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STAR-RECESSIVE, A SPONTANEOUS MUTATION IN *DROSOPHILA MELANOGASTER*

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In a genetics experiment conducted in November 1937 with *Drosophila melanogaster* and involving the dominant mutant Star (S, in chromosome 2– at locus 1.3; causing an irregularity in the arrangement of eye facets and facet hairs, the homozygote being lethal), a number of flies appeared with small narrow eyes. When these were mated *inter se,* all of the F_1 had abnormal eyes, but these varied in size from that of S/+ (see Table IV) to a narrow slit of red pigment on which only a few facets were scattered. A clue to the manner of inheritance of the type with narrow eyes was found by mating a narrow-eye male to a wild-type female, with the result shown in Table I:

TABLE I. — F_1 Distribution (P_1: wild-type ♀ x narrow-eye ♂).

February 14, 1938	Wild-type	Star
Totals	82	58

An F_1 wild-type female was then outcrossed to a Star Curly Dichaete male (genotype S/Cy; D/C3x), with the result given in Table II:

TABLE II. — Result of Outcross of F_1 wild-type ♀ x (S/Cy; D/C3x) ♂.

February 28, 1938	Star Dichaete and Star (C3x)	Curly Dichaete and Curly (C3x)	Narrow-eye Dichaete and Narrow-eye (C3x)
Totals	48	83	22

Since the narrow-eye flies in Table II were all non-Curly they must have carried Star; moreover, they must have carried some factor (or factors) which profoundly "enhanced" Star even though that factor had not expressed itself in the mother which was heterozygous for it but was non-Star. For reasons given below the symbol, S^r, meaning Star-recessive, was adopted for this factor at the suggestion of Dr. Bridges.

Chromosome Carrying Star-recessive

In order to determine which chromosome carries S^r, a Star, Star-recessive (C3x) (i. e., narrow-eye) male from Table II was crossed to

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a (S/Cy; D/C3x) female with the result shown in Table III, where the non-Star offspring have been omitted since it is only in Star flies that S^r can be detected. Distribution with respect to sex was random.

TABLE III. — Result of Cross (S/Cy ; D/C3x) ♀ x (S/S^r ; C3x/ +) ♂.

March 21, 1938	Star Curly	Star Curly Dichaete	Star Star-recessive	Star-recessive Star Dichaete
Totals.....	14	22	11	20

This result agrees with expectation calculated on the basis that S^r is in the second chromosome. We would expect none of the Star Curly nor Star Curly Dichaete offspring to have S^r; while, on the other hand, all of the Star non-Curly flies would carry S^r.

At this point an attempt was made to build up a constant breeding stock of S^r which would not carry Star. From Table III, a (S/S^r; D/?) male was outcrossed to a Cy/Bl female. F_1 Curly Dichaete (non-Star) males, genotype (S^r/Cy; D/+), were backcrossed to Cy/Bl females. By selecting in the F_2 only the Curly non-Dichaete (non-Bl) and mating these *inter se*, a stock was started whose parents had had their I and III pairs of chromosomes entirely replaced by normal ones derived from the Cy/Bl stock. The Cy/S^r x Cy/S^r mating produced approximately one third non-Curly flies which had rough eyes approaching S/+ eye in size. These S^r/S^r when inbred gave a constant rough-eyed stock. Considered apart from its effect with Star in S/S^r, S^r was behaving as a simple recessive. A summary of the phenotypes of the various combinations of S, S^r and the + allel is given in Table IV; fertility is normal throughout:

TABLE IV

Genotype	Eye	Wing Venation	Viability
1. S^r/ +	+ ; occasionally a few facets disarranged.	+	+
2. S/ +	Smaller than + ; rough.	+	Good
3. S^r/S^r	Smaller and rougher than S/ + ; may approach + eye in appearance.	Sometimes broken at tips of L2–L5.	Fair
4. S/S^r	Smaller than S^r/S^r; few or no facets.	L2–L5 extensively interrupted.	Poor

Localization of Star-recessive

It was noted that in numerous matings in which S/S^r females had been mated to males with normal II chromosomes, e. g., the mating in Table I, the cross-over S S^r/+ +, if phenotypically like S/S^r, never appeared. From this it was now assumed that either S^r

is an allel or near the locus of Star, or it is present with an inversion. In order to determine the frequency of crossing-over between S and S^r, an al S ho/Cy male was mated to a S^r female and F_1 al S ho/S^r females were crossed to al ho males (al-aristaless, 0.0; ho-heldout, 4.0) with the result shown in Table V:

TABLE V. — Result of Backcross (July 10, 1938) (al S ho/ + S^r + ♀ x al ho ♂).

Parental Combinations		Recombinations				N	R1 al–S	R2 S–ho
Aristaless Star Heldout	Wild-type	Arista-less	Star Heldout	Arista-less Star	Heldout			
1,339	1,488	25	11	62	42	2,967	1.2%	3.5%

No individuals of the S/S^r type appeared; yet the absence of crossing-over between S and S^r was not proven since S S^r/++ might not have been separable from S/+. Upon testing one al and three ho cross-over types to al S ho/Cy, each was found to carry S^r as evidenced by the appearance of Star Star-recessive in the F_1. This indicates that S^r is to the left of ho and corroborates previous findings by a somewhat analogous procedure that S^r is to the left of dumpy (dp, 13.0).

Allelomorphic Tests

To determine whether or not S^r is an allelomorph of Star, S^r females were mated to S/Cy males and F_1 S/S^r females were backcrossed to S^r males with the result shown in Table VI:

TABLE VI. — Result of Backcross. (S/S^r ♀ x S^r ♂).

August 30, 1938	Star Star-recessive	Star-recessive	Wild-type	N
Totals.....	1,507	1,727	1	3,235

If crossing-over between S and S^r occurred, the class S^r/+ would be wild-type and could be separated from S/S^r; and S^r/S^r; even though the reciprocal cross-over S S^r/S^r might be inseparable from S/S^r. The exceptional wild-type female which appeared was shown to be of genotype S^r/+, which would be one of the cross-over types sought. Yet, since only one occurred in 3,235 flies it could not be certain that it was a cross-over; for, a reversion of the S^r gene to + or the appearance of an inhibitor of S^r might have produced the same result.

The experiment was repeated using al S ho/S^r females by S^r males, with the result given in Table VII:

TABLE VII. — Result of Backcross (al S ho/ + S^r + ♀ x S^r ♂).

October 24, 1938	Star Star-recessive	Star-recessive	N
Totals.....	1,711	1,871	3,582

A final test made use of the mating: al S ho/S^r females by males homozygous for the three recessives — al, S^r, and ho — with the result shown in Table VIII:

TABLE VIII. — Result of Backcross (al S ho/ + S^r + ♀ x al S^r ho ♂).

Parental Combinations		Recombinations						
Aristaless Star Star-Recessive Heldout	Star-recessive	Aristaless Star-recessive	Star Star-Recessive Heldout	Aristaless Star Star-Recessive	Star-Recessive Heldout	N	Region 1 al–S	Region 2 S–ho
394	1,948	19	9	36	71	2,477	1.1%	4.3%

With the exception of a possible cross-over type in Table VI, there is strong evidence that Star-recessive is an allelomorph of Star.

A PERIPHERAL VASCULAR SYSTEM AS SEEN BY MEANS OF A CLARK WINDOW IN THE EAR OF THE RABBIT

(A DEMONSTRATION)

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A window has been devised in such a manner that it can be placed in the ear of a rabbit. New blood vessels which grow into the window may be visualized by the use of the microscope. Studies of the development of the capillary network may be made and the reaction of the newly formed vessels to various stimuli may be determined.

The window consists of several layers of celluloid and so constructed that a space of known depth is left between the two halves of the window into which the ingrowth of new vascular tissue may take place. These windows are so constructed that the known depth of the space into which the vessels grow is 75 $\mu\mu$. Transmitted light may be carried through this tissue very easily and the vessels and circulation observed.