Literature.

The prompt mention in our lists of "Books of the Week" will be considered by us an equivalent to their publishers for all volumes received. The interests of our readers will guide us in the selection of works for further notice.

DARWIN'S BOTANICAL STUDIES.*

BY PROFESSOR ASA GRAY, LL D.

THREE of Mr. Darwin's volumes relate to the economy of flowers as regards reproduction, and to the adaptations of many of them to be benefited by the visits of insects. These volumes, taken in the order of publication, are: 1. That on "The Various Contrivances by which Orchids are Fertilized by Insects," brought out in 1862, but re-elaborated recently in a second edition, which appeared early in the past year; 2. "The effects of Cross and Self-Fertilization in the Vegetable Kingdom," which was published in the year preceding; 3. The volume now before us, which concludes the series, but which is in part of much earlier date; about half the volume being a reprint, with many additions and some corrections, of two or three papers which were contributed to the Linnæan Society of London and published in its journal, one of them in the same year in which the book on orchid fertilization first appeared. These papers were hardly accessible to general readers, and yet are necessary to the full presentation of a very popular and fascinating subject, which Mr. Darwin has made his own. Not that this volume—or either of the three—is light, popular reading; for this, in particular, is filled with statistics and tables and numerical details, and the topic is too remotely associated with what is called Darwinism to derive an adventitious interest from the "Origin of Species" and the "Descent of Man." But it has an interest and a value of its own—one which is shared by two preceding works of Mr. Darwin, which should be reckoned in the series—that on climbing and that on insectivorous plants. While Darwin's other and more famous works have opened new channels of thought and new lines of speculation, these have led into new fields of observation and of easy research—not in far-off regions, or under the microscope, which comparatively few can possess or be trained to use; but in the common things which are everywhere around us, in which, with newly-opened eyes, we may now read new meanings, and discern plans, adaptations, contrivances which the philosophers of the past generation never dreamed of, but which are made so plain that even a child may mainly understand and be interested in them. The educational value of this new knowledge can hardly be overestimated and is only beginning to be felt.

Our meaning may be illustrated from the matter which first presents itself in this book on *The Different Forms of Flowers or Plants of the Same Species.* Why should a plant have two kinds of flowers? When the two kinds are of opposite sexes—as in willow trees—the immediate reason why is obvious enough. But in the cases which first take our author's attention both kinds are equally perfect, both have stamens and pistils, and, therefore, all that is requisite for seed-bearing. Why should individuals raised from seeds of the same pod differ in their flowers, and yet all the flowers be perfect? The difference is one which a casual observer would not be likely to notice. Not many of those who adorn their rooms with pots of Chinese primroses in winter, or of English primroses in spring, or who gather Houstonias in our low meadows, have observed that, while in the blossoms of one clump the tip of the pistil projects, in those of another clump the same position is occupied by the tips of the anthers; that when the tip of the pistil, or stigma, is exposed at the orifice of the flower the stamens are situated lower down within; that when the anthers project the shorter pistil places the stigma of that flower at the same hight as the anthers of the other. Still, this reciprocal relation has long been known to botanists, and in the case of primroses the English florists have names to designate the

* THE DIFFERENT FORMS OF FLOWERS OR PLANTS OF THE SAME SPECIES. By CHARLES DARWIN, LL.D. London: Murray. New York: D. Appleton & Co., 1877. Pp. 352.

two sorts. Mr. Darwin has the credit not of discovering the two kinds, but of finding out the meaning of it.

In the first place, he saw that here was something to be explained. He was not content, as his predecessors were, with noting that the thing was so; but he assumed that there was a reason why. And he then set to work, in the true inductive mode (but not in Lord Bacon's way), to discover this reason. He conceived an hypothesis of a general principle which would completely explain these cases. He found that it would equally explain a great variety of other cases; that within its proper limits it would explain them all; and he, therefore, inferred that the supposed principle was a true one. The principle is that "Nature abhors perpetual self-fertilization"; or, expressed without metaphor and in its application to the case in hand, that these flowers, though consisting of both sexes and capable of self-fertilization, were intended to act as if of separate sexes—that the pollen from the anther of one kind of flower was intended to reach and fertilize the pistil of the other kind, and so reciprocally. He then confirmed this particular supposition by observation; saw that certain insects, habitually visiting these blossoms for nectar or other food, actually carried pollen from the high anthers of one flower to the high stigma of the other sort, and from the low anthers of the latter to the low stigma of the former; that the adjustments and lengths were such as to secure this cross-fertilization; and, finally, the intention was made the more manifest by experiments which proved that pollen of the one sort would act promptly and effectively upon the stigma of the other sort, but less so and sometimes not at all upon its own stigma. The illustrations of this principle in various similar or analogous cases and the confirmation of it by evidence, mostly in the way of experiment, fill the larger part of this volume.

The conclusion is that there is some advantage in having two sexes in plants, as well as in animals; that this advantage is gained sometimes by having flowers of separate sexes in distinct plants, as in willows, but there with the disadvantage that half the trees are barren; or on different flowers of the same individual, as in pines and oaks, but still half the flowers are barren; or, finally, by the reciprocal fertilization of hermaphrodite flowers, and here with the economical advantage that all may be fruitful. Such is the economy of Nature. But she is multifarious in her economy. In the book on orchids Mr. Darwin shows how the same economy is subserved, and the cross-breeding made equally sure, in hermaphrodite flowers of one sort, the parts of which are so arranged that the pollen can seldom act at all except when transported by insects, while then in most cases it will be transported from one flower and from one plant to another. In these publications attention is directed to various different arrangements—"contrivances," as they are fittingly termed—for securing the general or the occasional cross-fertilization of flowers in a great variety of kinds, which were formerly thought to close-fertilize. And in the volume on the effects of cross and self-fertilization it is shown by experiments, more or less convincing, that such cross-breeding is beneficial. We might feel assured that it was from the manifold and elaborate arrangements which conspire to secure it. But, as these depend for success upon extraneous agencies—upon insects, winds, etc.—and are, therefore, more or less precarious, they are supplemented by other and seemingly contradictory arrangements for a certain amount of close-fertilization also.

Such are the topics of the book before us and of the related volumes of the series. Those who know of the author only through his writings upon evolution, and who look on these with misgiving or alarm, may yet share with us the interest with which we welcome works like these. To restore the idea of *intention* to its rightful place in natural history is no insignificant achievement. To open fresh fields of observation, which are accessible to all, old and young, in which new illustrations of curious contrivance and beneficial intention may be discovered in great variety by common observers, who have comprehended the principle and learned to use their eyes, is one of the latest and best contributions of science to education.

HARVARD COLLEGE.

DR. JAMES FREEMAN CLARKE'S six sermons on *Essentials and Non-essentials in Religion* (American Unitarian Association) is a very serious and very excellent discussion of the doctrines of Christian faith from the standpoint of one who calls himself a Unitarian, but allies himself with Evangelical believers in his and their contest against Naturalism or Positivism or Agnosticism. The chief points which he makes are as follows: The faith of the Old Testament worthies was essentially the same as all true faith—"a looking up with trust to something higher than themselves; a confidence that, besides all that is seen and temporal, there is something divine, invisible, eternal." Christ was: 1. A man, with all human attributes; 2. A patriotic Jew, completely emancipated from all Jewish prejudices and bigotry, a Son of Man, rather than son of Abraham; 3. The Way, the Truth, the Life, full of inspiration, and having the right to speak with authority; 4. One "who came to bring sinners to God, to bring pardon for sin," who first revealed the infinite pardoning love of God, who first brought in "the great doctrine of the overcoming, all-conquering, omnipresent power of divine love to redeem the lowest, to save the most abandoned"; 5. "The Son of God, and Divine—because filled full of the Divine truth and love, as always abiding therein. He, alone of the sons of men, was always resting on the Infinite love. He has sent the same spirit, in less degree, into the world, and enabled us all to say 'Our Father.'" His divinity consisted "in living in constant communion with God, so as to be a perpetual manifestation of the Divine truth and love." We will not stop to quote his defense of miracles against Naturalism, nor his doctrine of the inspiration of the Bible, which is, like much of his writing, less vague in its denials than in its affirmations, nor his defense of the Church. One of the best chapters is that on conversion, which he recognizes, as an eclectic theologian like him might be expected to, to be either by "catastrophe" or "evolution," either consciously sudden or the growing fruit of early education. "It will not do," he says, "to assume that all respectable, decent, and well-behaved people are necessarily going the right way. They may really be going down, not up—slowly, insensibly, perhaps, but steadily. And, if so, they must be called upon to repent and to make themselves a new heart and a new spirit. And that will probably be a sudden change." But the conversion is nothing unless its value is proved by subsequent right life. "Unless we enter this kingdom of truth and love, what good in passing the portal? The only advantage in beginning to go on this journey is that we should keep on and arrive at the end. Is Christianity a life? Then, in order to live, we must be born; but, unless we grow up, what good in being born?" The spirit of the book is most excellent, and what it lacks is definiteness of statement. It seems as if it were impossible for a Unitarian to use such terms as "divine," "atonement," "inspiration" in any but the vaguest sense. It is not now the erroneousness that we object to, for much error can be pardoned on subjects about which we cannot know certainly; but haziness of definition and statement is an intellectual offense which is not condoned by the utmost kindliness of fraternal and Christian temper.

....The December *Portfolio* has a delightful etching by Lhuillier, of Gainsborough's portrait of Lady Georgiana Spencer, as a child; also a *heliogravure* copy of an "Annunciation," by the old engraver "W," whom Prof. Sidney Colvin supposes to be Wolgemut, with whom Albert Dürer served his apprenticeship; also a very pleasant, though quite dark etching by P. Rajon, entitled "Prayer," and representing an old peasant grandmother, with a Bible open on her knees, teaching a little girl to pray. Prof. Colvin's essay on Dürer, his teachers, his rivals, and his followers, is the most important in this number.

....Mr. Octavius B. Frothingham has prepared a useful biography of *Gerrit Smith* (G. P. Putnam's Sons). With his religious and political views he is familiar and in sympathy; but the picture he draws is none the less accurate. With certain limitations, Gerrit Smith was an honest and uncompromising reformer, who played no unimportant part in the great fight against slavery. The book has value as a contribution to political history; and we are glad that it has been so competently prepared that no other life of Smith is needed. A finely engraved portrait is prefixed.

....We have received Vol. VIII of the ever-welcome *Aldine*. The separate numbers have been increased from twenty-eight to forty-four pages, admirably printed on excellent paper giving the best effect to the large