE

Tamiasciurus hudsonicus streatori (Red squirrel)

2n=46

AUTOSOMES: 42 Metacentrics, submetacentrics and subtelocentrics
2 Acrocentrics

SEX CHROMOSOMES: X Submetacentric
Y Metacentric

Secondary constrictions may occur on a number of chromosomes, but usually not on homologous chromosomes.

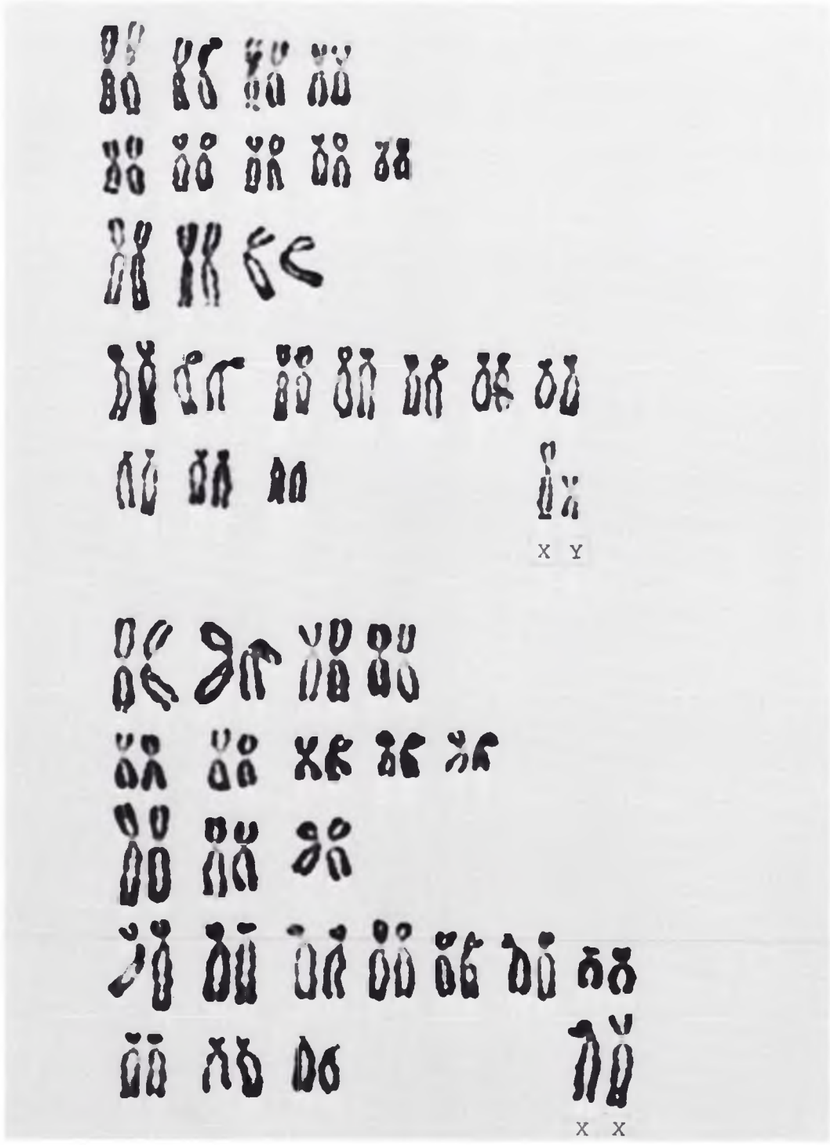
The specimens were collected in the State of Washington by Dr. Murray L. Johnson, University of Puget Sound, Tacoma, Washington, USA. A total of 4 samples (2♂♂,2♀♀) were analyzed. Lung cultures were used in all cases for karyological studies.

A single female specimen of T. h. loquax trapped from the State of Vermont (according to an animal dealer) showed 46 chromosomes but a different karyotype.

Order: RODENTIA Family: SCIURIDAE

Tamiasciurus hudsonicus streatori (Red squirrel)

2n=46



# Order: RODENTIA

## Family: HETEROMYIDAE

***Perognathus intermedius*** (Rock pocket mouse)

Volume 1, Folio 11, 1967

Order: RODENTIA Family: HETEROMYIDAE

Perognathus intermedius (Rock pocket mouse)

2n=46

AUTOSOMES: 10 Large metacentrics or submetacentrics
4 Small submetacentrics or subtelocentrics
30 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Large submetacentric
Y Small metacentric

No distinct secondary constrictions. Identification of X somewhat equivocal but not too difficult. Identification of Y very easy.

The male specimen was collected at Las Cruces, New Mexico, USA, and the female specimen was collected from Ward County, Texas, USA.

Order: RODENTIA Family: HETEROMYIDAE

Perognathus intermedius (Rock pocket mouse)

2n=46

# Order: RODENTIA

## Family: CRICETIDAE

***Baiomys taylori subater*** (Northern pygmy mouse)

2n = 48

Order: RODENTIA Family: CRICETIDAE

Baiomys taylori subater (Northern pygmy mouse)

2n=48

AUTOSOMES: 46 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Large subtelocentric
Y Small subtelocentric

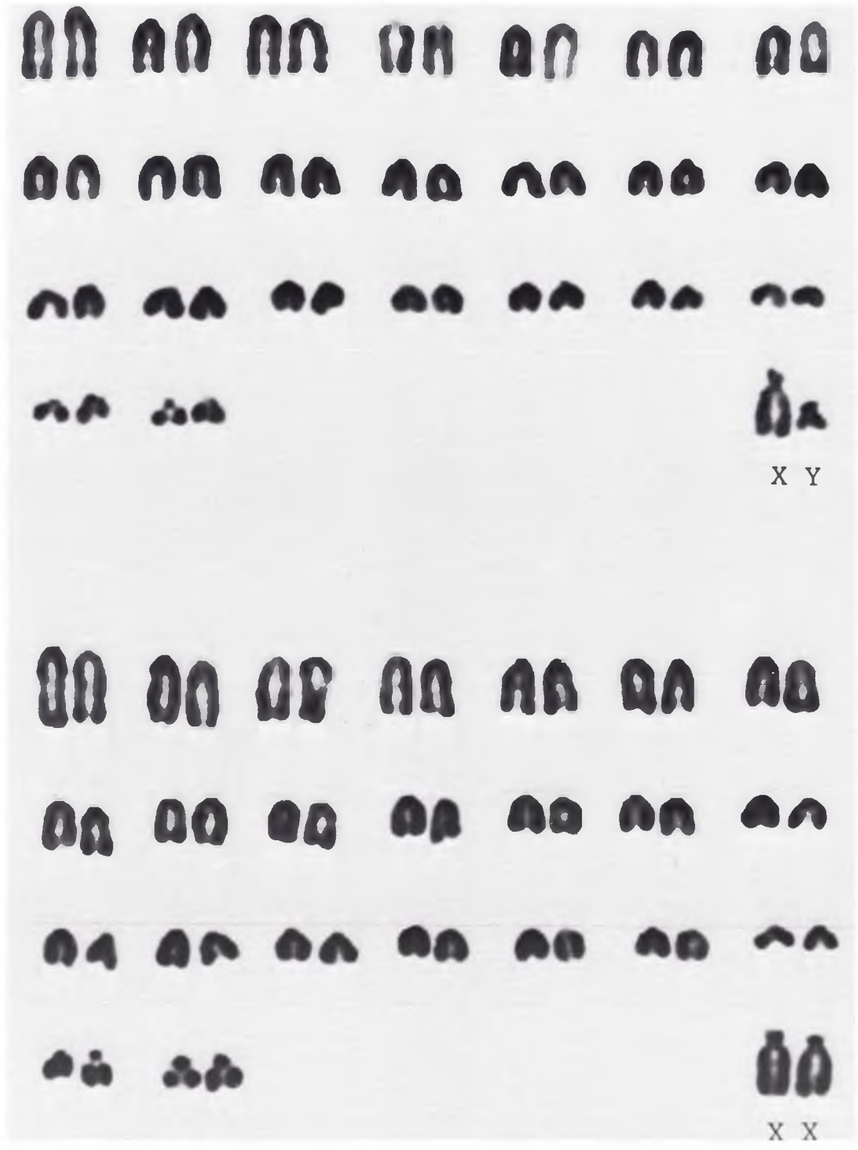
The autosomes form a continuous length gradation. Two pairs of the smallest members of autosomes may show secondary constriction near the centromere.

Two animals (one male and one female) were collected at College Station, Texas, USA. Lung cultures were used for karyological studies.

Order: RODENTIA Family: CRICETIDAE

Baiomys taylori subater (Northern pygmy mouse)

2n=48



# Order: RODENTIA

## Family: CRICETIDAE

***Cricetulus griseus*** (Chinese hamster)

2n = 22

Order: RODENTIA Family: CRICETIDAE

Cricetulus griseus (Chinese hamster)

2n=22

AUTOSOMES: 14 Metacentrics or submetacentrics
6 Subtelocentrics

SEX CHROMOSOMES: X Medium-sized submetacentric
Y Medium-sized submetacentric

The long arm of the X may show a weak secondary constriction at the distal third. However, without autoradiography with tritiated thymidine, the X may be indistinguishable from chromosomes No. 4. The Y chromosome is morphologically unique.

The specimens were originally donated by Dr. M. A. Bender, Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA. Cell lines (♂,Don; ♀,Dede) derived from lung cultures were used. They are available at the American Type Culture Collection.

REFERENCES:


1) Ford, D.K. and Yerganian, G.: Observations on the chromosomes of Chinese hamster cells in tissue culture. J. Nat. Cancer Inst. 21:393, 1958.

2) Bender, M.A. and Gooch, P.C.: Spontaneous and X-ray-induced somatic chromosome aberrations in the Chinese hamster. Intern. J. Rad. Biol. 4: 175, 1961.

3) Ohno, S. and Weiler, C.: Relationship between large X-chromosome and side-by-side pairing of the XY-bivalent observed in the Chinese hamster, Cricetus griseus. Chromosoma 13:106, 1962.

4) Hsu, T.C. and Zenzes, M.T.: Mammalian chromosomes in vitro. XVII. Idiogram of the Chinese hamster. J. Nat. Cancer Inst. 32:857, 1964.

5) Hsu, T.C.: Mammalian chromosomes in vitro. XVIII. DNA replication sequences in the Chinese hamster. J. Cell Biol. 23:53, 1964.

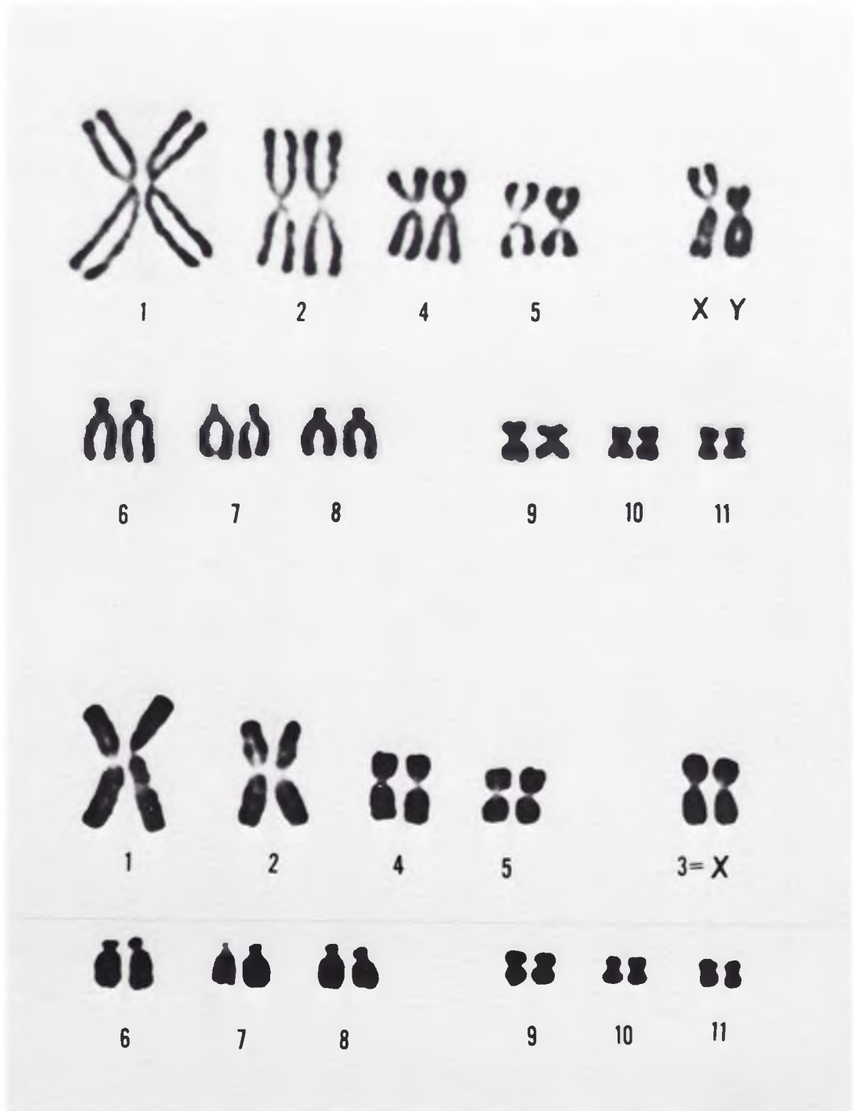
6) Utakoji, T.: On the homology between the X and the Y chromosomes of the Chinese hamster. Chromosoma 18:449, 1966.



Order: RODENTIA Family: CRICETIDAE

Cricetulus griseus (Chinese hamster)

2n=22

# Order: RODENTIA

## Family: CRICETIDAE

***Mesocricetus auratus*** (Syrian or "golden" hamster)

2n = 44

Order: RODENTIA Family: CRICETIDAE

Mesocricetus auratus (Syrian or "golden" hamster)

2n=44

AUTOSOMES: 34 Metacentrics, submetacentrics or subtelocentrics
8 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric (duplicate type)
Y Submetacentric

The karyotypes displayed were prepared from fetal tissue cultures and kindly supplied by Dr. M. Galton, Hanover, New Hampshire. They have been published by Galton & Holt and are reproduced with permission of the publishers. The long arm of X and Y are late replicating as shown by the autoradiographs. In several publications the Y chromosome is not identified correctly.

REFERENCES:


1) Awa, A., Sasaki, M. and Takayama, S.: An in vitro study of the somatic chromosomes in several mammals. Jap. J. Zool. 12:257, 1959.

2) Ohno, S. and Weiler, C.: Sex chromosome behavior pattern in germ and somatic cells of Mesocricetus auratus. Chromosoma 12:362, 1961.

3) Lehman, J. M., Macpherson, I. and Moorhead, P.S.: Karyotype of the Syrian hamster. J. Nat. Cancer Inst. 31:639, 1963.

4) Galton, M. and Holt, S.F.: DNA replication patterns of the sex chromosomes in somatic cells of the Syrian hamster. Cytogenetics 3:97, 1964.

5) Fredga, K. and Santesson, B.: Male meiosis in the Syrian, Chinese, and European hamsters. Hereditas 52:36, 1964.

6) Schmid, W.: Karyotypes and labeling studies of Cavia porcellus, Microtus agrestis and Mesocricetus auratus. Mammalian Chromosomes Newsletter No. 18:152, 1965.



Order: RODENTIA Family: CRICETIDAE

Mesocricetus auratus (Syrian or "golden" hamster)

2n=44


# Order: RODENTIA

## Family: CRICETIDAE

***Microtus pennsylvanicus pennsylvanicus*** (Meadow vole)

2n = 46

Order: RODENTIA Family: CRICETIDAE

Microtus pennsylvanicus pennsylvanicus (Meadow vole)

2n=46

AUTOSOMES: 6 Metacentrics, submetacentrics or subtelocentrics
38 Acrocentrics or telocentrics

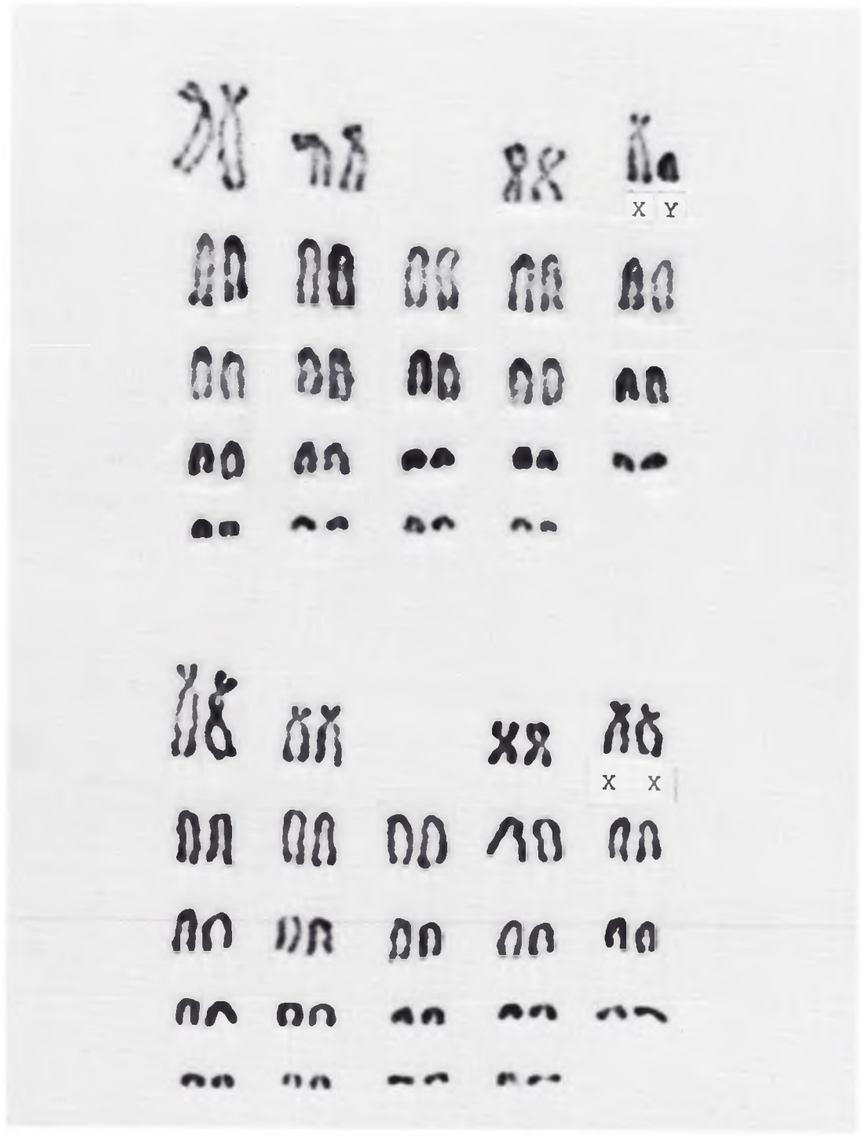
SEX CHROMOSOMES: X Subtelocentric
Y Telocentric

The specimens (2♂♂,1♀) were collected by Mr. Larry L. Deaven from Center County, Pennsylvania, USA. Bone marrow and lung cultures were used for karyological studies.

Order: RODENTIA Family: CRICETIDAE

Microtus pennsylvanicus pennsylvanicus (Meadow vole)

2n=46



# Order: RODENTIA

## Family: CRICETIDAE

***Onychomys leucogaster*** (Northern grasshopper mouse)

2n = 48

Order: RODENTIA Family: CRICETIDAE

Onychomys leucogaster (Northern grasshopper mouse)

2n=48

AUTOSOMES: 46 Metacentrics, submetacentrics and subtelocentrics

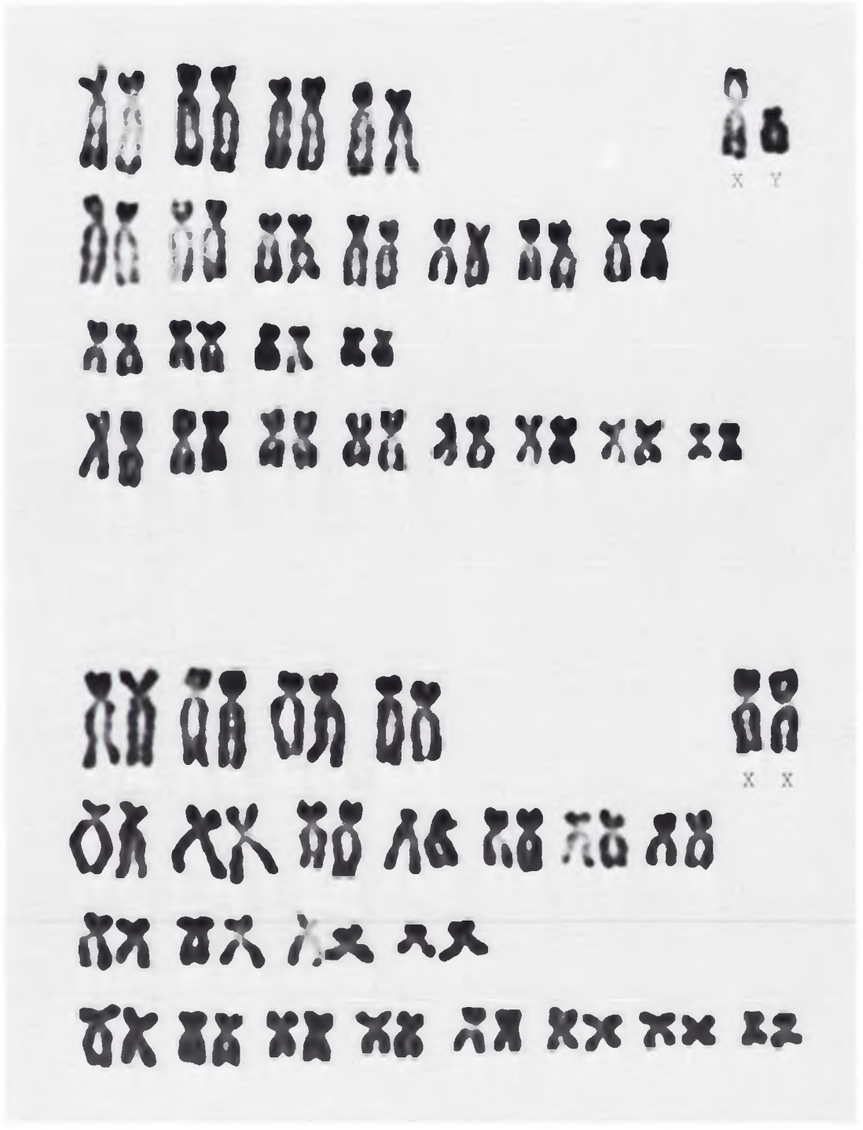
SEX CHROMOSOMES: X Submetacentric
Y Subtelocentric

Specimens collected by Mr. James L. Patton in Vernon, Texas, USA. Lung cultures were used for karyological studies.

Order: RODENTIA Family: CRICETIDAE

Onychomys leucogaster (Northern grasshopper mouse)

2n=48



# Order: RODENTIA

## Family: MURIDAE

***Mus musculus*** **(Mouse)**

2n = 40

Volume 1, Folio 17, 1967

Order: RODENTIA Family: MURIDAE

Mus musculus (Mouse)

2n=40

AUTOSOMES: 38 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Acrocentric
Y Acrocentric

The individual elements cannot be distinguished; however, by radioautography Galton and Holt were able to identify X and Y as shown (karyotypes kindly provided by Dr. M. Galton, Hanover, New Hampshire. Preparations shown are from C57BL/10J mouse embryos).

Minor structural differences in various strains of mice have been observed, both in autosomes (Levan et al.) and the Y chromosome (Levan et al.; Crippa; Nowell).

REFERENCES:


1) Stich, H.F. and Hsu, T.C.: Cytological identification of male and female somatic cells in the mouse. Exp. Cell Res. 13:358, 1960.

2) Levan, A., Hsu, T.C. and Stich, H.F.: The idiogram of the mouse. Hereditas 48:677, 1962.

3) Ford, E.H.R. and Woollam, D.H.M.: A study of the mitotic chromosomes of mice of the Strong line. Exp. Cell Res. 32:320, 1963.

4) Crippa, M.: The mouse karyotype in somatic cells cultured in vitro. Chromosoma 15:301, 1964.

5) Galton, M. and Holt, S.F.: Asynchronous replication of the mouse sex chromosomes. Exp. Cell Res. 37:111, 1965.

6) Bennett, D.: The karyotype of the mouse, with identification of a translocation. Proc. Nat. Acad. Sci. 53:730, 1965.

7) Nowell, P.C.: An unusual Y chromosome in Swiss mice. Mammalian Chromosomes Newsletter No. 17:73, 1965.

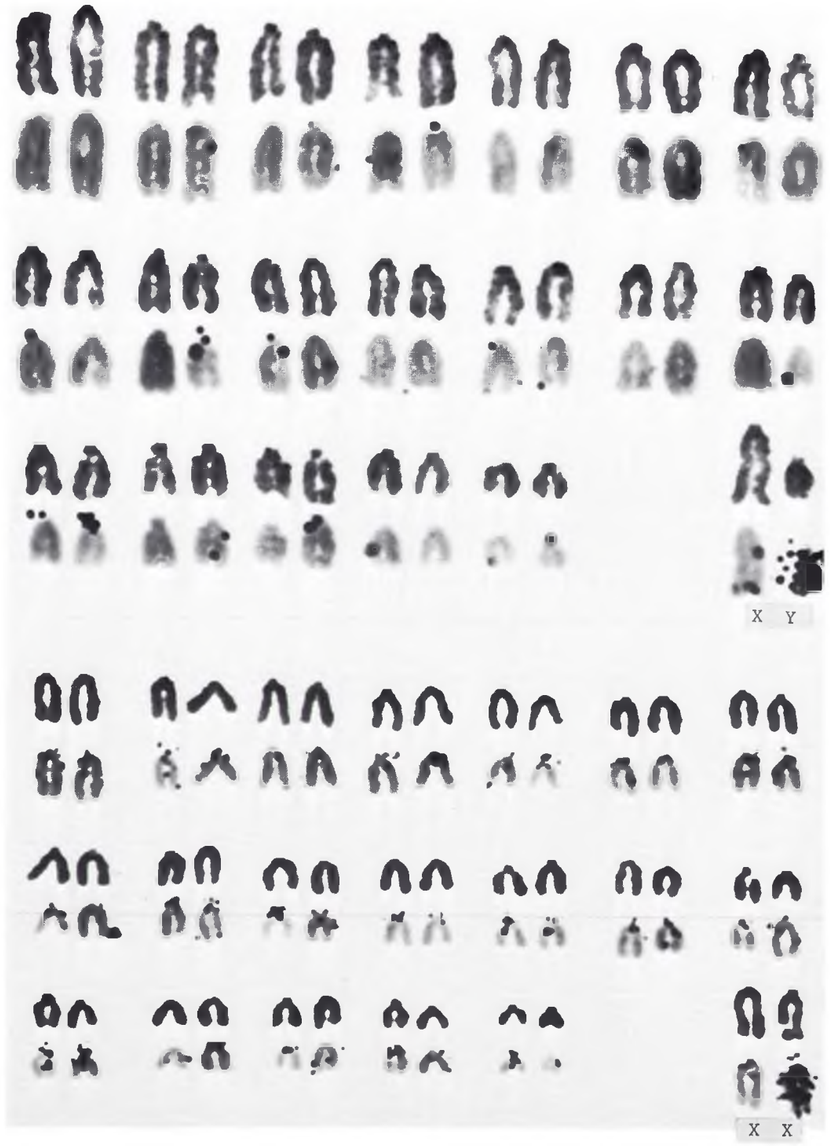
8) Loughman, W.D.: Mouse peripheral blood white cell culture. Mammalian Chromosomes Newsletter No. 18:145, 1965.



Order: RODENTIA Family: MURIDAE

Mus musculus (Mouse)

2n=40

# Order: RODENTIA

## Family: MURIDAE

***Rattus norvegicus*** **(Rat)**

2n = 42

Volume 1, Folio 18, 1967

Rattus norvegicus (Rat)

2n=42

AUTOSOMES: 22 Metacentrics, submetacentrics or subtelocentrics
18 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Acrocentric
Y Acrocentric

The second largest autosome has satellites. Two types of X have been described within strains. It may have prominent short arms or none. The Y is polymorphic among strains, acrocentric and the smallest element with positive heteropyknosis or, equal in size to medium-sized autosomal acrocentrics without heteropyknosis.

Karyotypes were prepared from skin cultures of normal "white rats."

REFERENCES:

1) Makino, S. and Hsu, T.C.: Mammalian chromosomes in vitro. V. The somatic complement of the Norway rat, Rattus norvegicus. Cytologia 19:23, 1954.

2) Tjio, J.H. and Levan, A.: Comparative idiogram analysis of the rat and the Yoshida rat sarcoma. Hereditas 42:218, 1956.

3) Fitzgerald, P.H.: Cytological identification of sex in somatic cells of the rat, Rattus norvegicus. Exp. Cell Res. 25:191, 1961.

4) Hungerford, D.A. and Nowell, P.C.: Sex chromosome polymorphism and the normal karyotype in three strains of the laboratory rat. J. Morph. 113: 275, 1963.

5) Vrba, M.: Idiogram of the rat (Rattus norvegicus) and reliability in identification of individual chromosomes. Folia Biologica 10:75, 1964.

6) Dowd, G., Dunn, K. and Moloney, W.C.: Chromosome studies in normal and leukemic rats. Blood 23:564, 1964.

7) Yoshida, T.H., Nakamura, A. and Fukaya, T.: Chromosomal polymorphism in Rattus rattus (L.) collected in Kusudomari and Misima. Chromosoma 16:70, 1965.

8) Allison, J.E., Stanley, A.J. and Gumbreck, L.G.: Sex chromatin and idiograms from rats exhibiting anomalies of the reproductive organs. Anat. Rec. 153:85, 1965.

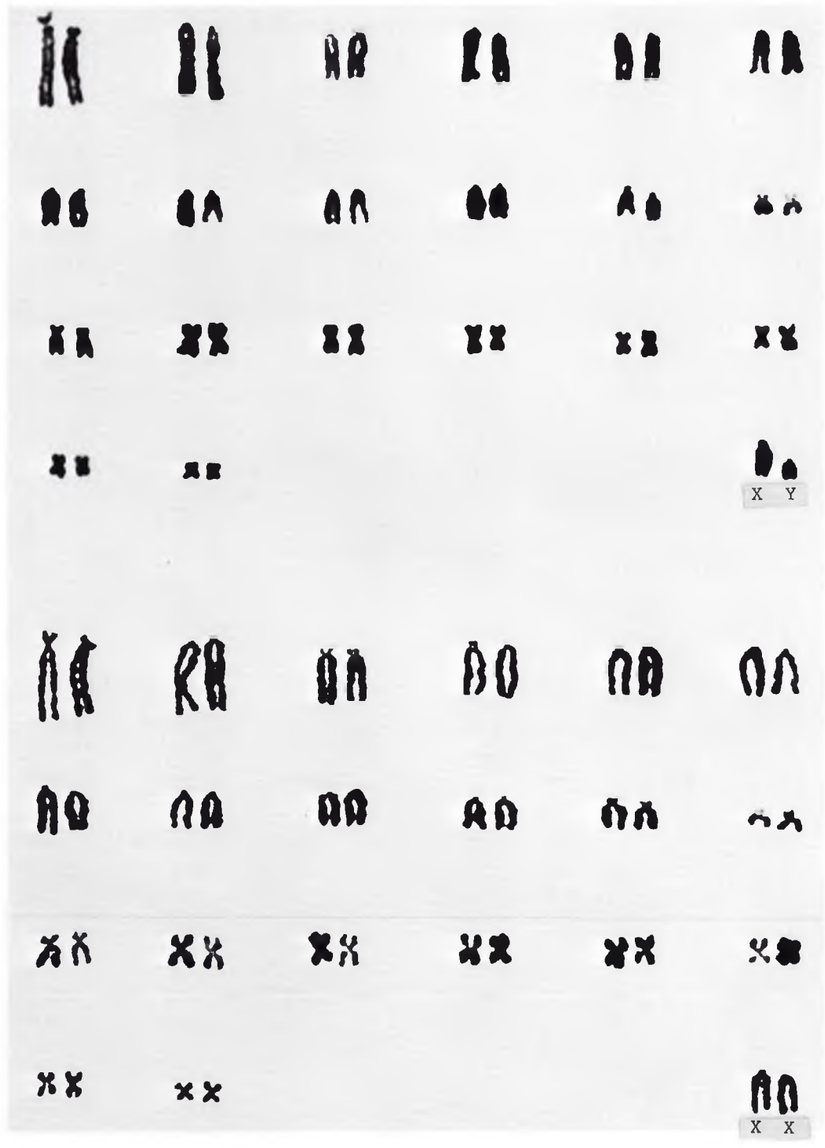
9) Zieverink, W.D. and Moloney, W.C.: Use of the Y chromosome in the Wistar/ Furth rat as a cellular marker. Proc. Soc. Exp. Biol. Med. 119:370, 1965.

10) Moloney, W.C., Boschetti, A.E. and Dowd, G.: Observations on leukemia in Wistar and Wistar/Furth rats. Blood 26:341, 1965.

Order: RODENTIA Family: MURIDAE

Rattus norvegicus (Rat)

2n=42



# Order: RODENTIA

## Family: CHINCHILLIDAE

***Chinchilla laniger*** (Chinchilla)

2n = 64

Order: RODENTIA Family: CHINCHILLIDAE

Chinchilla laniger (Chinchilla)

2n=64

AUTOSOMES: 62 Metacentrics or submetacentrics

SEX CHROMOSOMES: X Large metacentric (duplicate type)
Y Small submetacentric

One pair of small submetacentric elements has prominent satellites.

Karyotypes shown are from kidney cultures and corresponding autoradiographs are placed beneath individual elements.

REFERENCES:

1) Nes, N.: The chromosomes of Chinchilla laniger. Acta Vet. Scand. 4: 128, 1963.

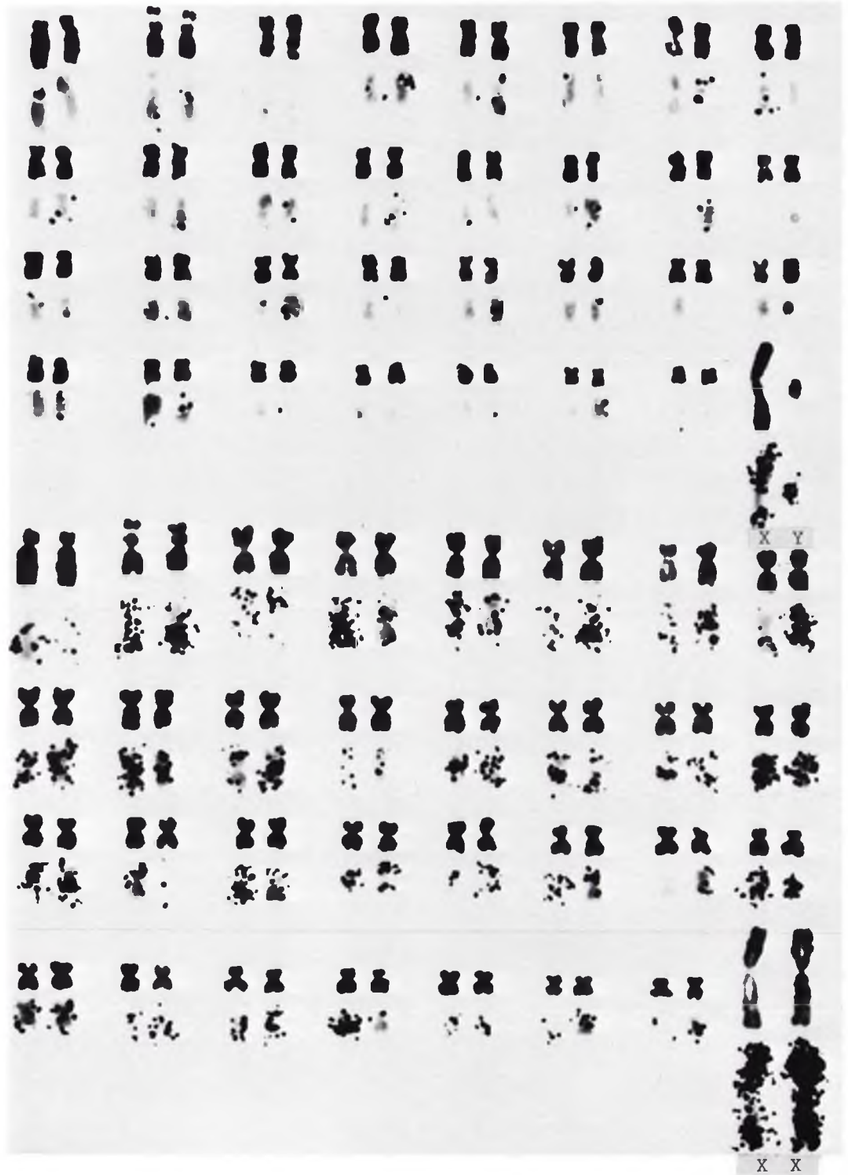
2) Galton, M., Benirschke, K. and Ohno, S.: Sex chromosomes of the chinchilla: allocycly and duplication sequence in somatic cells and behavior in meiosis. Chromosoma 16:668, 1965.

3) Fredga, K.: Chromosome studies in five species of South American rodents (Suborder Hystricomorpha). Mammalian Chromosomes Newsletter No. 20:45, 1966.

Order: RODENTIA Family: CHINCHILLIDAE

Chinchilla laniger (Chinchilla)

2n=64



# Order: CARNIVORA

## Family: CANIDAE

*Canis familiaris* (Dog)
2n = 78

Volume 1, Folio 20, 1967

Order: CARNIVORA Family: CANIDAE

Canis familiaris (Dog)

2n=78

AUTOSOMES: 76 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Minute metacentric

The male karyotype was obtained from lymphocyte culture of a normal domestic dog. Skin and kidney cultures were established from a female "grey collie", and the karyotypes obtained from these were indistinguishable from those of a normal dog. The karyotype appears to be identical in all races of dogs with the exception of the Y which is described as a small acrocentric in some reports.

REFERENCES:


1) Moore, W. Jr. and Lambert, P.D.: The chromosomes of the beagle dog. J. Heredity 54:273, 1963.

2) Sofuni, T. and Makino, S.: A supplementary study on the chromosomes of venereal tumors of the dog. Gann 54:149, 1963.

3) Brown, R.C., Swanton, M.C. and Brinkhous, K.M.: Canine hemophilia and male pseudohermaphroditism. Cytogenetic studies. Lab. Invest. 12:961, 1963.

4) Reiter, M.B., Gilmore, V.H. and Jones, T.C.: Karyotype of the dog (Canis familiaris). Mammalian Chromosomes Newsletter No. 12:170, 1963.

5) Gustavsson, I.: The chromosomes of the dog. Hereditas 51:187, 1964.

6) Pakes, S.P. and Griesemer, R.A.: Current status of chromosome analysis in veterinary medicine. J.A.V.M.A. 146:138, 1965.

7) Basrur, P.K. and Gilman, J.P.W.: Chromosome studies in canine lymphosarcoma. Cornell Veterinarian 56:451, 1966.

8) Newnham, R.E. and Davidson, W.M.: Comparative study of the karyotypes of several species in Carnivora including the giant panda (Ailuropoda melanoleuca). Cytogenetics 5:152, 1966.

9) Ford, L.: The normal male and female dog mitotic karyotype. Mammalian Chromosomes Newsletter No. 19:3, 1966.

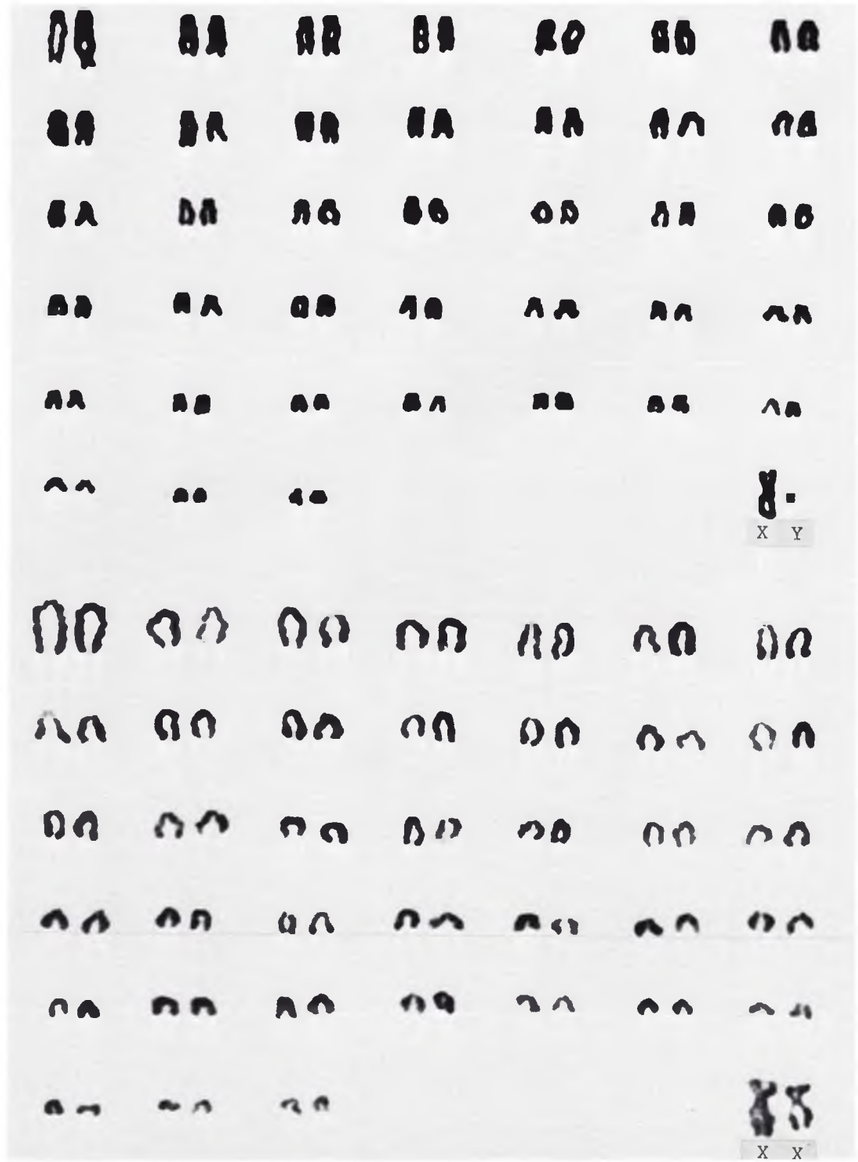
10) Chiarelli, B.: Data on the karyology of different races of Canis familiaris. Mammalian Chromosomes Newsletter No. 21:160, 1966.



Order: CARNIVORA Family: CANIDAE

Canis familiaris (Dog)

2n=78

# Order: CARNIVORA

## Family: CANIDAE

***Canis latrans*** (Coyote)

2n = 78

Volume 1, Folio 21, 1967

Order: CARNIVORA Family: CANIDAE

Canis latrans (Coyote)

2n=78

AUTOSOMES: 76 acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Minute

Skin biopsies of the two animals from the State of Washington, USA were kindly provided by Dr. H. V. Thuline. The karyotypes are indistinguishable from various races of the domestic dog (Canis familiaris).

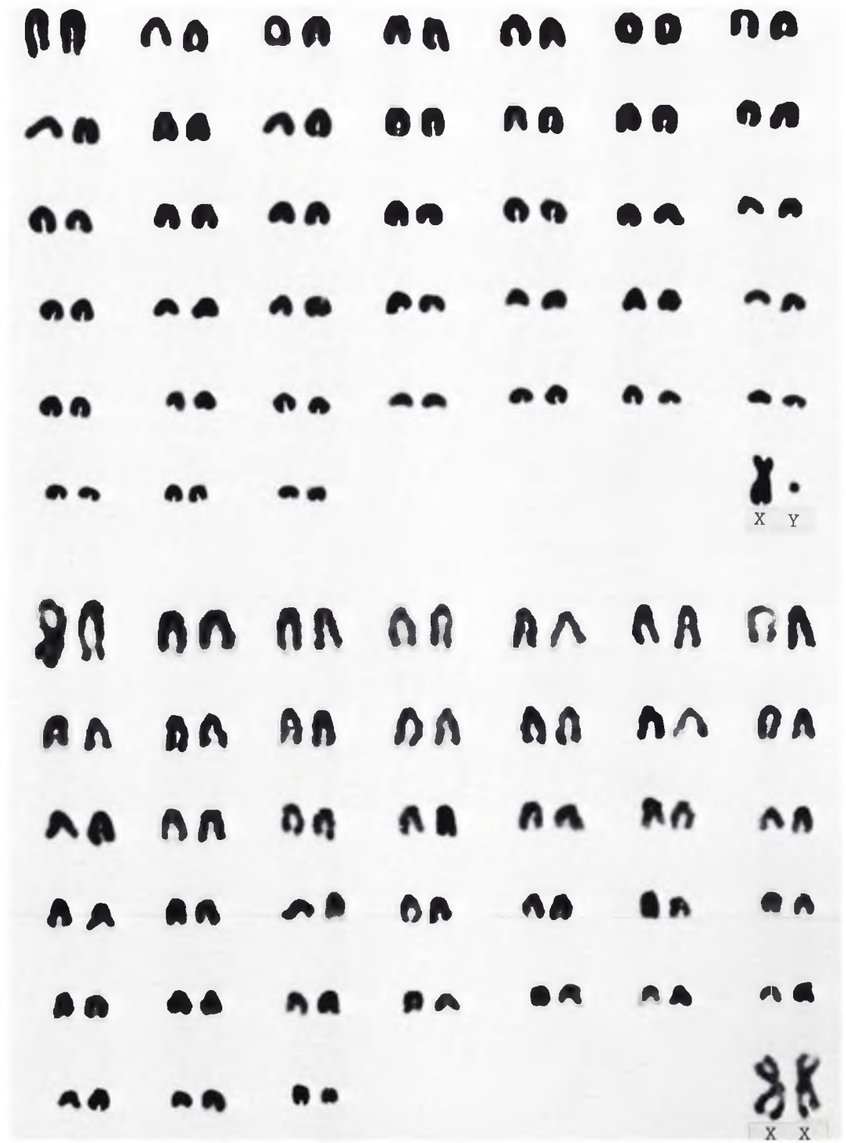
REFERENCES:

Benirschke, K. and Low, R.J.: Chromosome complement of the coyote, Canis latrans. Mammalian Chromosomes Newsletter No. 15:102, 1965.

Order: CARNIVORA Family: CANIDAE

Canis latrans (Coyote)

2n=78



# Order: CARNIVORA

## Family: URSIDAE

***Selenarctos thibetanus*** (Asiatic black bear)

2n = 74

Order: CARNIVORA Family: URSIDAE

Selenarctos thibetanus (Asiatic Black Bear)

2n=74

AUTOSOMES: 8 Metacentrics or submetacentrics
64 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Acrocentric

Secondary constrictions are present in one or more pairs of acrocentrics, similar to those seen in the American black bear. The male animal's metaphase was kindly supplied by Dr. Rosemary E. Newnham (London, England). Specimens from the female were obtained at Antwerp Zoo (Belgium) through the courtesy of Dr. Agathe Gijzen. Both preparations shown are from fibrous tissue cultures.

REFERENCES:

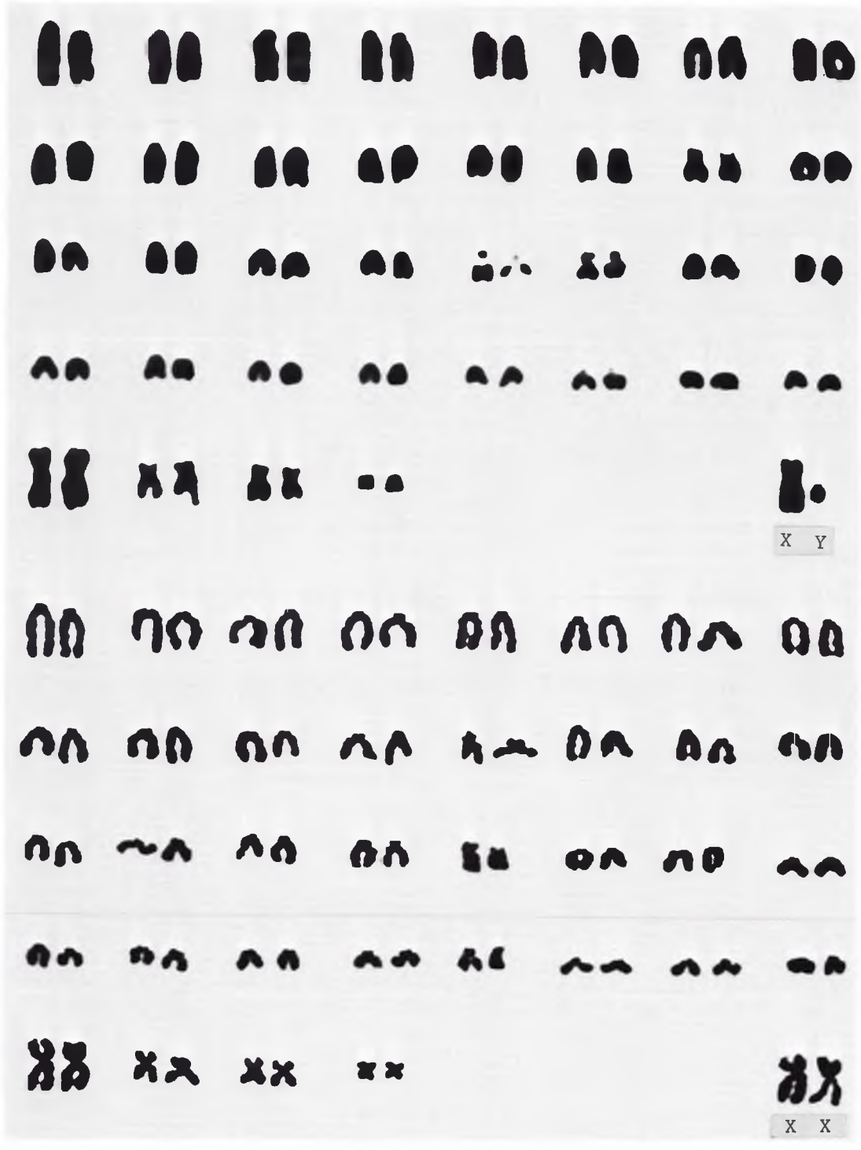
1) Newnham, R.E. and Davidson, W.M.: Comparative study of the karyotypes of several species in carnivora including the giant panda (Ailuropoda melanoleuca). Cytogenetics 5:152, 1966.

2) Benirschke, K., Young, E. and Low, R.J.: Chromosome studies on four carnivores. Mammalian Chromosomes Newsletter No. 21:148, 1966.

Order: CARNIVORA Family: URSIDAE

Selenarctos thibetanus (Asiatic black bear)

2n=74



# Order: CARNIVORA

## Family: URSIDAE

***Ursus americanus*** (American black bear)

2n = 74

Order: CARNIVORA Family: URSIDAE

Ursus americanus (American black bear)

2n=74

AUTOSOMES: 8 Metacentrics or submetacentrics
64 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Acrocentric

One or two pairs of small acrocentrics often have secondary constrictions of the long arms near the centromere.

The male animal was obtained in New Hampshire, USA. The female animal's preparation was kindly supplied by Dr. Rosemary E. Newnham (London, England). Both preparations were made from fibrous tissue cultures.

REFERENCES:

1) Low, R.J., Benirschke, K., Grimmer, J.L. and Schneider, T.G.: The chromosomes of three bears. Mammalian Chromosomes Newsletter No. 13:3, 1964.

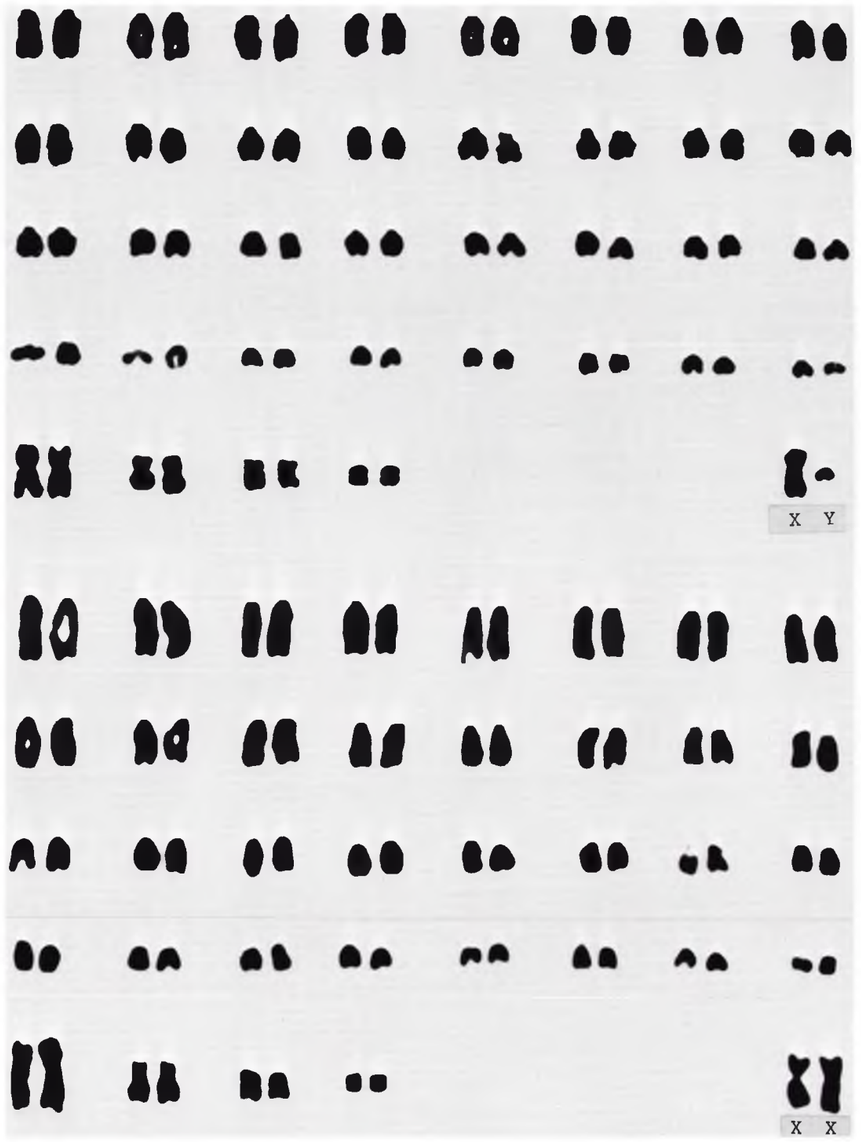
2) Newnham, R.E. and Davidson, W.M.: Comparative study of the karyotypes of several species in carnivora including the giant panda (Ailuropoda melanoleuca). Cytogenetics 5:152, 1966.

3) Benirschke, K.: Sterility and fertility of interspecific mammalian hybrids. In: Comparative Aspects of Reproductive Failure, K. Benirschke ed. Springer-Verlag, New York 1967.

Order: CARNIVORA Family: URSIDAE

Ursus americanus (American black bear)

2n=74



# Order: CARNIVORA

## Family: PROCYONIDAE

***Bassariscus astutus*** (Ringtailed cat)

2n = 38

Order: CARNIVORA Family: PROCYONIDAE

Bassariscus astutus (Ringtailed cat)

2n=38

AUTOSOMES: 36 Submetacentrics and subtelocentrics

SEX CHROMOSOMES: X Submetacentric
Y Small telocentric

One pair of relatively large autosomes shows a knob-like short arm. Secondary constriction is located on the short arm of a pair of small subtelocentric. Identification of X is somewhat equivocal, because one pair of autosomes possesses similar morphology. However, this autosomal pair tends to be more metacentric than the X. Identification of the Y is unequivocal.

The female specimen was collected from Sonora, Texas, USA by Mr. James L. Patton. Muscle cultures were initiated for karyological studies. The male animal was a display specimen of the Houston Zoological Garden, Houston, Texas, USA. Skin cultures were used.

REFERENCES:

Hsu, T.C. and Arrighi, F.E.: Karyotypes of 13 Carnivores. Mammalian Chromosomes Newsletter No. 21:155, 1966.

Order: CARNIVORA Family: PROCYONIDAE

Bassariscus astutus (Ringtailed cat)

2n=38

# Order: CARNIVORA

## Family: PROCYONIDAE

***Procyon lotor*** (North American raccoon)

2n = 38

Volume 1, Folio 25, 1967

Order: CARNIVORA Family: PROCYONIDAE

Procyon lotor (North American raccoon)

2n=38

AUTOSOMES: 30 Metacentrics, submetacentrics or subtelocentrics
6 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Submetacentric or subtelocentric

A pair of small subtelocentrics (pair No. 14) possesses distinctive satellite on the short arm, similar to pair E1 of domestic cat.

Five specimens have been studied, all from Central Vermont and New Hampshire, USA. Lymphocyte, kidney and skin fibroblast cultures show similar results. The karyotypes shown were prepared from kidney cultures. The karyotypes are in agreement with findings reported by Hsu and Arrighi (2 specimens) and Todd (1 specimen) but differ from the 2n=42 previously reported by Walknowska for unknown reasons.

REFERENCES:

1) Walknowska, J.: Les chromosomes chez les carnivores. I. Le raton laveur, Procyon lotor, L. Folia Biol. (Warsaw)9:303, 1961.

2) Benirschke, K., Young, E. and Low, R.J.: Chromosome studies on four carnivores. Mammalian Chromosomes Newsletter No. 21,148, 1966.

3) Hsu, T.C. and Arrighi, F.E.: Karyotypes of 13 carnivores. Mammalian Chromosomes Newsletter No. 21,155, 1966.

4) Todd, N.B.: The karyotypes of the raccoon (Procyon lotor L.), coatimundi (Nasua narica L.) and kinkajou (Potos flavus Schreber). Mammalian Chromosomes Newsletter No. 21,153, 1966.

Order: CARNIVORA Family: PROCYONIDAE

Procyon lotor (North American raccoon)

2n=38

# Order: CARNIVORA

## Family: MUSTELIDAE

***Mephitis mephitis*** (Striped skunk)

2n = 50

Order: CARNIVORA Family: MUSTELIDAE

Mephitis mephitis (Striped skunk)

2n=50

AUTOSOMES: 44 Metacentrics or submetacentrics
4 Acrocentrics

SEX CHROMOSOMES: X Large submetacentric
Y Minute telocentric

One pair of medium-sized submetacentrics bears a deep secondary constriction on the long arm near the centromere.

The male specimen was donated by the Houston Zoological Garden, Houston, Texas, USA. The female specimen was purchased from a family which kept the animal as a pet. The animal was originally captured in the Baton Rouge area, Louisiana, USA. Several additional specimens from Texas and from Mexico showed identical karyotypic characteristics.

REFERENCES:

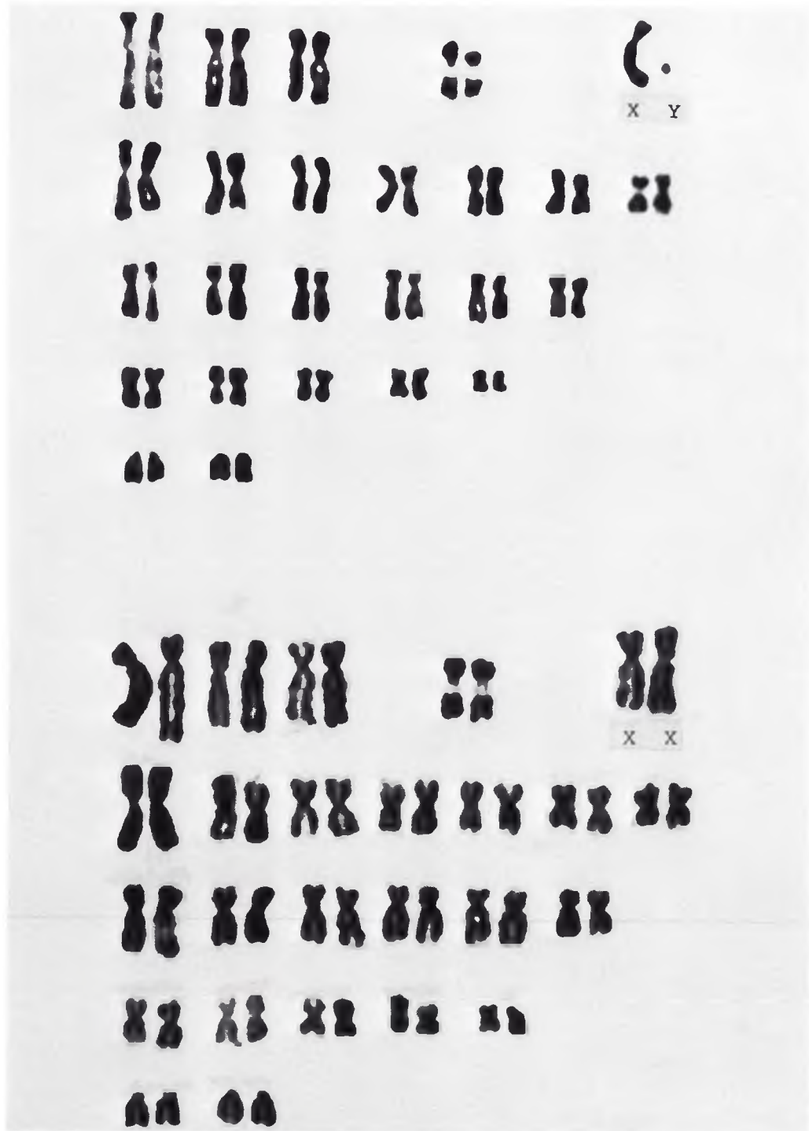
1) Fredga, K.: Chromosome studies in six species of Mustelidae and one of Procyonidae. Mammalian Chromosomes Newsletter No. 21:145, 1966.

2) Hsu, T.C. and Arrighi, F.E.: Karyotypes of 13 Carnivores. Mammalian Chromosomes Newsletter No. 21:155, 1966.

Order: CARNIVORA Family: MUSTELIDAE

Mephitis mephitis (Striped skunk)

2n=50



# Order: CARNIVORA

## Family: MUSTELIDAE

***Mustela putorius furo*** **(Ferret)**

**2n = 40**

Volume 1, Folio 27, 1967

Order: CARNIVORA Family: MUSTELIDAE

Mustela putorius furo (Ferret)

2n=40

AUTOSOMES: 28 Metacentrics, submetacentrics or subtelocentrics
10 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Small metacentric

One of the smallest pairs of acrocentric autosomes bears a secondary constriction on the long arm near the centromere. The short arm is much shorter than the satellite-bearing autosomes of the cat or a number of the Carnivores.

Two males and one female were purchased from an animal breeder for initiation of skin cultures for karyological studies.

REFERENCES:

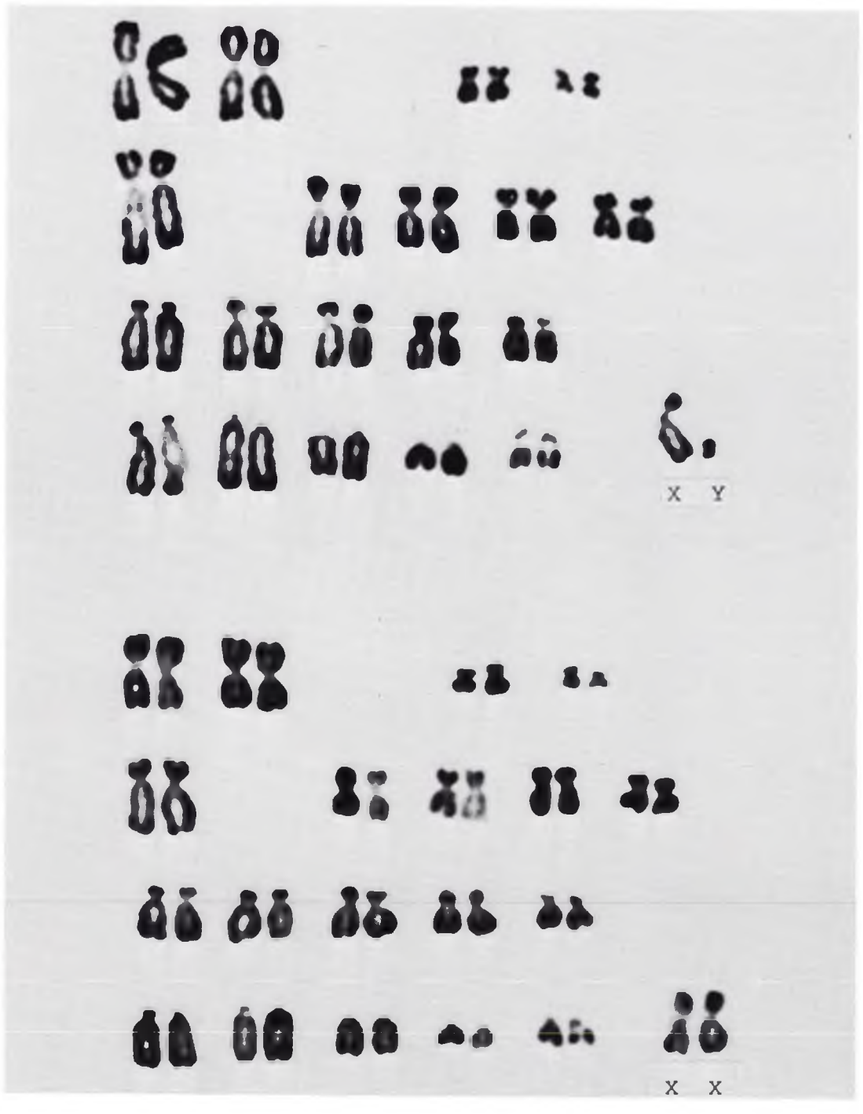
1) Fredga, K.: Chromosome studies in six species of Mustelidae and one of Procyonidae. Mammalian Chromosomes Newsletter No. 21:145, 1966.

2) Hsu, T.C. and Arrighi, F.E.: Karyotypes of 13 Carnivores. Mammalian Chromosomes Newsletter No. 21:155, 1966.

Order: CARNIVORA Family: MUSTELIDAE

Mustela putorius furo (Ferret)

2n=40



# Order: CARNIVORA

## Family: MUSTELIDAE

***Spilogale putorius*** (Spotted skunk)
2n = 64

Volume 1, Folio 28, 1967

Order: CARNIVORA Family: MUSTELIDAE

Spilogale putorius (Spotted skunk)

2n=64

AUTOSOMES: 8 Metacentrics, submetacentrics or subtelocentrics
54 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Minute telocentric

One of the largest autosomal pairs bears a deep secondary constriction in the middle. Identification of the sex elements is not difficult.

The female specimen (S. p. interrupta) was collected in Houston, Texas, USA. Lung cultures were used for karyological studies. The male specimen was donated by Dr. Rodney A. Mead in 1965, then at the University of Montana, Missoula, Montana, USA. The animal was collected from Florida, belonging to subspecies S. p. ambarvalis.

Several additional specimens collected from Eastern USA showed identical karyotype. Western subspecies, e.g., S. p. phenax and S. p. latifrons, exhibit different karyological characteristics. Polymorphism at the subspecies level is therefore evident.

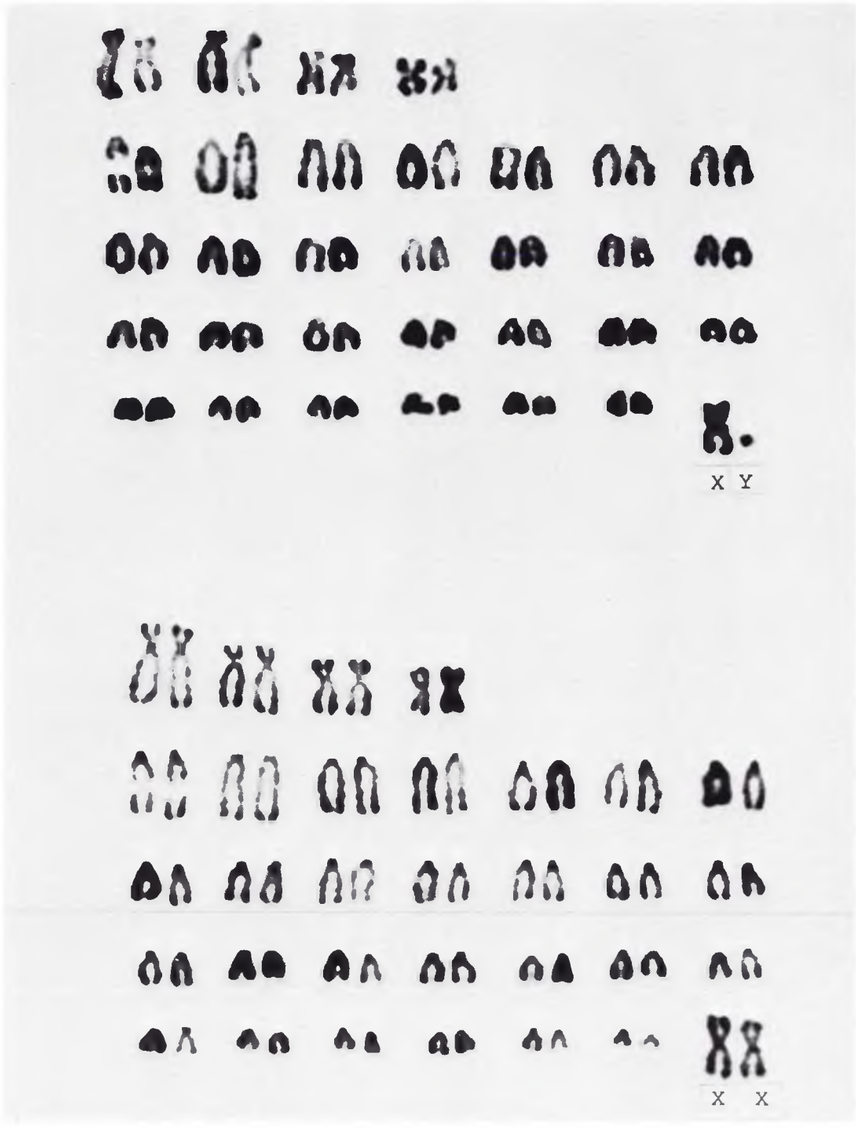
REFERENCES:

Hsu, T.C. and Arrighi, F.E.: Karyotypes of 13 Carnivores. Mammalian Chromosomes Newsletter No. 21:155, 1966.

Order: CARNIVORA Family: MUSTELIDAE

Spilogale putorius (Spotted skunk)

2n=64



# Order: CARNIVORA

## Family: VIVERRIDAE

***Actictis binturong*** (Binturong)
2n = 42

Volume 1, Folio 29, 1967

Order: CARNIVORA Family: VIVERRIDAE

Actictis binturong (Binturong)

2n=42

AUTOSOMES: 22 Submetacentrics or subtelocentrics
18 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Medium-sized submetacentric
Y Small subtelocentric

One pair of small submetacentric autosomes bears a secondary constriction on the short arm. The morphology of this chromosome pair is very similar to that of chromosomes E1 of domestic cat. Identification of the X is unequivocal.

Skin biopsies from one male and one female were used to initiate cultures for karyological studies. These animals were display material of the Houston Zoological Garden, Houston, Texas, USA.

REFERENCES:

Hsu, T. C. and Arrighi, F. E.: Karyotypes of 13 Carnivores. Mammalian Chromosomes Newsletter No. 21:155, 1966.

Order: CARNIVORA Family: VIVERRIDAE

Actictis binturong (Binturong)

2n=42

# Order: CARNIVORA

## Family: VIVERRIDAE

***Suricata suricatta*** **(Mierkat)**

**2n = 36**

Volume 1, Folio 30, 1967

Order: CARNIVORA Family: VIVERRIDAE

Suricata suricatta (Mierkat)

2n=36

AUTOSOMES: 34 Metacentrics, submetacentrics or subtelocentrics

SEX CHROMOSOMES: X Submetacentric
Y Telocentric

Identification of the sex chromosomes is not difficult.

The specimens were display animals of the Houston Zoological Garden. Skin biopsies were used to initiate cell cultures for karyological studies.

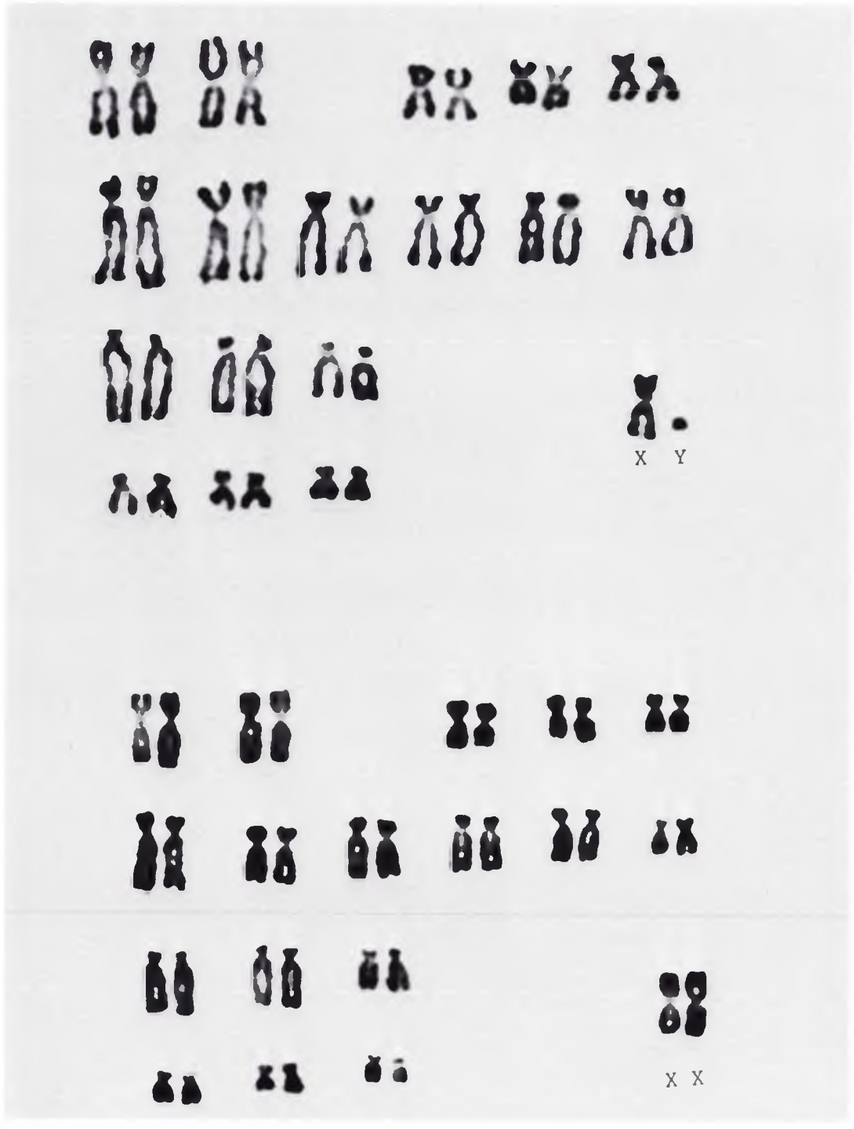
REFERENCES:

Todd, N.B.: The karyotype of the lesser Indian mongoose (Herpestes javanicus Geoffroy), the mierkat (Suricata suricatta Desmarest) and comments on the taxonomy and karyology of the Viverridae. Mammalian Chromosomes Newsletter No. 21:154, 1966.

Order: CARNIVORA Family: VIVERRIDAE

Suricata suricatta (Mierkat)

2n=36



# Order: CARNIVORA

## Family: FELIDAE

***Felis catus*** (Domestic cat)

2n = 38

Volume 1, Folio 31, 1967

Order: CARNIVORA Family: FELIDAE

Felis catus (Domestic cat)

2n=38

AUTOSOMES: 32 Metacentrics, subtelocentrics or subtelocentrics
4 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Subtelocentric

Among the small submetacentrics (3 pairs), the largest pair (E1) bears a deep secondary constriction on the short arm. This pair is present in karyotypes of all members of Felidae thus far analyzed.

The nomenclature system used here follows the San Juan agreement.

Fetal lung cultures (3♀♀,2♂♂) were used for karyological studies.

REFERENCES:


1) Thuline, H.C. and Norby, D.E.: Spontaneous occurrence of chromosome abnormality in cats. Science 134:554, 1961.

2) Ohno, S., Stenius, C., Weiler, C.P., Trujillo, J.M., Kaplan, W.D. and Kinosita, R.: Early meiosis of male germ cells in fetal testis of Felis domestica. Exp. Cell Res. 27:401, 1962.

3) Matano, Y.: A study of the chromosomes in the cat. Jap. J. Genet. 38: 147, 1963.

4) Chu, E.H.Y., Thuline, H.C. and Norby, D.E.: Triploid-diploid chimerism in a male tortoiseshell cat. Cytogenetics 3:1, 1964.

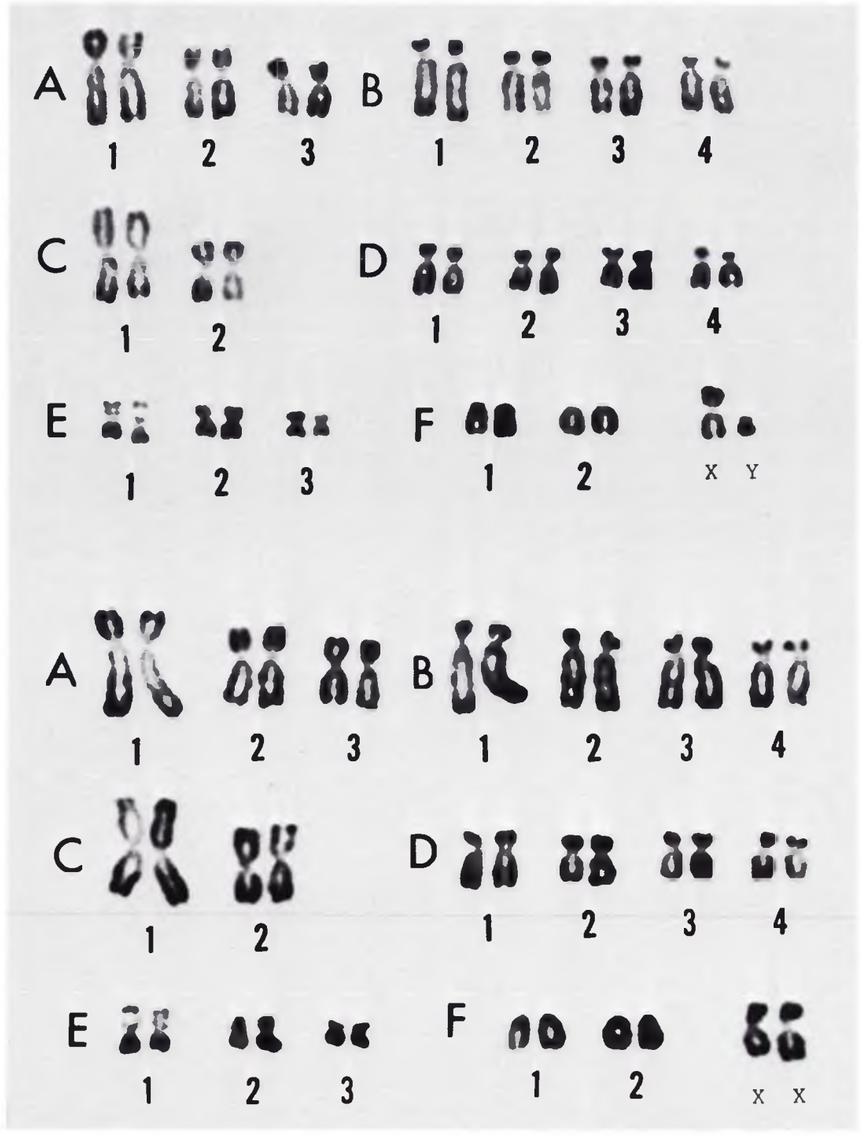
5) Hsu, T.C. and Rearden, H.H.: Further karyological studies on Felidae. Chromosoma 16:365, 1965.



Order: CARNIVORA Family: FELIDAE

Felis catus (Domestic cat)

2n=38

# Order: CARNIVORA

## Family: FELIDAE

***Felis pardalis*** (Ocelot)

2n = 36

Volume 1, Folio 32, 1967

Order: CARNIVORA Family: FELIDAE

Felis pardalis (Ocelot)

2n=36

AUTOSOMES: 34 Metacentrics, submetacentrics or subtelocentrics

SEX CHROMOSOMES: X Submetacentric
Y Minute submetacentric

No telocentric chromosomes (Group F of the cat karyotype), but an extra metacentric pair in Group C.

Skin biopsy specimens obtained from animals from the Houston Zoological Garden to initiate cell cultures for karyological studies.

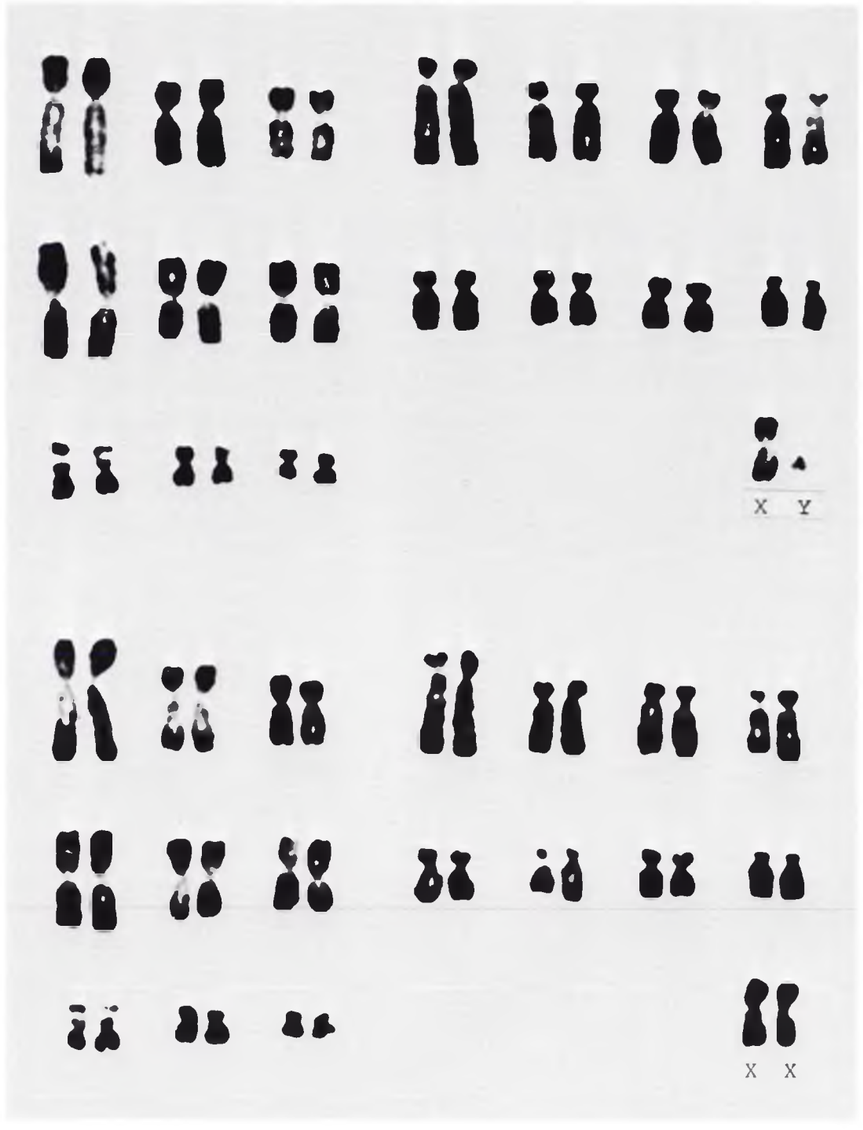
REFERENCES:

Hsu, T.C., Rearden, H.H. and Luquette, G.F.: Karyological studies on nine species of Felidae. Amer. Nat. 97:225, 1963.

Order: CARNIVORA Family: FELIDAE

Felis pardalis (Ocelot)

2n=36



# Order: PERISSODACTYLA

## Family: EQUIDAE

***Equus asinus*** **(Donkey)**

2n = 62

Volume 1, Folio 33, 1967

Equus asinus (Donkey)

2n=62

AUTOSOMES: 38 Metacentrics, submetacentrics or subtelocentrics
22 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric or subtelocentric
Y Acrocentric

Characterization of two small pairs of acrocentrics is arbitrary; they could also be considered subtelocentrics in some preparations. In contrast to other equidae, the X of the donkey has a more terminal centromere. The Y is the smallest acrocentric.

The male karyotype is from a skin culture of E. a. somalicus, the female karyotype comes from a skin culture of a Sicilian donkey.

Numerous donkeys have now been studied with similar findings. The subspecies E. a. somalicus (Somali wild ass - 2 specimens) and E. a. africanus (Nubian wild ass - 1 specimen) were studied at the Catskill Game Farm, Catskill, New York, USA, with similar results.

REFERENCES:

1) Benirschke, K., Brownhill, L.E. and Beath, M.M.: Somatic chromosomes of the horse, the donkey and their hybrids, the mule and the hinny. J. Reprod. Fertil. 4:319, 1962.

2) Trujillo, J.M., Stenius, C., Christian, L. and Ohno, S.: Chromosomes of the horse, the donkey and the mule. Chromosoma 13:243, 1962.

3) Martin, G.G. and Lopez-Saez, J.F.: Dotaciones cromosomicas en los mamiferos domesticos. Genét. Ibér. 14:7, 1962

4) Makino, S., Sofuni, T. and Sasaki, M.S.: A revised study of the chromosomes in the horse, the ass and the mule. Proc. Japan Acad. 39:176, 1963.

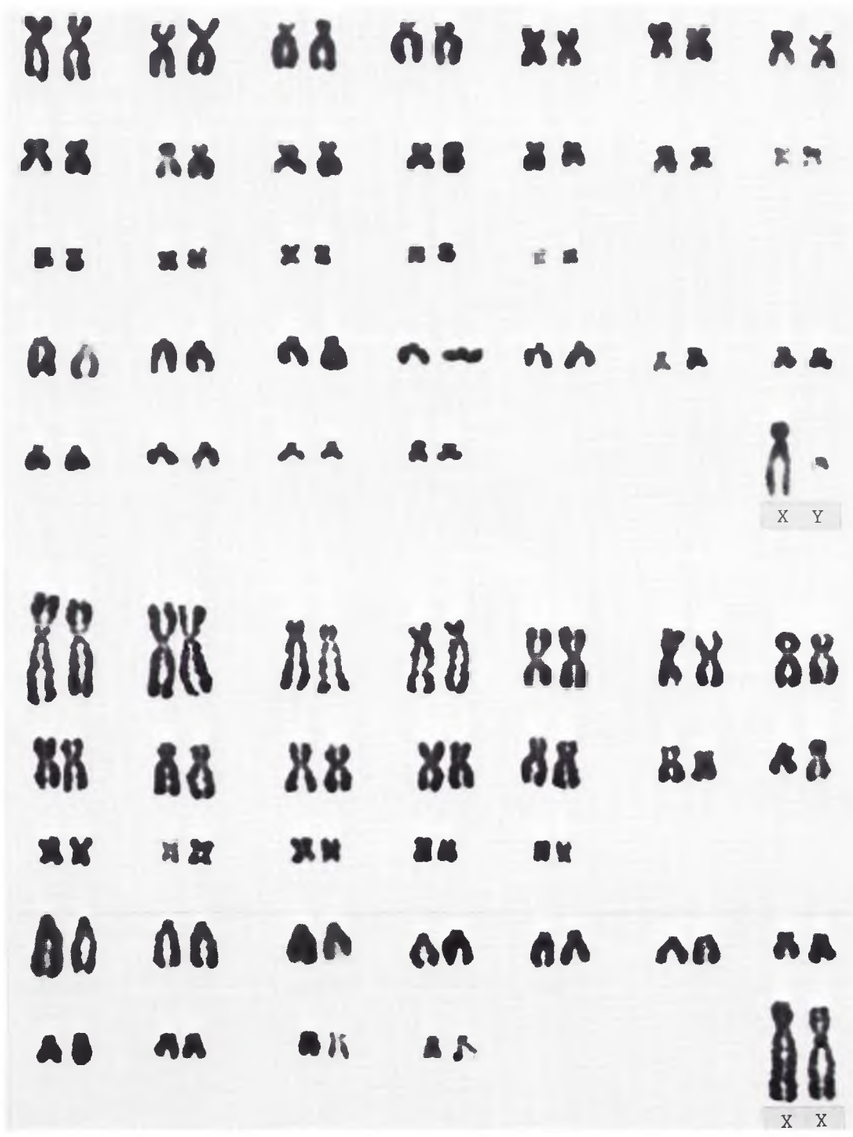
5) Mutton, D.E., King, J.M. and Hamerton, J.L.: Chromosome studies in the genus Equus. Mammalian Chromosomes Newsletter No. 13:7, 1964.

6) Benirschke, K. and Malouf, N.: Chromosome studies of Equidae. Zool. Garten, in press.

Order: PERISSODACTYLA Family: EQUIDAE

Equus asinus (Donkey)

2n=62



# Order: PERISSODACTYLA

## Family: EQUIDAE

***Equus caballus*** (Domestic horse)

2n = 64

Volume 1, Folio 34, 1967

Order: PERISSODACTYLA Family: EQUIDAE

Equus caballus (Domestic horse)

2n=64

AUTOSOMES: 26 Metacentrics, submetacentrics or subtelocentrics
36 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Acrocentric

One acrocentric element has frequently marked secondary constrictions of the long arms near the centromere. Delicate satellites occur on the short arm of the largest chromosome.

Numerous specimens have been studied by many investigators, employing skin, kidney and fibrous tissue as well as lymphocytes. In addition, hybrids with donkeys and zebras have confirmed these results. Various races (Appaloosa, Clydesdale, Shetland and Fjord ponies) have morphologically identical karyotypes.

REFERENCES:

1) Rothfels, K.H., Axelrad, A.A., Siminovitch, L., McCulloch, E.A. and Parker, R.C.: The origin of altered cell lines from mouse, monkey and man, as indicated by chromosome and transplantation studies. Proc. IIIrd Canad. Cancer Conf., p. 189. Academic Press, New York, 1959.

2) Benirschke, K., Brownhill, L.E. and Beath, M.M.: Somatic chromosomes of the horse, the donkey and their hybrids, the mule and the hinny. J. Reprod. Fertil. 4:319, 1962.

3) Trujillo, J.M., Stenius, C., Christian, L. and Ohno, S.: Chromosomes of the horse, the donkey and the mule. Chromosoma 13:243, 1962.

4) Sasaki, M.S. and Makino, S.: Revised study of the chromosomes of domestic cattle and the horse. J. Hered. 53:157, 1962.

5) Sasaki, M.S. and Sasaki, M.: Changes of somatic chromosomes of the horse in serial in vitro transfers. Cytogenetics 1:291, 1962.

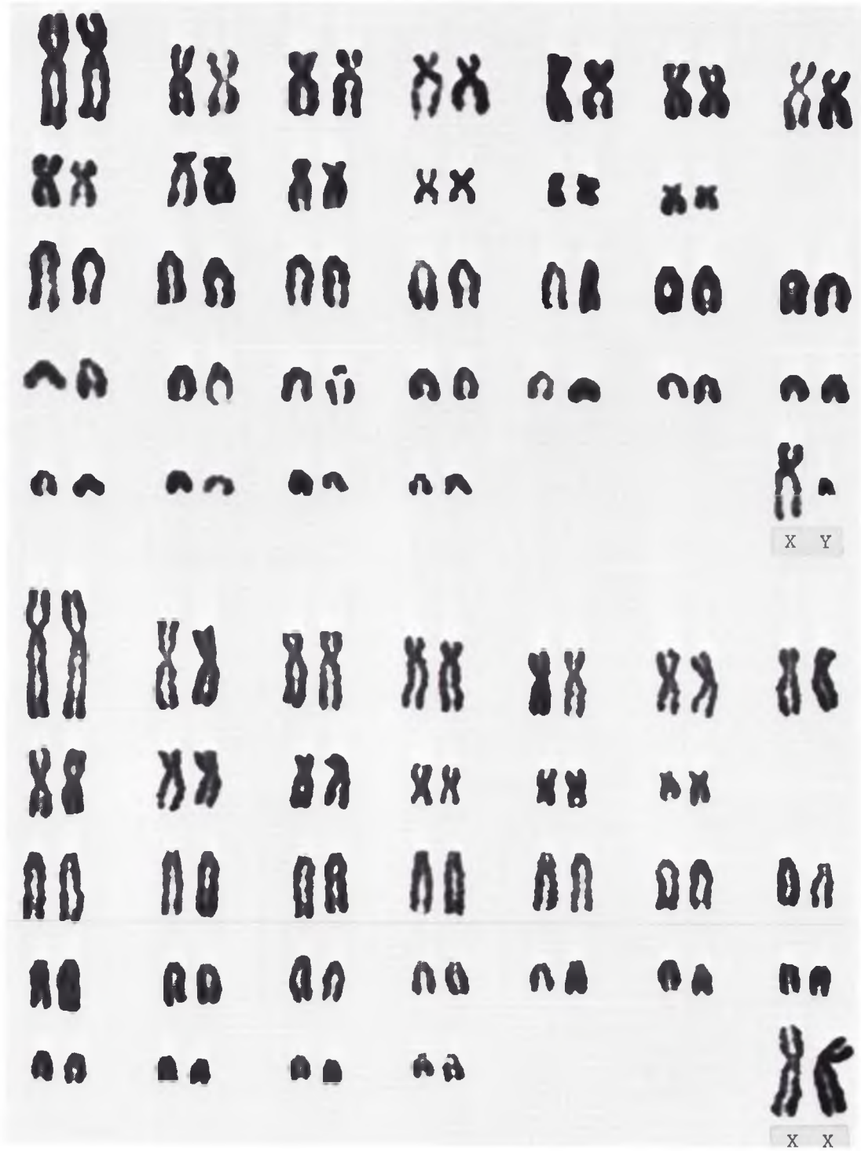
6) Martin, G.G. and Lopez-Saez, J.F.: Dotaciones cromosomicas en los maniferos domesticos. Genet. Iber. 14:7, 1962.

7) Benirschke, K. and Malouf, N.: Chromosome studies of Equidae. Zool. Garten, in press.

Order: PERISSODACTYLA Family: EQUIDAE

Equus caballus (Domestic horse)

2n=64



# Order: PERISSODACTYLA

## Family: EQUIDAE

***Equus hemionus onager*** (Persian wild ass, Onager)

2n = 56

Volume 1, Folio 35, 1967

Order: PERISSODACTYLA

Family: EQUIDAE

Equus hemionus onager (Persian wild ass, Onager)

2n=56

AUTOSOMES: 46 Metacentrics, submetacentrics or subtelocentrics
8 Acrocentrics

SEX CHROMOSOMES: X Submetacentric
Y Minute (subtelocentric ?)

Classification of the fourth row, particularly the fourth pair (here called subtelocentrics) is difficult with the limited material available. Delicate satellites on the short arms of the second pair in the fourth row (autosome No. 20) are seen occasionally.

Two male specimens from the Catskill Game Farm, Catskill, New York, USA, have been studied by lymphocyte and skin fibroblast culture. Two modes (2n=54,56) appeared in the first specimen, the second was clearly 2n=56. The female karyotype is unimodal 2n=56 and was kindly provided by Dr. J. L. Hamerton (London, England) from an animal at the London Zoo.

REFERENCES:

1) Hamerton, J.L.: Unpublished findings (karyotype of female). 1966

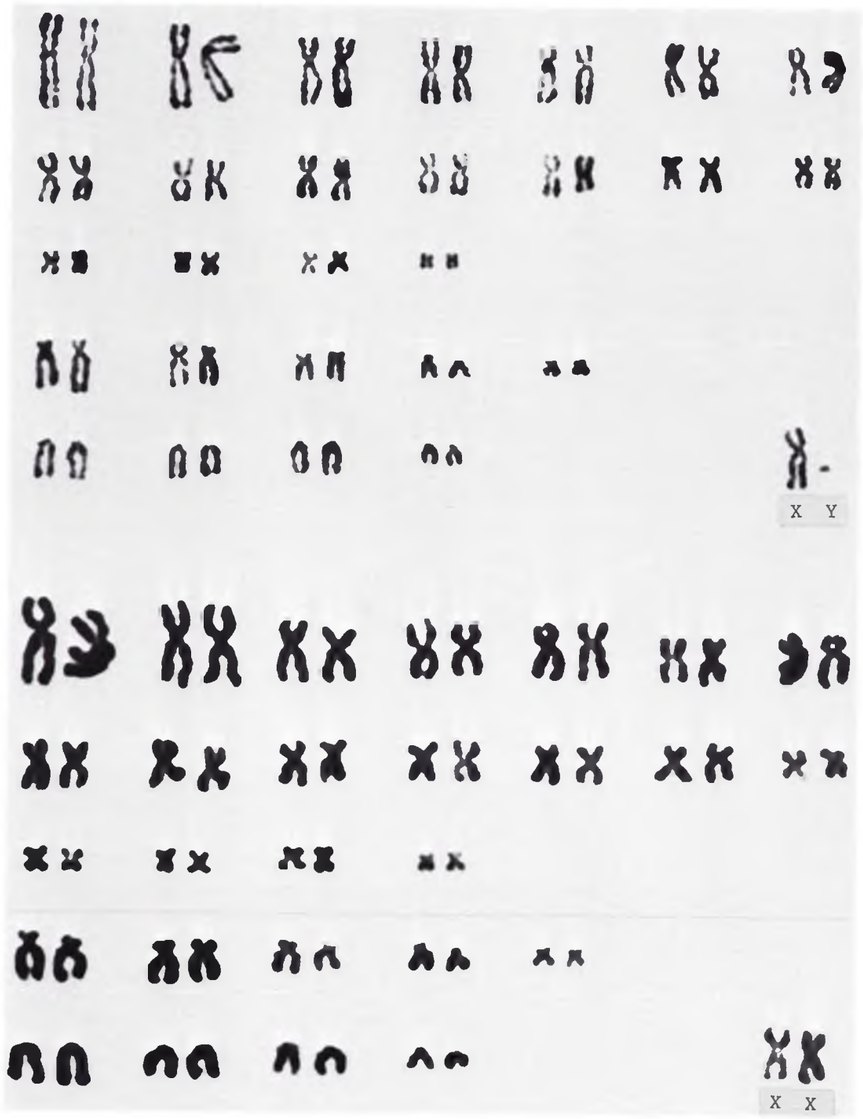
2) Benirschke, K. and Malouf, N.: Chromosome studies of Equidae. Zool. Garten, in press.

Order: PERISSODACTYLA

Family: EQUIDAE

Equus hemionus onager (Persian wild ass, Onager)

2n=56



# Order: PERISSODACTYLA

## Family: EQUIDAE

***Equus przewalskii*** (Mongolian wild horse)

2n = 66

Volume 1, Folio 36, 1967

Order: PERISSODACTYLA Family: EQUIDAE

Equus przewalskii (Mongolian wild horse)

2n=66

AUTOSOMES: 24 Metacentrics, submetacentrics and subtelocentrics
40 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Acrocentric

One of the small acrocentrics shows frequently a pronounced secondary constriction of the long arm near the centromere, similar to that of the domestic horse. Delicate satellites occur on the short arms of the largest chromosome.

Six specimens of the Catskill Game Farm, Catskill, New York, USA, have been studied from skin biopsies and lymphocyte culture. One additional male animal and one hybrid have been examined by Koulisher and Frechkop with similar findings. These animals are registered in the pedigree book (Volf). The karyotypes displayed here are from 1) Romeo, male, pedigree book No. 253 and 2) Belle, female, pedigree book No. 163.

REFERENCES:

1) Benirschke, K., Malouf, N., Low, R.J. and Heck, H.: Chromosome complement: Differences between Equus caballus and Equus prezewalskii, Poliakoff. Science 148:382, 1965.

2) Volf, J.: Pedigree Book of the Prezewalski Horse. Zoological Garden, Prague, 1964, 1965, 1966.

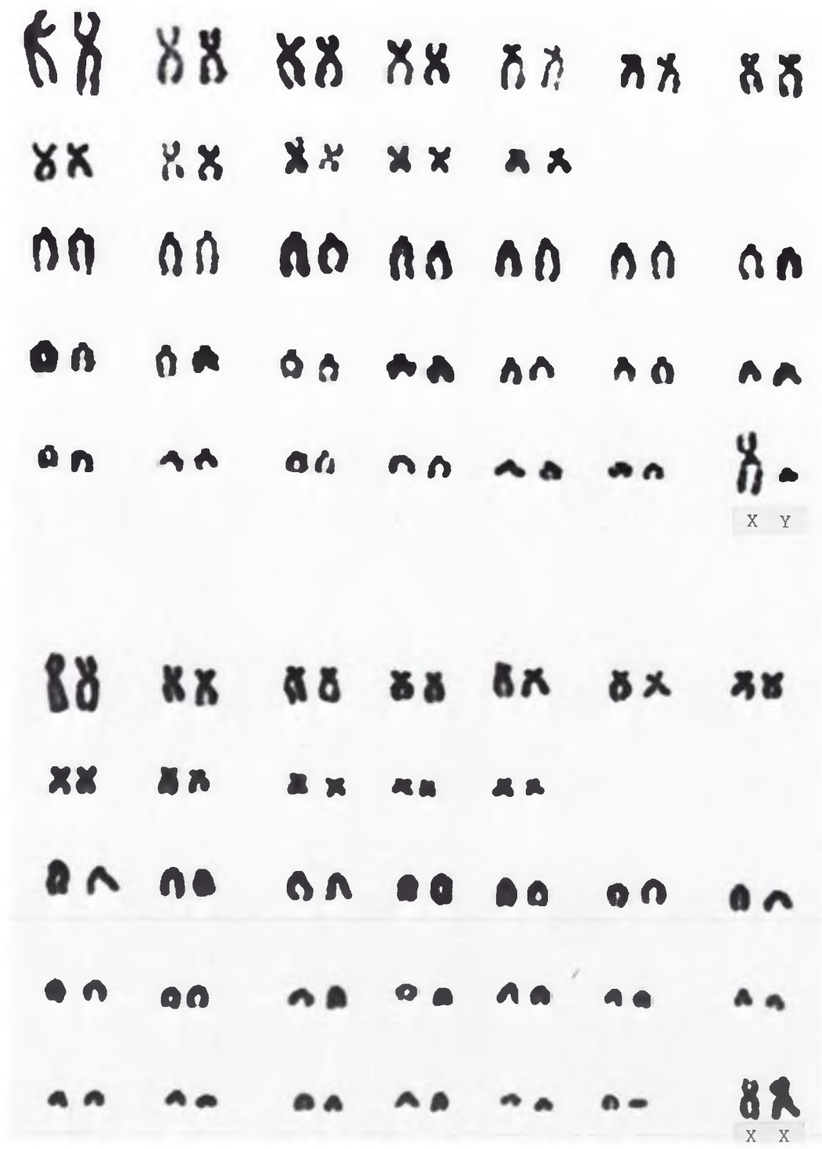
3) Koulisher, L. and Frechkop, S.: Chromosome complement: A fertile hybrid between Equus prjewalskii and Equus caballus. Science 151:93, 1966.

4) Benirschke, K. and Malouf, N.: Chromosome studies of Equidae. Zoolog. Garten, in press.

Order: PERISSODACTYLA Family: EQUIDAE

Equus przewalskii (Mongolian wild horse)

2n=66



# Order: PERISSODACTYLA

## Family: EQUIDAE

***Equus zebra hartmannae*** (Mrs. Hartmann's mountain zebra)

2n = 32

Volume 1, Folio 37, 1967

Order: PERISSODACTYLA Family: EQUIDAE

Equus zebra hartmannae (Mrs. Hartmann's mountain zebra)

2n=32

AUTOSOMES: 26 Metacentrics or submetacentrics
4 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Minute

Delicate satellites are often seen in ideal preparations at the short arm of the submetacentric elements shown here as number 3.

Two male and one female animals from the Catskill Game Farm, Catskill, New York, USA, were studied by skin biopsy with similar findings. The X chromosome is difficult to identify, however, one larger metacentric element is "late replicating" in autoradiographic studies using tritiated thymidine. This is considered to be the X chromosome (Figure); it conforms in quantity to the "original X" of Ohno et al. Quantitative measurements of nuclear DNA (Atkins) of this species compare with those of the donkey (E. asinus) and man.

REFERENCES:

1) Ohno, S., Becak, W. and Becak, M.L.: X-autosome ratio and the behavior pattern of individual X-chromosomes in placental mammals. Chromosoma 15: 14, 1964.

2) Benirschke, K. and Malouf, N.: Chromosome studies of Equidae. Zool. Garten, in press.

Order: PERISSODACTYLA Family: EQUIDAE

Equus zebra hartmannae (Mrs. Hartmann's mountain zebra)

2n=32

# Order: ARTIODACTYLA

## Family: SUIDAE

***Sus scrofa*** **(Domestic pig)**

**2n = 38**

Order: ARTIODACTYLA Family: SUIDAE

Sus scrofa (Domestic pig)

2n=38

AUTOSOMES: 24 Metacentrics, submetacentrics or subtelocentrics
12 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Small metacentric

One pair of small metacentrics bears a deep secondary constriction on the short arm near the centromere.

Karyotypes presented here are gifts of Dr. A. F. McFee, University of Tennessee, Oak Ridge, Tennessee, USA. Lymphocyte cultures.

REFERENCES:


1) Ruddle, F.H.: Chromosome variation in cell populations derived from pig kidney. Cancer Research 21:885, 1961.

2) Makino, S., Sasaki, M.S., Sofuni, T. and Ishikawa, T.: Chromosome condition of an intersex swine. Proc. Jap. Acad. 38:686, 1962.

3) McConnell, J., Fechheimer, N.S. and Gilmore, L.O.: Somatic chromosomes of the domestic pig. J. Animal Sci. 22:374, 1963.

4) Stone, L.E. A chromosome analysis of the domestic pig (Sus scrofa) utilizing a peripheral blood culture technique. Can. J. Genet. & Cytol. 5: 38, 1963.

5) Haag, J. and Santucci, J.: Evolution quasi diploide d'une souche cellulaire de rein de porc. Annales de Génétique 7:71, 1964.

6) Hard, W.L. and Eisen, J.D.: A phenotypic male swine with a female karyotype. J. Heredity 61:255, 1965.

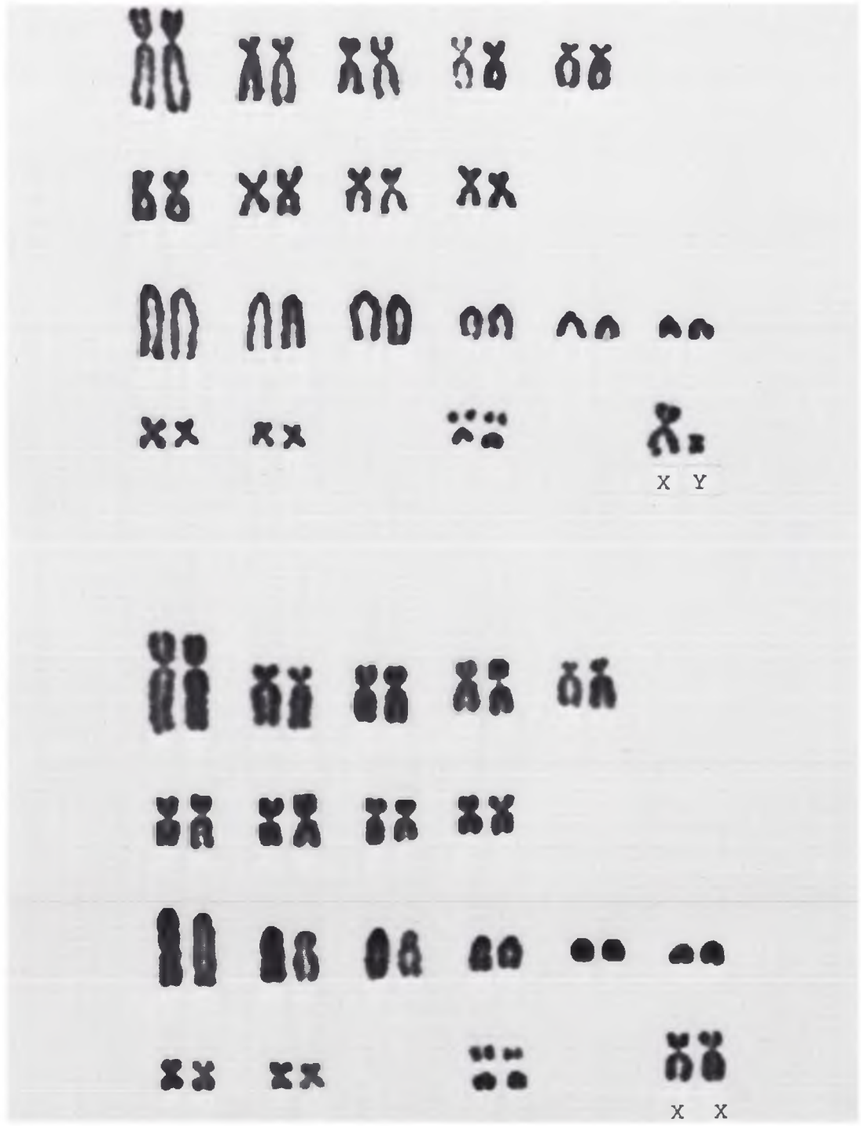
7) McFee, A.F., Banner, M.W. and Rary, J.M.: Variation in chromosome number among European wild pigs. Cytogenetics 5:75, 1966.



Order: ARTIODACTYLA Family: SUIDAE

Sus scrofa (Domestic pig)

2n=38

# Order: ARTIODACTYLA

## Family: SUIDAE

***Sus scrofa*** **(European wild boar)**

**2n = 36**

Order: ARTIODACTYLA Family: SUIDAE

Sus scrofa (European wild boar)

2n=36

AUTOSOMES: 26 Metacentrics, submetacentrics or subtelocentrics
8 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Small metacentric

One pair of small metacentrics bears a secondary constriction on the short arm near the centromere. The X also has a secondary constriction.

The karyotypes presented here are gifts of Dr. A. F. McFee, University of Tennessee, Oak Ridge, Tennessee, USA. Leucocyte cultures. The animals were obtained from eastern Tennessee, USA, either raised in captivity or trapped in the wild. When a comparison is made between the karyotype of the domestic swine and that of the European wild boar reported here, one readily finds that the former has two extra pairs of acrocentrics, and the latter, one extra pair of submetacentrics. Indication of a Robertsonian fusion from the two acrocentrics to the submetacentric is strong. However, since the animals were descendents of the European wild boar imported from Germany to USA early in this century, the fusion may or may not represent the original chromosome constitution of the European wild boar. That is to say, the translocation may have arisen in Tennessee. In a report by Muramoto et al. (1965), the wild boar Sus vittatus leucomystax showed chromosomes identical with those of the domestic swine, and the two species hybridize.

REFERENCES:


1) Muramoto, J., Makino, S., Ishikawa, T., and Kanagawa, H.: On the chromosomes of the wild boar and the boar-pig hybrids. Proc. Jap. Acad. 41:236, 1965.

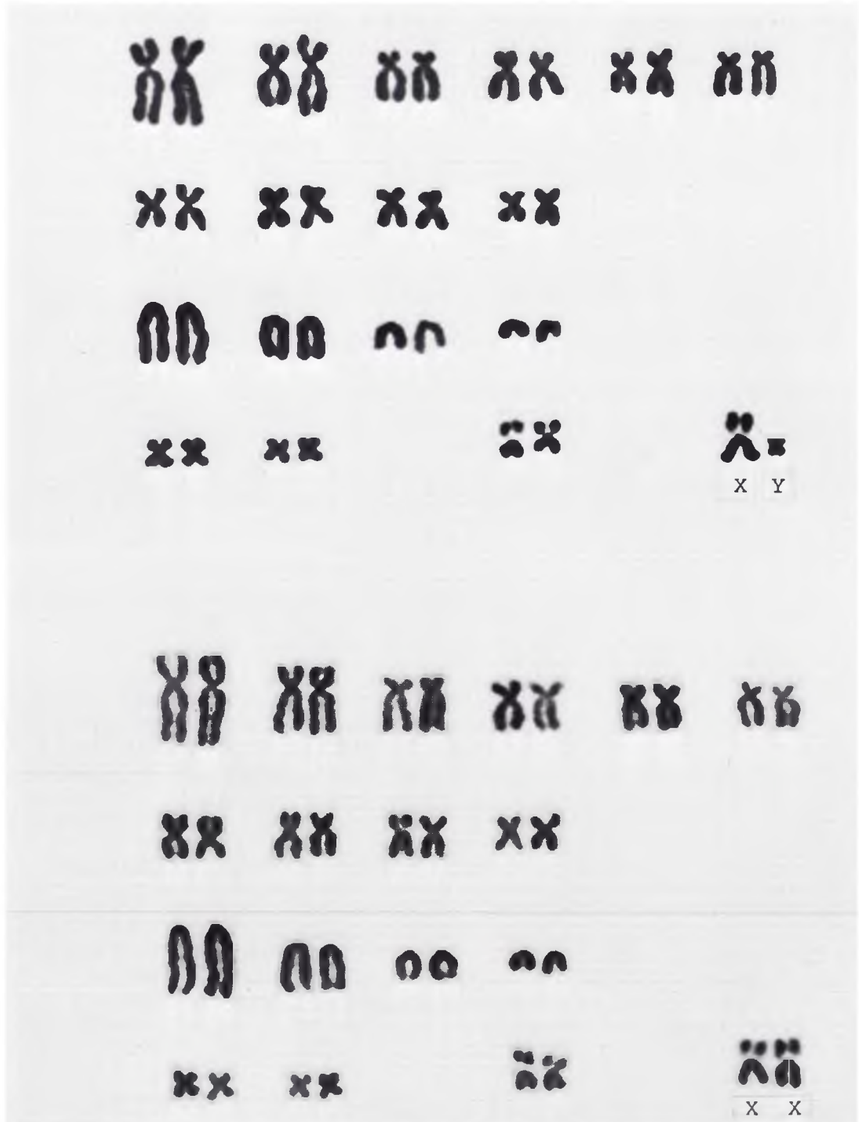
2) McFee, A.F., Banner, M.W., and Rary, J.M.: Variation in chromosome number among European wild pigs. Cytogenetics 5:75, 1966.



Order: ARTIODACTYLA Family: SUIDAE

Sus scrofa (European wild boar)

2n=36

# Order: ARTIODACTYLA

## Family: CAMELIDAE

***Vicugna vicugna*** (Vicuna)
2n = 74

Order: ARTIODACTYLA Family: CAMELIDAE

Vicugna vicugna (Vicuna)

2n=74

AUTOSOMES: 14 Metacentrics or submetacentrics
58 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Submetacentric or subtelocentric

One animal of each sex (Catskill Game Farm, Catskill, New York, USA) was studied by the lymphocyte technique. Many elements are difficult to classify (subtelocentrics or acrocentrics); however, the karyotypes are similar to other camelidae published in that seven pairs of small metacentric chromosomes can readily be distinguished.

REFERENCES:

1) Capanna, E. and Civitelli, M.V.: The chromosomes of three species of neotropical camelidae. Mammalian Chromosomes Newsletter No. 17:75, 1965.

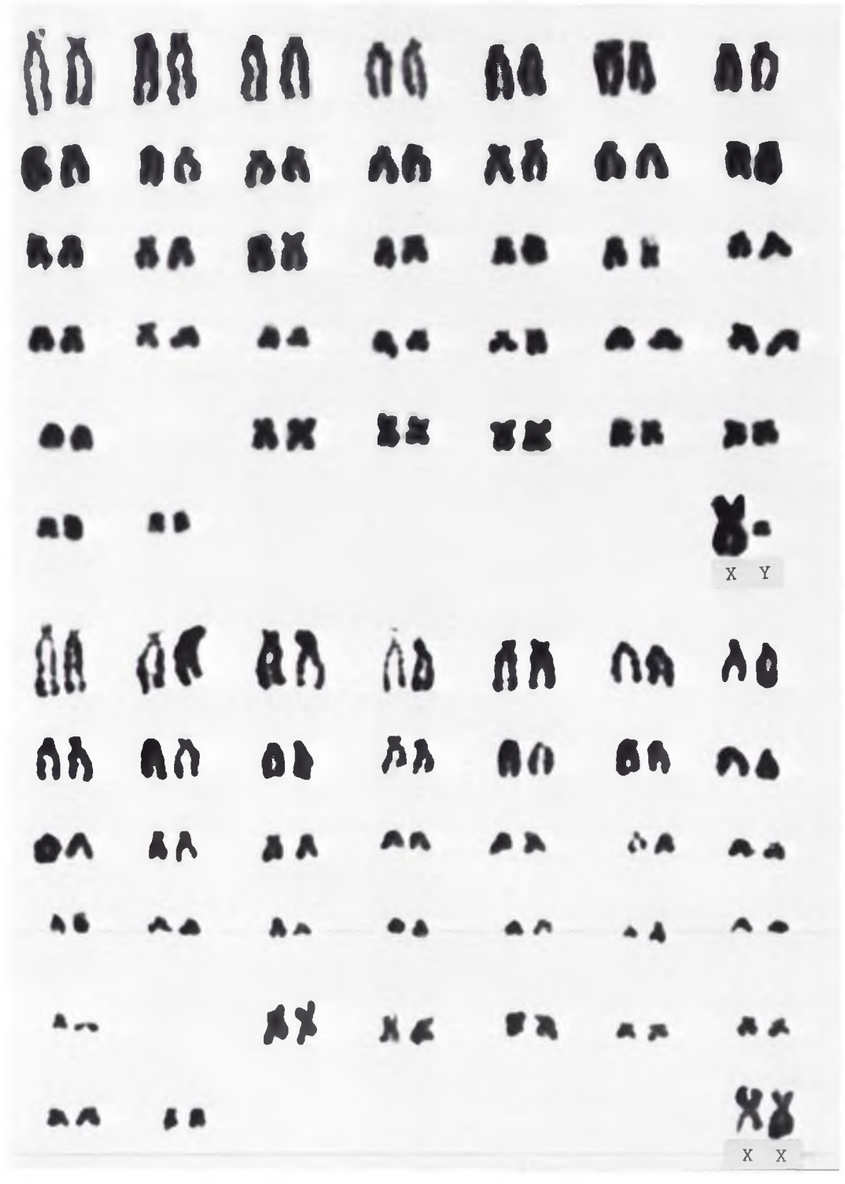
2) Hungerford, D.A. and Snyder, R.L.: Chromosomes of a European wolf (Canis lupus) and of a bactrian camel (Camelus bactrianus). Mammalian Chromosomes Newsletter No. 20:72, 1966.

3) Benirschke, K.: Sterility and fertility of interspecific mammalian hybrids. In Comparative Aspects of Reproductive Failure, K. Benirschke, ed. Springer-Verlag, New York, 1967.

Order: ARTIODACTYLA Family: CAMELIDAE

Vicugna vicugna (Vicuna)

2n=74



# Order: ARTIODACTYLA

## Family: CERVIDAE

***Dama dama*** (Fallow deer)

2n = 68

Volume 1, Folio 41, 1967

Order: ARTIODACTYLA Family: CERVIDAE

Dama dama (Fallow deer)

2n=68

AUTOSOMES: 2 Metacentrics
64 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Acrocentric
Y Submetacentric

The X chromosome has been identified as the largest acrocentric element by its "late replication" in radioautography using tritiated thymidine.

In addition to the specimens described by Gustavsson and Sundt we have studied one male and one female fallow deer by skin fibroblast culture from the Catskill Game Farm, Catskill, N.Y. The results are identical.

REFERENCES:

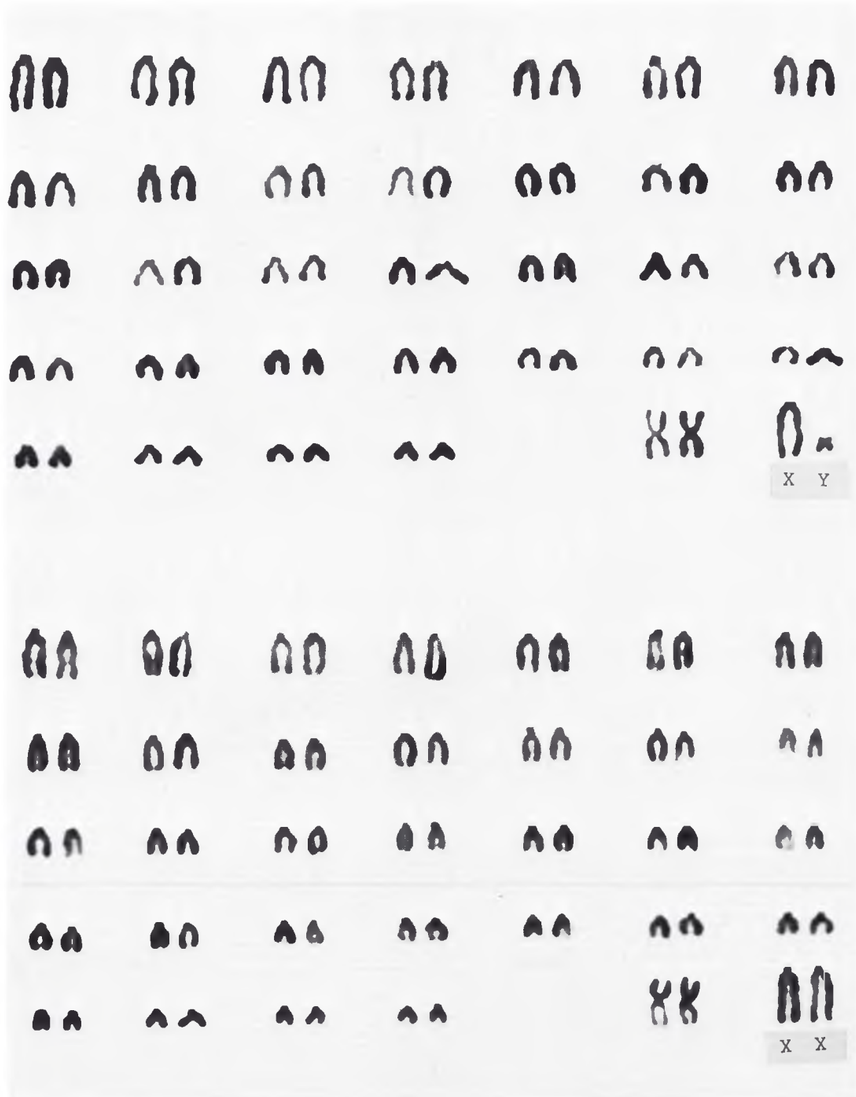
1) Gustavsson, I. and Sundt, C.O.: Chromosome studies in five species of deer representing the four Genera Alces, Capreolus, Cervus and Dama. Mammalian Chromosomes Newsletter No. 18:149, 1965. Cytogenetics, in press.

2) Wurster, D. H. and Benirschke, K.: Chromosome studies in some deer, the springbok, and the pronghorn, with notes on placentation in deer. Cytologia, in press.

Order: ARTIODACTYLA Family: CERVIDAE

Dama dama (Fallow deer)

2n=68



# Order: ARTIODACTYLA

## Family: CERVIDAE

***Odocoileus hemionus*** (Mule deer)

2n = 70

Order: ARTIODACTYLA Family: CERVIDAE

Odocoileus hemionus (Mule deer)

2n=70

AUTOSOMES: 2 Submetacentrics
66 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Metacentric

The largest pair of autosomes possesses very delicate satellites at the ends of the long arms, not visible in the reproductions.

One female and four male animals were studied by fibroblast culture from subcutaneous tissues. No structural differences from the white-tailed deer are discernible.

The specimens were shot in North Dakota, USA and made available through the kindness of Dr. W. L. Hard.

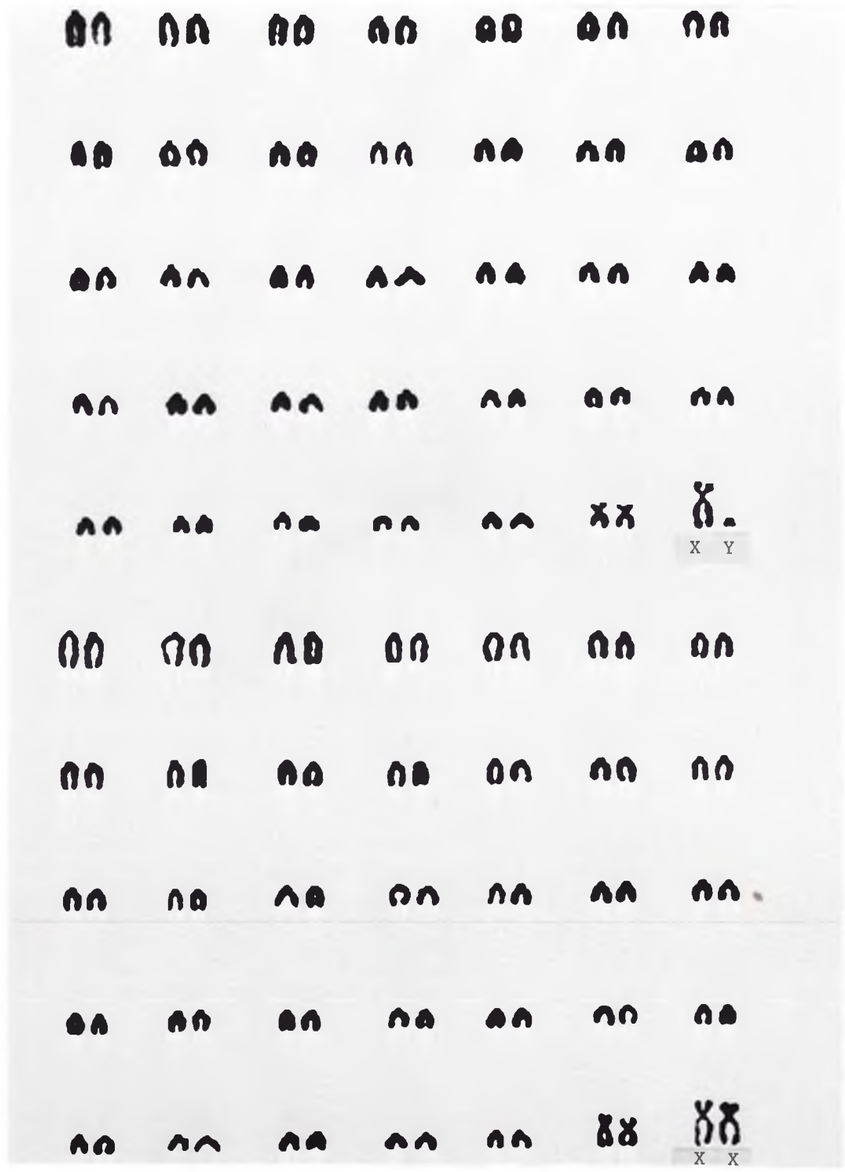
REFERENCES:

Wurster, D.H. and Benirschke, K.: Chromosome studies in some deer, the springbok, and the pronghorn, with notes on placentation in deer. Cytologia, in press.

Order: ARTIODACTYLA Family: CERVIDAE

Odocoileus hemionus (Mule deer)

2n=70



# Order: ARTIODACTYLA

## Family: CERVIDAE

***Odocoileus virginianus*** (Whitetailed deer)

2n = 70

Order: ARTIODACTYLA Family: CERVIDAE

Odocoileus virginianus (Whitetailed deer)

2n=70

AUTOSOMES: 2 Submetacentrics
66 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Metacentric

The largest pair of autosomes possesses very delicate satellites at the ends of the long arms, not visible in the reproductions.

Four female and two male animals were studied, both by lymphocyte and fibroblast culture. Two antlered does have identical karyotypes. Blood chimerism was absent in twins.

The specimens studied were shot in Central Vermont, USA. The karyotypes displayed were prepared from fibroblast cultures.

REFERENCES:

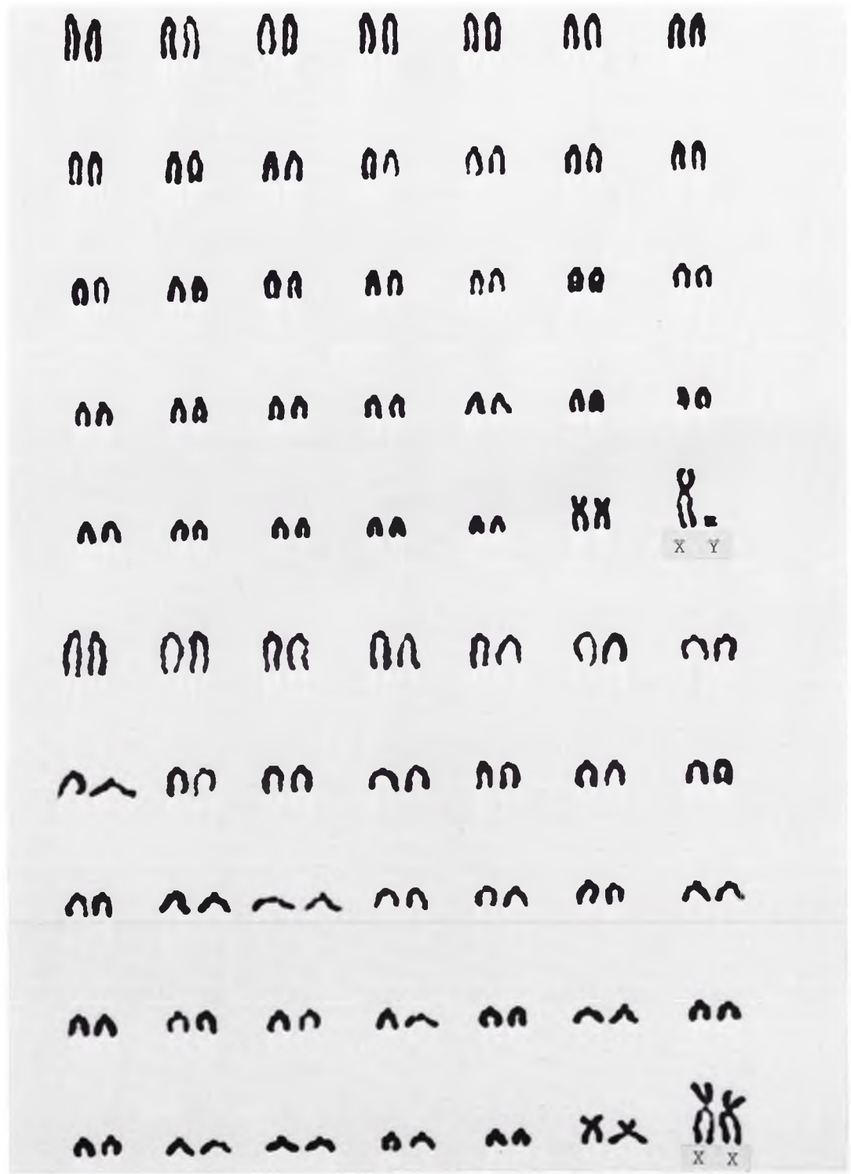
1) Benirschke, K., Brownhill, L., Low, R. and Hoefnagel, D.: The chromosomes of the white-tailed deer, Odocoileus virginianus borealis, Miller. Mammalian Chromosomes Newsletter No. 10:82, 1963.

2) Wurster, D.H. and Benirschke, K.: Chromosome studies in some deer, the springbok, and the pronghorn, with notes on placentation in deer. Cytologia, in press.

Order: ARTIODACTYLA Family: CERVIDAE

Odocoileus virginianus (Whitetailed deer)

2n=70



# Order: ARTIODACTYLA

## Family: BOVIDAE

***Bos taurus*** (Cattle)

2n = 60

Volume 1, Folio 44, 1967

Order: ARTIODACTYLA

Family: BOVIDAE

Bos taurus (Cattle)

2n=60

AUTOSOMES: 58 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Large submetacentric
Y Small submetacentric

The karyotypes shown here were taken from slides made from lymphocyte cultures, courtesy of Dr. Nat M. Kieffer, Texas A & M University, College Station, Texas, USA.

REFERENCES:


1) Melander, Y.: The mitotic chromosomes of some cavicorn mammals (Bos taurus L., Bison bonasus L. and Ovis aries L.). Hereditas 45:644, 1959.

2) Nichols, W.W., Levan, A. and Lawrence, W.C.: Bovine chromosomes by the peripheral blood method. Hereditas 48:536, 1962.

3) Sasaki, M.S. and Makino, S.: Revised study of the chromosomes of domestic cattle and the horse. J. Heredity 53:157, 1962.

4) Crossley, R. and Clarke, G.: The application of tissue-culture techniques to the chromosomal analysis of Bos taurus. Genet. Res. 3:167, 1962.

5) Gartler, S.M. and Burt, B.: Replication patterns of bovine sex chromosomes in cell culture. Cytogenetics 3:135, 1964.

6) Yosida, T.H. and Lamontain, E.J.: Chromosomes of normal and dwarf cattle. Jap. J. Genet. 38:351, 1964.

7) Basrur, P.K. and Gilman, J.P.W.: Blood culture method for the study of bovine chromosomes. Nature 204:1335, 1964.

8) Herschler, M.S. and Fechheimer, N.S.: Centric fusion of chromosomes in a set of bovine triplets. Cytogenetics 5:307, 1966.

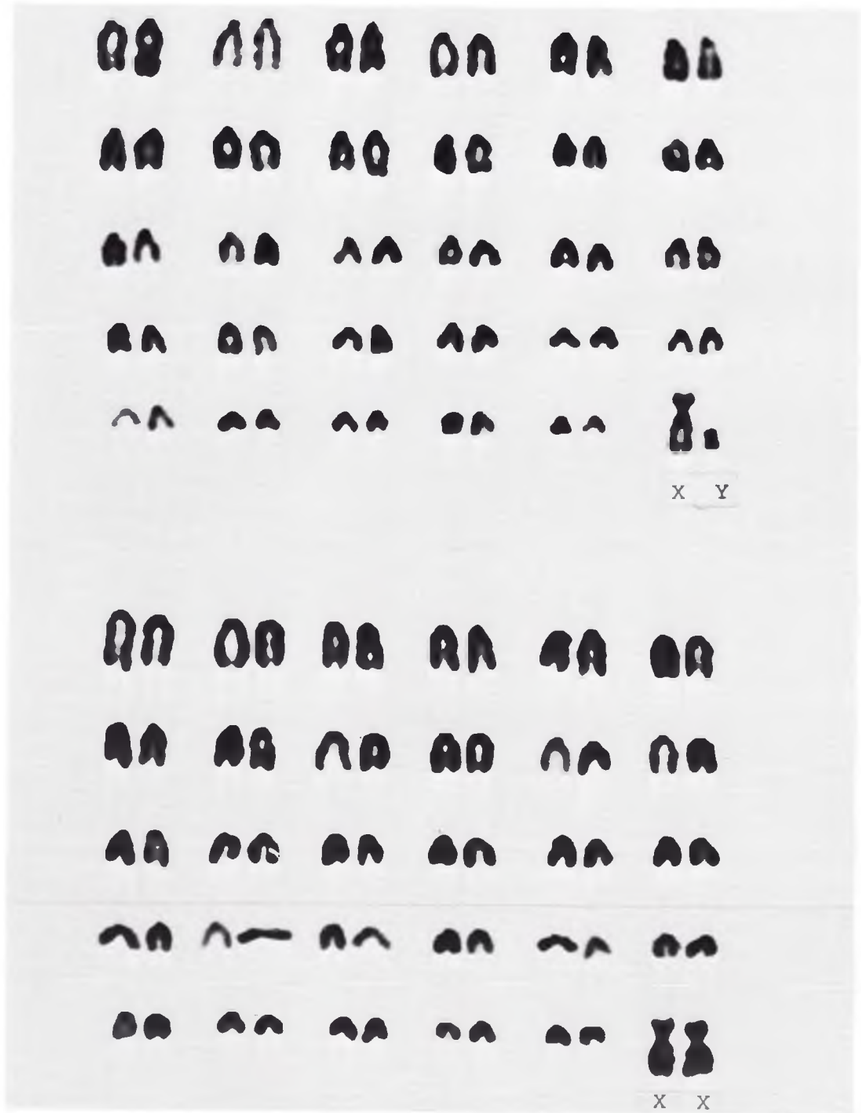


Order: ARTIODACTYLA

Family: BOVIDAE

Bos taurus (Cattle)

2n=60

# Order: ARTIODACTYLA

## Family: BOVIDAE

***Ovis aries*** (Domestic sheep)

2n = 54

Order: ARTIODACTYLA Family: BOVIDAE

Ovis aries (Domestic sheep)

2n=54

AUTOSOMES: 6 Large metacentrics
46 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Acrocentric
Y Very small metacentric

The X is slightly larger than the largest acrocentric autosome. It is not difficult to identify. The Y is very easy to identify.

The karyotypes presented here are gifts of Dr. A. F. McFee, University of Tennessee, Oak Ridge, Tennessee, USA. Leucocyte cultures.

REFERENCES:


1) Nakanishi, Y.H. and Mizutani, M.: Observations on the somatic chromosomes of lamb cells in culture. Texas Rep. Biol. & Med. 17:134, 1959.

2) Melander, Y.: The mitotic chromosomes of some cavicorn mammals (Bos taurus L., Bison bonasus L. and Ovis aries L.). Hereditas (Lund) 45: 649-664, 1959.

3) Borland, R.: The chromosomes of domestic sheep. J. Hered. 60:61, 1964.

4) McFee, A.F., Banner, M.W. and Murphree, R.L.: Chromosome analysis of peripheral leucocytes of the sheep. J. Anim. Sci. 24:551, 1965.

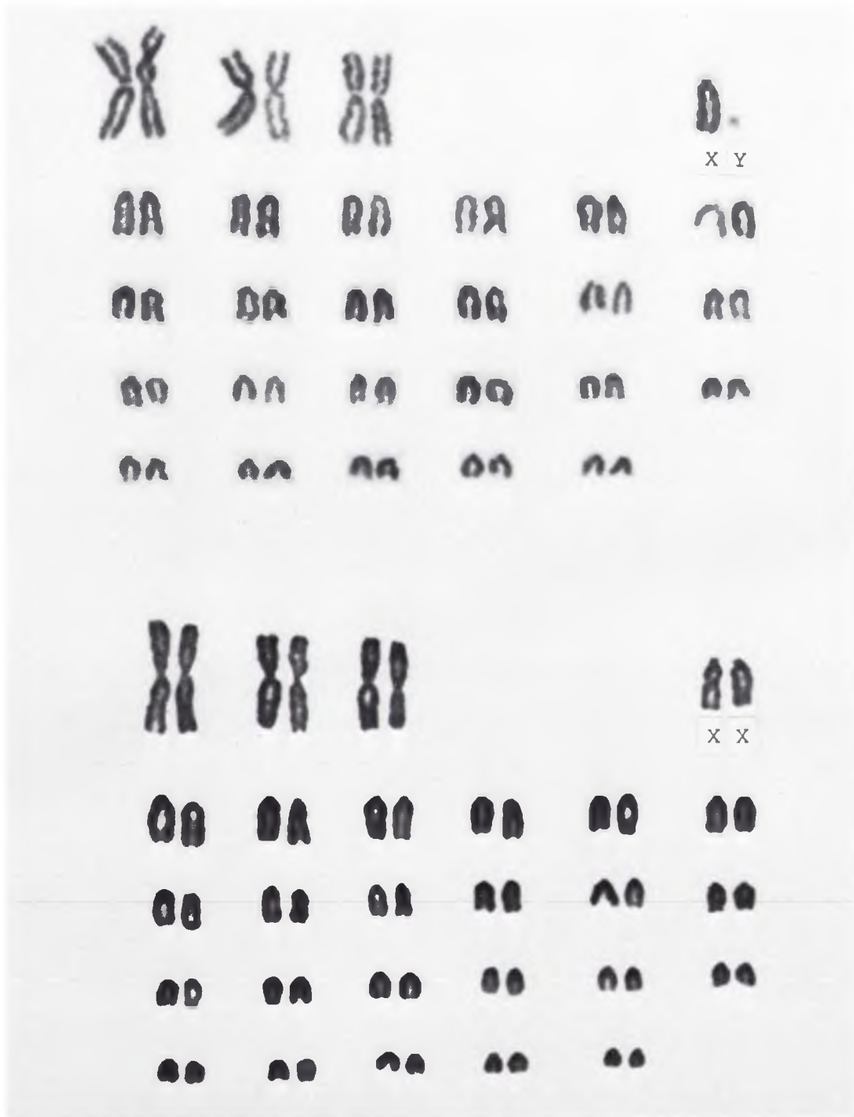
5) Buttle, H.L. and Hancock, J.L.: The chromosomes of goats, sheep and their hybrids. Research in Veterinary Sci. 7:230, 1966.



Order: ARTIODACTYLA Family: BOVIDAE

Ovis aries (Domestic sheep)

2n=54

# Order: PRIMATES

## Family: CALLITHRICIDAE

***Callithrix jacchus*** (Common marmoset)

2n = 46

Order: PRIMATES Family: CALLITHRICIDAE

Callithrix jacchus (Common marmoset)

2n=46

AUTOSOMES: 30 Metacentrics, submetacentrics or subtelocentrics
14 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Subtelocentric and metacentric

Like other marmosets, this species bears fraternal twins and most animals are blood chimerae. There appears to be polymorphism of the structure of Y. In some of our specimens it is the smallest metacentric element as shown here, in other specimens this is a minute chromosome having an apparent subtelocentric configuration (Wohnus and Benirschke). The latter authors have given quantitative data on this species' complement.

Eight animals have been studied (2 had the Y shown), which were imported from different regions of Brazil and conformed to the description by Hill. The karyotypes shown were prepared from kidney cultures.

REFERENCES:


1) Hill, W.C.O.: Primates. Vol. 3. Interscience Publishers, Inc., New York, 1957.

2) Benirschke, K., Anderson, J.M. and Brownhill, L.E.: Marrow chimerism in marmosets. Science 138:513, 1962.

3) Benirschke, K. and Brownhill, L.E.: Further observations on marrow chimerism in marmosets. Cytogenetics 1:245, 1962.

4) Benirschke, K. and Brownhill, L.E.: Heterosexual cells in testes of chimeric marmoset monkeys. Cytogenetics 2:331, 1963.

5) Chiarelli, B. 1961, quoted by Bender, M.A. and Chu, E.H.Y.: The chromosomes of primates. Chapter 7 in Evolutionary and Genetic Biology of Primates. J. Buettner-Janusch, ed. Vol. I. Academic Press, New York 1963.

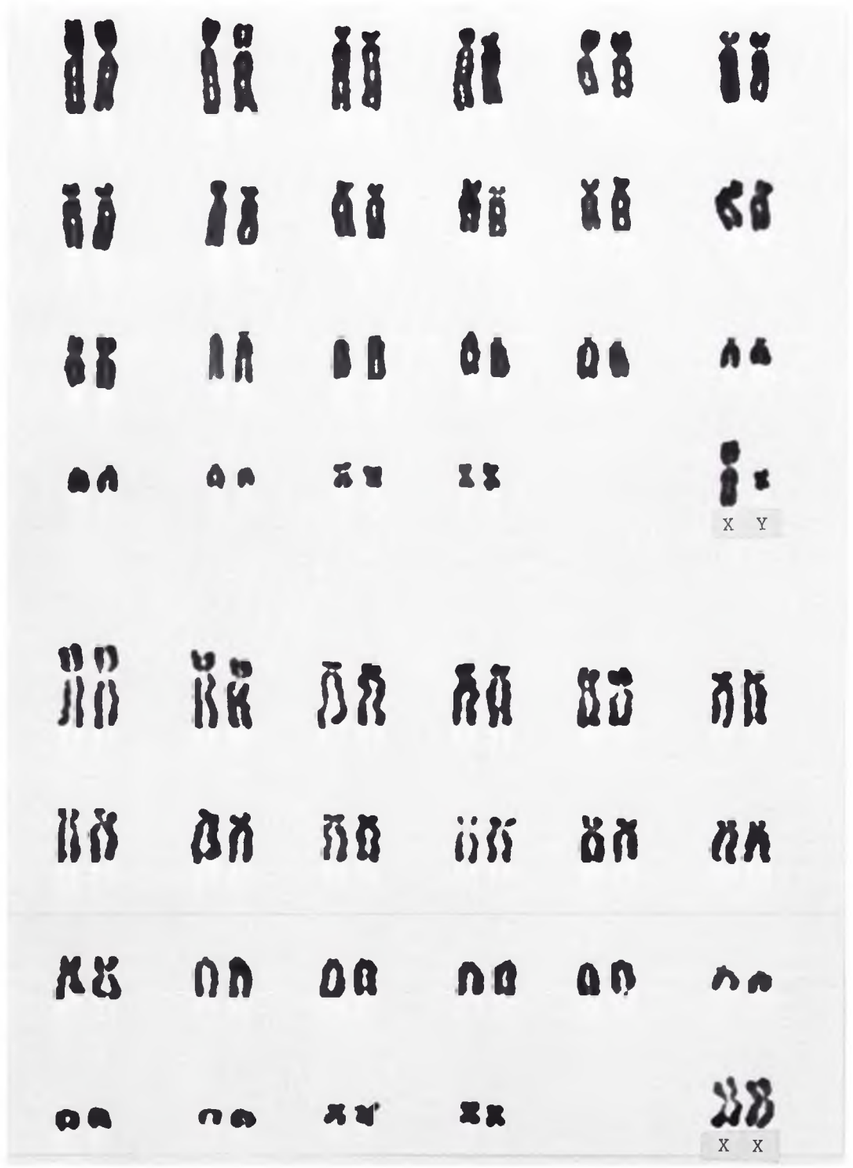
6) Wohnus, J.F. and Benirschke, K.: Chromosome analysis of four species of marmosets (Callithrix jacchus, Tamarinus mystax, Tamarinus nigricollis, Cebuella pygmaea). Cytogenetics 5:94, 1966.



Order: PRIMATES Family: CALLITHRICIDAE

Callithrix jacchus (Common marmoset)

2n=46

# Order: PRIMATES

## Family: CALLITHRICIDAE

***Cebuella pygmaea*** (Pygmy marmoset)
2n = 44

Order: PRIMATES Family: CALLITHRICIDAE

Cebuella pygmaea (Pygmy marmoset)

2n=44

AUTOSOMES: 32 Metacentrics, submetacentrics or subtelocentrics
10 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Subtelocentric

This species differs from all other members of this family by having 44 elements as compared to 46 for the others. Two acrocentrics have presumably fused to make a new submetacentric element, here placed as number 5. Quantitative comparisons of some of these species can be found by Wohnus and Benirschke. Like other marmosets, the pygmy marmoset bears fraternal twins and the animals are blood chimerae. Therefore, the female karyotype here is from a bone marrow cell of the male animal whose karyotype from a kidney cell is shown first.

Five male animals have been studied with identical findings. They were imported from Brazil.

REFERENCES:

1) Benirschke, K. and Brownhill, L.E.: Further observations on marrow chimerism in marmosets. Cytogenetics 1:245, 1962.

2) Benirschke, K. and Brownhill, L.E.: Heterosexual cells in testes of chimeric marmoset monkeys. Cytogenetics 2:331, 1963.

3) Wohnus, J.F. and Benirschke, K.: Chromosome analysis of four species of marmosets (Callithrix jacchus, Tamarinus mystax, Tamarinus nigricollis, Cebuella pygmaea). Cytogenetics 5:94, 1966.

Order: PRIMATES Family: CALLITHRICIDAE

Cebuella pygmaea (Pygmy marmoset)

2n=44

# Order: PRIMATES

## Family: CERCOPITHECIDAE

***Cercopithecus aethiops sabaceus***

(Vervet monkey, African green monkey)

2n = 60

Volume 1, Folio 48, 1967

Order: PRIMATES Family: CERCOPITHECIDAE

Cercopithecus aethiops sabaceus (Vervet monkey, African green monkey)

2n=60

AUTOSOMES: 58 Metacentrics, submetacentrics and subtelocentrics

SEX CHROMOSOMES: X Large submetacentric
Y Small submetacentric

One pair of subtelocentric autosomes bears a deep secondary constriction on the long arm near the centromere. Satellites may also be detected on the short arm of the smallest acrocentric chromosomes.

Karyotypes were made from primary kidney cultures donated by Dr. Fred Rapp, Baylor University Medical School, Houston, Texas, USA.

REFERENCES:

1) Bender, M.A. and Chu, E.H.Y.: The Chromosomes of Primates. In: Evolutionary and Genetic Biology of Primates. Vol. 1, p. 261, Acad. Press, N.Y., 1963.

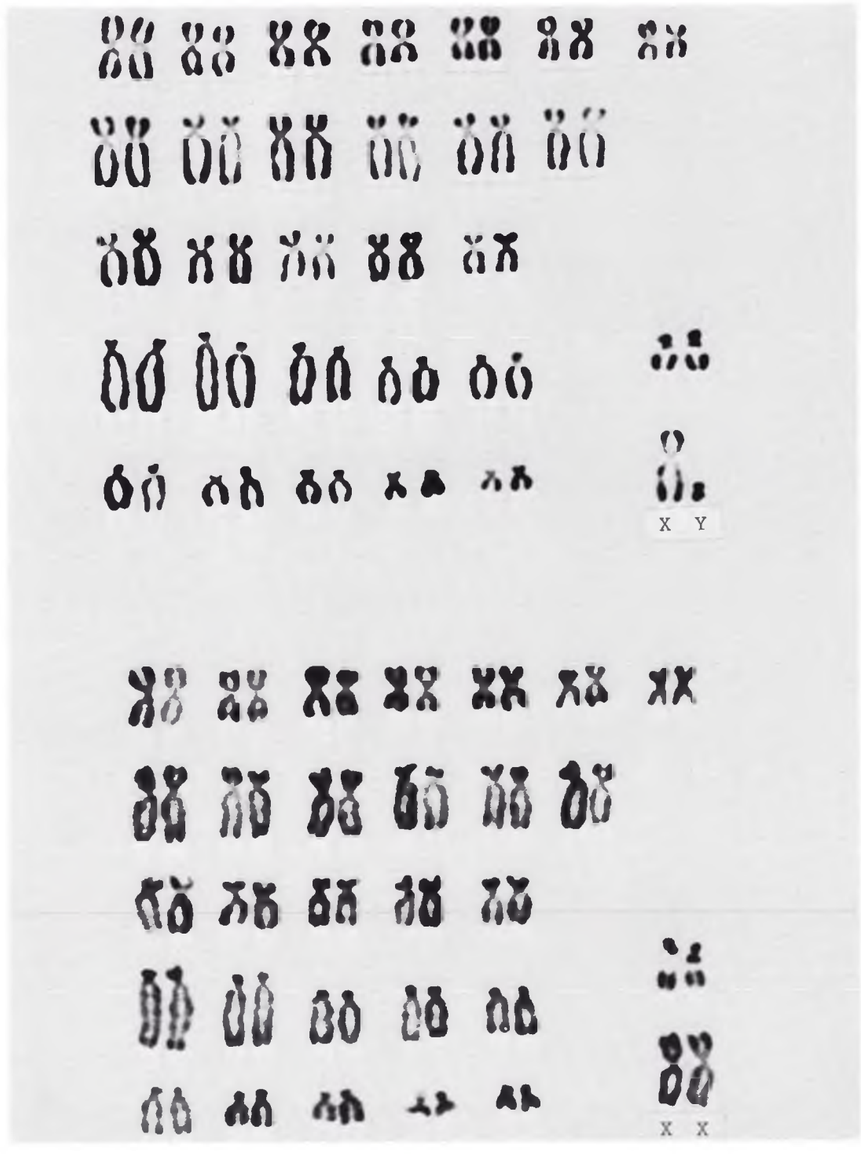
2) Chu, E.H.Y. and Bender, M.A.: Chromosomal cytology and evolution in Primates. Science 133:1399, 1961.

3) Ruzicska, P. and Hsu, T.C.: The karyotype of the African green monkey (Cercopithecus aethiops sabaceus). Texas Rep. Biol. & Med., in press.

Order: PRIMATES Family: CERCOPITHECIDAE

Cercopithecus aethiops sabaceus (Vervet monkey, African green monkey)

2n=60



# Order: PRIMATES

## Family: PONGIDAE

***Pan troglodytes*** (Chimpanzee)
2n = 48

Order: PRIMATES Family: PONGIDAE

Pan troglodytes (Chimpanzee)

2n=48

AUTOSOMES: 34 Metacentrics, submetacentrics or subtelocentrics
12 Acrocentrics or telocentrics

SEX CHROMOSOMES: X Submetacentric
Y Acrocentric

At least 25 animals have now been studied with similar findings. Chiarelli, and Hamerton et al. report minor structural differences for the subspecies P. t. paniscus (pygmy chimpanzee). Satellites occur on the short arms of the acrocentrics. The Y may occasionally be metacentric (Chu and Bender). Quantitative comparisons of the karyotypes of apes have been published by Hamerton et al. The male metaphase is of P. t. troglodytes and was kindly supplied by Dr. H. P. Klinger (New York) and was previously shown as Figs. 3d and 4g by Hamerton et al. The female is from a skin biopsy of P. t. kindly supplied by Dr. H. F. Smetana (New Orleans, Louisiana).

REFERENCES:

1) Young, W.Z., Merz, T., Ferguson-Smith, M.A. and Johnston, A.W.: Chromosome number of the chimpanzee, Pan troglodytes. Science 131:1672, 1960.

2) Chu, E.H.Y. and Bender, M.A.: Chromosome cytology and evolution in primates. Science 133:1399, 1961.

3) Chu, E.H.Y. and Bender, M.A.: Cytogenetics and evolution of primates. Ann. N. Y. Acad. Sci. 102:253, 1962.

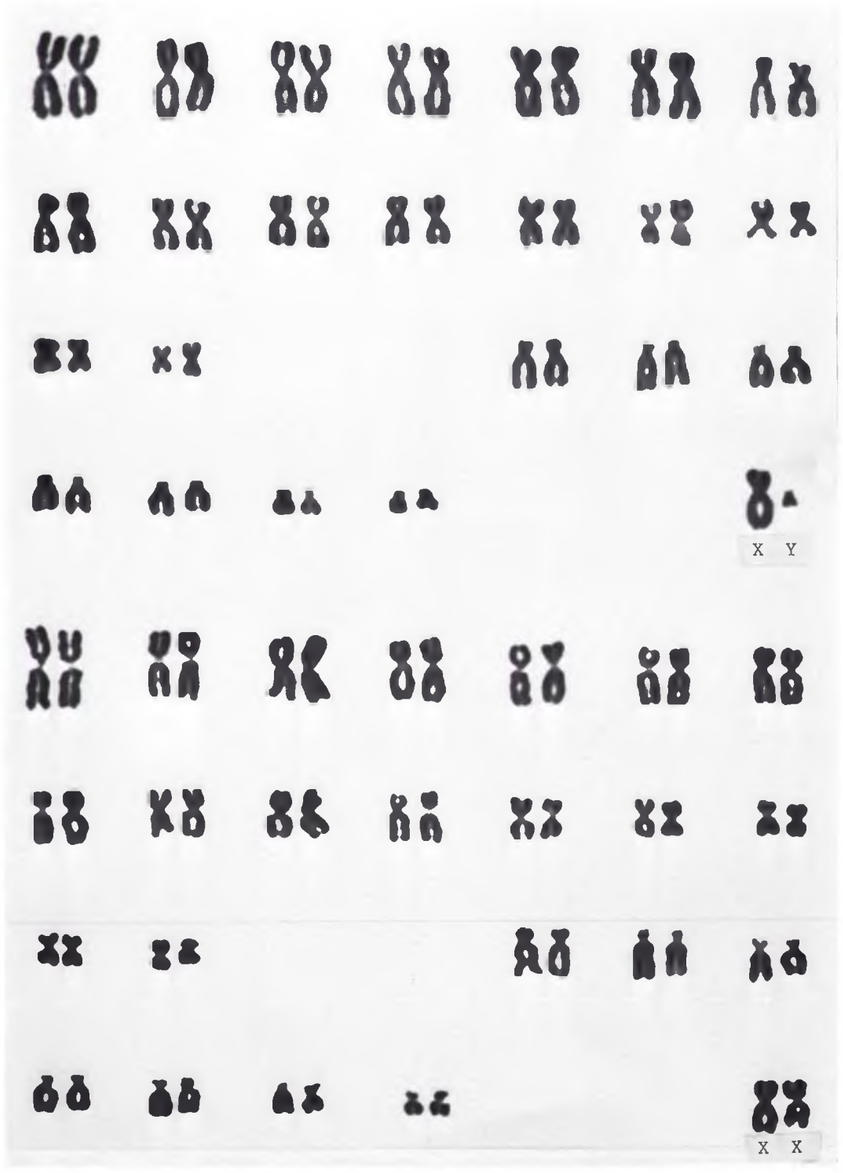
4) Chiarelli, B.: Comparative morphometric analysis of primate chromosomes. I. The chromosomes of anthropoid apes and of man. Caryologia 15:99, 1962.

5) Hamerton, J.L., Klinger, H.P., Mutton, D.E. and Lang, E.M.: The somatic chromosomes of the Hominoidea. Cytogenetics 2:240, 1963.

Order: PRIMATES Family: PONGIDAE

Pan troglodytes (Chimpanzee)

2n=48



# Order: PRIMATES

## Family: HOMINIDAE

***Homo sapiens*** **(Man)**

**2n = 46**

Volume 1, Folio 50, 1967

Order: PRIMATES Family: HOMINIDAE

Homo sapiens (Man)

2n=46

AUTOSOMES: 34 Metacentrics, submetacentrics or subtelocentrics
10 Acrocentrics

SEX CHROMOSOMES: X Submetacentric
Y Acrocentric

The karyotype is arranged according to the London conference agreement. Secondary constrictions of the ninth autosome are often prominent; the acrocentric autosomes all have satellites; elements 16 often differ in size more than other autosomes; Y is of variable length and structure. Karyotypes from several races show no distinguishable differences. The karyotypes shown come from lymphocyte cultures of normal individuals (Caucasian).

REFERENCES:


1) Tjio, J.H. and Levan, A.: The chromosome number of man. Hereditas 42: 1, 1956.

2) Ford, C.E. and Hamerton, J.L.: The chromosomes of man. Nature 178:1020, 1956.

3) Levan, A. and Hsu, T.C.: The human idiogram. Hereditas 45:665, 1959.

4) Denver classification: A proposed standard system of nomenclature of human mitotic chromosomes. Lancet i:1063, 1960.

5) London conference on the normal human karyotype. Ciba Foundation Guest Symposium. Cytogenetics 2:264, 1963.

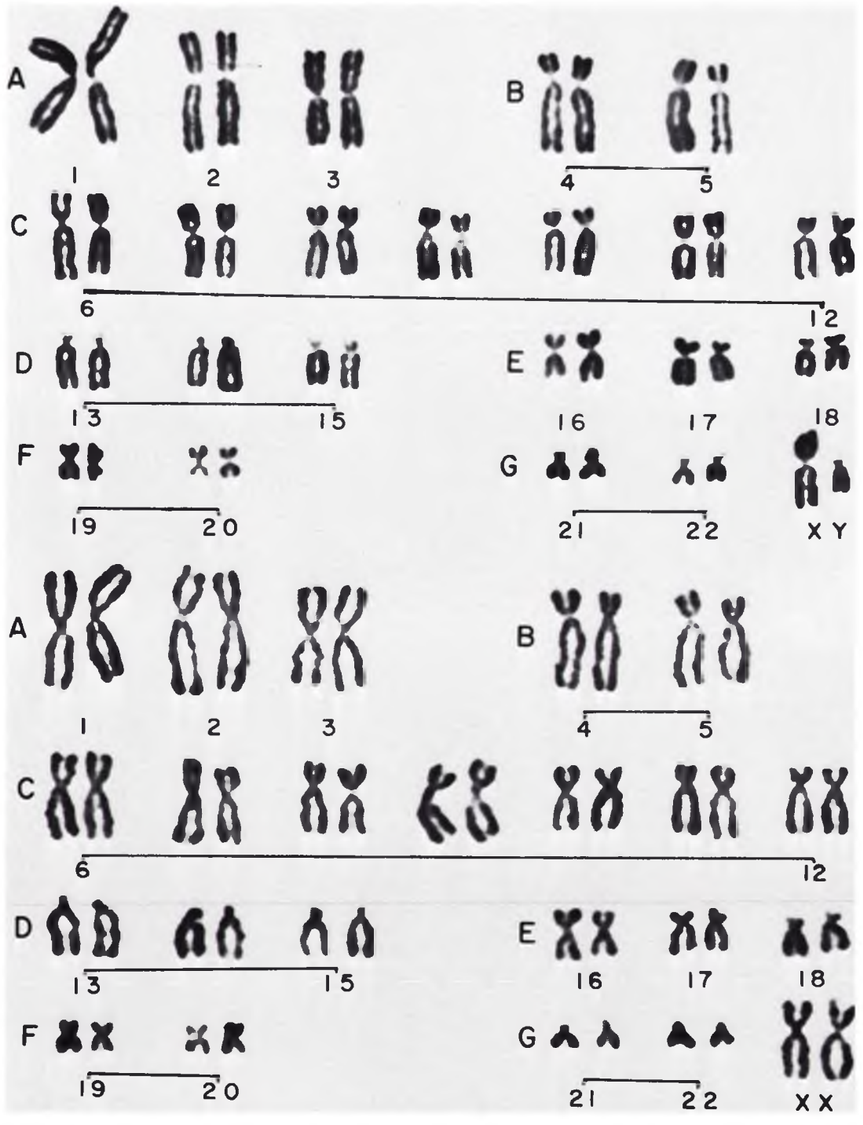
6) Hamerton, J.L., Klinger, H.P., Mutton, D.E. and Lang, E.M.: The somatic chromosomes of Hominoidea. Cytogenetics 2:240, 1963.



Order: PRIMATES Family: HOMINIDAE

Homo sapiens (Man)

2n=46

# Index