OBSERVATIONS ON DESMIDIACEÆ, WITH A LIST OF SPECIES FOUND IN TASMANIA.

[By E. D. Harrop.]

These beautiful plants are of an herbaceous green color, and belong to the Cryptogamic division of the vegetable kingdom. They have attracted attention not only on account of the striking beauty and variety of their forms, but also by reason of the doubt as to their position, whether in the animal or vegetable kingdom, having caused considerable discussion amongst learned algologists. They are now almost universally assigned to the vegetable kingdom. The presence of starch in the ludochrome, and their mode of conjugating, constitute incontestable proofs of their vegetable organisation, notwithstanding the arguments of Professors Ehrenberg, Dalrymple, and Bailey to the contrary.

The principal arguments in favor of their animality are passed in review by Ralfs. They are,—first, the power of voluntary motion that they possess; second, their increase by voluntary division; third, the definite organ, possessed by some genera, in which active molecules appear to enjoy an independent motion, and the parieties of which appear capable of contracting upon its contents; fourth, the swarming motion which takes place at a certain stage of their growth. Other arguments have been advanced in support of this side of the question, and Ehrenberg went so far as to describe orifices, having protruding organs or feet immediately behind them, the basis of such organs being the moving molecules which are always opened at the ends of the Closterium. Notwithstanding the great improvement in the microscope since the time of this distinguished Professor, his observations have never been corroborated, and there is little doubt but that in this instance he allowed his imagination to overrule his general accuracy.

The power of motion and increase by self-division have now been abandoned as proofs of animality. It is manifest that they can transport themselves or, perhaps are transported under the subtle influence of light, from one place to another; for if a mass of Desmidieæ be placed in a glass vase, the one side of which is exposed to the sun's rays, we shall find, after a short time, that most of them have found their way to the illuminated side of the glass. Professor Bailey also writes,—"I have had species of Closterium and Euastrum confined in a compressor, in water perfectly free from other bodies, and they moved so fast that I found it impossible to sketch their forms with the Camera Lucida until they were killed." I

have also observed this fact, but the movement always seemed to me of an irregular and involuntary kind, not nearly so vigorous as that of the Diatomaceæ, which Professor Max. Schultze has shown to be caused by protoplasm coming out of and re-entering minute perforations in the shell of the Diatom.

The most extraordinary phenomenon exhibited by some of the Desmidieæ is that swarming of zoospores mentioned above. I have observed it in the genera Docidium and Cosmarium. The zoospores in the Desmid appear to be endowed with tumultuous life, and the motion can be compared only to the swarming of bees. But although this motion has been claimed as a proof of animality, it has never been observed in any undisputed animal organism, whilst it has been frequently seen in several species of Confervoid Algæ. My own observation extends to a specimen of the Draparnaldia Nana obtained from the North Esk River. I made a note of the process at the time which I will here transcribe,—" Within each cell of the plant there were several small dark vesicles interspersed throughout the endochrome. These vesicles moved about. The branches of the plant fell from their pristine erect position as if overcome by the weight of the endochrome, or, as if the cell walls might be decaying. Then the endochrome in each cell divided into two portions, within each of which were some of the dark moving vesicles above mentioned. These two divisions of endochrome rapidly assumed an oval form, and obtained a surrounding of cellulose. Presently each evinced agitation as if suddenly endowed with life, and they commenced to revolve and beat from one side to the other of the containing cell as if anxious to escape. In a minute or two more their cell burst, and they shot out twirling round and round, rushing hither and thither as if in ecstasies at their newly acquired life power. After from five to ten minutes of this display of active life they became more sober and gradually assumed a quiescent state, some resting singly, but the greater number aggregating." It is a marvellous sight. You are watching a beautiful but inert plant; suddenly its branches droop, and as suddenly the contents of each cell became endowed with impetuous, tumultuous, exuberant life.

Each frond in the Desmidieæ is a single cell, and each cell has a suture, in some species hardly recognisable, in others the constriction is so deep as to extend almost entirely across the cell, the segments being joined only by a narrow isthmus giving it the appearance of two cells instead of one. That the frond is a single cell there can be no doubt, however much appearances in some species *(vide* Micrasterias, Euastrum, Cosmarium) may lead one to think otherwise. The proof that there is no septum between the segments is readily seen, for

if an opening be made in one of the segments the contents of both will escape thereout; and, moreover, we observe granules passing the whole length of the frond without impediment. A further proof lies in the conjugation of the cells and the formation of sporangia. The formation of one sporangium only at the point of contact of the two fronds does not accord with the notion of each frond having two cells.

The multiplication of cells by transverse division is full of interest, if only on account of its being the principal mode of reproduction in the protozoa. The process is exhibited as observed by me in a species of Closterium at page 4, fig. 2, of the accompanying book of illustrations. The fission takes place at the centre on the line of division of the two segments, the constriction becoming deeper and deeper until separation ensues. During the process the endochrome in each segment gradually separates and assumes the position of that in the mature plant, *vide* fig. 2, 6. On separation, the obtuse end becomes pointed, fig. 2, c., and lengthens out until complete development is attained.

It has been recorded that probably the Desmidiaceæ are truly reproduced only in two modes; the one by the escape of the granular contents immediately after the swarming process, and the other by the formation of sporangia, resulting from the conjugation of the cells. Late authorities mention four: first, cell division; second, the retraction of contents from parent cells and transformation of same into ciliated zoospores; third, division of cell contents into a number of zoospores; fourth, conjugation. My own observations on the Closterium striatolatum lead me to add another mode, viz., by the formation of a spore in each segment of the frond without conjugation, *vide* illustrations, page , figs 1, 1b. 1c. Whilst in coupling one sporanguim results from the connection of two fronds, we have here two spores in each frond. I made a large gathering of the C. Striatolatum this summer, and failed to find any of them in a state of conjugation, although it is commonly observed in this Desmid; whilst in all those sufficiently mature, I found spores as depicted in the figures, besides great numbers of them in the water free from the fronds. Fig. 1c. shows the frond ruptured and the spore ready to pass out. The ultimate history of these spores I shall endeavor to trace through the ensuing winter and spring. The universality of the Desmidieæ can be readily understood when we find their germs protected in indurated spore cases such as these. They may be wafted by the wind, or carried by various animals to any distance, when meeting with suitable conditions they burst into life. Darwin mentions fine dust clouds, which, on examination, were found to contain a large

percentage of infusorial forms, falling on board the "Beagle," when several hundred miles from any land.

It is considered that those sporious bodies, called Xanthidium, found in flint are sporangia of Desmids. We have the exact fac-simile of them in the sporangia of the Cosmarium and Staurastrum. Sporangia and empty fronds have been found in tertiary deposits under the bones of extinct mammalia, which fact furnishes us with the strongest evidence of the powers of resistance to change of some of these humble and delicate organisms.

The uses of Desmidieæ are not much known. They evolve oxygen and tend to keep the water clear in which they exist. They also form food for all the entomostraca and many other animalculæ. A few months ago I lost a fine gathering of Closterium ascerosum, which I had put aside in a small bottle for the purpose of mounting, by having accidentally admitted a voracious Daphnia pulex; and I read that a recent observer saw a rotifer, the Notommata myrmeleo, seize a Closterium and suck the whole frond quite free of chlorophyll.

In giving the subjoined list of Desmidieæ I may mention that there are many species which I have not been able to recognise, especially of the genus Closterium. These apparently new species I have not ventured to name. At some future time I intend forwarding specimens and drawings to some competent algologist for identification and record.

For two or three years I have made gatherings of the Docidium verticellatum, figured at page 2. This species has not yet been found in England, although it is abundant both on the Continent of Europe and in America.

My gatherings have been made mostly from pools which are dug up during the summer. As they are plants whose favorite haunt is the open moor, and are taken in greatest numbers from perennial ponds, I have no doubt but that the Lake District and other likely places would render many rare, and perhaps new forms.

Most of the species here recorded will be found in the book of drawings. These figures are drawn under the Camera Lucida, and colored most attentively after nature.

A LIST OF TASMANIAN DESMIDIEÆ.

Closterium	lunula	Closterium	setaceum
,,	striatolatum	,,	Ehrenbergii
,,	acerosum	,,	acutum
,,	rostratum	,,	10 species, new

Docidium verticellatum
„ baculum
„ Ehrenbergii
„ truncatum
Hegalotheca dissiliens
Desmidium Swartzii
Cosmarium margaritiferum
„ pyramidatum
Euastrum ansatum
Staurastrum muticum
„ dejectum
Staurastrum gracile
„ bifida
Penium Bribisonnii
„ truncatum (?)
Micrasterias rotata
„ 1 U.S.
Pediastrum tetras
„ simplex
„ ellipticum
Auhistrodesmus falcatus
Sphœrozosma elegans.