Results obtained can be used to help determine whether immunological control of metastases is feasible in human cancer.

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References and Notes

1. Z. M. Naib, A. J. Nahmias, W. E. Josey, *Cancer* **19**, 1026 (1966); W. E. Rawls, W. A. F. Tompkins, J. L. Melnick, *Amer. J. Epidemiol.* **89**, 547 (1969).
2. I. Royston and L. Aurelian, *Proc. Nat. Acad. Sci. U.S.A.* **67**, 204 (1970).
3. L. Aurelian, J. D. Strandberg, L. V. Meléndez, L. A. Johnson, *Science* **174**, 704 (1971).
4. R. Duff and F. Rapp, *J. Virol.* **8**, 469 (1971); *Nature* **233**, 48 (1971).
5. ———, *Perspect. Virol.*, in press.
6. R. Glaser, R. Duff, F. Rapp, *Cancer Res.* **32**, 2803 (1972).
7. K. Habel, *Proc. Soc. Exp. Biol. Med.* **106**, 722 (1961); H. O. Sjögren, I. Hellström, G. Klein, *Cancer Res.* **21**, 329 (1961).
8. F. Rapp, *J. Bacteriol.* **86**, 985 (1963).
9. B. Zbar, I. Bernstein, T. Tanaka, H. J. Rapp, *Science* **170**, 1217 (1970).
10. J. H. Coggin, K. R. Ambrose, N. G. Anderson, *J. Immunol.* **105**, 524 (1970); R. Duff and F. Rapp, *ibid.*, p. 521.
11. I. Hellström and K. E. Hellström, *Int. J. Cancer* **4**, 587 (1969).
12. This study was conducted under contract 70-2024 within the Special Virus Cancer Program of the National Cancer Institute, National Institutes of Health.

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Translocation Trisomic Mice: Production by Female but Not Male Translocation Carriers

Abstract. *In man, there is generally a greater chance for a translocation trisomic child to be born if the mother rather than the father is the translocation carrier. The same type of inheritance has occurred in the mouse. Female mice heterozygous for the reciprocal translocation* T(**14;15**)6Ca *have produced a high frequency of translocation trisomic offspring. Male mice heterozygous for the same translocation have produced no translocation trisomic offspring. Thus, the laboratory mouse may provide a model for studying the cause of this phenomenon.*

In man, when the parent carrying a reciprocal or Robertsonian translocation is the mother, the probability is generally increased that a child will be born with a specific type of chromosomal defect, a translocation trisomy (*1*). An example is the high frequency of children born with Down's syndrome from translocation carrier mothers compared to those from translocation carrier fathers (*2*). The reason why this type of chromosomal abnormality tends to be transmitted through females but not males is unknown.

I have found the same phenomenon in mice carrying the reciprocal translocation *T*(**14;15**)*6Ca* (hereafter *T6*). This translocation is a reciprocal exchange between chromosomes 14 and 15 (*3*), such that the rearranged chromosome with the centromere end of 15 and noncentromere end of 14 (15^{14}) is extremely small and cytologically identifiable by conventional staining procedures (*4*, *5*). The piebald (*s*) gene on chromosome 14 is located so close to the *T6* breakpoint that it is used to mark the translocation (*5*, *6*).

Translocation trisomic offspring were produced in crosses that were originally designed to locate the *T6* breakpoint in chromosome 15 in relation to the centromere and the underwhite (*uw*) locus (*7*). In these crosses individual + *T6* +/*uw* + *s* mice were crossed to *uw* + *s*/*uw* + *s* mice. The young were visually scored for *uw* and *s*, and their chromosomes were analyzed for the presence of chromosome 15^{14}. Care was taken to cytologically distinguish *T6*/+ mice that had 40 chromosomes (including 14, 14^{15}, 15^{14}, and 15) from those mice that appeared *T6*/+ but actually had 41 chromosomes (including 14, 14, 15, 15, and 15^{14}), and thus were trisomic for the chromosomal regions contained in chromosome 15^{14} (*5*, *7*). Since all of the mice with 41 chromosomes were phenotypically nonunderwhite piebald, the *uw* locus (*uw*+ allele) is located on chromosome 15^{14} (*7*) and the *s* locus (*s*+ allele) is located on chromosome 14^{15} (*5*).

Table 1. Results of crosses involving *T6* and *uw*.

Phenotype	Total	Progeny analyzed (No.)	Chromosomes (No.)
Cross: ♀ + *T6* +/*uw* + *s* × ♂ *uw* + *s*/*uw* + *s*			
+ *T6* +	58	26	40
uw + *s*	53	18	40
+ *T6 s*	21*	8	41
uw + +	0		
Total	132	52	
Cross: ♀ *uw* + *s*/*uw* + *s* × ♂ + *T6* +/*uw* + *s*			
+ *T6* +	27	7	40
uw + *s*	38	3	40
+ *T6 s*	0		
uw + +	0		
Total	65	10	

* Of the 13 mice whose chromosomes were not analyzed, 7 died before chromosome counts were taken, and the remaining 6 are being tested for fertility. By age 2 weeks the mice with 41 chromosomes were smaller than their normal sibs. The deleterious effect of the *s*/*s* condition, megacolon, appears to be intensified in these mice.

The translocation trisomics are retarded in development, their viability is greatly reduced, and they have a nervous, shaky behavior (*8*). The testes of the males are small, possibly indicating sterility. However, two presumed translocation trisomic females—which are nonunderwhite piebald, display the nervous, shaky behavior, and were retarded in development—have produced 20 young; nine of these appear to be translocation trisomics.

Study of gametogenesis in female and male *T6*/+ mice may allow us to understand why this chromosomal defect is generally transmitted through mammalian females but not mammalian males.

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References and Notes

1. T. L. Hamerton, *Human Cytogenetics* (Academic Press, New York, 1971), vol. 1, p. 412.
2. L. S. Penrose and G. F. Smith, *Down's Anomaly* (Little, Brown, Boston, 1966), p. 218.
3. M. Nesbitt and U. Francke, *Genetics* **69**, 517 (19 → O. J. Miller, P. A. Miller, R. E. Kouri, P. W. Allerdice, V. G. Dev, M. S. Grewal, J. J. Hutton, *Proc. Nat. Acad. Sci. U.S.A.* **68**, 1530 (1971).
4. C. E. Ford, in *Tissue Grafting and Radiation*, H. S. Micklem and J. F. Loutit, Eds. (Academic Press, New York, 1966), pp. 197–206; C. E. Ford, T. L. Hamerton, D. W. H. Barnes, J. F. Loutit, *Nature* **177**, 452 (1956).
5. E. M. Eicher and M. C. Green, *Genetics* **71**, 621 (1972).
6. T. C. Carter, M. F. Lyon, R. J. S. Phillips, *J. Genet.* **53**, 154 (1955).
7. E. M. Eicher, in *43rd Annual Report 1971–1972*, W. K. Whitten, Ed. (Jackson Laboratory, Bar Harbor, Maine, 1972), p. 67; E. M. Eicher, *Mouse News Lett.*, in press.
8. B. M. Cattanach [*Cytogenetics* **6**, 67 (1967)] also found *T6* translocation trisomic mice that exhibited abnormal behavior.
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