Int. Ped. Book of Snow leopards 3: 135 – 138, 1982

Comparison of Chromosome Banding Patterns in The Snow Leopard (Panthera uncia) and in Other Felids

U. Gripenberg,[1] V. Söderlund,[1] C. Wahlberg[2] and L. Blomqvist[2]
[1] University of Helsinki, Department of Genetics, P. Rautatiekatu 13, SF-00100 Helsinki 10, Finland
[2] Helsinki Zoo, SF-00570 Helsinki 57, Finland

The cytogenetics of the snow leopard (Panthera uncia) is of great interest from many points of view. The karyotype evolution in Felidae enlightens taxonomical relationships between different species. Chromosome defects are furthermore known to cause infertility, fetal vastage and congenital malformations.

Several cases of an eye defect, multiple ocular coloboma (MOC), have been diagnosed in snow leopards in the zoos of Helsinki, Zurich, Amsterdam and Omaha. Chromosome research has been performed in searching for the cause to this congenital malformation (1). Since 1980 four more animals have been studied comprising at present 13 chromosomally studied snow leopards in total. Of the 13 animals studied, six individuals were affected by MOC, seven were unaffected by this eye defect. No difference in the chromosome structure between affected and unaffected individuals has been found.

The purpose of the continued snow leopard chromosome research has been to study the cytogenetic relationships between this species and other closely related species.

Material and methods

The species and individuals studied in the present work are listed in Table 1. Chromosome preparations have been made from blood cultures and bone marrow. Several banding techniques have been used (QGQ, GAG, CBG, RBG, Ag-NOR).

Results

The absence of any visible chromosome changes in snow leopards affected with MOC has been confirmed.

The chromosome banding patterns of the four species studied is shown in Figure 1. Arrows point out chromosomes with regions of special interests.

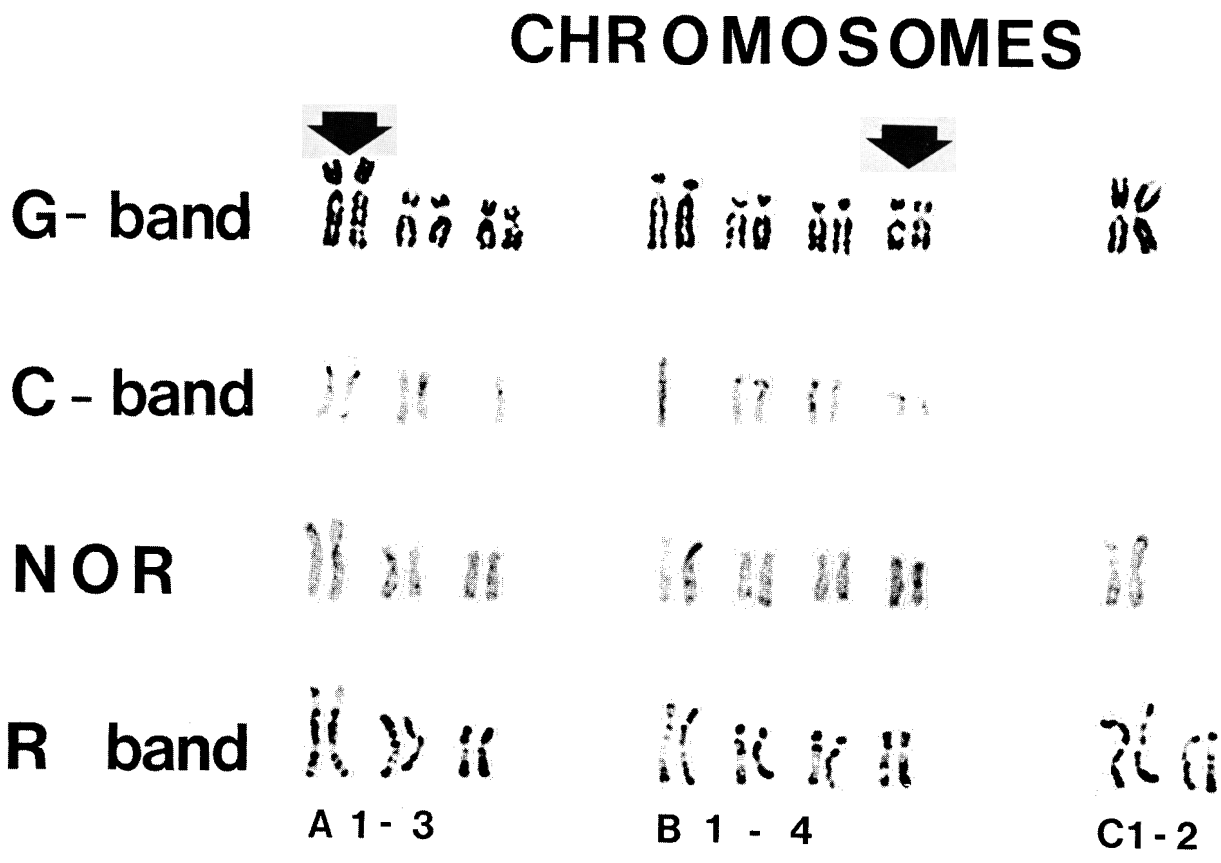
In the short arm of chromosome A1 an unstained paracentric region (see Fig. 1) is present in the karyotype of the lion. Also in the snow leopard a similar light region can be observed. Arrows of A1 of the snow leopard and the lion point out the chromosomes demostrating such gaps in their short arms close to the centromere. Wurster-Hill and Gray (2) first noticed this difference between the karyotypes of the lion and the tiger.

Chromosome B4 has identical banding patterns in the snow leopard, the lion and other Pantherae (2, 3) and in the lynx (see Fig. 1). The domestic cat, however, has a smaller short arm of B4 and furthermore there is a light band on the large arm of B4 close to the centromere. A light band of identical appearance is found proximally in the short arm of B4 in Pantherae and in the lynx. Compared with the standard cat karyotype a small segment of B4 of Panthera and Lynx has undergone an inversion.

Group C and E show no differences in the banding patterns between the four species (Fig. 1). An arrow points out the black NOR-region on E1 of the snow leopard. Identical NOR-regions are found in E1 of all felid species studied.

In group D the second chromosome is known to be different in lion and cat (Fig. 1). The lion has a weakly stained area close to the centromere on the short arm. A similar area seems to be present in D2 of the other species except in D2 of the cat.

In ancestors to now living felid species chro-



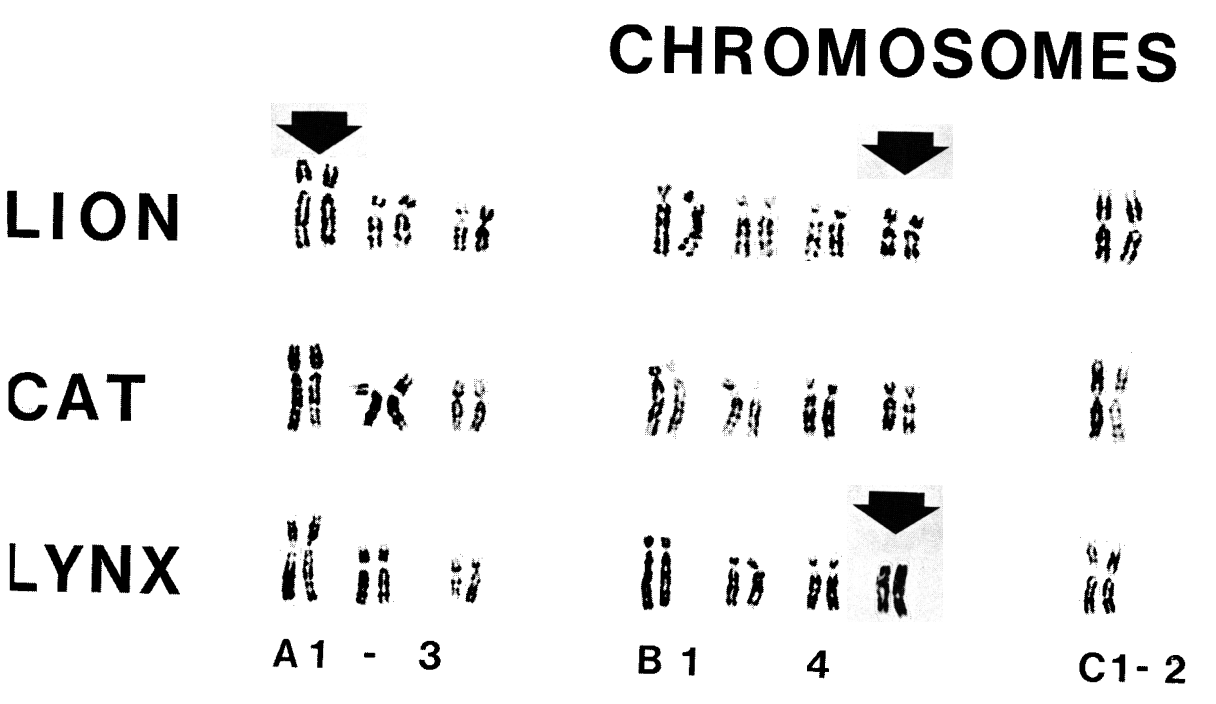
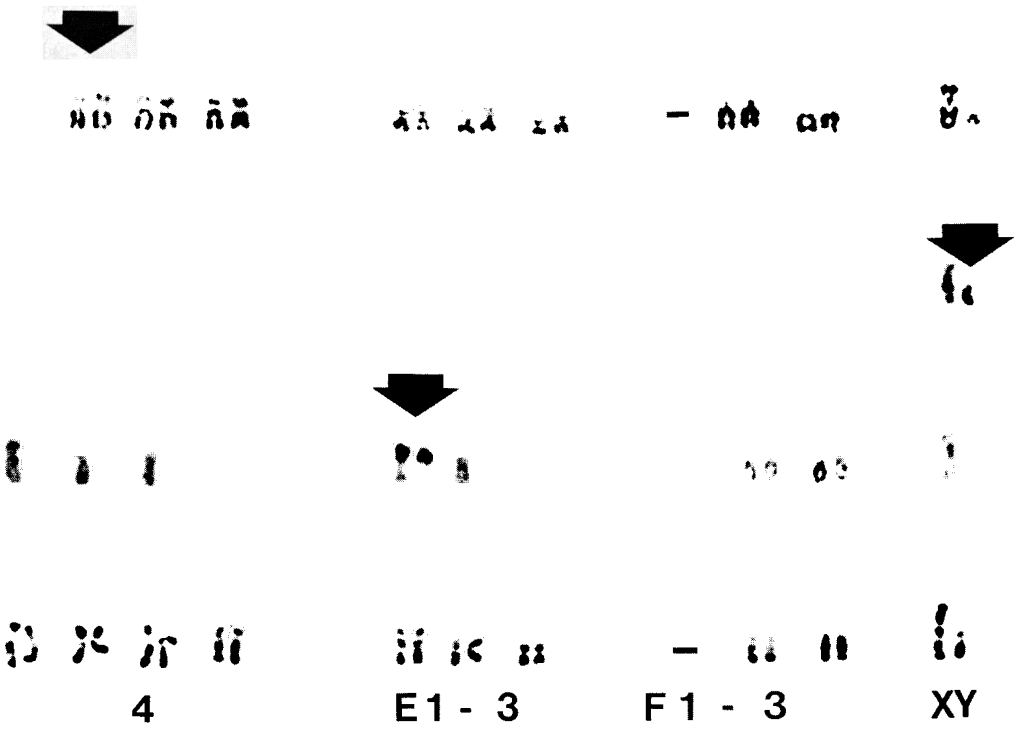
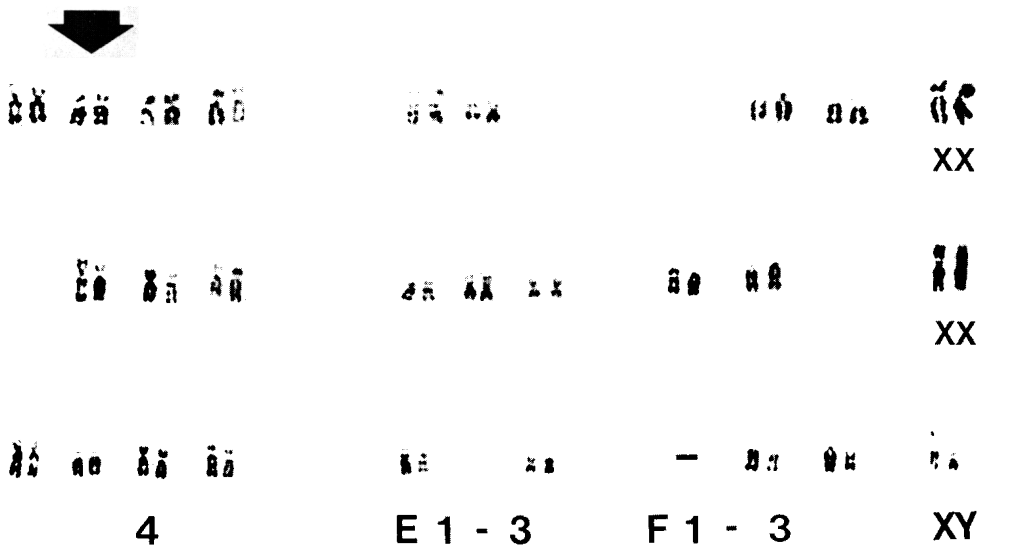


Figure 1 G-, C-, Ag-NOR and R-banded karyotypes of the snow leopard.

THE SNOW LEOPARD



OF OTHER FELIDS (G-band)



G-banded karyotypes of the lion, the domestic cat and the lynx. Explanation in the text.

PANTHERA UNCIA
MOC
0.1 Veronika (Helsinki 36)
0.1 unnumbered, dead (Ve 01)
0.1 unnumbered, dead (Ve 02)
1.0 Valter (Helsinki 35)
1.0 Vladimir (Helsinki 40)
1.0 Vasili (Helsinki 48)
UNAFFECTED
0.1 Vuokko (Helsinki 14)
0.1 Ning Ku (Oklahoma 18)
1.0 Ville (Helsinki 2)
1.0 Visna (Helsinki 38)
1.0 Kara (Cincinnati 6)
1.0 Ulan (Helsinki 43)
1.0 Bator (Helsinki 44)
PANTHERA LEO
0.1 Helsinki Zoo (B 37/81)
0.1 Helsinki Zoo (B 58/81)
FELIS CATUS
0.1 Helsinki (B 43/81)
0.1 Helsinki (B 45/81)
0.1 Helsinki (B 56/82)
0.1 Helsinki B (B 57/82)
LYNX LYNX
0.1 Helsinki Zoo (B 40/81)
1.0 Helsinki Zoo (B 47/81)
0.1 Helsinki Zoo (B 48/81)
1.0 Helsinki Zoo (B 71/82)

Table 1. Cytogenetically studied individuals of the four species Panthera uncia, Panthera leo, Felis catus and Lynx lynx. The snow leopards are classified into two groups: individuals with MOC and unaffected individuals.
1.0 = male, 0.1 = female

mosome group F most likely consisted of three pairs: F1, F2 and F3. Wurster-Hill and Gray (2) showed that in the domestic cat this chromosome group is represented by F1 and F2, in the lion and the tiger by F2 and F3. The snow leopard and the lynx have the same pairs F2 and F3 as the Pantherae.

The sex chromosomes have identical patterns in all felids studied. C-banding technique shows a large dark block on the X chromosome covering the proximal part of the short arm, the centromere and part of the long arm (Fig. 1). Most of the long arm of the Y chromosome is heavily stained by the C-banding technique.

Discussion and conclusion

The snow leopard, the lion and the other Pantherae (tiger, leopard and jaguar) show almost identical banding patterns (3). An unstained region close to the centromere of A1 seems to be common for the lion and the snow leopard. As already in the previous report has been stressed, the great similarities in banding patterns of the snow leopard and other Pantherae indicate a close phylogenetic origin.

The banding pattern of the lynx appears very similar to the pattern of Pantherae.

Small inversions in chromosomes B4 and D2 characterize the karyotypes of snow leopard, other Pantherae and lynx.

These recent cytogenetic findings have to be intergrated in our knowledge regarding phylogeny and taxonomy of the felids. A possible future revision of the systematics of Felidae requires further chromosome studies especially of species with a disputed taxonomic position and of species occupying key positions in the phylogenetic evolution.

References
1. *SÖDERLUND, V., GRIPENBERG, U., WAHLBERG C. and BLOMQVIST, L.: Chromosome studies in the snow leopard (Panthera uncia). Int. Ped. Book of Snow leopards 2: 168–182, 1980*
2. *WURSTER-HILL, D.H. and GRAY, C.W.: Giemsa banding patterns in the chromosomes of twelve species of cats (Felidae). Cytogenet. Cell Genet. 12: 377–397, 1973*
3. *WURSTER-HILL, D.H. and GRAY, C.W.: The interrelationships of chromosome banding patterns in procyonids, viverrids, and felids. Cytogenet. Cell Genet. 14: 306–331, 1975*