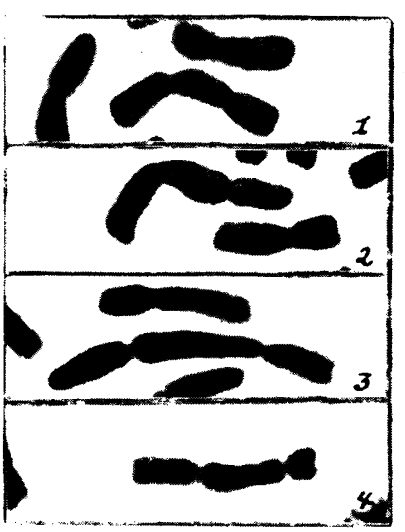
($2n = 28$) was made. The F_1 plants were partially fertile (about 45 percent) and I now have on hand 75 g of F_2 seed. The number of chromosomes in each seedling will be determined by germinating the seeds on absorbent paper and examining metaphase of mitosis in the primary roots. The chromosome number of the seedlings should vary from 28 to 42. Fragment chromosomes should be fairly common, and I had originally hoped for a dicentric in every 100–200 seeds. So far, 40 seeds have been examined, and out of these I have isolated two plants that have a dicentric chromosome.

One seedling had 27 normal chromosomes and a dicentric. Some variability in number existed among cells, depending upon how the dicentric separated and upon the inclusion or exclusion of broken arms following rupture of bridges (Table 1). The variability in the length of the intercentric region also shows that some bridges were formed by the separation of the dicentric chromatids. The dicentric was present in only two of the three roots examined. The third root had 28 chromosomes. The distal arms of the dicentric were not equal—thus, the dicentric is not an isodicentric. All other viable F_2 seeds have had four satellited chromosomes. In the cells of this plant only three satellited chromosomes are obvious and possibly one satellited chromosome is involved in the dicentric.

The other dicentric was found in a seedling with 39 normal chromosomes. The chromosome number varied considerably in the cells of this plant. The dicentric was present in only about one-quarter of the cells of the one root examined in detail. It was present in two of the three roots examined. Many of the cells with resting nuclei had micronuclei, indicating a loss of some chromosome material. This dicentric is probably less stable than the one first described.



Photomicrographs from wheat root-tip cells of dicentric chromosomes with some normal chromosomes for comparison. Figures 1, 2, and 3 are dicentric A, and Fig. 4 is dicentric B. Note the dissimilar distal arms in the dicentric B. Workers unfamiliar with wheat chromosomes may confuse these chromosomes with those that have a secondary constriction. Those who are familiar with wheat chromosomes will note the differences in length and the position of the two constrictions. (×2000)

Table 1. Variability in chromosome number and the presence or absence of dicentrics in the root tips from the two plants.

Dicentric A		Dicentric B	
No. of chromosomes	No. of cells	No. of chromosomes	No. of cells
27 plus a dicentric	19	39 plus a dicentric	8
28 no dicentric	2	39 no dicentric	2
29 no dicentric	1	40 no dicentric	16
	—	41 no dicentric	5
	22		—
			31

Since the dicentrics were not isodicentrics, it is unlikely that they arose from sister reunion after a break in a chromosome. I feel that they support my original theory on the origin of dicentrics in wheat. In any event their presence shows that F_2 seed of an interspecific cross is a likely source of experimental material. Whether these dicentrics will persist until meiosis remains to be seen. They are present in combinations of chromosomes that should have considerable fertility. Seed set may be good, and the dicentric may be transmitted intact. It may also be possible to use these stocks in a planned breeding program. They offer several possibilities.

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14 December 1954.

Non-Mendelian Segregation in a Single Tetrad of Saccharomyces Ascribed to Gene Conversion

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Gene conversion (*1*) is the interaction, occurring at meiosis, between the dominant and the recessive allele in a heterozygote, resulting in the transformation of one or more dominant alleles into the corresponding recessive allele, or vice versa. Gene conversion is essentially a directed mutation occurring at meiosis as a result of the effect of homologous alleles upon each other; it does not occur (or is not apparent) at the meiosis of homozygous diploids.

Conversion of white to pink yeasts has been pre-

viously reported (*2*) : two tetrads, each producing one white and three pink cultures, were discovered in a pedigree comprising 60 tetrads; in 57 other tetrads, regular segregation of the genes controlling pinkness and whiteness occurred. (All four clones were white in one tetrad because of the segregation of a tetraploid zygote.) The 3 : 1 segregations were ascribed to gene conversion, but the clones arising from the tetrad were not studied genetically.

After these data had been collected, more than 2500 tetrads were analyzed before the appearance of the irregular tetrad, which is the subject of this paper. Nearly one-half of the asci were heterozygous for pink and white, and regular segregation of pinkness and whiteness occurred in all heterozygous tetrads. No pink cultures were found among the numerous progeny of hybrids homozygous for white, proving that mutation from white to pink (as distinguished from gene conversion) is extremely rare. Homozygous pink hybrids invariably produced four pink clones per tetrad. The stability of the pink-white pedigree, indicated by the 7-yr lapse before finding a third irregular tetrad, establishes its usefulness as a genetical marker and validates its choice as an indicator of non-Mendelian segregation.

Pink cultures are adenine-dependent (*3*). Pink clones undergo variation from pink (adenine-dependent) to adenine-dependent white with high frequency on *vegetative* reproduction. The derived white cultures are stable on vegetative reproduction (on media containing adenine) with regard to both adenine-dependence and whiteness. When adenine-dependent white clones (derived from pink) are outcrossed to normal white clones (that is, adenine-independent), regular (2 : 2) segregation of pink (adenine-dependent) and white (adenine-independent) is found among the tetrads, proving that the change from adenine-dependent pink to adenine-dependent white occurring on vegetative growth has not affected the gene controlling adenine-dependence. Throughout this analysis all clones were tested for adenine-dependence and adenine-independence by growth in an adenine-deficient medium; all pink clones were adenine-dependent and all adenine-dependent clones were pink immediately upon isolation of the ascospores. Thus, the variation (*Dauermodifikation*) from adenine-dependent pink to adenine-dependent white occurring in vegetative propagation did not constitute a difficulty in the genetical analysis.

The purpose of this paper is to present the genetical analysis of the clones derived from the recently isolated irregular tetrad for pink and white, since the individual clones derived from the irregular tetrads previously described were not analyzed genetically. The genotype of the exceptional tetrad is described in Fig. 1 (family I). The zygote was heterozygous for the genes *DX/dx, GA/ga,* and *MG/mg* in addition to the genes controlling pinkness and whiteness. *DX/dx* segregated independently of *GA/ga,* producing a tetratype tetrad and proving that all four products of meiosis had been recovered and, therefore, that the irregularity in regard to pinkness and whiteness could not be the result of the disintegration of one of the four nuclei produced by meiosis and its replacement by an extra mitosis following the meiosis—a mechanism originally proposed by Winge and Roberts (*4*).

Nine other sister tetrads in family I showed regular segregation for pinkness and whiteness. Families II and III were produced by outcrossing the white culture derived from the irregular tetrad by pink cultures from other sources. A sample tetrad from each family is described in which regular segregation for at least three separate marker genes occurred, thus establishing the regular haploid nature of the white culture derived from the irregular tetrad. Families IV, V, and VI, respectively, show the results of outcrossing the three different pink clones derived from the irregular tetrad with other haploid stocks. The regular segregation of the genes for which the outcrosses were heterozygous in all three families establishes the regular haploid nature of the three pink cultures. The fact that all four clones are haploid excludes the possibility that

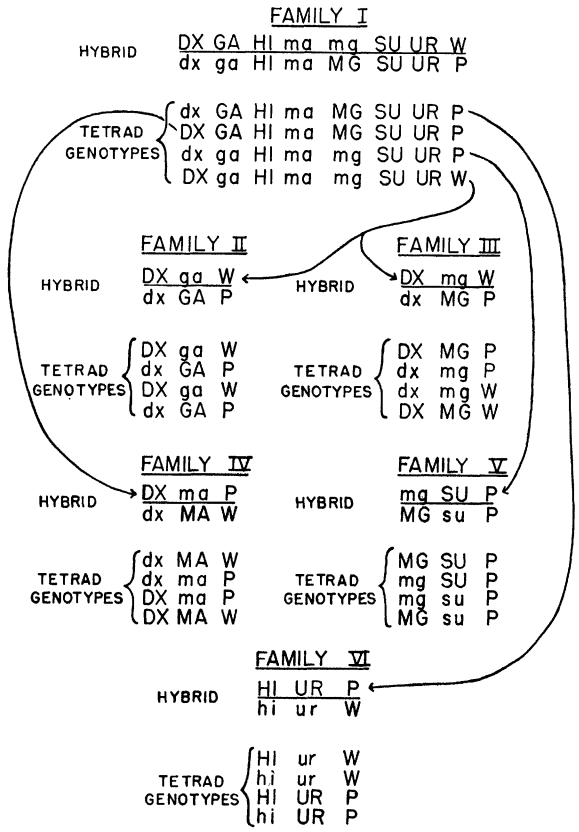

Fig. 1. The genetical analysis of six families derived from a tetrad in which non-Mendelian segregation of a gene controlling pinkness and whiteness (*P/W*) occurred. The genes *DX/dx* control the fermentation of dextrin; *GA/ga* control the fermentation of galactose; *HI/hi* control the synthesis of histidine; *MA/ma* control the fermentation of maltose; *MG/mg* control the fermentation of alpha-methyl glucoside; *SU/su* control the fermentation of sucrose; and *UR/ur* control the synthesis of uracil.

the irregular ratio could have originated by fusion following an extra mitosis, as was proposed by Winge and Roberts (*5*).

The haploid nature of the four clones from the irregular tetrads was confirmed by other criterions of ploidy. Pittman and Pedigo (*6*) studied their x-ray survival rates and found that they yielded target values of 1, proving their haploid nature. Ogur and St. John (*7*) analyzed the nitrogen per cell and the Klett reading per cell and found that these criterions of ploidy also established the haploid nature of the four cultures. Detailed genetical analysis of the families will be presented elsewhere (*8*).

Since no other proposal concerning a mechanism capable of producing three recessives and one dominant from a diploid zygote has proved adequate, it is inferred that the irregular segregation described here is an example of gene conversion.

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17 January 1955.

Communications

Structure of Diatretyne 2, an Antibiotic Polyacetylenic Nitrile from *Clitocybe diatreta*

The polyacetylene, diatretyne 2 (*1, 2*), that is, "diatretyne nitrile" has the structure 7-cyano-2-heptene-4,6 diynoic acid (I), which differs from that of diatretyne 1 (*2*)—that is, "diatretyne amide" (II)—only in that it possesses a nitrile group instead of the amide group (*3, 4*).

$$\underset{\text{(diatretyne nitrile)}}{\underset{\text{(I)}}{HOOC{-}CH{=}CH{-}C{\equiv}C{-}C{\equiv}C{-}C{\equiv}N}}$$

$$\underset{\text{(diatretyne amide)}}{\underset{\text{(II)}}{HOOC{-}CH{=}CH{-}C{\equiv}C{-}C{\equiv}C{-}CONH_2}}$$

The antibiotic activity previously attributed to II (*1, 5*) was due entirely to contamination with about 1 percent of I. A synthetic sample of II (*6*), as well as a natural sample freed of I by countercurrent distribution, showed no activity against *Micrococcus pyogenes* var. *aureus* in concentrations as high as 1 mg/ml. Diatretyne nitrile is active at a concentration of about 0.1 μg/ml.

The structure of I was elucidated by analysis of the polyacetylene and its reduction product, in conjunction with the ultraviolet absorption spectrum of I (*1, 2*) and by interconversion of the nitrile and amide.

A sample of I gave the following analytic values: found, C 66.19, H 2.15, N 9.70, O 22.05, N.E. 143; calculated for $C_8H_3NO_2$ (145.11), C 66.21, H 2.08, N 9.65, O 22.05, N.E. 145.

Catalytic reduction of I using Adams PtO_2 catalyst gave a crystalline water-soluble product, which analyzed well (except for the N value) for $C_8H_{17}NO_2$, the molecular formula for an amino-octanoic acid, presumably III, the expected reduction product of I. The low N value may be due to the presence of secondary amine (IV), a probable by-product of the reduction. Found, C 60.36, H 10.56, N 7.91; calculated for $C_8H_{17}NO_2$, C 60.34, H 10.76, N 8.80. Calculated for a mixture of 87 percent of III plus 13 percent of IV, C 60.79, H 10.71, N 8.25.

$$\underset{\text{(III)}}{HOOC(CH_2)_6CH_2NH_2} \qquad \underset{\text{(IV)}}{[HOOC(CH_2)_6CH_2]_2NH}$$

The ultraviolet absorption spectrum of I shows maxima characteristic of an entriyne (*1, 2*); that is, the C ≡ N grouping conjugated to the acetylenic system behaves chromophorically like a C ≡ C grouping in the same position.

Diatretyne nitrile was hydrolyzed to II and the reaction followed spectrophotometrically. The product was isolated and analyzed. The analytic values agreed with the theoretical for II plus about 11 percent of the di-acid: found, C 58.70, H 3.30, N 7.61, O 30.30; calculated for $C_8H_5NO_3$ (163.13), C 58.90, H 3.09, N 8.59, O 29.42; calculated for a mixture of 89 percent of the amide and 11 percent of the acid, C 58.86, H 3.02, N 7.64, O 30.48.

The reverse conversion, dehydration of II to I involved distillation from P_2O_5, in vacuum at about 150°C. As was to be expected, the yield of I was only a few percent of the theoretical, owing to destruction of the major portion of the polyacetylenes under these relatively drastic conditions. However, the presence of I could be demonstrated by the ultraviolet absorption spectrum of the product and by its activity against *M. pyogenes* var. *aureus*. The ultraviolet absorption spectrum showed the maxima characteristic of I. The potency of the product calculated on the basis of its optical density at 302 mμ compared with the known $E^{1\text{ percent}}_{1\text{ cm}}$ value of the maximum of I at this wavelength was the same as that of pure samples of I.

Nitriles of biological origin have rarely been reported (*7*), and I is believed to be the first example of a biologically produced polyacetylenic nitrile. Its antibiotic activity must be attributed entirely to substitution of a nitrile group for an amide group, in a molecule of otherwise identical structure (*2*). The