

THE HISTORY OF THE SEX-CELLS FROM THE TIME OF SEGREGATION TO SEXUAL DIFFERENTIATION IN  
CYMATOGASTER.

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ABSTRACT.

Cymatogaster is a small fish, abundant along the coast of California and extending as far north as Alaska. It inhabits the shallow water of bays. It is a member of the viviparous family Embiotocidæ, and in it viviparity has produced changes greater than in any other member of the family with the possible exception of *Abeona minima*. I have described the general development elsewhere and wish to give an account of the reproductive cells from their first appearance till the sexes have become distinct. An account of the early history of these cells I have published in the Journal of Morphology for 1893. I there traced these cells from their early segregation till they became located in the mesentery of the hind gut in larvae 2.5 mm. long. During this time they did not divide. These same cells that originally became segregated as sex cells migrated with the development till they became located as noted above. In larvae 5 and 7 mm. long the cells still retain their individuality, but have undergone a measurable change. Soon after the 7 mm. stage is passed the sex cells begin to divide. In the meanwhile they have migrated laterad and lie for the most part in a longitudinal fold of the peritoneum where they are mixed with a few cells of peritoneal origin which later give rise to the entire stroma of the sex glands. In one case such a sex ridge was formed much further forward than usual, in connection with a few sex cells which were accidentally belated in their migration. Behind, the sex ridges of the two sides are united into a single ridge. The descendants of one of the original sex cells divide rhythmically so that in later stages little nests of sex cells in the same stage of



division are frequently found. There is considerable variation in the rate of segmentation in larvae of the same size, but the following will give an idea of the segmentations and the number of sex cells in different stages :

Size of Larva.	No. of Sex Cells.	No. of Generations From Fertilization.
.45— 5 mm.	9— 15	5
8 mm.	22	6
10 mm.	28— 183	6— 9
12 mm.	39— 143	7— 9
15—17 mm.	638—2,280	11—13 Sexes distinct.
16—25	2,200—8,000	13—15

The sexes can first be distinguished after about eleven segmentations from fertilization. The differences are first apparent in the tunic of peritoneal cells which has become much thickened on the median side of the sex ridge. A small groove on the outer ventral part of the sex ridge is the first indication of the ovarian cavity and is the surest criterion of the female. In the male the sex gland remains much more circular in cross section and no groove is developed. Much later, histological differences in the sex cells can be made out. These differences consist in the long, slender chromatin threads of the female cell just before division, being represented in the male of the same stage by short thick bars. The paper was illustrated by black board sketches and about three hundred figures. In summing up it was concluded that the peculiarities of the sex cells are due to histogenesis, and their function to the division of labor and not to the transmission from generation to generation of unchanged germ-plasm. Many of the causes assigned as determining sex are not applicable to the present case. While the when, the where and the how, the sexes become distinct is determined for *Cymatogaster*, the why is still left in doubt.



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