SPONTANEOUS OCCURRENCE OF ROBERTSONIAN CENTRIC FUSION IN MOUSE

Miss JAMEELA, S. SUBRAMANYAM and DWARKANATH K. MURTHY
Cytogenetics Laboratory, Department of Genetics, Osmania University, Hyderabad 500 007, *India*

Abstract

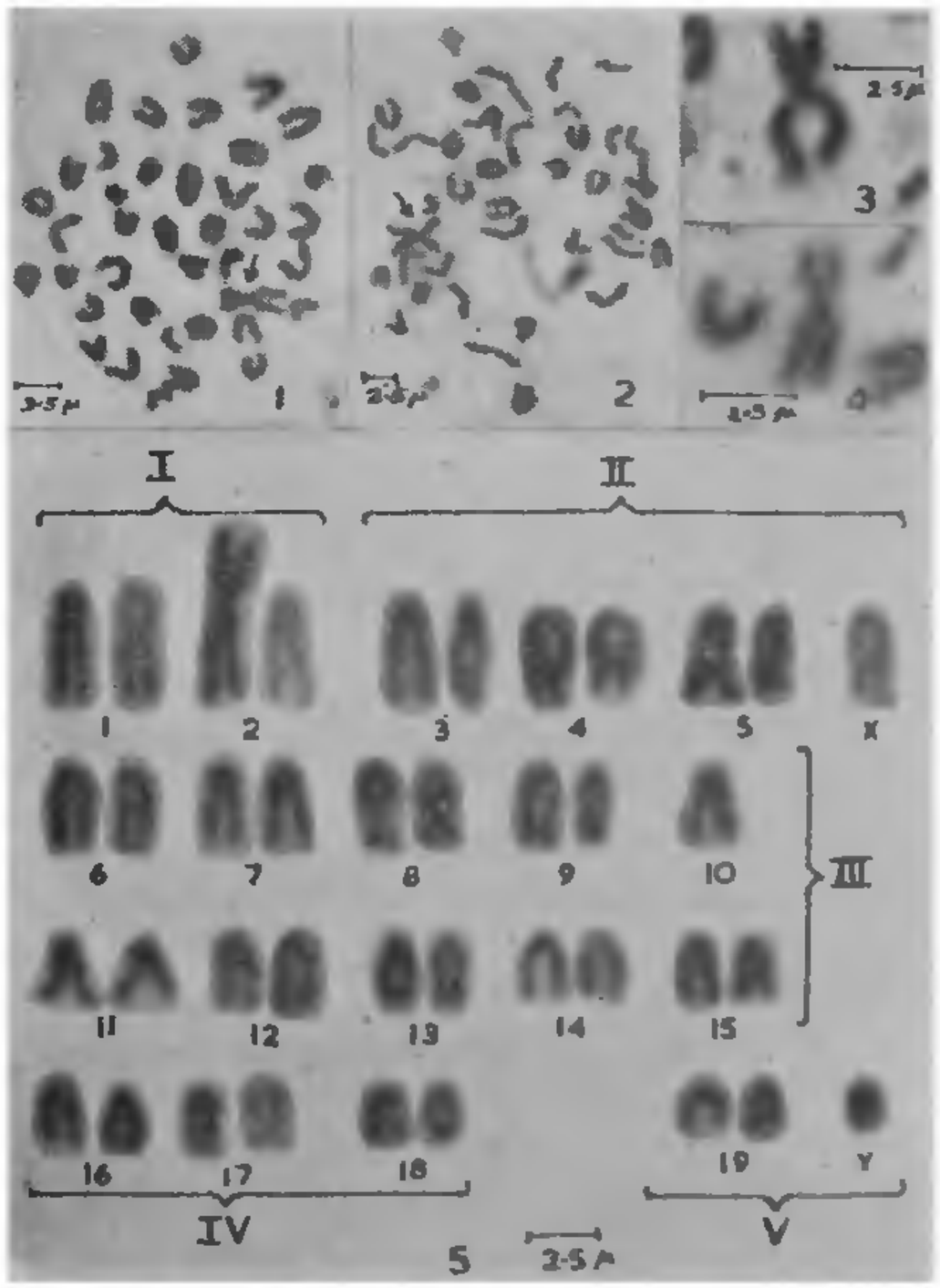
In experiments with the antihypertensive agent guanithidine sulphate a C_3H/He strain mouse revealed a submetacentric and 38 acrocentric chromosomes consistently in all the 500 metaphases scored. The karyotype showed its formation by Robertsonian centric fusion between a member of the second and another of the tenth chromosome pair. Spontaneous occurrence of this is discussed in the light of available evidence.

Introduction

THE diploid number of forty acrocentric chromosomes of *Mus musculus* are karyotyped into five groups in decreasing order of their lengths[1]. Chromosomal rearrangements in the form of Robertsonian centric fusions are reported to occur in some strains of mice[2–9]. Highly inbred mice belonging to C_3H/He strain are extensively used in this department for cytological and genetic studies. In one of the experiments on the cytological effects of an antihypertensive agent, a male mouse was discovered exhibiting a large submetacentric chromosome in a heterozygous state in all the metaphases scored. These observations are reported here.

Results and Discussion

Chromosome preparations were made from bone marrow of a mouse sacrificed 24 hr following administration of 0·026 mg guanithidine sulphate (Ismelin) by the standardised air drying technique. They were stained in Giemsa and screened. All the five hundred analysed metaphases revealed a large submetacentric and 38 normal acrocentric chromosomes. Figs. 1 and 2 indicate the presence of submetacentric chromosomes (arrows). Figs. 3 and 4 denote the enlarged chromosomes from two more metaphases. In all the spreads, it was consistently the same chromosome that was encountered. Karyotypes were constructed in order to precisely identify the chromosomes participating in the process. Figure 5 displays the submetacentric chromosome formed by a centric fusion between a member of the I and another from the III group. This was confirmed by screening other karyotypes also. As no supernumerary chromosome fragment was seen in any, it could be surmised that it might have been lost during the formation of the submetacentric from two acrocentrics. This is in consonance with the view of White[10]. Techniques have been devised in the recent past to project the banding profiles of chromosomes[11,12]. Application of these procedures may throw further light on members of the participating pair since mouse chromosomes differ from each other with only narrow margins of lengths. The mouse in the present study did not exhibit any phenotypic abnormality. The phenotype has been recorded to be normal even with two Robertsonian translocations, Rb (2.3) and Rb (X. 3), in NMRI mice[9]. A lack of phenotypic variation from the normal mouse, might be explained on the basis that except for altering the linkage groups, such changes do not substantially vary the quantum of genetic material. Further the regions involved are well known to carry heterochromatin as



Figs. 1–5. Figs. 1 and 2. Metaphases with a submetacentric (arrow) and 38 acrocentric chromosomes in each plate. Figs. 3 and 4. Enlargements of two submetacentric chromosomes. Fig. 5. Karyotype showing the position of the submetacentric chromosome formed by a centric fusion of a member of the second and another of the tenth chromosome pair. I to V indicate groups while chromosome pairs are serially numbered.

demonstrated by C banding methods. It is also known that satellite DNA which is localized in the centromeric heterochromatin of mouse plays a vital role when Robertsonian changes occur[13]. Comings[14] cites this as one of the uses of what he terms as "junk DNA". Moreover the Robertsonian concept of possessing forty fundamental arms[15] is maintained.

Such centric fusions, which were completely absent in controls and repetitive experiments of the same dose and period, were observed in other treated series to the overall extent of 0·55% only. The induction of such a feature in material exposed to reserpine with a frequency of 2·6% was described elsewhere. A gradation in the mode of its formation was also traced[16]. Since such a phenomenon is very rare, the occurrence of Robertsonian centric fusions in all cells scored (100%) in the present context cannot be attributed to drug treatment. Hence it might be concluded that centric fusion had occurred in the same generation or alternatively it must have arisen in one of the parents in the previous generation and the marker chromosome was inherited and maintained by selection. It is rather difficult to say as to which of these was the operative mechanism leading to such a situation. However the centric fusion reported here had a spontaneous origin.

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