DIMORPHISM IN THE GENITALIA OF FLOWERS.

By Professor Asa Gray.

Two principal kinds of dimorphism in the genitalia of flowers have been noticed in a great number of instances, and put on record in various works; but the instances have not been collected and systematized, nor had the import of the most curious case been made out until elucidated by Mr. Darwin. There is, first, the dimorphism which Mr. Darwin has illustrated in his paper "On the two forms, or Dimorphic Condition, in the species of *Primula*." This was long ago named *diœcio-dimorphism* (see Flora of N. America, ii. p. 38, etc.), a name which pretty well expresses the thing as now understood; for these blossoms, although hermaphrodite structurally, are functionally as if diœcious or nearly so, the end subserved being fertilization of the ovules of one flower by the pollen of another flower on another individual.

The diœcio-dimorphous species of *Plantago* had seemed to confuse this case with the next; that is, the short-stamened flowers appeared to be fertilized in the closed flower, and the long-stamened and generally sterile plants therefore to be generally useless. This could hardly be; and a recent observation on a single specimen (likely to be confirmed in others) shows the top of the style projecting from the tip of the closed corolla. This refers the case to the same category with *Houstonia*, *Primula*, etc., to which *P. pusilla* and *P. heterophylla*, having the corollas of the short-stamened form open in anthesis and the stigma projecting, evidently belong. It is to be noted that dimorphism, both of this and of the following sort, is apt to be variable, either in mode or in degree, in different species of the same genus, and also that it seldom occurs in all the species of a genus, some of them being unaffected, while others in some genera are nearly polygamous or diœcious,—which is all very favourable to the conclusions that Mr. Darwin wishes to draw.

The second case, which equally belongs to structurally hermaphrodite flowers, is practically the reverse of the first. It is the case in which, besides the normal flowers of the species, which for the most part are rarely or sparingly fertile, other flowers are produced which never open, their development being as it were arrested in the bud, but which are

very prolific of seed. Here the stigma is, and must needs be, fertilized by pollen from the anthers of the same flower, the two being shut up together in the same closed bud. The acaulescent Violets and the common wild species of *Impatiens* are good examples of the kind. In fact, here impregnation is effected as it were in the early bud; wherefore we had indicated these as cases of *precocious fertilization*. Here the pollen is unusually active, sending out its tubes while still in the anther, and thereby, in *Impatiens*, etc., attaching the anthers to the stigma. In the first case, Nature takes great pains to secure the cross-fertilization of individuals of the species; in the other, on the contrary, she takes equal pains to secure self-fertilization. The end in the first case, as Mr. Darwin maintains (we believe upon good philosophical grounds, now in the course of vindication by experiment), is to ensure the perpetuation of the species, since close-breeding or continued self-fertilization tends to sterility, while wider breeding is recuperative. We leave it to Mr. Darwin's sagacity to ascertain the end in the opposite case, noting that here the most undoubted close-fertilization for infinite generations shows no apparent tendency towards sterility, but rather the contrary.

From another point of view which we are accustomed to take, however, we may suppose that as one result of the cross-fertilization must needs be to keep down variation by repeated blendings, so the design of close-fertilization may be to allow and to favour the perpetuation of varieties; self-fertilization, without selection, being just the condition which should most favour both the multiplication of new varieties and their preservation. That such would be the operation, as long ago expounded,* appears to us so clear, that we were somewhat surprised at finding that the reviewer of Darwin's *Primula* paper in the 'Natural History Review' (ii. p. 238) regards the separation of sexes, and therefore cross-fertilization, as favouring variation, and self-fertilization as necessarily inimical to it. This probably comes from not considering that while close-breeding tends to keep a given form true,—in virtue of the ordinary likeness of offspring to parent,—it equally and in the same way tends to perpetuate a variation once originated from that form, and also, along with selection (natural or artificial), to educe and further develope or confirm said variety. On the other hand, free cross-breeding of incipient varieties *inter se* and with their original types is

* 'American Journal of Science and Art,' vols. xvii. and xix.

just the way to blend all together, to repress all salient characteristics as fast as the mysterious process of variation originates them, and fuse the whole into a homogeneous form.

We will also remark (in reference to p. 236, line 31, and p. 238, line 3 *et seq.*, of the above-mentioned review) that the Chestnut does exhibit manifest rudiments of stamens in its pistillate flowers; also that, on morphological grounds, we should look upon hermaphroditism, rather than the contrary, as the normal or primary condition of flowers, and inquire how and why so many became diclinous, rather than "how and why they ever became hermaphrodite." Forms which are low in the scale as respects morphological completeness may be high in the scale of rank founded on specialization of structure and functions.—*From the American Journal of Science and Art*, xxxiv., *with corrections by the Author.*

CORRESPONDENCE.

Vegetation about Cape Arid, South-west Australia.

King George's Sound, January 31, 1863.

By the last mail-steamer I forwarded to Sir William J. Hooker a box containing some roots of the monster *Macrozamia*, which I procured at Cape Arid last November, and had conveyed to this place in a boat which happened to be on its way hither. I hope they will arrive safe and do well. I have made a trip to the Russell ranges, which bear about north from Cape Arid fifty miles, but on two occasions was compelled to retreat to the coast from want of water. I have not obtained many novelties, the country passed over being barren in the extreme, vegetation stinted, and no timber, only a patch of *Casuarineæ* of about twenty-five square miles. I was much disappointed, expecting to make a rich collection in a country where no collector had ever been.

George Maxwell.

Explosion of the Pods of Acanthus mollis.

Rye Lane, Peckham, April, 1863.

All the circumstances that led to the production of so remarkable a work as Goethe's Essay on the Metamorphosis of Plants, a work much more talked about than known, have a special interest. I may therefore be allowed to call your attention to a passage from Goethe's history of his botanical studies, and which has also reference to the fact mentioned by Mr. Smith, at p. 74 of