

Morphological Changes in *Euglena mesnili*

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In order to understand the normal physiological and behavioral capacities of an organism, it is usually studied under its normal environmental conditions. To understand its complete capabilities, however, an organism should be investigated under less optimal, even unfavorable, environmental conditions. *Euglena mesnili* has been observed undergoing extreme morphological changes in response to unfavorable culture conditions. These "monster" forms are believed to represent a physiological response to the depletion of certain necessary chemical compounds from the medium.

Similar formations have been reported previously in other species of *Euglena*, although no explanation for their morphological changes was attempted. Gojdics (1934) reported an anomalous form of *Euglena deses* with five parts attached to a common body. No nucleus could be observed and one of the five arms was actively moving, seemingly in the process of breaking off from the large central mass. In all other respects its morphology appeared normal.

Euglena mesnili Deflandre and Dusl, 1935, has been kept in stock in the Cambridge University collection and, since 1953, in the Indiana University Algal Culture Collection (No. LB 370). The culture observed here was obtained from Indiana University. Stocks were transported with little organic matter in the vial, suitable for preparing immediate subcultures. In the present case, however, the organisms were left in the original vial for one month. *Euglena* requires organic and inorganic compounds, but in a month-old-culture vial the organic material is very limited. When examined, after one month, most cells were irregular in form and less than 10% of the individuals were normal. The depletion of chemical compounds appeared to be the only major environmental difference between a culture containing many irregular forms and one containing predominantly normal forms.

Many of the irregular formations observed in *Euglena mesnili* were similar to that reported by Gojdics in *E. deses*, although the number of aberrant individuals was much greater. In addition to the most common form, i. e., several arms attached to a large common mass (Fig. 1), several other interesting formations were observed. These included an enlarged, star-shaped form densely packed with chromatophores (not illustrated), and many individuals combining characteristics of dividing cysts, nonmoving semicontracted pseudopodia, and narrow spikes of cytoplasm joined to a sphere.

The arms of these irregular forms were usually in motion, first contracting into rounded balls, then quickly extending into slender pseudopodia-like structures, reminiscent of pseudopodial movement. One major difference, however, was that the locations of arms on the central mass remained constant. Often coincident with the contraction-extension movement was the twisting movement of an entire arm. This was only observed, though, in relatively large arms with only narrow cytoplasmic bridges connecting with the rest of the body (Fig. 2). Such movements possibly indicate fission between the arm and the central mass, though no complete fission was observed.

Chromatophores were seldom observed in actively contracting arms. Instead, they remained packed in the central body area. However, in such

an individual, discussed above (Fig. 2), the arm was nearly the size of an average normal *E. mesnili*. Both the arm and the central body contained many chromatophores which were seen moving across the cytoplasmic bridge. In the star-shaped form previously mentioned, all four arms and the central body were densely packed with chromatophores. This differed from the previous individuals in that the arms were joined by a very broad attachment. In addition, individuals such as the star-shaped ones were never seen in motion.

Each arm normally possessed a stigma, or eyespot. In *E. deses*, Goidics (1934) even observed an eyespot fragment into five pieces in an irregular form with five arms.

Evidence accumulated by observation seems to indicate the possibility that some type of multiple fission, or related activity, can be induced in *Euglena mesnili*, and possibly other *Euglena* species, when they are maintained for extended periods under unfavorable environmental conditions. The most obvious inducement seems to be a depletion of necessary chem-

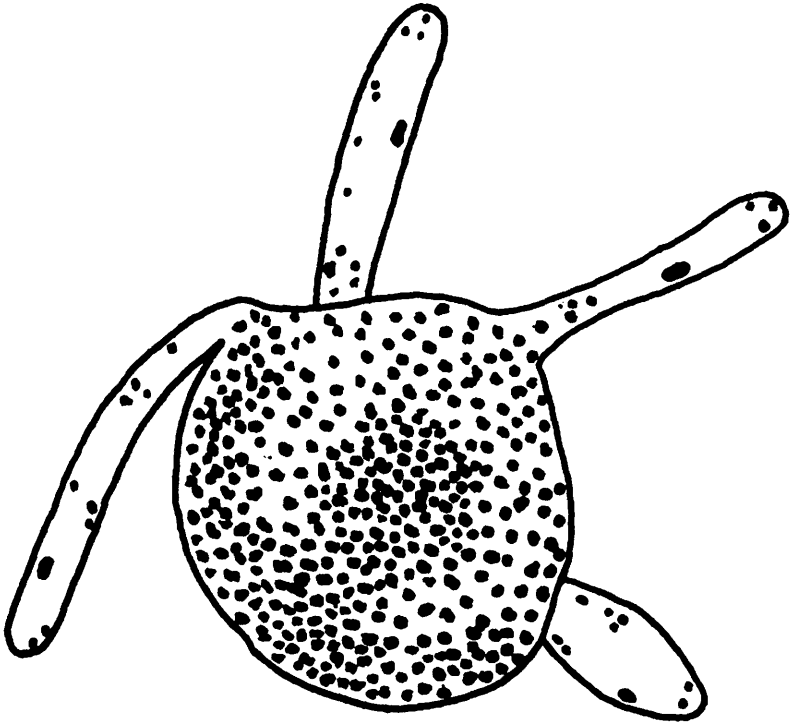


Fig. 1

Figure 1. This figure shows the most commonly occurring morphology. Four arms almost devoid of chromatophores are attached to a central spherical mass, densely packed with chromatophores. Each arm contains a stigma.

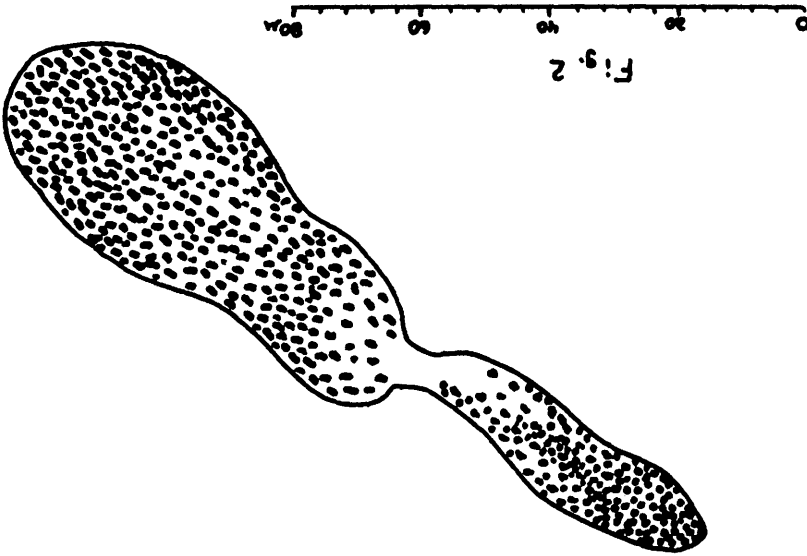


Figure 2. In this figure an almost normally shaped *Euglena* arm is seen attached by a wide cytoplasmic bridge to the larger mass. Both parts contain numerous chromatophores. In the culture the *Euglena*-like arm was seen twisting and contracting as if separating from the larger mass, as in normal fission.

ical compounds from the environmental medium.

Evidence of multiple fission includes (1) the observation of several arms, usually four in number but varying from two to five, attached to a common spherical chromatophore-containing body; (2) the fact that these arms were observed to attain the size and approximate shape of a normal *E. mesnili* in some of the atypical individuals; (3) the observation of certain movements, described above, in which the arms appear to be slowly separating from the central body; and (4) the observation that the arms each possess an eyespot, characteristic of individual *Euglena* cells.

Future work must be done to support the hypothesis presented here. Such work will include investigations (thus far unsuccessful) of the nucleus, the attempt to observe the complete phase of life and reproduction in one individual, and an identification of environmental conditions inducing this activity.

LITERATURE CITED

- Deflandre, G., and H. Dusi. 1935. Description d'une Euglène nouvelle, *Euglena mesnili* nov. spec. Arch. Zool. Exp. Gen. 77: Notes et Revues 12-14.
- Gojdics, M. 1934. The cell morphology and division of *Euglena deses* Ehrbg. Trans. Amer. Microsc. Soc. 53:299-310.