

The application of a concave achromatic lens to the wired micrometer of a telescope, arose out of the series of trials that were made for the purpose of correcting the aberrations of the eye-glasses applied to the telescope constructed by the author for the Royal Society, with a fluid-correcting lens, on the plan suggested by Professor Barlow. The concave lens, being interposed between the object-glass and the eye-glass, and being at the same time achromatic, combines the advantages of doubling the magnifying power, without a corresponding diminution of light, and without altering the apparent distances of the threads of the micrometer. The results of the trials made with telescopes to which this addition was made, are given in a letter to the author from the Rev. W. R. Dawes, of Ormskirk; from which it appears that Mr. Dollond's method was attended with complete success. Mr. Dawes states, that, in order to put its illuminating power to a severe test, he had examined with this instrument the satellites of Saturn and the minute companion of κ Geminorum, but could discover no decided difference in the apparent brightness of the former, allowance being made for the difference in the power employed; and the latter star was seen quite as distinctly with a much smaller power.

Extracts are subjoined from a letter of Professor Barlow's to the author, containing formulæ for the construction of the lens.

March 6th, 1833.

MARK ISAMBARD BRUNEL, Esq., Vice-President, in the Chair.

The reading of a paper, entitled, "On the Structure and Functions of tubular and cellular Polypi, and of Ascidiaë." By Joseph Jackson Lister, Esq., F.R.S.—was commenced.

March 13th, 1833.

JOHN WILLIAM LUBBOCK, Esq. M.A., V.P. and Treasurer, in the Chair.

The reading of Mr. Lister's paper was resumed and concluded.

This paper contains the account of a great number of observations made by the author during the last summer, while he was at the southern coast of England, on several species of *Sertularia*, *Plumularia*, *Tubularia*, *Campanularia*, *Flustra*, and other polypiferous zoophytes, and also on various *Ascidia*. Each specimen was placed for examination in a glass trough with parallel sides, before the large achromatic microscope of the author, directed horizontally; and care was taken to change the sea-water frequently, which was done by means of two syphons, the one supplying fresh water, while the other carried off the old; a plan which succeeded in keeping the animals in perfect health and vigour. The drawings which were taken of the

appearances that presented themselves were traced with a camera-lucida, slid over the eye-piece of the microscope.

In a specimen of the *Tubularia indivisa*, when magnified 100 times, a current of particles was seen within the tube, strikingly resembling, in the steadiness and continuity of its stream, the vegetable circulation in the *Chara*. Its general course was parallel to the slightly spiral lines of irregular spots on the tube; on one side flowing from, and on the other towards, the polypus, each current occupying one half of the circumference of the tube. The particles were of various sizes, some very small, others larger, but apparently aggregations of the smaller: a few were nearly globular, but in general they had no regular shape. At the knots, or contracted parts of the tube, slight vortices were observed in the current; and at the ends of the tube the particles were seen to turn round, and pass over to the other side. Singular fluctuations were also observed in the size of the stomach and of the cavity of the mouth; the one occasionally enlarging, while the other contracted, as if produced by the passage of a fluid from the one into the other and its subsequent recession, thus distending each alternately. This flux and reflux took place regularly at intervals of 80 seconds; besides which two currents were continually flowing, both in the mouth and stomach; an outer one in one direction, and an inner one in the opposite direction.

In all the species of *Sertularia* examined by the author, currents of particles were observed passing along the soft substance which occupies the axis of the stem and branches, and were even seen extending into the substance of the polypi themselves, and traversing the stomachs belonging to each. Contrary to what happens in the *Tubularia*, the stream does not, in these animals, flow in the same constant direction; but after moving towards one part for about a minute or two with considerable velocity, it becomes much slower, and then either stops or exhibits irregular eddies, after which it resumes its motion with the same velocity as before, but in the contrary direction; and so on alternately, like the ebb and flow of the tide. If the current be designedly obstructed in any part of the stem, those in the branches go on without interruption, and independently of the rest. It appears from a passage which the author has quoted from Cavolini, that he had noticed the circumstance of currents existing in the interior of *Sertularia*, but had not detected their continuation into the stomachs of the expanded polypi. Similar phenomena, which the author describes in detail, were observed in several *Campanularia* and *Plumularia*; and several particulars are noticed with regard to the ovaries, and to the movements of the fluids contained in the ova of these zoophytes, before their exclusion from the body of the parent. In some cases, the young polype, after it has attained a certain growth, but while still adhering to the parent, becomes decomposed, and, its substance being absorbed into the body of the latter, it entirely disappears. Changes of the same kind frequently take place in different parts of the whole group; one of the polypes being seen to shrink and gradually disappear, while others shoot forth in more luxuriant growth, rapidly acquiring a large size. The author regards the

circulating fluids in these animals as the great agent both in the absorption and the growth of parts, and throws out the suggestion, that as it flows into the stomach, it may also act as a solvent to the food received into that cavity. The particles which exist in these fluids show their analogy to those in the blood of the higher animals on the one hand, and to those in the sap of vegetables on the other: some appear to be derived from the digested food, and others from the melting down of parts absorbed. In these polypi the author never saw the least appearance of cilia, or of currents in the surrounding water, which are so frequently met with in other tribes of zoophytes.

The latter part of the paper is occupied by the account which the author gives of his various observations, first, on *Ascidia*, of which he enters into an anatomical description; secondly, on the internal currents of water, permeating the branchial sacs, and determined by the vibratory movements of cilia which are seen in that animal; and, thirdly, on the alternations in the course of the circulation of the blood in the vessels, which at one time flows in one direction, and, after a certain interval, takes the contrary course; so that the same vessel which at one time performs the function of an artery, performs, at another, that of a vein. This phenomenon of alternate currents, like that in the *Sertularia*, was met with in every specimen of *Ascidia* which was examined by the author, and also in a *Polyclinium*.

The paper concludes with several observations on *Flustra*, from which, as far as relates to the circulation of currents, the author was led to results in many respects analogous to the preceding.

A paper was then read, entitled, "On the Theory of the Moon." By J. W. Lubbock, Esq., V.P. and Treasurer of the Royal Society.

The author, adverting to the appearance of M. Plana's admirable work entitled *Théorie du Mouvement de la Lune*, enters into a comparison of the analytical methods employed by that author and M. Damoiseau, and points out some differences in the numerical values of the coefficients of some of the arguments in the expression for the true longitude of the moon in terms of her mean longitude. He then prosecutes the subject by a series of analytical investigations, which are not susceptible of abridgement, but from which he obtains formulæ which do not quite agree with those of M. Plana.

A paper was also read, entitled, "Some Suggestions relative to the best method of employing the new Zenith Telescope lately erected at the Royal Observatory." By John Pond, Esq., F.R.S., Astronomer Royal.

During the observations made by the author, in the course of last summer, with the new zenith telescope lately erected at the Royal Observatory, for the purpose of measuring the zenith distance of γ Draconis, it occurred to the author to avail himself of subsidiary observations on another star, of about the fifth magnitude, which has nearly the same zenith distance towards the south that γ Draconis has towards the north, and which passes the meridian between 20 and 30 minutes, in time, after it. The angular distance between the