Genet. Res., Camb. (1967), **9**, *p.* 375
With 1 *plate*
Printed in Great Britain

A probable case of mitotic crossing-over in the mouse

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(*Received* 4 *October* 1966)

The mouse skin shown in Plate I has been in my possession since 1958 as an interesting specimen, 'probably illustrating somatic crossing-over'. Though of no great value as an isolated case, it gains importance by association with Grüneberg's extensive survey (1966) of evidence for mitotic crossing-over in the mouse and forms a useful addendum to it, especially as it is apparently the only published case of twin-spotting in the mouse, though twin-spotting is a regular consequence of somatic crossing-over in *Drosophila*.

Incidentally, Grüneberg used the term 'somatic crossing-over' both in the title and in the text, to include crossing-over manifested as gonadal mosaicism. Since the important and common feature of all these crossovers is their occurrence in mitotic cells and it is only of secondary importance whether they have arisen in soma or germ line (or both) it would seem that 'mitotic crossing-over' would be a better inclusive term. The case which is the subject of this note was, however, undoubtedly somatic in origin.

Mitotic crossing-over differs from several other phenomena which may have an outward resemblance to it, by producing two complementary genotypes, though one of these is usually indistinguishable phenotypically from the heterozygous state from which it arose. In the case described herein both homozygotes are distinguishable from the heterozygote. The mouse was non-agouti and heterozygous for c^{ch} (*chinchilla*) and c (*albino*). The heterozygote is fawn-coloured and the homozygotes are sepia ($c^{ch}\ c^{ch}$) and white ($c\ c$). Somatic crossing-over between the c-locus and the centromere would produce just such a twin-spotting as is shown in the plate. Presumably the crossover occurred in a primordial melanocyte on the neural crest and the complementary daughter nuclei passed to opposite flanks. The diffuse nature of each spot is typical of coat-colour mosaicism in the mouse, as exemplified by the random inactivation of sex-linked colour genes.

An alternative explanation for the twin spots which needs to be considered is non-disjunction of the c^{ch}-bearing chromosome, producing complementary clones which would be trisomic ($c^{ch}c^{ch}c$) and monosomic (c–). The expected phenotypes would be dark and white respectively but since the chromosome involved (linkage group I) is large and important, the viability of the monosomic clone would be doubtful.

Genes for white-spotting (e.g. s and W^v) were absent from the stock. If they had arisen *de novo* in this animal they would not have produced a complementary dark patch.

The mouse was heterozygous for the small T6 chromosome which has been used as a cytological marker in many experiments on bone-marrow chimaerism, but this chromosome shows no linkage with group I and is probably irrelevant to the twin-spotting.

REFERENCE

Grüneberg, H. (1966). The case for somatic crossing-over in the mouse. *Genet. Rex.* **7**, 58–75.

Postscript

After writing the above account I found a reference to two similar cases in 'Genetical and functional mosaicism in the mouse', by L. B. Russell (pp. 153–181), in *The Role of Chromosomes in Development* (Editor M. Locke, Academic Press, 1964). Two mice, also of constitution $aac^{ch}c$, showed twin-spotting of the two coat colours described above. They are not illustrated and the relative sizes and positions of the complementary patches are not given. Nevertheless, they would appear to represent the phenomenon described here: mitotic crossing-over.