

A HETEROCHROMOSOME OF MALE ORIGIN IN ECHINOIDS.

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The observations of Baltzer ('09) seem to have led to an immediate conclusion that in echinoids the female is the heterogametic sex while the male is homogametic. My observations on the *Hipponoë* ♂ × *Toxopneustes* ♀ cross, taken in conjunction with those of Heffner ('10) and Pinney ('11) show that this conclusion cannot be final. The study of the material mentioned has given convincing evidence that in *Hipponoë esculenta* (*Tripneustes esculentus*), a heterochromosome is carried by half of the spermatozoa and that the dimorphism of somatic chromosome groups in straight fertilized *Hipponoë* and *Hipponoë* ♂ × *Toxopneustes* ♀ material must be correlated with dimorphism of the spermatozoa.

The heterochromosome in question is hook-shaped in form (*H* Fig. 1, *A*, *H* Fig. 2, *B*). In a study of fifty-two spindles in

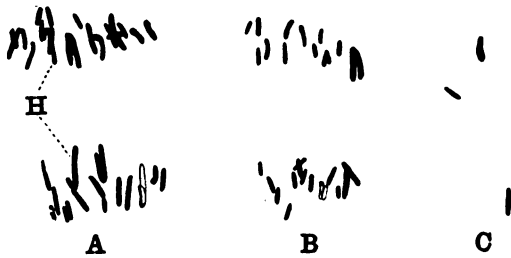


FIG. 1. *Toxopneustes* ♀ × *Hipponoë* ♂. Three longitudinal sections of one spindle in anaphase. In *A* and *B* two chromosomes left in outline for sake of clearness. 33 chromosomes shown. Hooks in side view. ×1,500.

which I was able to reach a definite conclusion as to the presence or absence of the hook-shaped element, it was found to be present in twenty-eight and absent in twenty-four instances (Fig. 3).

Miss Pinney ('11) has been able to show the occurrence of this element in half of the straight fertilized *Hipponoë* eggs. The

non-occurrence of such an element in *Toxopneustes* eggs has been shown by Heffner ('10) and by further study in my laboratory with this point in mind. I have been able to determine that this hook-shaped chromosome is present in half of the *Toxopneustes* eggs which have been fertilized by *Hipponoë* sperm.

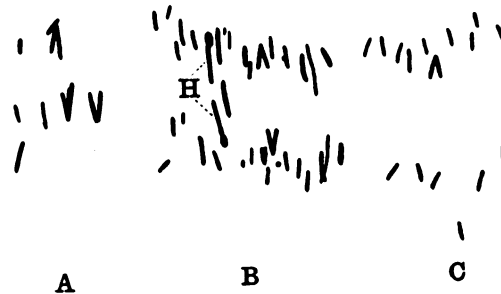


FIG. 2. *Toxopneustes* ♀ × *Hipponoë* ♂. Three longitudinal sections of one spindle in anaphase. 31 chromosomes shown. Hooks in front view. ×1,500.

By this analysis of the subject it is therefore shown: (1) That the hook-shaped chromosome is peculiar to *Hipponoë*, (2) that this chromosome is carried by the *Hipponoë* spermatozoa, and (3), that, since this element is found in half of the straight fertilized

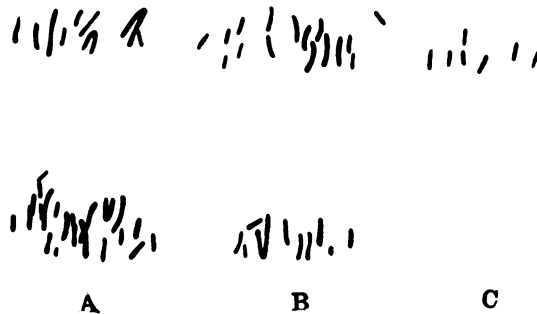


FIG. 3. *Toxopneustes* ♀ × *Hipponoë* ♂. Three longitudinal sections of one spindle in anaphase. 32 chromosomes shown. No hooks present. ×1,500.

eggs and in half of the cross fertilized eggs it must be present in but half of the spermatozoa.

No conclusive statement can as yet be made regarding the number of chromosomes in these eggs. The old idea that the somatic number of chromosomes in echinoderms is either eighteen

or thirty-six is evidently incorrect. Pinney ('11) has shown for *Hipponoë* 32 or 33. Heffner ('10) counted 36 for *Toxopneustes*. Pinney ('11) counted 37 or 38 in anaphase plates in *Toxopneustes*, counts which I was able to verify. In the cross fertilized eggs figured in this paper the counts vary. Fig. 1 shows 33; Fig. 2 shows 31; Fig. 3 shows 32.

Miss Pinney ('11) has given as full a discussion of the subject as the facts known at this time warrant. For a conclusive resumé a full knowledge of the development of the germ cells in these forms now seems almost imperative.

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