upper part of the *lower* Silurian; but on page 566 he says that the oldest known insect is the *Palæoblattina* of the *upper* Silurian.

We might mention others, but they are all trifling. In fact, the accuracy of the book is extraordinary.

In conclusion, we must heartily and most gratefully welcome the new edition. It is hard to say what American would be without Dana's Manual. Its encyclopedic fullness and yet extreme conciseness makes it hard reading for those who come to it without serious purpose. The word '*Manual*' exactly expresses its purposes and uses. It must be in the hands of every special student; it must lie on the table of every teacher of Geology to be consulted on every subject of doubt.

I had just finished this notice when the sad news of Dana's death was flashed across the continent. All recognized that this event could not be long delayed; but none the less it came as a shock to every man of science in the country. We are thankful that he lived to finish this new edition, for it is indeed the only fitting monument. No monument is worthy of a man of science except that which he erects for himself.

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A Handbook of Systematic Botany. By Dr. E. Warming. Translated and edited by M. C. Potter. 8vo. pp. 620, fig. 610. London, Swan, Sonnenschein & Co. New York, Macmillan & Co. 1895.

This excellent English translation of Professor Warming's important work will be welcomed by all students and it cannot fail to have a wide use as a text-book. The descriptions of the groups are clear, concise and complete, the illustrations capital and many of them original, and the press-work leaves nothing to be desired.

The arrangement of groups is from simple to complex—the only arrangement compatible with our present knowledge. The special application of this principle may be best stated in Dr. Warming's own words as printed in the preface:

"Each form which, on comparative morphological considerations, is clearly less simple, or can be shown to have arisen by reduction or through abortion of another type having the same fundamental structure, or in which a further differentiation and division of labor is found, will be regarded as younger, and as far as possible, and so far as other considerations will admit, will be reviewed later than the 'simpler,' more complete or richer forms. For instance, to serve as an illustration: Epigyny and Perigyny are less simple than Hypogyny; the Epigynous *Sympetalæ*, *Choripetalæ*, *Monocotyledones* are, therefore, treated last; the *Hydrocharitaceæ* are considered last under the *Helobieæ*, etc. Zygomorphy is younger than Actinomorphy; the *Scitamineæ* and *Gynandræ*, therefore, follow after the *Lillifloræ*, the *Scrophulariaceæ* after the *Solanaceæ*, *Linaria* after *Verbascum*, etc. Forms with united leaves indicate younger types than those with free leaves; hence the *Sympetalæ* come after the *Choripetalæ*, the *Sileneæ* after the *Alsineæ*, the *Malvaceæ* after the *Sterculiaceæ* and *Tiliaceæ*, etc.

"Acyclic (spiral-leaved) flowers are older than cyclic (verticillate-leaved) with a definite number, comparing, of course, only those with the same fundamental structure. The *Veronica*-Type must be considered as younger, for example, than *Digitalis* and *Antirrhinum;* these again as younger than *Scrophularia; Verbascum*, on the contrary, is the least reduced, and, therefore, considered as the oldest form. Similarly the one-seeded, nut-fruited *Ranunculaceæ* are considered as a later type (with evident abortion) than the many-seeded, follicular forms of the order; the *Paronychieæ* and *Chenopodiaceæ* as reduced forms of the *Alsineæ* type; and the occurrence of few seeds in an ovary as generally arising through reduction of the many-seeded forms. The *Cyperaceæ* are regarded as a form derived from the *Juncaceæ* through reduction, and associated with this, as is so often the case, there is a complication of the inflorescence; the *Dipsacaceæ* are again regarded as a form proceeding from the *Valerianaceæ* by a similar reduction, and those in their turn as an off-shoot from the *Caprifoliaceæ*, etc. Of course these principles of systematic arrangement could only be applied very generally; for teaching purposes they have often required modification."

While there is wide difference of opinion among botanists as to the relative degree of complexity of some of the families, and the sequence adopted by Engler and Prantl in

their 'Natürliche Pflanzenfamilien' will appeal to many students as in some respects more philosophical, all the suggestions contained in this book must be regarded as very valuable.

Plants are here divided into five great divisions: (1) Thallophyta; (2) Muscineæ; (3) Pteridophyta; (4) Gymnospermæ; (5) Angiospermæ. We note in this a departure from some recent views where the divisions 2, 3 and 4 have been grouped under the primary division Archegoniatæ, and from others where the divisions 4 and 5 have been grouped as Spermatophyta.

Dr. Warming does not discuss the relative value of these different views, contenting himself with alluding to them. We may note that the disadvantage of recognizing the Archegoniatæ as above circumscribed is found in the fact that the female organs of the Angiosperms are also archegones. It must be admitted that the grouping here maintained has many points in its favor, but it is our opinion that the term 'sub-kingdom' is more explicit for the primary groups than 'division.'

The Thallophyta are divided into 'subdivisions': (a) Myxomycetes, (b) Algæ, (c) Fungi. It is said of the Myxomycetes that "they occupy quite an isolated position in the vegetable kingdom, and are perhaps the most nearly related to the group of Rhizopods in the animal kingdom." The Bacteria are treated, unphilosophically, it would seem to us, as a family of Algæ, being grouped with the Schizophyceæ under the class Schizophyta. The treatment of the higher Algæ and Fungi is not essentially different from that of other recent authors. (It should be remarked that the arrangement and description of the Thallophytes is largely contributed by Dr. E. Knoblauch.) The Fungi imperfecti are placed at the end of the subdivision, and the only groups admitted to this category are the Saccharomyces-forms, the Oidium-forms and Mycorhiza. Lichens are discussed under Ascomycetes and Basidiomycetes.

The Muscineæ are treated as (1) Hepaticæ and (2) Musci frondosi. Neither in these nor in the Pteridophyta do we find any views very different from those of other recent authors. In the Gymnosperms we find the three classes, Cycadeæ, Coniferæ and Gneteæ, maintained; the Coniferæ are distinctly separated into two families, Taxoideæ and Pinoideæ, which is a suggestion of much importance.

Under the Angiospermæ we find a discussion of the systematic value of the primary group Chalazogams, recently suggested by Treub. It will be remembered that Treub found that in the curious genus Casuarina the pollen-tube entered the ovule near the chalaza, and on this character proposed to divide the Angiosperms into Chalazogames and Porogames, *Casuarina* being the only genus known to him that would fall into his first group. Dr. Warming concludes, from the more recent observations of Nawaschin and Miss Benson, which indicate the similar entrance of the pollen-tube in *Betula*, *Alnus*, *Corylus* and *Carpinus*, that our knowledge of this phenomenon is as yet too meagre to warrant us in maintaining the views of Treub, and so he adopts the usual grouping into Monocotyledones and Dicotyledones. His primary grouping of the Monocotyledones is as follows: (1) Helobieæ, Juncaginaceæ being taken as the lowest type; (2) Glumifloræ, in which he includes the Juncaceæ, a position which we do not believe can be satisfactorilly maintained; (3) Spadicifloræ; (4) Enantioblastæ; (5) Liliifloræ; (6) Scitamineæ and (7) Gynandræ. It will be observed that in this arrangement he differs considerably in detail from that of Eichler and Engler and Prantl. The primary division of the Angiospermæ is into (1) Choripetalæ, beginning with Salicaceæ and ending with Hysterophyta (parasites such as the Lorantha-

ceæ and Santalaceæ), and (2) Sympetalæ, beginning with Bicornes and ending with Aggregatæ.

An appendix, contributed by the translator, gives a useful tabulation of the system of Ray (1703), Linnæus (1733), A. L. de Jussieu (1789), A. P. DeCandolle (1819), Endlicher (1836–40), Brongniart (1843), Lindley (1845), A. Braun (1864), Bentham and Hooker (1862–83), Sachs (1882), Eichler (1883), Engler (1892). N. L. B.

The Story of the Stars. G. F. Chambers. New York. D. Appleton & Co. 1895. Pp. 160.

The Messrs. Appleton have begun with this small monograph their *Library of Useful Stories*, a series of paper covered booklets intended to embrace the ground of science, history, etc. This initial number, by Mr. George Chambers, an English astronomical writer of long experience, proves to be rather better than a first impression would lead one to judge; for the illustrations, which first strike the eye, are for the most part simply execrable. What excuse for the absence of more and better ones, in these days of inexpensive engraving? Its curiously insular mannerisms might readily have been corrected by a half hour's work of an American editor, who should also have toned down those provincial oddities of style which mar this book even more, because of its smaller size, than the same author's large *Descriptive Astronomy.*

Curiously false implications are wrought into the first chapter, though only a page or two in length. If the manifold uses of astronomy are to be competently brought before the public mind to-day, and the reasons for the support of that science from the public exchequer suitably defended, it is only by telling a few simple things exactly as they are. Now, it may be true in England that, if "the staff belonging to either establishment [the Royal Observatory or the Nautical Almanac Office] were to resort to the fashionable expedient of a strike for higher pay," then, among other dire results, "Our railway system would become utterly disorganized. A few trains could run, but the intervals between them would have to be considerable, and they could only travel by daylight and at very low speeds," but we do not exactly see why. Rather the fact is that, if both these establishments were permanently closed henceforth, the present state of astronomy is such that all the public business of determining time for railways and of preparing data for navigating ships could be done for the fiftieth part of the budget now devoted to the Nautical Almanac and the Royal Observatory; and any government maintaining such costly establishments, with their corps of trained observers and expert computers, merely for this simple though important purpose, would be very foolish indeed. Not only would the expenditure be extravagant, but wholly unjustifiable. These institutions are maintained for quite other purposes; and the significant work of the great government observatories (excellently done in England, France and Russia, and which in this country we have been trying for a half century to do, though not succeeding very well because the proper organization is lacking) lies in quite other fields, the immediate serviceableness of which is by no means universally conceded. Blanketing all this under the antiquated plea of utility in time and navigation is clearly wrong and wholly indefensible.

Mr. Chambers's attempt to popularize seems rather hard, and on the whole of doubtful success. Excellent scientific explanations go on for a while, when suddenly the author, seemingly suspecting that he is less interesting than he ought to be, plunges patchily into something purely literary, or indulges in some incongruous expression not exactly ludicrous, but giving an undignified