Interpubic Ligament: Elasticity in Pregnant Free-tailed Bat

Abstract. *The disparity between the size of the bony pelvis of a pregnant free-tailed bat and the single full-term fetus is so great that in order for birth to occur the interpubic ligament has to stretch to more than 15 times its original length. It is a living elastic band that contains an abundance of elastic fibers.*

I studied the pelvises of 32 pregnant bats (*Tadarida brasiliensis cynocephala*, LeConte), killed at all stages of their gestation period of 11 to 12 weeks, as well as those of five female bats killed shortly after parturition (Fig. 1, A–F). At autopsy the bony pelvic birth canal consisted of two coxal bones that posteriorly were articulated with the sacrum and anteriorly were interconnected by an interpubic ligament (Fig 1B). The ligament was about the same length in the early pregnant bats as it was in the late pregnant ones. Its average length was 1.75 mm (range, 1.10 to 2.35 mm) in all of the females, including the postpartum ones. The widest diameter of the bony pelvic birth canal was in the transverse interacetabular plane in all of the females and averaged 3.35 mm (range 3.00 to 4.00 mm). The widest diameter of the five newborn bats was in their caudal trunk region and averaged 16.00 mm (range, 15.50 to 16.20 mm) (Fig. 1, A and B).

The relatively large, single newborn of each of the postpartum females was able to pass through the very small birth canal because of the great elasticity of the interpubic ligament. The ligament had to increase in length during parturition by at least 15 times or more. I missed seeing the newborn pass out of the mother. This passage takes place in about 1.5 minutes in this species (*1*). The mother hangs in the usual upside down position while the baby is born rear end first.

The interpubic ligaments were sectioned serially at 7 μ and were stained with Weigerts' resorcin-fuchsin elastic stain. The outer articular capsule portion of the interpubic ligament contains an abundance of elastic fibers (Fig. 1, C–E). At the periphery of the capsule the elastic fibers blend with those contained in the stroma of the abdominal wall and pelvic muscles that insert upon the ligament. As one passes from the capsule toward the core of the ligament, the elastic fibers intermingle with collagen fibers (Fig. 1F). The core consists almost entirely of collagen fibers. The elastic fibers of the ligament stretch during parturition, whereas the inelastic collagen fibers probably slide in relation to each other

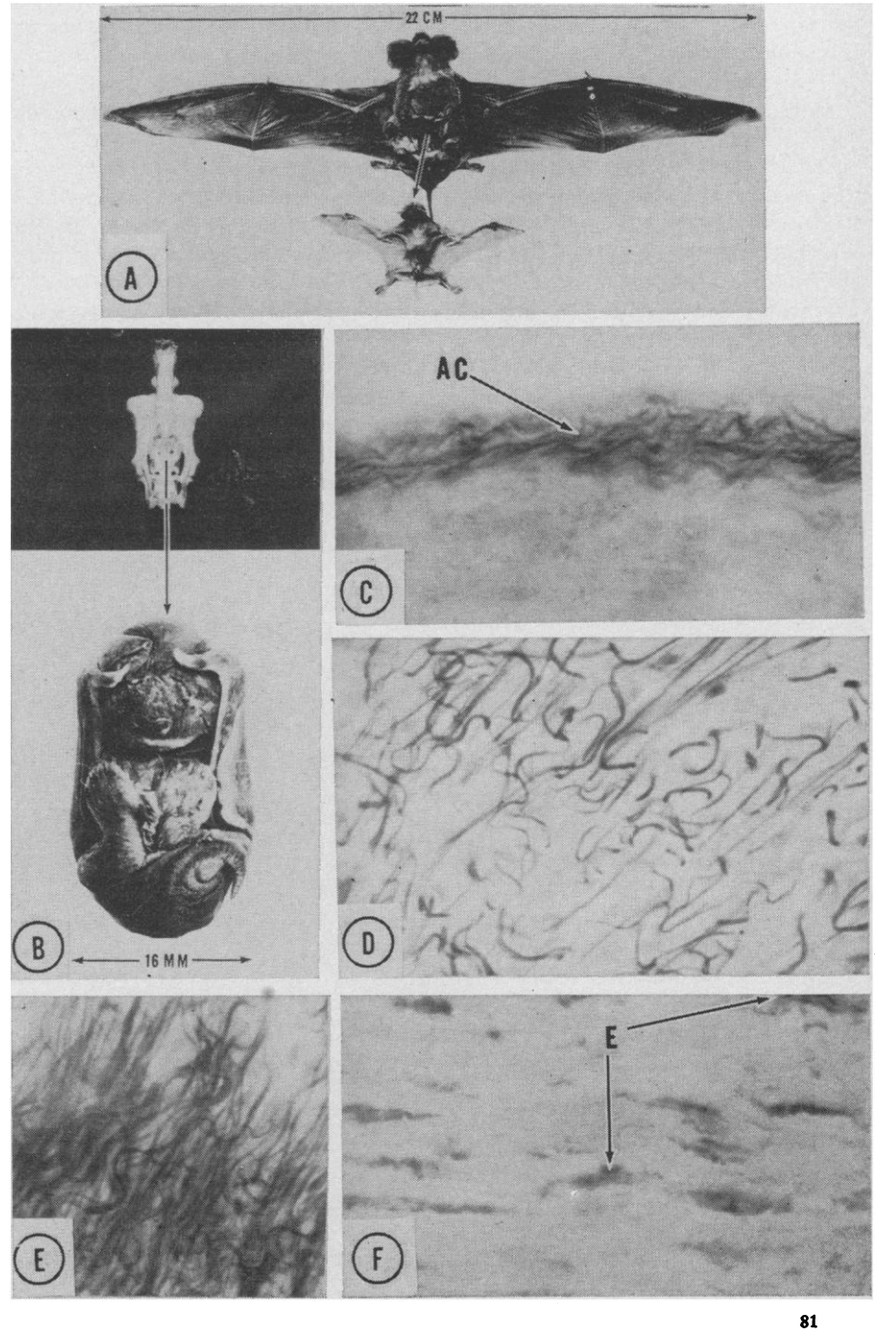

Fig. 1. (A) A full-term free-tailed bat was removed by Caesarian section, unfolded, and placed next to its mother to show its relatively large size. (B) A newborn bat in its folded condition below the bony pelvis of its mother. The arrow passes behind the interpubic ligament to trace the route the newborn took through the pelvic birth canal. Both the newborn and pelvis are magnified about 1.5 times their actual size. (C) A section of an interpubic ligament showing the abundance of elastic fibers in its articular capsule (*AC*). (D) A section of the periphery of the articular capsule portion of an interpubic ligament showing loosely arranged elastic fibers. (E) A tangential section through the articular capsule of an interpubic ligament showing a mass of elastic fibers. (F) A section deep to the articular capsule of an interpubic ligament showing elastic fibers (*E*) interspersed among collagen fibers.

as they do in the hormonally altered ground substance of the ligament of the pregnant mouse (*2*).

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References and Notes

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3. I thank E. V. Newton for technical assistance and Drs. R. J. Stephens and O. W. Henson for procuring the bats. Supported by Public Health Service research grant AM 09499-14.

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Mole Rat Spalax: Evolutionary Significance of Chromosome Variation

Abstract. *Four forms of mole rats with diploid numbers of chromosomes of 52, 54, 58, and 60, respectively, were found in Israel and the vicinity. The differences between the chromosome sets are due to whole-arm (Robertsonian) changes and pericentric inversions. The geographic distribution of the different forms is contiguous. Only a few hybrid individuals have been discovered. These chromosome forms are tentatively considered as sibling species, almost completely isolated by cytogenetic and possibly ethological mechanisms. The weak dispersal powers of mole rats may have contributed to a rapid fixation of adaptive homozygous chromosomal changes.*

Mole rats from different parts of Israel and the vicinity appear morphologically quite uniform; individuals from all over the Middle East are called *Spalax ehrenbergi* Nehring 1898 (*1*). We have found, however, that the chromosome complement of these subterranean rodents varies from region to region. Four major types have been detected so far.

The diploid chromosome numbers ($2n$) of these forms are 52, 54, 58, and 60. The chromosome sets consist of metacentric and acrocentric chromosomes in different proportions. Three groups of chromosomes were distinguished by the type of chromosome changes involved (Table 1 and Fig. 1). Group A is composed of the unchanged chromosomes which are shared by all members of this series. Group B (Robertsonian chromosomes) and group C (inverted chromosomes), defined by their postulated history of rearrangement, contribute to the differences observed between the various chromosome sets.

All metacentric chromosomes, including the X chromosome, can be individually characterized and have been given designations (Fig. 1). Only a few of the acrocentric chromosomes, however, can be identified individually. The assignment of particular acrocentric chromosomes to the three groups, as well as their matching in pairs, is thus largely arbitrary. The Y chromosome is one of the smallest acrocentric chromosomes.

There are 18 pairs of unchanged chromosomes, including the X and Y chromosomes. Seven pairs of the shared autosomes are metacentric, and ten are acrocentric. The Robertsonian chromosomes consist of four pairs of metacentric chromosomes at one end of the series ($2n = 52$) and of eight pairs of acrocentric chromosomes at the other end ($2n = 60$). The two other karyotypes ($2n = 54$ and $2n = 58$) possess three pairs and one pair of metacentric chromosomes, respectively. The acrocentric chromosomes of this group are considered equal in genetic content to the corresponding arms of the metacentric chromosomes. The inverted chromosomes are related presumably through pericentric inversions. In group C the metacentric chromosomes are confined to the two lower numbered karyotypes.

The numerical relationships of the karyotypes are summarized in Table 1. Assuming that the homologous chromosomes of group C have the same length, regardless of the position of the centromere, one arrives at one and the same corrected figure of "arms" for all chromosome forms. The karyotypes in Fig. 1 were arranged so as to bring out the similarity in the quantity of chromosome material in the four forms.

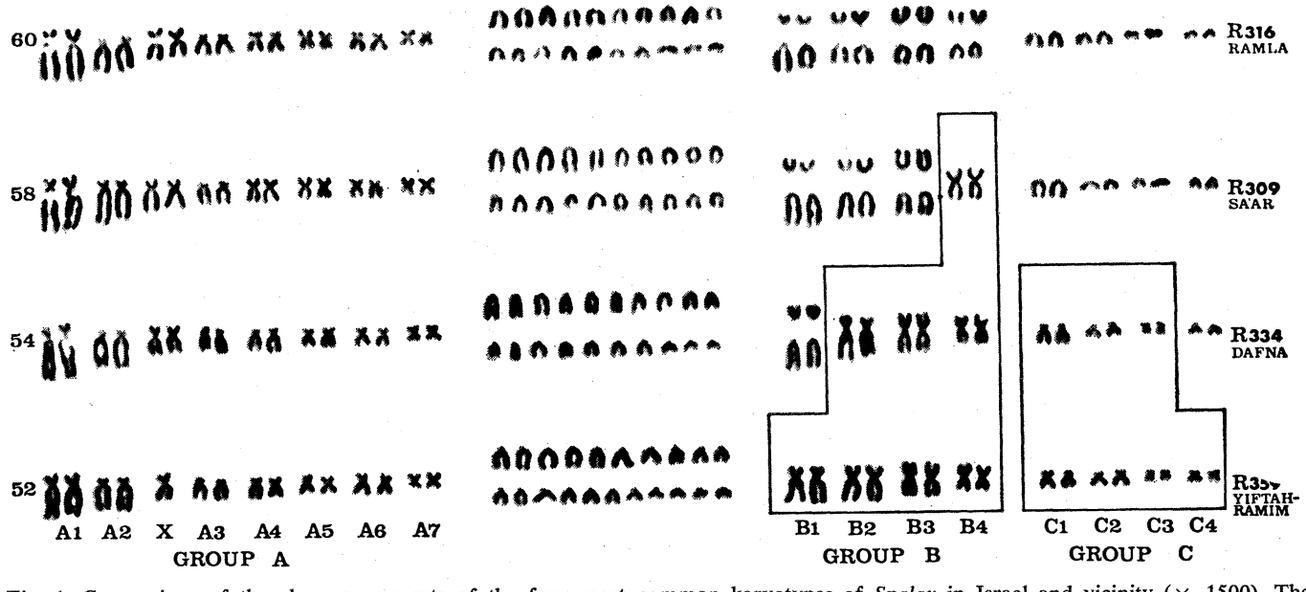

Fig. 1. Comparison of the chromosome sets of the four most common karyotypes of *Spalax* in Israel and vicinity (× 1500). The metacentric chromosomes of groups B and C are in boxes. The serial numbers and the localities of the animals utilized are at the right-hand side. The $2n$ numbers are on the left-hand side. Karyotypes were analyzed in hypotonically treated dividing bone marrow cells. The $2n = 52$ karyotype belongs to a male; the others are from females.