

stability requirement of Lagrange-Dirichlet). In addition, the conditions are satisfied in the other extreme case of complete non-integrability, as represented by the case of metric transitivity, a case underlying the classical ergodic hypothesis of statistical mechanics. In fact, this case is characterized by the condition that  $\varphi_P(V)$  be always the ratio of the volumes of  $V$  and  $S$ ; so that, in particular,  $\varphi_P(V)$  is independent of  $P$ .

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<sup>1</sup> Birkhoff, G. D., *Proc. Nat. Acad. Sci.*, **17**, 656-660 (1931).

<sup>2</sup> Wintner, A., *Proc. Nat. Acad. Sci.*, **18**, 248-251 (1932).

<sup>3</sup> Wintner, A., and Hartman, P., *Amer. J. Math.*, **61**, 977-984 (1939).

## Genetical Sterility in *Pisum sativum*

COMPLETELY sterile plants were observed by Miss Pellaw in the offspring of a plant chimerical for structural hybridity. The fertile and half-sterile branches both gave a certain proportion of sterile plants. This character has been further studied in material kindly supplied to us by Miss Pellaw. The sterility, which is occasioned by a complete failure of pairing at meiosis, is present on both male and

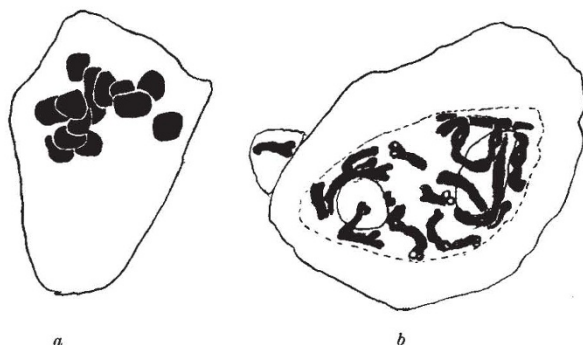


Fig. 1 ( $\times c. 2100$ )

female sides. Illustrated are two stages in meiosis from the ovule showing in Fig. 1a, metaphase I with 14 univalents, and in Fig. 1b prophase II after a 13:1 distribution of chromosomes. The general behaviour at meiosis would appear to be similar to the case reported for *Datura* by Bergner, Cartledge, and Blakeslee<sup>1</sup>. The character is inherited as a recessive, the following segregation values having been obtained from semi-sterile  $F_1$ 's: 73 semi-steriles; 57 fertiles; 33 steriles, and from fertile  $F_1$ 's: 29 fertiles; 14 steriles. Five out of eight fertiles, and seven out of ten semi-steriles tested were found to be heterozygous for sterility. Sterility may be due to a single gene, but it is more probable, in view of its origin, that a complex of genes, due to a deficiency or duplication associated with the reciprocal translocation, is involved. This is being further investigated.

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<sup>1</sup> Bergner, A. D., Cartledge, J. L., and Blakeslee, A. F., *Cytologia*, **6**, 19-37 (1934).

## A Pigmented Nucleus

In the course of our work on growth-promoting substances, we have cultured many different kinds of pollen tubes as test subjects during the last two years. We discovered a very unusual kind of nucleus in the tube of *Hymenocallis tubiflora*. The germinal nucleus is naturally pigmented and is of a reddish-brown colour. This was particularly fortunate for us because it permitted us to follow changes in form and position of the nucleus in the various stages of germination, from the time that the grains were sown, up to the time when the well-developed tube burst at the tip and the nucleus emerged and came to lie free on the surface of the culture medium. The favourable colour made it easy to photograph the nucleus in different phases while it was alive.

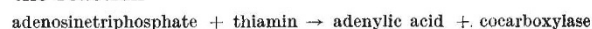
So far as we are informed, no previous mention of a pigmented nucleus has been made.

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## Mechanism of the Enzymatic Phosphorylation of Thiamin

WE have previously demonstrated that thiamin pyrophosphate may be synthesized from the free vitamin by the action of enzymes present in alkaline washed brewer's bottom yeast, provided that hexosediphosphate and certain factors present in boiled aqueous extracts of animal tissues are present<sup>1,2</sup>. Synthesis under these conditions was completely inhibited by 0.005 *M.* sodium iodoacetate, but was relatively unaffected by 0.04 *M.* sodium fluoride. More recently<sup>3</sup>, we have demonstrated that cozymase and acetaldehyde may be substituted for the boiled tissue extract with no change in the degree of synthesis or of the iodoacetate inhibition. Phosphoglyceric acid may also be substituted for the boiled tissue extract, but under these conditions iodoacetate fails to affect the synthesis while fluoride causes complete inhibition<sup>3</sup>. Using specially prepared alkaline washed yeast, we have found that cocarboxylase synthesis with phosphoglyceric acid is considerably diminished. It may be restored, however, by the addition of catalytic quantities of adenylic acid. As a result of these experiments we have proposed the reaction



Experiments performed in an attempt to test this equation directly showed that synthesis may be performed with adenosinetriphosphate, but only after a lag of 40-60 minutes. The velocity of the synthesis in the presence of phosphoglyceric acid is considerably greater. The degree and velocity of the synthesis with adenosinetriphosphate may be stimulated by the addition of cozymase, and it is inhibited by iodoacetate. These results may be explained by the finding that glucose inhibits the synthesis of cocarboxylase in the presence of phosphoglyceric acid and adenylic acid. The poor synthesis with only added adenosinetriphosphate may be explained on the basis of the competition of other phosphate