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Genetic control of maturity in *Tetrahymena pyriformis**

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1. INTRODUCTION

Tetrahymena pyriformis, syngen 1, exconjugants usually have an immature period between 50 to 100 fissions in length, depending on the particular inbred strain studied (Nanney & Caughey, 1953, 1955). However, a small fraction of exconjugant clones (4 to 10% in different strains) may mate as early as 10 or 15 fissions after conjugation. These 'early mature' clones manifest all the characteristics of true conjugants, that is, of having undergone nuclear reorganization: mating types are redetermined and, in crosses between strains, early mature pairs are heterozygous for the available genetic markers. To determine the basis for early maturity, a breeding analysis was instituted on an early maturing pair. In this report, we present evidence for the Mendelian inheritance of the early maturity trait.

2. MATERIALS AND METHODS

Inbred 'family' F (see Phillips, 1967, for a description of this family) of *T. pyriformis*, syngen 1, was the source of the early mature pair. The culture medium was a dilute (1:70 or 1:100) 1% proteose peptone solution inoculated with *Aerobacter aerogenes*. Crosses, pair isolations, serial transfers and determinations of mating type were performed as previously described by Nanney & Caughey (1955) and Nanney, Caughey & Tefankjian (1955). The scoring of conjugant pairs was accomplished as follows. The two exconjugant clones from an isolated pair were allowed to remain together in a depression slide for about 2 days after the pair was isolated. After this time no cells were present in some of the depressions and the pair was classified as dead. In other depressions the clones had grown rapidly, exhausted the food supply, and produced many conjugating pairs. Because these clones failed to show the usual post-conjugation lag, and because they manifested no loss of sexual maturity, such pairs were classified as non-conjugants. This classification was further justified by examining the mating types of sublines from many such pairs; the appearance of only the parental mating types confirmed the diagnosis. The remaining synclones grew more slowly, usually about 5 or 6 fissions. Three subclones were initiated from each of these cultures and the original depression was retained and observed for conjugating pairs as the food supply was depleted. Because one of the participants in non-conjugation may fail to survive, a failure of conjugation in the first depression culture does not prove non-conjugation. Moreover, non-conjugation occasionally yields defective cells with slow growth rates, so that non-conjugant and exconjugant synclones sometimes appear very similar after two days. Nearly all the slow-growing cultures can, however, be unambiguously classified by a combination of maturation and mating type ascertain-

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ment on the derived sublines. Early mature pairs were defined as those which gave rise to exconjugant subclones which mated with reactive testers in the first to third serial transfers (10 to 30 fissions). At this time, normal pairs gave negative reactions under the same conditions.

3. RESULTS

The results of a series of crosses among the early maturing clones and between their progeny are presented in Table 1. In matings of early mature clones, about one-fourth of

Table 1. *Segregation of early mature trait*

Phenotype of parents	Number of pairs analyzed for viability	Non-conjugant pairs	Dead	Ratio of dead/ conjugant pairs	Number of pairs analyzed for maturity	Early mature	Normal
Early mature × early mature	1172	75	288	0·26	45	30	15
Early mature × normal (test crosses)	720	35	14	0·02	671	367	304

the progeny died, and the segregation ratio of early matures to normals was 2:1. In test crosses between early matures and normal clones, about half the progeny were early matures and half were normal late matures.

The early mature pairs are further distinguishable from the late maturing pairs by a difference in the initial growth rate, which was markedly *reduced* in the early mature pairs. This difference usually disappeared by the second or third serial transfer (20 to 30 fissions). Finally, although all the subclones of an early mature pair were usually concordant, a small but consistent fraction of the pairs had some early and some late maturing subclones.

These data indicate the presence of a mutant gene (or chromosome) dominant for early maturity in heterozygotes but lethal in homozygotes. We have assigned the symbol *Em* to this determinant. The slight excess of early mature pairs in the test crosses is interpreted as being due to the high background rate of appearance of this trait. The 'mosaic' pairs may reflect phenomena similar to those observed in other heterozygotes in *Tetrahymena* and described as 'allelic repression' (Nanney, 1963). The genetic control described in this note differs significantly from other systems of genetic control of maturity in ciliates (see Siegel, 1957; Hiwatashi, 1960).

SUMMARY

A new mutation, *Em*, is described for *T. pyriformis*, syngen 1. This dominant mutation eliminates the normal immature period in heterozygotes but is lethal in the homozygous state.

This paper is dedicated to Dr. Ralph Cleland in honor of his 75th birthday.

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