KARYOGRAM OF THE INBRED MOUSE STRAIN C57B1/Gif

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Mice of an inbred strain are the best object for genetic, teratologic, radiobiologic, and immunobiologic investigations. Mice, along with man, are best studied from the genetic point of view.

Among the methods used in these investigations, the study of chromosomes occupies a major place. However, upon compiling karyograms of chromosomes of mice a number of difficulties must be met. It is known that chromosomes of mice are formations of an acrocentric type with rather indiscernible morphologic characteristics and differ from one another only in size. The differences in size are small—the ratio between the largest and smallest chromosomes is $3^1/_2$-$2^1/_2$:1 [1]; and this is not a sufficiently objective criterion for their characterization. Furthermore, the technical methods of making preparations cause certain morphological changes of the chromosomes. This fact not only complicates differentiation of the autosomes and compilation of the karyograms, but can be interpreted as the results of conditions which acted during the experiments and lead to false conclusions.

In the present work we studied the morphological characteristics of chromosomes, using current methods of investigation. At the same time we attempted to compile the karyogram of chromosomes of normal cells.

METHOD

In the investigations we used male and female mice of the inbred strain C57B1/Gif, which from a genetic point of view are homogeneous and are frequently used in genetic, radiobiologic investigations, and in tissue transplantation.

The chromosomes were studied in cells of the spleen, thymus, and marrow. The chromosome preparations were made by one of the methods described by Fox and Zeiss [2] in our modification [5]. The chromosomes were studied and photographed in 100 cells at the metaphase stage.

RESULTS

Just as for other strains of Mus musculus, the diploid set for mice of the C57B1/Gif strain consists of 40 chromosomes. The appearance in certain cells of a hypoploid set of chromosomes (with 38, 39 chromosomes) is the result of methodical errors. In certain cells of the spleen of young animals and in particular in individual cells of the bone marrow, polyploid sets of chromosomes are also encountered. This evidently is explained by differentiation of the hemocytoblasts with the formation of small forms of young megakaryoblasts.

In the studied material the chromosomes were divided by shape into four morphological types: 1) oblong chromosomes in a relatively uncoiled state (Fig. 1, a); 2) chromosomes in a more or less open state (Fig. 1, b); 3) chromosomes in a condensed state (Fig. 1, c); 4) a type which in our opinion can be best used for the karyogram study (Fig. 1, d). In this case the form of the chromosomes is similar to the Latin letters U or V with the arms more or less parallel to the axis passing through the centromere of the chromosome. While studying the latter type of chromosomes of females it was possible to detect two pairs of chromosomes which were longer and one pair of chromosomes which were shorter than the others.

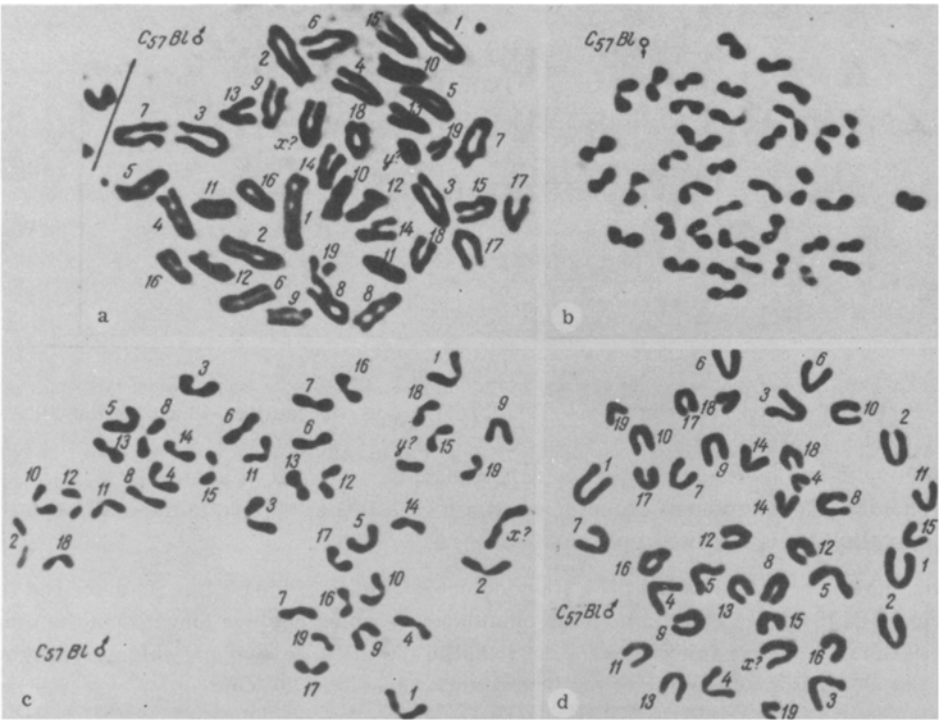

Fig. 1. Morphological types of chromosomes of C57B1/Gif mice. a) Oblong chromosomes in a relatively uncoiled state; b) chromosomes in a more or less open state; c) chromosomes in a condensed state; d) type of chromosome which can be best used for compiling karyograms. Objective 40 x , ocular 20 x .

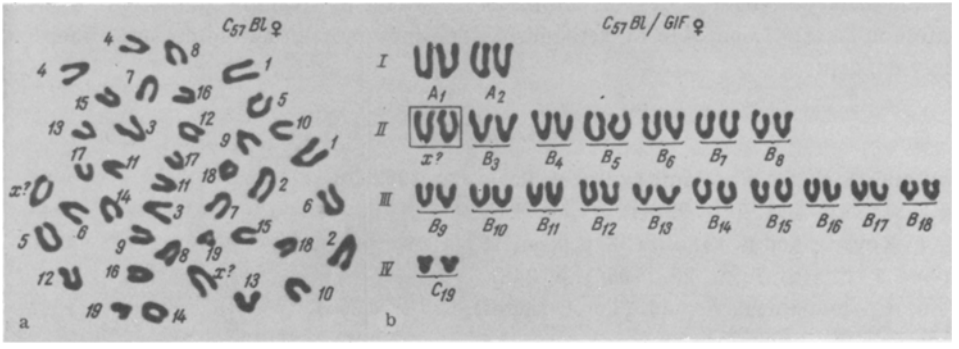

Fig. 2. Karyogram of female C57B1/Gif mice. Objective 40 x , ocular 20x .

For the males, we were able to elicit along with the chromosomes characteristic of the females, the Y-chromosomes characteristic of the females, the Y-chromosome which did not differ in size or was smaller than the shortest of the pairs of chromosomes.

When compiling the karyograms (Figs. 2 and 3) the longest autosomes were placed in the first row designated by the letter A, and numbered 1 and 2. The other autosomes were arranged in conformity with their size in the II and III rows, designated by the letter B, and numbered from 13 to 18. The shortest autosomes were placed in the IV row, designated by the letter C, and the figure 19. For the females (see Fig. 2) in the II row in the frame the first autosome pair we assumed to be XX-chromosomes, although we do not have accurate criteria for their identification. For the males and females the numeration and distribution of autosomes in the karyogram are the same with the exception of one chromosome in the II row for males (see Fig. 3), which remained without a pair (probably the X-chromosome) and in the IV row, together with autosome C 19, is an unpaired dwarf chromosome (Y-chromosome).

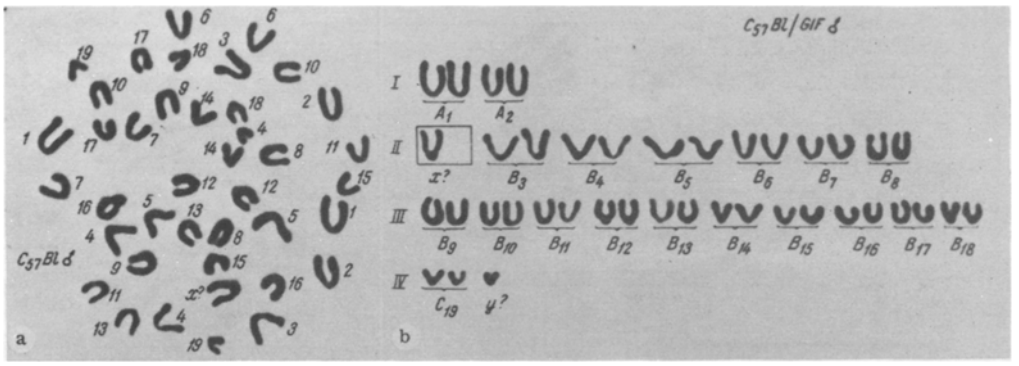

Fig. 3. Karyogram of male C57Bl/Gif mice. Objective 40 ×, ocular 20 ×.

The morphology of chromosomes has been widely studied by a number of authors [1, 3, 5]. Our results of studying the morphology of chromosomes of the mouse strain C57Bl/Gif coincide in the main with the conclusions of other authors, but also have a number of peculiarities.

Thus, for example, Ford and Woollam [1], studying chromosomes of mouse line A, described in addition to the autosomes identified by us two other pairs of chromosomes (of which one was longer than the other) having "secondary constrictions." These autosomes were not found in the mice we studied, which possibly reflects a difference between the chromosomes of mice of the inbred strains A and G57Bl/Gif.

Neither heteropycnosis of the X-chromosome [3] nor "secondary constrictions" in the smallest autosome pair of the mouse strains Swiss and DBA [4] were detected in our experiments.

It is apparent from our investigations that the optimal compilation of the karyogram is possible for chromosomes of the fourth type. In the case of the uncoiled, open, or condensed chromosomes, identification of the autosome pairs A1, A2, C19 and the Y-chromosomes is quite difficult. At the same time the distribution of autosomes B 3-18 by their size in the II and III rows remains subjective. From Fig. 1, a and b we can also judge the difficulties encountered when compiling karyograms of such chromosomes where, for example, the largest and the smallest pairs of chromosomes are completely impossible to distinguish, since most pairs of autosomes are either extremely extended or extremely condensed.

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