heart; Cheriff Pasha, "an indispensable man in Egyptian administration," only leaving one office to hold another; and the late Mouffetish, who, after attaining a degree of power which the Khedive has conceded to no one else, came to such a tragical end during the recent visit of Mr. Goschen. Those who are interested in the future of Egypt will read with especial pleasure Mr. de Leon's description of Tewfik Pasha, the heir to the throne. "Less politic and plausible than his father, Prince Tewfik inspires you with belief in his sincerity, and that he means what he says. You feel that here is a man whom you can trust."

Of Egyptian products, Egyptian education, the Egyptian army, the debt, the new Courts, the Suez Canal, and the great unfinished *barrage* of the Nile, both authors have much to say, and the reader may consult either; but for statistics and well-arranged details he will always gain most by turning to the pages of Mr. McCoan. Many readers will probably find no part of either volume more interesting than that in which two writers who both know Egypt so well foreshadow what is, in their opinion, the probable future of the country. To estimate this it is necessary, as a beginning, to understand the relations of Egypt to the Porte. The account given by Mr. McCoan of these relations is very ample and lucid, and he especially draws attention to the final Firman of 1872, by which all the restrictions on the Khedive's sovereignty which up to that time still remained were abrogated, except the duty of paying tribute and the inability to have diplomatic representatives. It must be remembered that this, and also the preceding Firman by which the descent of the sovereignty of Egypt was altered from the eldest male descendant of Mehemet Ali to the eldest son of the Khedive, were communicated to and accepted by the Powers; and although, according to the arrangement of 1841, Halim Pasha, a son of Mehemet Ali's old age, who, it is said, is to be the new Turkish Ambassador at Vienna, is the next heir, yet the right of Tewfik Pasha has, it may be said, been accepted as part of an arrangement acquiesced in by Europe. That the absurd rule of the Mahomedan succession should be abrogated in favour of a son of the reigning Viceroy, whose character is, in the language of Mr. de Leon, that of a man to be trusted, is an obvious gain to Egypt. It is also tolerably certain that the Khedive will live, and that this son will live after him, under the protection and care of England and France. What shape this protection will henceforth take is necessarily a matter of pure conjecture; but the conjectures of well-informed guessers are always worth listening to. What Mr. de Leon anticipates or hopes is that, under the guidance of Western Europe, Egypt may become a constitutional country, with sound views of law and finance, and that the shadow of the stranger may be ultimately altogether withdrawn. Mr. McCoan chiefly dwells on the probability, or, as he seems to say, the certainty, that before long the last ties that bind Egypt to the Porte will be broken, and this he appears to think the main point to be gained. "Egypt for the Egyptians" is, in his opinion, the main and the legitimate cry of the country; and he thinks that, whatever may be the result of the present Turkish war, Egypt will be brought nearer the desired end, being able to ask for independence in return for assistance from successful Turkey, and to seize on it from unsuccessful Turkey. If this independence of Turkey is obtained, it seems to Mr. McCoan almost immaterial whether its blessings are enjoyed under the rule of a native prince uncontrolled by any foreign Power or under "the fostering and disinterested protection of England." The views of the two writers are in some respects different; but what is really important to notice is that they both agree in ascribing to Egypt a much greater inherent vitality and much more energy than she is usually credited with. Let us hope they are right, and that there are Egyptians in Egypt capable of making of Egypt a nation independent and self-sufficing, if not absoluteiy great. Modesty is the failing at present of these men, and they are so retiring that to the casual observer they seem non-existent. But, if they will but show themselves, they may count on receiving from Western Europe the welcome which would be their due.

DARWIN'S FORMS OF FLOWERS.*

MR. DARWIN'S latest contribution to vegetable physiology is manifestly the result of the important generalizations which he had lately to announce upon the process of cross-fertilization in plants. His whole series of works may be said in some sense to follow and fit into each other as parts of one organic whole, the ruling idea being throughout the enforcement and illustration of the great natural law of evolution whether in vegetable or animal life. That from first to last he has kept this purpose consciously before his mind, and has ordered or mapped out his researches in the field of nature with this methodical arrangement always in view, is more than we would venture to assert. It may be from a kind of unconscious logic guiding the operations of his mind, and giving a bias to his instincts for research, that so definite a thread of connexion makes itself traceable through his successive writings, bringing out that unity and continuity of purpose which he has loved to make clear through all the operations of nature. That nature has beneficent ends in view, that the inevitable and ceaseless struggle for life is directed to the improvement, the permanence, and the welfare of organic beings, is the cardinal doctrine of the Darwinian creed. It is in the recognition of this great truth that teleology, once the ruling principle of the schools, but banished for awhile from the domain of physics, has found for itself anew a place among the logical powers of philosophy. Even among the purists of Positivism, owing in great measure, we cannot doubt, to the influence of Mr. Darwin, it has become in nowise a matter of scoffing to talk of an end or purpose in nature, and the blind sequence of facts or phenomena receives light from the revelation of a beneficent power pervading time and space and life. The fertilization of plants with the maximum of benefit to each species, and with the minimum of effort, expenditure, or waste, has been thus established, as it were, as the basis of the new philosophy of botany. That plants have had their structure modified and developed for this special purpose is the thesis which Mr. Darwin has set himself for years the task of expounding and illustrating. And that the production and modification of the forms of flowers have been subsidiary to the same beneficent end is what seems to us to form the moral of the interesting volume before us. Why are different forms of flowers found upon plants of the same species? By what process or owing to what law are flowers, varying not only in size, richness, or complexity, but in structural type or figure, engendered from plants identical in origin and in order, and, to all appearance at least, subject to the same conditions?

Now to this question we cannot say that Mr. Darwin has furnished more than an approximate answer. Nor does he himself profess to have furnished an answer at all full or exact. His treatment of the wide class of phenomena indispensable to a solution can be described only as tentative. He has brought together, with his wonted industry and patience, an immense array of facts in proof of the natural law under discussion; and he may be held to have satisfactorily established the preliminary truth that differently formed flowers are actually produced upon plants of the same stock. But he has hardly shown his habitual grasp of the problem in its bearing upon the general law of evolution, or upon that specific law of beneficent arrangement which he has taught us to read in nature. With characteristic modesty he disclaims the right to speak as a professional botanist. But it is not to technical knowledge of botany that we should be inclined to look for the solution of a problem so wide in its philosophical relations; nor even among specialists could we hope for a keener perception of natural facts, or a more exhaustive survey of the whole province of plant life. Mr. Darwin is not concerned with more than the accepted classification of flowers, which, imperfect and artificial as it is, the groups often passing into one another, sufficiently serves the purpose of his inquiry. As far as their sexual relations are involved, he is content with the fourfold division of Linnæus, treating in turn of hermaphrodite, monœcious, diœcious, and polygamous species of plants.

Passing over the less important subdivisions of the hermaphrodite class, our author first concentrates his attention upon the two sub-groups of heterostyled and cleistogamic plants, which are the most prominent and interesting of their order. When first brought to the notice of botanists fifteen years ago, the former of these groups was distinguished by him as dimorphic or trimorphic, the better name of "heterostyled" having since been given it by Hildebrand. The commonly received test of the specific character of these plants—their pistils and stamens differing greatly in length—is shown by Mr. Darwin to be insufficient. To it he adds the difference in size of the pollen grains and the state of the stigma. All are adapted for reciprocal cross-fertilization, and it is to the evidence of enhanced fertility of the plants under this process that Mr. Darwin's researches are directed:—

> We may feel sure that plants have been rendered heterostyled to ensure cross-fertilisation, for we now know that a cross between distinct individuals of the same species is highly important for the vigour and fertility of the offspring. The same end is gained by dichogamy or the maturation of the reproductive elements of the same flower at different periods,—by diœciousness—self-sterility—the prepotency of pollen from another individual over a plant's own pollen,—and lastly, by the structure of the flower in relation to the visits of insects. The wonderful diversity of the means for gaining the same end in this case, and in many others, depends on the nature of all the previous changes through which the species has passed, and on the more or less complete inheritance of the successive adaptations of each part to the surrounding conditions. Plants which are already well adapted by the structure of their flowers for cross-fertilisation by the aid of insects often possess an irregular corolla, which has been modelled in relation to their visits; and it would have been of little or no use to such plants to have become heterostyled. We can thus understand why it is that not a single species is heterostyled in such great families as the Leguminosæ, Labiatæ, Scrophulariaceæ, Orchideæ, &c., all of which have irregular flowers. Every known heterostyled plant, however, depends on insects for its fertilisation, and not on the wind; so that it is a rather surprising fact that only one genus, Pontederia, has a plainly irregular corolla.

Why some species are more adapted than others for cross-fertilization, or why, if they once were, they have since lost such adaptation, and are now in consequence self-fertilized, has to some extent been discussed in Mr. Darwin's previous work. The reason why certain species have been adapted to this end by being made heterostyled rather than by any of the other processes specified is to be sought, he proceeds to suggest, in the manner in which heterostylism originated—an obscure subject, on which he does not profess to throw much light, but which is well worthy of discussion. The first step towards a species becoming heterostyled is most probably great variability in the length of the pistil and stamens, or of the pistil alone. This is highly conspicuous in *Primula veris* and *vulgaris*. It is so strongly marked in *Amsinckia spectabilis* and *Nolana prostrata*, that before experimenting upon them he

* *The Different Forms of Flowers or Plants of the same Species.* By Charles Darwin, M.A., F.R.S. London: Murray. 1877.

thought both species heterostyled. Now it is not difficult to conceive the different effects which would be produced by the visits of insects when the organs of fertilization were once differentiated in size and proportion. Take a highly varying species, with all or most of the anthers exserted in some individuals, and in others seated low down in the corolla, the stigma also in like manner varying in position. Insects visiting such flowers would have different parts of their bodies dusted with pollen, to be carried to the next flower visited. Now, were the longer stamens nearly equalized in length in a certain number of individual plants, the pistil being more or less reduced, while in a number of others the shorter stamens were similarly equalized with the pistil more or less increased in length, cross-fertilization would be secured with little loss of pollen. And this change, Mr. Darwin argues, would be so highly beneficial to the species that we may readily believe it to be the normal effect of natural selection. This is at least more probable than the view of H. Müller, that ordinary or homostyled plants have become heterostyled by mere natural habit, which seems to mean little more than natural chance. There may, of course, be hidden constitutional differences between individuals of the same species; but these in turn probably owe their development to influences connected with the external surroundings. Among these causes, great stress is reasonably laid by our author upon the distinction between legitimate and illegitimate unions. The result of experiments designed to test these effects is to bring into clear light the law which Mr. Darwin here enunciates. In Table XXXIII., in particular, he shows how much more feeble each form is when legitimately fertilized with pollen from a distinct form than with its own-form pollen. The fertility of these unions may be judged by two standards—the proportion of flowers which in either case yield capsules, and the average number of seeds per capsule. Another remarkable difference is seen in the size of the pollen grains, those from the anthers of the short-styled form, the tubes of which have to penetrate the longer pistil of the long-styled form, being larger than the grains from the other form. This curious relation led Delphino, as it formerly did Mr. Darwin himself, to connect the larger size of the grains in the short-styled flowers with the greater supply of matter needed for the development of their larger tubes. Doubts were, however, suggested to our author's mind by the case of *Linum*, in which the grains of the two forms are of equal size, whilst the pistil of one is about twice as long as that of the other. And these doubts have since been strengthened by the cases of *Limnanthemum* and *Coccocypselum*, in which the grains are of equal size in the two forms, whilst in the former germs the pistil is nearly thrice, and in the latter twice, as long as in the other form. In plants at large there is no close relationship traceable between the size of the pollen grains and the length of the pistil. At the same time, our author is loth to give up the belief that the pollen grains from the longer stamens of heterostyled plants have become larger in order to allow of the development of longer tubes; and he seeks to reconcile the conflicting facts by the supposition that in some species the tubes are developed wholly, or almost wholly, from matter contained within the grains, in other species from matter yielded by the pistil, it being necessary in the former that the grains of the two forms should differ in size relatively to the length of the pistil which the tubes have to penetrate, but not so in the other case. That the relative length of these organs is in some way an adaptation for the safe transport of the pollen from the one form to the other he has hardly a doubt, this law moreover having a direct and significant bearing upon the general principle of progressive fecundation.

Under the second sub-group of hermaphrodite flowers come those which, instead of being perfect and fully expanded, are minute and completely closed, having their petals rudimentary, some of the anthers being often aborted, and the remainder, together with the stigmas, much reduced in size. These flowers are notwithstanding perfectly fertile. This distinction between ordinary open and minute closed flowers was known before the time of Linnæus, and gave rise to much controversy about the sexuality of plants. These closed flowers received from Dr. Kuhn the name of cleistogamic. In their small size, and in their never opening, they resemble buds. Besides having their organs slight or rudimentary, they have their pollen grains few in number, with thin, transparent coats. They neither secrete nectar nor emit any odour. Hence, as well as from their corolla being rudimentary, insects do not visit them, nor, if they did, could they effect an entrance. Such flowers are in consequence nominally self-fertilized, producing, however, abundance of seed. To the forty-four genera of this kind of flower enumerated by Kuhn Mr. Darwin has added a few more, making the whole number of genera fifty-five. It is far from easy, indeed, to decide in all cases what flowers are to be classed as cryptogamic. Some would include among them the vine, which has its flowers imperfectly open, and yet bears fruit. In certain aquatic and marsh plants, as *Ranunculus aquatilis* and *Alisma natans*, the flowers remain closely shut so long as they are submerged, and in this condition fertilize themselves, yet produce open flowers when exposed to the air. These are consequently excluded from the true cleistogamic class. There is no difference in number or appearance to be traced between the seeds produced by cleistogamic and perfect flowers. To what end nature has given birth to this distinction between plants is by no means clear. That it is entirely due to arrested development, Mr. Darwin gives reasons for doubting, though this may be so in some cases, as in *Viola*, where the lower rudimentary petal is larger than the others; in *Impatiens*, where in the cleistogamic flowers there is the vestige of a spur; and in *Ononis*, which has the ten stamens united in a tube. It is Delphino's belief that cleistogamic flowers have been developed in order to secure the production of seeds under climatic or other conditions which tend to prevent the fertilization of perfect flowers. This may hold good, Mr. Darwin allows, to some extent, but he discerns a far more efficient motive in nature in the production of seeds with little consumption of nutrient matter or expenditure of vital force. The flower is much reduced in size; but, what is far more important, an extremely small quantity of pollen has to be formed, none being lost through the depredation of insects or from weather, and pollen contains much nitrogen and phosphorus. We here, then, come upon a beneficent end which is in harmony with the operations of nature throughout. It gives, as we have said, unity and continuity to the great plan of vital organization. Such is the moral which Mr. Darwin has from the first taught us to educe from the study of nature in all her forms. In this his latest work he has not perhaps so much set this lesson consciously or systematically before our eyes as let it evolve itself from the mass of admirably ordered and highly significant details which his keen and careful study of botanical forms has enabled him to accumulate. His book may be found too technical in language, as well as too replete with minute and special facts, to yield pleasure to the general reader. Nor can it be said that the writer has put forth with his usual success those exceptional powers of analysis and generalization which have been wont to enrich science with some new formula or some more compact and definite law of the natural world. The volume is a collection of highly valuable observations, out of which we should be glad to see him evolve more fully and explicitly that inner or implicit meaning which we have striven to the best of our apprehension to grasp, and to aid our readers to realize for themselves.

SANKEY'S SPARTAN AND THEBAN SUPREMACIES.*

INSTEAD of the holocaust (may we call it?) which used to be offered to his less fortunate predecessors, the youthful student of Greek history at the present day may sit down to a neat little banquet of small dishes, proceeding in succession *ab ovo usque ad mala*—from the Aryan egg of Mr. Cox to the extremely light dessert supplied by other purveyors in the sketches of Greek social life artistically arranged by Professor Mahaffy. Mr. Sankey's contribution will, we hope, not be passed by unheeded, though it comes relatively late in the list, and has no seasoning to speak of to commend it to jaded appetites. In his preface, indeed, the author of *The Spartan and Theban Supremacies* states that he has "attempted to lighten to some extent the charge of dulness so often brought against the 'Hellenika' by borrowing many of the graphic touches of humour and description which frequently redeem its general dreariness." We cannot suppress a wish that he had enumerated these passages in his index, for they are not easy to find in the body of his work, which does little to invalidate Niebuhr's remark that to compare Xenophon with Thucydides would be like comparing Gleim with Goethe. Like most alliterative antitheses, this was rather less than more felicitous; still it has some point, for "Father Gleim" was the laureate of the early days of another supremacy based in its origin upon grenadiers. We are far from quarrelling with the Spartan simplicity of Mr. Sankey's own style, though it is rather long to have to wait for an episode told with exceptional spirit till we reach the battle of Leuctra. The joint editor of the *Epochs of Ancient History* series has set himself a modest task, and has performed it in a modest way. It would have been more ambitious, for instance, to attempt to fill a whole duodecimo with a narrative of the rise and fall of the Theban supremacy only. The history of Bœotia and of the Bœotian Federation would have made an interesting introduction; the designs of Iason of Pheræ an appropriate, and in some sense a novel, epilogue. But a certain independence of method and a certain originality of research would have been in this case requisite; while Mr. Sankey has merely sought to fill by a synchronistic narrative which should omit nothing of importance the gap between the "epochs" treated in the little books of Mr. Cox and Mr. Curteis.

Whatever may be our judgment of Xenophon—and we agree with Mr. Sankey that he little knew himself how true an Athenian he was—we have indeed occasion for gratitude towards him. Partisan as he is, even to *naïveté* in his partisanship, yet he remains our principal guide through that dark but eventful period of Greek history, the time of the second Spartan supremacy. As it is, our knowledge of the system of decarchies and harmosts established by Lysander is all too scanty; "of the internal history of the towns under their rule little is known; but from the ruthless rancour of Greek political life generally, and from the analogy of the Thirty at Athens, it may be judged that their members used their absolute liberty of action to satiate with blood their lust of vengeance, and to glut with plunder their rapacious cupidity." Our information as to the doings of the Thirty certainly comes to some extent from *ex-parte* statements, such as those of Lysias; but there can be no doubt as to the correctness of the picture. Mr. Sankey heightens its effect by contrasting at the outset the grievances of

* *The Spartan and Theban Supremacies.* By Charles Sankey. (Epochs of Ancient History Series.) London: Longmans & Co. 1877.