views, we nevertheless cordially welcome his work as a most important and interesting contribution to our knowledge of the physical geography of the sea. The reader will find in it a most interesting discussion of some of the most important questions connected with the distribution of marine animals; and many of the statements connecting these with the elucidation of facts in geology and physical geography will be found exceedingly valuable. We look forward with much impatience for the appearance of the second part, completing the work (which is announced to be published in December), as it will contain the results of Dr. Wallich's investigations into the structure and life-history of the Rhizopodal Fauna of the deep sea; and from the care with which his researches have been carried on, we have every reason to expect a highly valuable contribution towards the history of those singular creatures. This portion of his subject is barely commenced in the part before us; but, from the few pages here devoted to it, and the lettering of the beautiful plates appended to the work, nearly all of which illustrate the Rhizopoda, it would appear that Dr. Wallich's researches have led him to important systematic results.

On the various Contrivances by which British and Foreign Orchids are Fertilized by Insects, and on the good effects of Intercrossing. By Charles Darwin, M.A., F.R.S. London: John Murray. 12mo. 1862.

Among flowering plants there are few which excite our interest more than the Orchids, whether we consider merely the singularities of their external appearance, or the mysterious amalgamation of their male and female organs in a single central column. The strange and often grotesque forms of the flowers (simulating, as they frequently do, certain members of the animal kingdom), the great beauty of some species, and the remarkable epiphytal habits of others are quite sufficient to attract the attention of both the botanist and the horticulturist to these plants; and when we add to this that the above-mentioned amalgamation of the sexual organs of the flowers, instead of facilitating impregnation, as might have been expected, really seems to place obstacles in the way of the performance of this function, the interest excited by these plants will reach its climax. It is Mr. Darwin's object in the present work to clear up the mystery hanging over the process of impregnation in the Orchids, in order to apply the results thus obtained to the support of certain opinions advanced in his book on the 'Origin of Species.' In the practical part of his task, the explanation of the mode of fertilization, it seems to us that he is completely successful; but whether the arguments deduced therefrom on the general question be equally valid, is another affair.

It has long been supposed by some botanists, amongst whom Mr. Darwin cites Sprengel and Robert Brown, that in the fertilization of Orchids insects play a not unimportant part; but, as remarked by our author, from their assuming the pollen to be applied to the im-

pregnation of the same flower, they have missed discovering the true process. According to Mr. Darwin, the pollen of one flower is almost invariably employed to fertilize the seeds of another; and the contrivances by which this end is attained in different Orchids appear to us to be amongst the most remarkable presented by the vegetable kingdom. We may select one of the simplest forms of the process, namely that exhibited by *Orchis mascula*, as this will furnish a clue to the phenomena presented throughout the group.

In this plant the top of the column is occupied by the single anther, containing two pollinia or masses of pollen-grains, which are produced beneath into small slender stalks, each terminating in a viscid disk which is received into the back of the rostellum. The latter, which is the homologue of one of the stigmata, projects from the front of the column in such a manner as partially to fill up the orifice leading into the nectary, and on each side of it are the true stigmatic surfaces of the remaining two stigmata. The viscid disks of the pollinia are surrounded by a fluid which keeps them constantly moist, being protected from atmospheric influences by the rostellum. The action of this complex apparatus is explained, as follows, by Mr. Darwin:—

"Let us suppose," he says, "an insect to alight on the labellum, which forms a good landing-place, and to push its head into the chamber at the back of which lies the stigma, in order to reach with its proboscis the end of the nectary..... Owing to the pouch-formed rostellum projecting into the gangway of the nectary, it is scarcely possible that any object can be pushed into it without the rostellum being touched. The exterior membrane of the rostellum then ruptures in the proper lines, and the lip or pouch is most easily depressed. When this is effected, one or both of the viscid balls will almost infallibly touch the intruding body. So viscid are these balls that whatever they touch they firmly stick to. Moreover the viscid matter has the peculiar chemical property of setting, like a cement, hard and dry in a few minutes' time. As the anther-cells are open in front, when the insect withdraws its head, one pollinium, or both, will be withdrawn, firmly cemented to the object, projecting up like horns. The firmness of the attachment of the cement is very necessary, as we shall immediately see; for if the pollinia were to fall sideways or backwards, they could never fertilize the flower. From the position in which the two pollinia lie in their cells, they diverge a little when attached to any object. Now let us suppose our insect to fly to another flower:.... by looking at the diagram, it will be evident that the firmly attached pollinium will be simply pushed against or into its old position, namely into its anther-cell. How, then, can the flower be fertilized? This is effected by a beautiful contrivance: though the viscid surface remains immoveably affixed, the apparently insignificant and minute disk of membrane to which the caudicle adheres is endowed with a remarkable power of contraction, which causes the pollinium to sweep through about 90 degrees, always in one direction, viz. towards the apex of the proboscis, in the course, on an average, of thirty seconds. Now, after

this movement and interval of time (which would allow the insect to fly to another flower), it will be seen that if the pencil [or proboscis] be inserted into the nectary, the thick end of the pollinium will exactly strike the stigmatic surface."

That things go on in the way just described was demonstrated experimentally by Mr. Darwin by the simple expedient of thrusting the point of a pencil or some similar object into the orifice of the nectary, when one or both of the pollinia are certain to be removed, and the subsequent change of position for enabling the pollen to reach the viscid stigmatic surfaces of another flower may easily be observed. The occurrence of the same phenomena by the intervention of moths and other sucking insects is proved by the frequent occurrence of pollinia adhering to their proboscides. Mr. Darwin gives a list of twenty-three species of Lepidoptera on which pollinia of *Orchis pyramidalis* have been met with; he figures the head of a specimen of *Acontia luctuosa* with seven pairs of pollinia attached to its proboscis, and mentions one of a *Caradrina* which bore no fewer than eleven pairs of these pollen-masses.

As the general principle on which the fertilization of Orchids depends is nearly the same throughout, although the different means by which its effectuation is ensured present many beautiful and wonderful contrivances, the extract above given may suffice for our present purpose; the reader will, however, find the details given by Mr. Darwin on all points connected with the impregnation of these plants most interesting. We may, however, trespass a little further upon his time in order to advert to one case which appears to us particularly remarkable.

In *Catasetum*, one species of which is now known to be the male form belonging to a female plant placed by botanists in quite a different genus, the two pollinia are affixed to a common, broad and strong pedicle bearing at its lower end a single disk coated with viscid matter. The latter, however, is so turned into the interior of the column that no insect can by any possibility get at it, and indeed there seems to be nothing to induce even the most inquisitive insect to push his proboscis into the vicinity of the disk. How, then, is it to be set free? Mr. Darwin describes a pair of long, stiff and tapering organs, which he calls antennæ, projecting from the sides of the column close to the insertion of the pedicle of the pollinia; these hang down over the pouch-like labellum, in such a position that an insect moving about upon the latter can hardly fail to touch them. The slight irritation thus caused appears to produce some singular effect upon the tissues about the base of the pollinia: the membranes retaining the common pedicle in its position are ruptured; the heavy viscid disk is set free, and is drawn forth by the sudden extension of the previously curved pedicle, which straightens itself with such force as to jerk the pollinia out of their cells and project the whole organ to a distance often of two or three feet, the disk with its viscid coat being always carried foremost, ready to adhere to any object.

Mr. Darwin sums up, as follows, the phenomena presented by the genus including *Catasetum*, *Monachanthus*, and *Myanthus* of bota-

nists. He says, "We see a flower patiently waiting with its antennæ stretched forth in a well-adapted position, ready to give notice whenever an insect puts its head into the cavity of the labellum. The female *Monachanthus*, not having pollinia to eject, is destitute of antennæ. In the male and hermaphrodite forms, namely *Catasetum tridentatum* and *Myanthus*, the pollinia lie doubled up like a spring, ready to be instantaneously shot forth when the antennæ are touched; the disk end is always projected foremost, and is coated with viscid matter, which quickly sets hard, and firmly affixes the hinged pedicel to the insect's body. The insect flies from flower to flower, till at last it visits a female or hermaphrodite plant; it then inserts one of the masses of pollen into the stigmatic cavity. When the insect flies away, the elastic caudicle, made weak enough to yield to the viscidity of the stigmatic surface, breaks, and leaves behind the pollen-mass; then the pollen-tubes slowly protrude, penetrate the stigmatic canal, and the act of fertilization is completed. Who would have been bold enough," he adds, "to have surmised that the propagation of a species should have depended on so complex, so apparently artificial, and yet so admirable an arrangement?"

The consequence deduced by Mr. Darwin from the facts above referred to is stated by him in the following words:—"Considering how precious the pollen of Orchids evidently is, and what care has been bestowed on its organization and on the accessory parts,—considering that the anther always stands close behind or above the stigma, self-fertilization would have been an incomparably safer process than the transportal of the pollen from flower to flower. It is an astonishing fact that self-fertilization should not have been an habitual occurrence. It apparently demonstrates to us that there must be something injurious in the process. Nature thus tells us, in the most emphatic manner, that she abhors perpetual self-fertilization."

To this conclusion we may be permitted to demur. Even amongst Orchids, according to Mr. Darwin, some species, the most striking of which is the Bee-Orchis (*Ophrys apifera*), are organized for self-fertilization; and we do not see why the mere fact of the close juxtaposition of the sexual organs, coupled with the necessity for the impregnation of one flower by the pollen of another (admitting this to the fullest extent), should have more weight in proving that "Nature abhors self-fertilization" than the perfectly well-known fact that, whilst the majority of plants bear hermaphrodite flowers, others are monœcious and diœcious. It seems to us that, curious and interesting as are the phenomena revealed to us by Mr. Darwin, they are far from giving any support to the theory that self-impregnation is abhorrent to Nature, especially as there are many plants and animals in which, as far as we are aware, "perpetual self-fertilization" must prevail.

Apart from this theory and that of "natural selection," which we cannot think is much advanced by the present volume, we must welcome this work of Mr. Darwin's as a most important and interesting addition to botanical literature. It contains the details of a

vast number of curious phenomena, observed most carefully, and furnishes a most lucid exposition of the homologies of the singular flowers of which it treats. The illustrations also are excellent.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

May 13, 1862.—John Gould, Esq., F.R.S., in the Chair.

NOTICE OF A NEW SPECIES OF DOLPHIN (DELPHINUS CATALANIA), DISCOVERED IN NORTH AUSTRALIA BY MR. JOHN MACGILLIVRAY. BY DR. J. E. GRAY, F.R.S., ETC.

Mr. John Macgillivray has sent to Mr. Cuming, who has transferred them to the British Museum Collection, two skulls of a species of Dolphin or Bottlenose, which he regards as probably new.

These skulls were accompanied by the following notes:—

"DELPHINUS, n. s.

"*The larger of the two* skulls belonged to an individual killed off Cape Melville (within the Great Barrier Reefs), north-east coast of Australia, Sept. 5, 1860. It was a *female*, 7½ feet in length; and from it were taken two fœtuses, each 10 inches in length. The adult was of a very light lead-colour above and on the sides, gradually passing into the dirty leaden white of the lower parts, which were covered (as also the flippers) with longitudinally elongated blotches of dark lead-colour.

"*The smaller of the two* skulls represents another Porpoise of the same species, harpooned off Cape Flattery, on the north-east coast of Australia, Oct. 9, 1860. It was considerably smaller than the first one, being only 6¾ feet in length. It was a *female*. The colour was *exactly* lead-colour, fading into whitish on the lower parts between the anus and the snout. The sides were marked with small oblong spots of the same colour as the back. Measurements when recent:—

"Total length, snout to centre of tail, 6 feet 9 inches.

"Snout to base of dorsal, 3 feet; length of anterior border of dorsal 13 inches; height of dorsal 8 inches; width of dorsal 12 inches; from posterior border of dorsal to tip of tail, 2 feet 8 inches.

"Swimming-paws (midway between snout and dorsal) 13 inches long, and 5½ inches broad; from their base to end of snout, 13 inches.

"Tail 22 inches across from tip to tip.

"Anus 2 feet 2 inches in front of tail (centre of tip).

"Eye ¾ths of an inch in diameter, situated 1½ inch behind angle of mouth, and 12 inches from tip of upper jaw.

"Lower jaw projecting 1 inch beyond the upper.

"This Porpoise was occasionally seen, in small droves of from three to six, along the north-east coast of Australia, within the reefs. Two other species also were seen, but we could not fasten."