

## SOME REMARKS ON R. GOLDSCHMIDT'S CRITIQUE OF THE HYPOTHESIS OF MULTIPLE SEX-GENES.

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THROUGH the courtesy of Prof. Goldschmidt I was able to read his "critique" before its publication. A few remarks should be sufficient to define our respective positions clearly.

A salient property of the triploid intersexes in *Drosophila melanogaster* is the sensitivity of their sexual characteristics to the effects of both genetic and environmental factors. The intersexes possessing a "normal" chromosome complement (*e.g.* two *X*-chromosomes and three sets of autosomes) range in their phenotype from almost male-like to almost female-like individuals. Contrariwise, the sexual characters of females and males are relatively stable, and the same agents that produce a striking effect on intersexes fail to modify the sexual characters of the normal sexes to any appreciable degree. The explanation of this fact (not disputed by Goldschmidt) is that the sexual balance in the intersexes is very close to the critical threshold for femaleness *v.* maleness, while the balance in females and males is relatively far removed from this critical value.

It seems self-evident that the above property of the intersexes makes them more valuable as detectors of the agents modifying the sexual balance than are females and males. Dobzhansky and Schultz have shown that the addition of duplications for the different sections of the *X*-chromosome to the chromosomal complement of the intersexes results in shifts toward femaleness. All the different sections of the *X*-chromosome thus far tested (except the inert region) have been proven to contain female modifiers, and the effect of a given duplication has been shown to be roughly proportional to its cytological length. Moreover, the effects of the different sections are additive, and sections that are long enough transform intersexes into what amounts to fertile females. Such a transformation has been accomplished by at least two duplications involving different sections of the *X*-chromosome. Goldschmidt has chosen to disregard these facts, because "the addition of fragments may mean an addition of modifiers of the same type as those selected in the former experiments." This explanation is out of the question, since the several duplications tested came from as many different strains,

more than one strain of triploid females has been used, and no strain having sufficiently strong female modifiers to transform an intersex into a fertile female has ever been found.

It was expected, and was actually proved, that the same sections of the *X*-chromosome that produce a strong "femalising" effect in intersexes would have no effects on the sexual characters of females and males. However, again in accord with theoretical expectations, some long duplications were observed to induce intersexuality in males. Goldschmidt sweeps away also this evidence, believing that these were not intersexes but simply abnormal males. This is not the case: anybody familiar with the anatomy of the triploid intersexes in *Drosophila* can without difficulty distinguish the type III intersexes from males in which the imaginal disc of the external genitalia has failed to evert. Goldschmidt is more nearly right in criticising our usage of the word "superfemale", but again his conclusion that superfemales are merely abnormal hyperploids rather than hyperfeminine individuals is not necessarily correct, and in fact some unpublished data indicate that this is not so.

In the face of the existing evidence, the assumption of a special female sex-differentiator over and above the female modifiers present in all the parts of the genetically active region of the *X*-chromosome is unnecessary and warranted by no known fact. In any case, the burden of proof for this assumption lies on him who assumes. Any consideration based on how sex-differentiation might have arisen in phylogeny is beside the point, since the sex-determining mechanism in *Drosophila* (and in most other organisms) is clearly not of recent origin but is a product of long evolution.