

- Turner and E. Laver. "On some British Mosses and Ferns," by Muller M. Westring.
- 5 P.M. Civil Engineers: Discussion on the Orange Question. TRANSACTIONS, Feb. 23.—4 P.M. Technical Engineers: "On Fire Telegraphs," by H. von Nöcker-Dronowski.
- 5 P.M. Society of Arts.
- 12.30 P.M. Mr. Walter Bache's Concert.
- VICTORIAN, March 1.—4 P.M. Royal Institution: "Theory of Matter," by Dr. N. Poin.
- 5 P.M. Lecture, Institution: "English Nursery Tale," by W. H. Beattie.
- 5 P.M. Lecture: "Report on the Lichens, Mosses, and Bryophytes, and Ferns of the British Islands," by J. D. Hooker.
- 5 P.M. Royal Institution: "On a remarkable form of New Zealand Coleoptera," by Meyer A. Rehn. "Lithographia of New Zealand," by C. Koch.
- 5 P.M. Churchmen.
- 6.30 P.M. Royal Academy.
- Friday, March 23rd. (See Minutes of Arts: Indian Meeting.)
- 5 P.M. Theological: "On the Philosophy of the English Classics," by A. J. Ellis.
- 5 P.M. Mr. E. Leslie's Class.
- 5 P.M. Royal Institution: "The History of Birds," by Prof. Huxley.

SCIENCE.

The Effects of Cross and Self-Fertilisation in the Vegetable Kingdom. By Charles Darwin, M.A., F.R.S. (London: John Murray, 1876.)

This remark is sometimes made that Mr. Darwin's later books are less interesting than his earlier ones. This is only true in a certain sense. The great service which he has rendered to science—the result of which has been that biology has made greater progress within the last twenty years than during the preceding century—has been to revive the old theory, held by La Murek and other naturalists, of the Origin of Species by descent accompanied by variations; but with such modifications as have gradually forced the ascent of almost the whole scientific world; and to have combined with this the theory of Natural Selection, which we owe equally to the genius of Mr. Wallace and of himself. The Origin of Species contains the charter of this intellectual revolution, and must always stand out since as one of the landmarks of advancing science. This, therefore, has naturally been the most popular of Mr. Darwin's publications. Next in order comes the Descent of Man, and Selection in Relation to Sex. The interest of this book is mainly personal one; and this alone must account for its comparative popularity. But for the fact that in this branch of the question the object of biological investigation is at the same time its subject, there is nothing to raise the Descent of Man to a higher dignity than that of a supplementary chapter to the Origin of Species. The Variation of Animals and Plants under Domestication is mainly a huge collection of material in support of the main thesis of the Origin of Species, that individuals known to be descended from a common ancestor may be made to differ to an indefinite, or at all events to an unknown, extent. In the course of the laborious investigations carried on by Mr. Darwin, his attention was called to certain phenomena in the vegetable kingdom, which had not, indeed, heretofore altogether escaped notice, but the significance of which as links in a single connected chain he has been the first to point out. On two lines of enquiry it is found that phenomena which had hitherto been supposed to be confined to the animal are widely distributed also through the vegetable kingdom. In *Zoanthiferous Plants* we have copious illustrations of the singular fact that there is a class of plants

which feeds on already organised food-materials in a manner scarcely distinguishable from animals; in *The Mosses and Habits of Cheimite Plants* it is pointed out how difficult it is to set up a barrier of "spontaneity" between certain movements of animals and of plants. Very early in his investigations Mr. Darwin was induced to adopt the dictum of Andrew Knight, that "No hermaphrodite (plant) fertilises itself through a perpetuity of generations;" a point of the greatest importance in relation to any theory of the origin of species, and illustrated with great facility in his Fertilisation of Orchids, a new edition of which is just published. The present volume collects together an enormous assemblage of facts, from which the reader is able to draw a conclusion on this subject. It will therefore be seen that, even though Mr. Darwin's later works may not compare with the Origin of Species in the exaltation of a law of the first importance, they are of some of the less value to the scientific enquirer.

For the sake of determining certain points with respect to inheritance, and without any thought of the effects of close interbreeding, Mr. Darwin had raised close together two large beds of self-fertilised and crossed seedlings* from the same plant of a common willow, *Salix vulgaris*. The remarkable result that the crossed plants, when fully grown, were plainly taller and more vigorous than the self-fertilised ones, led to the large series of experiments the record of which we have now before us. The result confirms beyond doubt the law that "Cross-fertilisation is generally beneficial and self-fertilisation injurious; and that this is shown by the difference in height, weight, constitutional vigor, and fertility of the offspring from crossed as compared with that from self-fertilised flowers, and in the number of seeds produced." A similar series of experiments has been carried out by one of the small band of Continental naturalists who have worked along the same lines as Darwin, the Italian botanist Delpino; and, as we find no reference to these in the volume before us, we conclude that they have been carried on simultaneously, and without concert. Prof. Delpino's conclusions, recorded in the *Nuovo Giornale Botanico Italiano*, are altogether in harmony with those of his English fellow-worker. He classifies the mode of fertilisation in different plants under the following four heads, to which he gives appropriate names.—1. The anthers pollinate and fecundate the stigma of the same hermaphrodite flower: *homophilous Anisogamy*. 2. The anthers pollinate and fecundate the stigma in another flower of the same inflorescence, whether the flowers be hermaphrodite, unisexual, or polygamous: *homophilous Anisogamy*. 3. The anthers of one flower pollinate and fecundate the stigma of a flower belonging to a different inflorescence on the same individual, whether hermaphrodite, unisexual, or polygamous: *monoclinous Anisogamy*. 4. The anthers of a flower on any individual plant pollinate and fecundate only the flowers on a different individual, whether the flowers be hermaphrodite, poly-

* By "self-fertilised" and "crossed" plants, the author means throughout the offspring of self-fertilisation and cross-fertilisation respectively.

gamous, monoecious, or dioecious: *diisogamy*. The result of a number of experiments on the artificial fecundation of plants in the four different modes indicated above, is stated by Delpino to lead to the conclusion that their relative fertility is in the inverse order of that in which they have been mentioned.

Of the twelve chapters of Mr. Darwin's volume, nine are occupied almost entirely with the record of the observations from which the conclusions of the author were drawn; the remaining three are devoted to—"Means of Fertilisation," "The Habits of Insects in Relation to the Fertilisation of Flowers," and "General Results." Of these the one which will probably most interest the non-botanical reader is the one headed—"Means of Fertilisation." This contains, in fact, an outline sketch of a probable history of the mode of sexual propagation among plants, and is full of the most interesting speculation, as well as facts.

According to the view now generally adopted with regard to sexual reproduction in plants, the existence of hermaphrodite flowers appears, at first sight, to be a purposeless anomaly. It is, as it almost universally admitted, it is most advantageous for an ovule to be impregnated by a pollen-grain from a different flower, and still more so by one from a different individual, and if, moreover, a large number of flowers are so contrived that the pollen can only with great difficulty reach the stigma in the same flower at a time when they are in a receptive condition, where is the advantage of stamens and pistil occurring in the same flower? Why are they not always completely dissociated? An answer to this question is here furnished by Mr. Darwin with great ingenuity. Permanent self-fertilisation is undoubtedly injurious to plants; but the absence of any fertilisation at all is absolutely fatal; the only reason *d'être* of a flower is to produce seed, if not in one way, then in another. We have, therefore, in the hermaphrodite flower the result of a balance of forces. Cross-fertilisation, by the wind or by insects, must always be subject to a certain amount of uncertainty; when this fails, the ovules of an hermaphrodite flower have a chance of being self-fertilised at all. A few isolated exceptions, like that of the bee-crochis, in which self-fertilisation alone appears to be possible from generation to generation, require further examination.

The speculative question has recently excited considerable interest among botanists, whether hermaphroditism or dioecism is the more perfect form of floral development. Mr. Darwin inclines to the opinion that all the higher animals are the descendants of hermaphrodites, and that such hermaphroditism may possibly have been the result of the conjunction of two slightly different individuals which represented the two incipient sexes; whence results the bilateral symmetry of all the higher animals. In the same manner he thinks we have reason to believe that the higher plants are descended from extremely low forms which conjugated, and that the conjugating individuals differed somewhat from one another, the one representing the male and the other the female, so that plants were originally dioecious.

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Monocœtic and hermaphroditic plants were then subsequent successive developments, the result of budding; while in the course of ages it is evident that some plants have reverted to the monocœtic, others to the dioecious condition, and that a change in this direction may still be going on, of which we have illustrations in the occurrence of unisexual species in normally hermaphroditic families, as in the familiar case of *Lepidostichum*. The probable gradual steps from the dioecious to the hermaphroditic condition are thus traced:—

“By what graduated steps an hermaphroditic condition was acquired we do not know. But we can see that if a leucy-spermatid form, in which the two sexes were represented by some what different individuals, were to increase by budding either before or after conjugation, the two incipient sexes would be capable of appearing by buds on the same stock, or occasionally occur with various characters at the present day. The organism would then be in a monocœtic condition, and this is probably the first step towards hermaphroditism; for if very simple male and female flowers in the same stock, such consisting of a single stamen or pistil, were brought close together and surrounded by a common envelope in nearly the same manner as with the ferns of the *Ceratopteris*, we should have an hermaphroditic flower.”

The simplest form of sexual union would therefore be, according to this view, the process known as “conjugation,” such as we get for instance, in some filamentous Algae like *Spirogyra*, or in the unicellular Desmidiæ—the union of the contents of two apparently similar cells in different individuals. Mr. Darwin, however, insists strongly on the principle that the efficiency of such a union cannot consist in a mere mystical mixing of similar bodies, but must result from some difference between the two conjugating cells—whether they be externally similar, as in the case we are discussing, or so widely diverse as the pollen-grain and the embryo-sac of the ovule in flowering plants—the equalization of which is the object of the union. There must, therefore, if this view be correct, be some essential though at present undiscovered difference between the conjugating cells in *Spirogyra* or the Desmidiæ; and this inference is supported by several facts not mentioned by Mr. Darwin.

The amount of difference between two conjugating cells which is most beneficial to the resulting offspring is another factor in the question. In comparing the results of the interbreeding of animals with that of plants, Mr. Darwin points out that no possible interbreeding of animals can compare in closeness with the self-fertilization of hermaphroditic flowers, where conjugation takes place between cells of the same individual growing in close proximity to one another. The golden mean appears to be attained by the union of reproductive cells belonging to different individuals of the same species; and hence results the comparative fixity of species. As long as external conditions are uniform, there is no reason why a species should ever vary; for example, through long geological ages some deep-sea Brachiopoda do not vary; but as soon as these conditions are changed, the equilibrium is disturbed on one side or the other;

fertilization may be assumed to take place within the same; the species loses vigour and ultimately dies out; or beyond the mean: it becomes rarer and more variable, and gives rise to new varieties, and ultimately to a new species. Even in nature deficiencies from this mean occur. Instances are known, like that of the bee-orchid, in which apparently self-fertilization takes place from generation to generation without injurious results; while in others impregnation is effected as readily—in a few cases even more so—by pollen belonging to a different, though closely-allied, species, resulting in the production of fertile hybrids.

It will be seen, therefore, that even so apparently limited a subject as the cross-fertilization and self-fertilization of plants is invested by Mr. Darwin with general and varied interest; though all the questions raised are far from being worked out in the volume before us. There is still room for others to follow in his footsteps.

ALFRED W. BESSETT.

A Cosseyatory on Catullus. By Robinson Ellis, M.A., Fellow of Trinity College, Oxford. (Oxford: Clarendon Press, 1876.)

NINE years and more have elapsed since Mr. Ellis published his text of Catullus, with its elaborate critical apparatus and ingenious metrical divisions. The work is now completed by his commentary, one of the fullest and most careful, probably, that have ever been published in illustration of any classical author. The commentary is preceded by Prolegomena discussing the life, the style, and the metres of Catullus.

We have rarely seen so genuine a labour of love and conscientious care as the work before us. His great merit lies in the fulness of knowledge and width of reading brought to bear on the interpretation of Catullus, and in the thoroughness and minuteness with which every point of importance is sifted and discussed. It should be added, at the same time, that the notes are, we think, sometimes too lengthy for the necessities of the case and for the genius of the poet, and that Mr. Ellis is apt occasionally to wander out of the track into needless reticements.

Catullus was one of the most original—indeed, he has been thought by good judges the most original—of the Roman poets. It is certain that in his lyrics and epigrams he shows less trace than any Roman poet of direct Greek influence. The child of nature speaks in these immortal productions, using and moulding his native language with the clear aim and mastery which belongs only to simple passion and true creative genius. Nothing can be truer than Mr. Ellis's judgment on the relation of Catullus to his Greek models, which, as one of the most interesting passages in his Prolegomena, we quote in extenso:—

“How little that is truly Catullus can be ascribed to Alexandria, or, indeed, to any such imitation! For that Catullus did not confine himself to this school is shown, not only by his translation of Sappho's ode *Quæritur an ceteræ* *lece* *lece*, and his selection of his metres and subjects elsewhere, especially in his two Epitha-

mins, but so less by his imitation of other poets, Horace, Pindar, Anacreon, and, even more distinctly than these, of Anacrotiana. He was evidently a wide reader, and his translations prove that he was not a casual one, though the fragments preserved of the original of the *Clæna* do not correspond very closely with the extant version. But even if he could not have been what he was without assiduous study of the Greeks, it would be ridiculous to suppose that they did more than supply him with an outline; his genius is essentially Roman, no less in its simple and unaffected speech than in its Republican spirit of freedom. What is more, he is the only Roman in whose satire and art blend so happily that we lose sight of either in the perfection of the whole mass: unlike Lucan, he never ceases to be a poet, even where he speaks the language of prose; unlike Horace or Virgil, he is always as artist, yet with little of the consciousness of art. If, indeed, we compare Catullus with Horace, his only lyrical rival, we shall not be inclined to deny him the advantage in the competition. Horace in his happiest efforts always leaves an impression of labour: nothing is so charming in Catullus as his perfect spontaneity. Horace seems to write with a fixed plan; in Catullus ideas succeed each other as we can fancy those rising to the poet's mind. When Horace is copying Anacreon or Pindar, he theft is palpable, sometimes from the very ease which he takes to translate the idea his own; Catullus, even when he translates most liberally, transfigures his own nature into the words and measure as Italian we before.”

The last clause, perhaps, a little overstates the fact, but the criticism, as a whole, is eminently just.

Several questions relating to the poet's life suggest themselves to the reader of Catullus. Is the *Piso* of *Pisone* *comites*, *ceteris* *in* *comis*, the *Piso* of Cicero's invective? Is the *Gellius* of Catullus the *Gellius* of Cicero? Is *Lesbia* another name for the famous *Clodia*? What was the date of the *Bithynian* journey? As to *Piso*, Mr. Ellis is inclined to identify him with the conspirator (Ca. *Piso*) of B.C. 65. He finds a difficulty in making *Venerius* and *Fabullus* take two long journeys, one into Spain and the other into Macedonia. This compels him to put Catullus's *Bithynian* journey with *Mænnius*, no doubt contemporary with the journey of *Venerius* and *Fabullus*, mentioned in the twenty-eighth poem, into the year 65, not, as seems more natural, into the year 57, when L. *Piso* was in Macedonia and *Mænnius* proprietor in Bithynia. No propogatoral journey of *Mænnius* can be proved for 65, but Mr. Ellis catches at the possibility of one having taken place. We do not agree with his reasoning. There seems no reason why *Venerius* and *Fabullus* should not have taken two long journeys—travelling was not so uncommon at that time—and the synchronism of the known movements of L. *Piso* and *Mænnius*, in the year 57-56, is so striking that it seems exceedingly difficult not to refer the twenty-eighth poem to this date. The identification of L. *Piso* with the *Piso* of Catullus becomes more natural when we consider how often Cicero's enemies were also those of the poet. Again, if Catullus was in Bithynia in 65, his brother must have died early in that year, or in the year before, and Catullus would have been, supposing him to have been born in 87, twenty-one or twenty-two years of age at the time of the event. On the other hypothesis, Catullus must have