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# Cell division in *Staurastrum gracile* Ralfs. under the scanning electron microscope

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**Abstract.** *Staurastrum gracile* Ralfs. was grown in Chu's No. 10 culture medium, in a culture cabinet at 18–20° C with 16 hrs light and 8 hrs dark period. The cells exhibited polymorphism. The cells were fixed and their division and growth was examined under the scanning electron microscope.

**Keywords.** Desmids ; *Staurastrum gracile* Ralfs.

## 1. Introduction

The process of cell division is unique in desmid biology, with special reference to placoderms, and differs from the other algal groups. Some of the problems it solved, may help in providing a better understanding of some of the principles of morphogenesis and the control of the shape of cells in general. With each division of these, often elaborately-shaped desmids two daughter semicells are produced, which then acquire the typical complex and symmetrical shape of the parent semicells.

Having studied the morphological features, surface ornamentation and polymorphism under the scanning electron microscope (Vidyavati 1981), it was thought desirable to study the division of the cells also.

Previous work on cell division, under TEM and SEM, were mainly contributed by Dodge (1963), Drawert and Kalden (1967), Drawert and Mix (1961), Pickett-Heaps and Fowke (1969, 1970), Pickett-Heaps (1973, 1974, 1975), Schülle (1975) and Brook (1981).

## 2. Material and methods

*Staurastrum gracile* Ralfs. 679/3 was obtained from the culture collection of Algae and Protozoa, Cambridge, U K. The work was carried out at the Botany Department, Royal Holloway College, University of London, U K.

From the cultures thus obtained, unialgal isolations were made following Pringsheim's method and these cultures were maintained in Chu's (1942) 10 medium, at 18–20° C temperature, subjected to alternate light and dark conditions for 16 and 8 hrs, respectively.

Fixation from healthy cultures in exponential growth were made at hourly intervals in order to study the cells at various stages of division and follow the change in shape of the new semicells. The cells were fixed in 1% glutaraldehyde, made up in the culture medium (Chu's 10) for about 1 hr at room temperature, after washing in culture medium, they were then post-fixed for about 1 hr in 1% Osmium tetroxide also made up in the culture medium. They were then washed 3 times in culture medium. The cells were dehydrated in acetone of 30%, 50%, 70%, 90% and 100 %. Fixation, washing and dehydration were all carried out in the centrifuge tubes and each time the cells were centrifuged discarding the supernatant. The cells were then passed through critical point drying procedure. The dried specimens were moved from the CPD apparatus and were mounted on specimen stubs, using transfer on double-sided sticky tape. These were then coated quite heavily with carbon and gold. Specimens were examined at 15 KV in a jeel-JSM-25 S scanning electron microscope.

## 3. Observations and results

*Staurastrum gracile* Ralfs. is known for its polymorphic form, cells are variable, medium in size (length 27–60 $\mu$ ; breadth, including processes, 44–110 $\mu$ ; breadth of isthmus 5·5–13 $\mu$), constriction slight, usually an acute notch ; semicells variable, upper angles produced to from long, slender processes of variable length each with 3 or 4 minute spines and provided with denticulations. The vertical view is usually triangular, sometimes quadrangular, angles are produced to form long processes, chloroplasts are axile with a central pyrenoid in each semicell (West and West 1923).

For many placoderm desmids cell division seems to be the only means of reproduction. Sexual reproduction is rarely observed in nature or under laboratory conditions. During division, the cell symmetry is completely destroyed by a wall that grows around the narrow isthmus joining semicells. During the process of division, the cell enlarges at the isthmus region, and elongates, as a result the semicells are pushed further apart. The median septum then forms and the walls push out to produce the new semicells. As the semicell enlarges lobe formation proceeds and finally the arms of the typical species will be formed by further wall elongation.

When the primary wall is almost fully expanded, the outer secondary wall begins to be laid down with its pattern of ornamentation matching that already established, in the primary wall. The secondary wall also acquires its system of mucilage pores, the position of which are indicated very early in wall, deposition, which penetrate the entire secondary wall.

The daughter cells remain joined to one another, with their apices, until the shedding of the primary wall. These newly formed daughter cells move apart, probably due to the extrusion of mucilage.

It was found that cell division always occurred at a definite time after the beginning of the light period, when the light and dark periods were alternated regularly. This suggests that the onset of illumination triggers the events, which set cell division in motion. Schülle (1975) reported that the total period of development

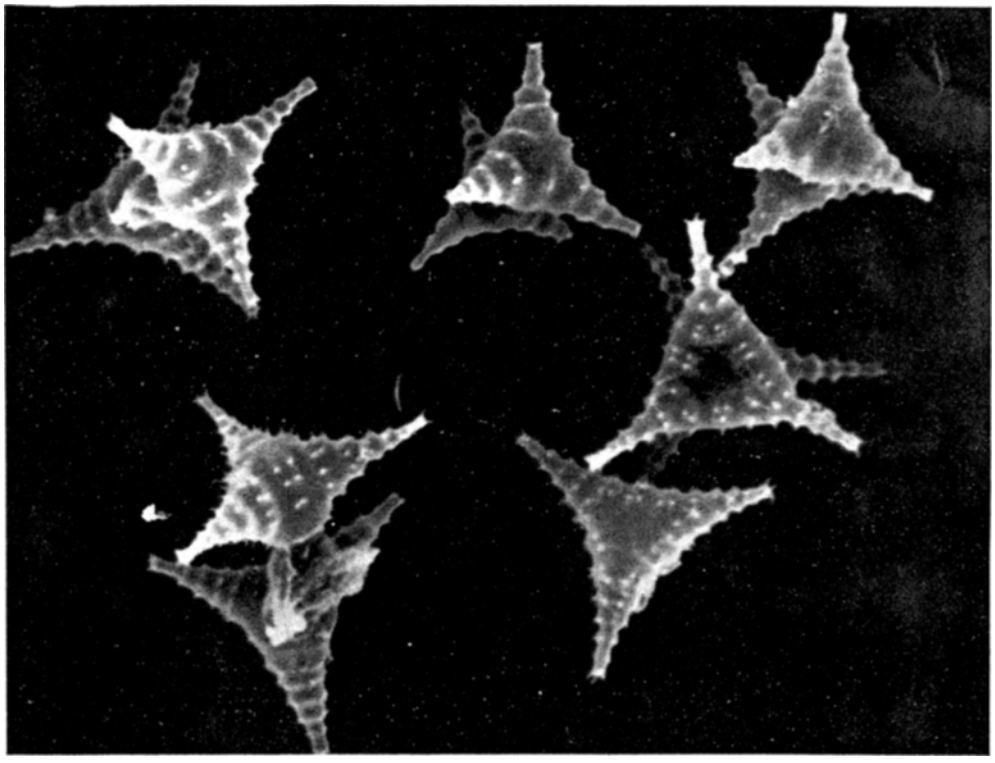
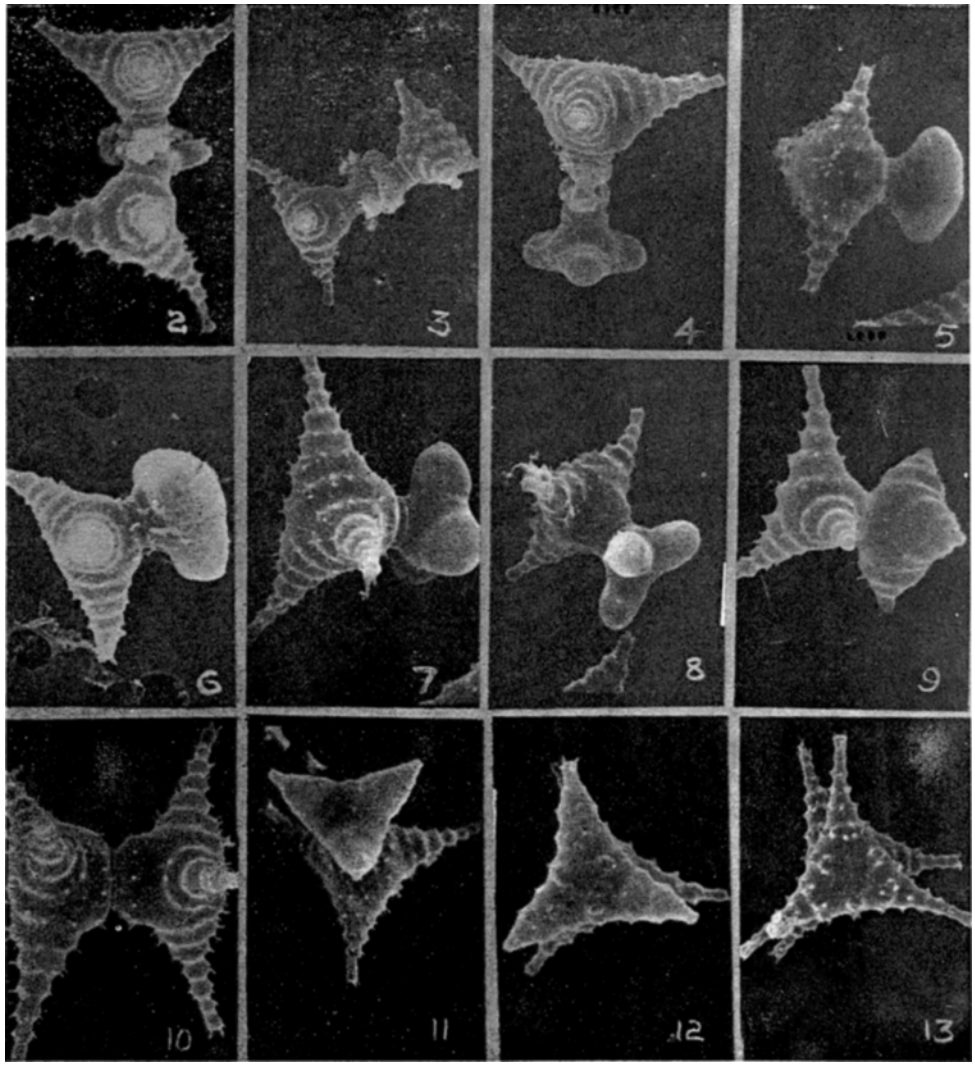


**Figure 1.** *Staurastrum gracile* Ralfs. showing triradiate form ( × 980).




**Figures 2–13.** *Staurastrum gracile* Ralfs. cell division. **2.** Isthmus region becoming elongated. **3** and **4.** Semi cells becoming separated. **5, 6** and **7.** The young semi cell showing bulged and lobed condition. **8.** The lobes elongating. **9.** The development of the typical ornamentation and shape of the semicell. **10.** Mature cell, in side-view. **11** and **12.** Development of the semicell in a triradiate form. **13.** Mature cell viewed from above. **[(2, 3, 11 end 13** (× 840). **4–10** and **12** ( × 1120)]

of newly-formed semicells was from 2–3 hrs. Their development was complete after this interval of time, but the actual separation of the newly formed cells usually took another 3 hrs. Under these conditions, cells divide only once every 24 hrs.

Scannnig electron microphotographs were taken at various stages of division. Figure 1 illustrates cells in a population, mostly, in a triradiate form. Figures 2, 3 and 4 show enlargement of the isthmus region. Figure 5 shows one smooth young semicell. Figures 6, 7 and 8 show young semicells bulged and lobe formation. Figure 9 shows the development of the typical ornamentation and shape of the semicell. Figure 10 shows mature cell in side-view. Figures 11 and 12 show development of the semicell in a triradiate form and figure 13 shows mature cell viewed from above. Thus figures 2–13 illustrate the various stages in the cell division of the species, under investigation.

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