procedure is only mentioned in passing on one of their earlier publications[3] and came to our attention after the completion of the present experiments). As is well known, the few surviving males in semi-lethal cultures are often abnormal. The Fahmys's 'visible' rate, relative to complete lethals, would therefore be very high, since most workers would include semi-lethals of very low viability with the complete lethals rather than with visibles. Moreover, the exclusion of the semi-lethals from the lethal class would further increase the visible rate relative to the lethal rate.

In conclusion, it might be pointed out that a lethal is often a visible of very low viability and that the distinction between 'lethals' and 'visibles' is really a matter of convenience. On general grounds, therefore, it is scarcely to be expected that any mutagenic agent should specifically produce visible effects, as contrasted to lethal.

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L. S. Altenburg
Edgar Altenburg

The Rice Institute,
Houston, Texas.
Oct. 1.

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A Position-Effect Explanation of Gene Conversion

Gene conversion was the name given by Winkler[1] to the transformation in a heterozygote of a + allele into a mutant allele, or of one mutant into another. He intended to explain recombination and crossing-over through digenic conversion of allele A into a in one chromosome and simultaneously of a into A in its homologue. Monogenic conversion, in only one chromosome, should also be possible, but this would not easily be distinguished from mutation. More recently, conversion has been used only in the monogenic sense[2] in which it is demonstrated chiefly through tetrad analysis from heterozygotes Aa when the expected Mendelian segregation of $2A : 2a$ is not obtained.

However, tetrads with three mutants and 1 + spores may be produced also from intragenic cross-over, that is, cross-over which takes place within a gross locus subdivided into sub-loci corresponding to sub-alleles or pseudo-alleles[3]. Typical intragenic cross-over has been demonstrated, for example, in the adenine-3 gross locus of *Neurospora*[4]. In a gene b subdivided into sub-alleles b_1 and b_2, the cross of a b_1 by a b_2 strain may be represented as $b_1 + \times + b_2$, and this will give a tetrad $b_1 +$, $+ +$, $b_1 b_2$, $+ b_2$. If no distinction is made between the phenotypes of b_1 and b_2, the apparent result is b, $+$, b, b, or three mutants to 1 +. This is apparent conversion, which may be separated from true conversion only when sub-alleles are distinguishable.

Variegated conversion—the production of variegation in a heterozygote, not attributable to any apparent chromosome aberrations—has been reported to occur in *Oenothera*[5], but further analysis will be necessary before it can be generally admitted. True conversion, not associated with variegation, may be called stable conversion or transmutation[6]. This is at present the most important form of conversion

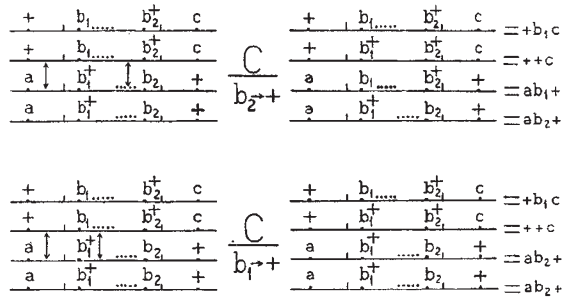

Fig. 1. Conversion of b_2 into + and of b_1 into +, corresponding respectively to asci 1 and 4 of Mitchell (ref. 7). Conversion results from relocation, by cross-over, of sub-alleles b_1 or b_2 adjacently to a different intermediary segment between them, which caused position effect (dotted) now reverting to +

since it has been plainly demonstrated to occur in *Neurospora*[7,8], and very probably in *Saccharomyces*[2,9] and some other species. Its importance stems from the fact that it constitutes a proved exception to Mendelian theory.

Two types of explanations have been advanced for true, stable conversion: namely, a differential and compensatory reduplication, for example, the + allele reduplicating twice while allele a does not reduplicate[7]; and a transfer of chemical groups from one allele to the other, so as to result in a kind of mutation. The transfer might also be effected as a dislocation of groups similar to a kind of Thompson's episomes[10], or through enzymes and during gene reduplication[6], or by means of a transductor[11], reminiscent of transduction phenomena in bacteria. These are *ad hoc* hypotheses which lead neither to generalization nor to the possibility of prediction. An explanation is offered here, based on mechanisms known to operate at other levels, and which it is only necessary to extend to the intragenic level. Stable conversion is explained by intragenic cross-over which, by separating sub-loci, restores the intragenic position effect that caused the mutant phenotype. Fig. 1 shows how the explanation works for two of the asci in the clearly demonstrated case of *Neurospora*[7]. For simplicity of lettering, the loci studied by M. B. Mitchell[7] will be designated a for pyrimidine-1, b_1 for pyridoxine pH-sensitive, b_2 for pyridoxine non-pH sensitive, c for colonial. Other markers, located far from the b gross locus, are not necessary for this explanation. b_1 and b_2 are sub-alleles. Between them will be a segment of the b gross locus which causes position effect (see also legend of Fig. 1). Other conversion-asci are similarly explained. The explanation implies negative interference[3].

Details of this work will be published elsewhere.

J. A. Serra

Institute of Zoology,
Faculty of Science,
Lisbon.

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