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Structural Connections between Flagellar Base and Stigma in *Dinobryon*

Brief Report

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With 3 Figures

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In the *Chrysophyceae* the putative photoreceptor system usually consists of a chloroplastidic stigma in juxtaposition to a swelling on the second (*i.e.*, smooth) flagellum (eyespot type B, after DODGE 1969). The flagellar swelling is generally considered to be the site of photoreception, with the stigma acting as a shield or filter for the light. It is possible, however, that the stigma might play a more active role in the photoreceptive process; if so, then the problem of impulse transfer from stigma to flagellum must be considered. Our examinations of the supposed photoreceptive system in *Dinobryon* have revealed some previously unreported structural details which might permit such impulse transfer.

The material for this investigation, *Dinobryon cylindricum* Imh. var. *alpinum* Bachm. was collected from natural populations in ponds in North Zealand, Denmark: Karlssø (27-4-72) (in cooperation with Dr. D. J. HIBBERD, Cambridge, England) and Børstingerød village pond (13-5-75). Standard methods were used for fixation and embedding.

Figs. 1 and 2 show the main components of the supposed photoreceptor system in *Dinobryon*. The stigma is located anteriorly in one of the two chloroplasts and consists of osmiophilic globules arranged in a monolayer overlain by the chloroplast envelope and one-to-several thylakoids (JOYON 1963, WUJEK 1969, FRANKE and HERTH 1973). The basal bodies, close to the stigma, lie at an angle to one another. The base of the flimmer-flagellum (I) is provided with an extensive root system, consisting of both a microtubular and a striated root, presumably providing mechanical support. The basal body

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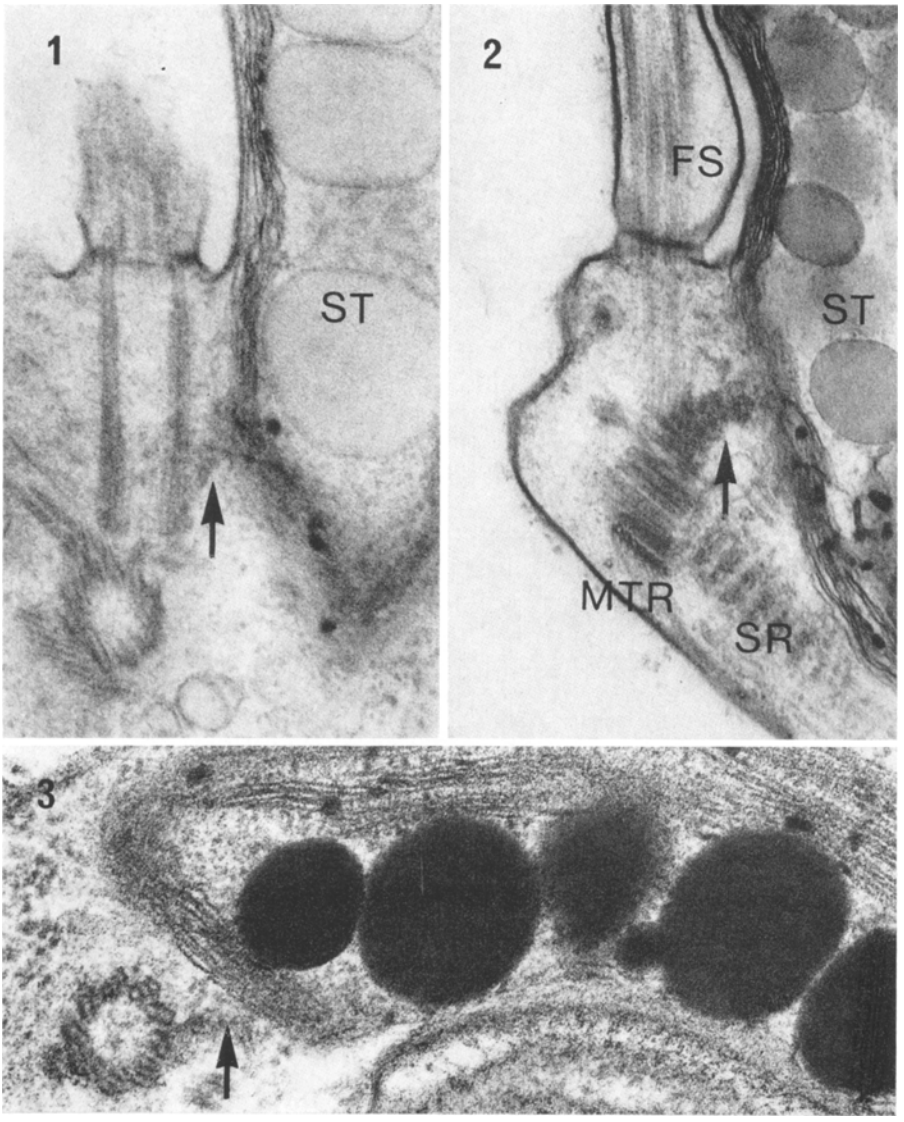

Fig. 1. Transverse section through apical portion of a *Dinobryon* cell. Basal body I with its root system is seen in transverse section, basal body II in longitudinal section. The connection between basal body II and the stigma region (*ST*) is indicated by an arrow. ×40,000

Fig. 2. Oblique section through apical portion of a *Dinobryon* cell shows stigma (*ST*), flagellar swelling (*FS*), and glancing sections of both flagellar bases. The microtubular root (*MTR*) and the striated root (*SR*) from basal body I are evident. The connection from basal body II to the stigma-containing part of the chloroplast is indicated (arrow). ×40,000

Fig. 3. Transverse section of basal body II shows connection (arrow) to the stigma region. ×48,000

of the smooth flagellum (II) has no such root or support system, but it is connected with basal body I by means of a bridge.

In favourable sections, an additional structural component can be seen, connecting the basal body II with the stigma-bearing part of the chloroplast (KRISTIANSEN and WALNE 1975). Fig. 1 shows this basal body in longitudinal section. The connection proceeds obliquely from the proximal part of the basal body to the stigma region of the chloroplast.

The transverse section (Fig. 3) shows that the connection apparently originates from two triplets, but both its mode of attachment to the chloroplast envelope and its structure remain obscure. It does not consist of microtubules but is reminiscent of the connections between cytoplasmic microtubules and basal bodies in tetrasporalean pseudocilia (LEMBI and WALNE 1969) and of the fibrous bridge that connects the two basal bodies in *Dinobryon* (KRISTIANSEN and WALNE, unpublished data).

The function of the connection is open for discussion. It might serve as a purely mechanical support, anchoring the basal body in a particular position with respect to other cellular components. In view of the still-unresolved controversies over the function of stigma and flagellar swelling respectively, however, it should be pointed out that the connection might serve as a means for impulse transfer from stigma to flagellum, and further discussions about photoreceptor-photoresponse systems should take such structures into consideration. Moreover, in view of the possible importance of this structure, one might expect to find it generally distributed in the *Chrysophyceae*. A survey of relevant papers has shown that such structures can be discerned in electron micrographs of several organisms, *e.g.*, in *Chromulina psammobia* in the early work by ROUILLER and FAURÉ-FREMIET (1958).

It would be of interest and potential significance in understanding the roles of stigmata and flagella-associated structures (swelling, parabasal bodies) if structures similar to those reported here were also found in other algal groups.

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