called fame or glory. The effective inducements will be the prospect of eminent usefulness, public consideration, the provision of all real facilities for his work, enough relief from pecuniary cares to leave his mind free for invention and forelooking, long tenure, and income enough to secure healthy recreations. He will not wish to receive a salary so high as to distinguish him widely from his colleagues the professors, except so far as the proper discharge of his functions involves him in expenditures from which they are exempt. He will want to work with a group of associates whose pecuniary recompense and prospects are not very unlike his own.

This educational expert will set a high value on freedom for himself. He will hope that trustees, faculties, alumni, and the supporting public, will permit him to carry out his own plans and provisions, or those which he espouses. He will hope that the responsibility he carries will entitle him to a certain deference for his judgments from his colleagues and the academic bodies. In short, a just academic freedom for the head of a university is more important than for any other person or group of persons connected with the university, for the reason that in education, as in every other function of democratic government, and every branch of the national industries, the problem how to create and develop real leadership is the most serious problem which confronts democratic society.

In all fields, democracy needs to develop leaders of high inventive capacity, strong initiative, and genius for cooperative government, who will put forth their utmost powers, not for pecuniary reward, or for the love of domination, but for the joy of achievement and the continuous, mounting satisfaction of rendering good service. This is just the kind of leader that democracy ought to produce for highly organized industries and for public service. The military commander is necessarily an autocrat; the hereditary ruler may be either a despot or a figurehead. The present type of industrial captain is too often governed by motives, and pursues ends, which are neither altruistic nor idealistic. None of these types is good for the democratic leader of the future, whether he is to serve in some great industry, in government, or in a university. At this moment the university administrator makes the best use now made of the powers of individualism on one hand, and of collectivism on the other, and understands better than any other leader in the world that in order to have successful cooperative action on the part of thousands of human beings, special emphasis must be laid on brotherhood in that admirable trinity—freedom, equality and brotherhood.

The American university gives an effective demonstration of the good results of the voluntary association in common work of many independent and unlike individuals possessing the maximum of goodwill; and academic freedom is, therefore, a good type of the considerate, humane freedom which will ultimately become universal.

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Scientific Books

Recent Literature on Echinoderms

There has been a marked increase in the attention given to the echinoderms, since the opening of the twentieth century, and during the last year especially, the contributions to our knowledge of the group have been numerous. Among these there are three which, for widely different reasons, particularly deserve attention.

Fisher's "Starfishes of the Hawaiian Islands"[1] is the first extended contribution

[1] "The Starfishes of the Hawaiian Islands," by Walter K. Fisher, acting instructor in zoology, Leland Stanford Junior University. Extracted

from a newcomer in the field, but it is easily the most important publication on starfishes which has appeared in America, at least since Alexander Agassiz's "North American Starfishes." Although Dr. Fisher is chiefly concerned with a systematic account of the Hawaiian Asteroidea, particularly those collected by the *Albatross* in 1902, many important morphological points are discussed and the geographical distribution of the species is given careful consideration. The introduction states that the *Albatross* collection consists of about 1,650 specimens, representing 60 species, of which the author considers 52 are new to science. This surprisingly large percentage of novelties is not so remarkable, however, when the situation of the Hawaiian group is considered, and it is remembered that, previous to this report, only eleven species (and at least two of these erroneously) were recorded from the islands. The classification used is a compromise between the two fundamentally different systems of Perrier and Sladen, with due reference to the work of Verrill, but unfortunately Fisher does not explain what principles have governed him in his choices, and we are left in the dark as to what characters he considers of the greatest importance in determining relationships. He apparently gives considerable weight to the absence, or presence and form, of paxillæ, superambulacral plates and pedicellariæ, all of which, while of value in classification, reveal notable diversities in nearly related forms. On the whole, however, there can be little question that Fisher has shown excellent judgment and his classification is probably as satisfactory as can be devised in the present state of our knowledge. The nomenclature used is admirable, for, following the sensible lead of Bell and Verrill, adherence is given to the International Code, and the pre-Linnæan names, resurrected or maintained by Sladen in his great *Challenger* monograph, are rejected. While this course results in the alteration of some familiar names (such as the change of *Cribrella* to *Henricia* and *Palmipes* to *Anseropoda*), there can be no doubt that it is a long step towards a stable nomenclature for starfishes. Following the introduction, ten pages are given to a synopsis of the Hawaiian Asteroid fauna and a discussion of its relationships. The most interesting points here brought out are that, although starfishes were taken at 126 stations, the *Albatross* collection consists almost entirely of sublittoral and continental forms, only three or four species having been taken in less than 20 fathoms and fewer than ten in more than 500 fathoms; that only one species previously recorded from the islands was taken; that the Hawaiian starfishes are distinctly Indo-Pacific in their relationships rather than American, notwithstanding that the ocean currents passing the islands are west-bound; that these west-bound currents have only brought five species of starfish to the islands; and that seven or eight Hawaiian species find their nearest relatives in the Atlantic Ocean or Caribbean Sea. The following 116 pages are taken up with the account of the Hawaiian starfish fauna, and open with an artificial key to the nineteen families recognized as occurring in the area under consideration. This key is clear and well arranged, and while obviously artificial in a few particulars (as such keys are of necessity bound to be), it will doubtless prove more useful than any similar key hitherto published. It is probable, however, that further investigation will reduce the number of families recognized by Fisher, for they are certainly of very unequal value as at present arranged. Such families as Mithrodiidæ and Heliasteridæ are certainly much less satisfactory than Astropectinidæ and Linckiidæ. Following the key, the families are taken up in their natural sequence, the synonymy being followed by an artificial key to the genera, and each genus, when containing more than a single form, is introduced by a key to the species. These keys are admirable in matter and form and make up in a measure for the absence of any diagnoses of families and genera (except those which are new). The descriptions of the new genera and species, and the remarks on

from U. S. Fish Commission Bulletin for 1903, Part III., pp. 987–1130, pls. I.–XLIX. Issued June 30, 1906. Washington: Government Printing Office, 1906.

previously known forms, and on nomenclature, leave nothing to be desired. The volume ends with two pages of glossary, two of bibliography, eight of explanation of plates, forty-nine plates, and a good index of three pages. The plates are of more than usual excellence, thirty-six being photographs (many enlarged), light figures on a black background, while the remainder are drawings of morphological details, chiefly by Dr. Fisher himself. The Bureau of Fisheries and Dr. Fisher are both to be congratulated on the appearance and the contents of this report, which will rank hereafter, in importance to students of the Asteroidea, with the classic works of Perrier and Sladen.

The report of the Echini of the *Valdivia* collections[2] is a great contribution to the taxonomy of the Echinoidea, from one of the most eminent of living Echinologists, and is the most elaborate work which he has yet produced. Among other reasons, it is notable for the attempt made to show details of structure, particularly the pedicellariæ, by means of microphotography. It is a quarto volume of 228 (63–290) pages, dealing with nearly one hundred different Echini, of which 71 were collected by the *Valdivia* at 62 stations. Of these, 23 were new to science at the time they were taken, but only three or four are described here for the first time, as preliminary reports on the collection were published in the Zoologischer Anzeiger in 1901 and 1905. Döderlein's work is, however, far more than a mere systematic account of the Echini of the *Valdivia,* for the first part of the volume consists of a discussion of the new system and principles of classification proposed by Mortensen, in which the pedicellariæ play such an important part. After a brief introduction and some remarks in regard to his methods of illustration, Döderlein proceeds to a short review of the recent works of Mortensen, de Meijere and A. Agassiz, following this with a dozen pages of discussion of the pedicellariæ and their value for purposes of classification, in which the writer reveals his sympathy with Mortensen's methods, although not oblivious to the difficulties which they involve. Several pages are given to remarks on the interrelationships of the different groups of Echini, and then comes an outline of the classification of the recent Echinoidea, as Döderlein would have it. This classification leaves out of account the evidence of paleontology and lays particular stress on the pedicellariæ. It divides the Echinoidea into two subclasses, *Cidariformia,* with the single family Cidaridæ, and *Diadematiformia,* with two orders, Regularia and Irregularia. The Regularia includes two suborders with a single family each and two with five families each. The Irregularia consists of two suborders, Clypeastroidea with four families and Spatangoidea with six families. It is hardly probable that this classification will be widely accepted, for it is difficult to believe that the Spatangoids are more nearly related to the Diadematidæ and Echinothuridæ, than are the Cidaroids, and surely the mere position of the anal opening is not of greater morphological significance than the presence or absence of the complicated "Aristotle's lantern," as the position assigned the Clypeastroids forces one to believe Döderlein assumes. Following the outline of the proposed classification, 183 pages are given to a discussion of the seventeen families represented in the *Valdivia* collection, with full descriptions, models of their kind, of all new species, important accounts of many little-known forms, and elaborate descriptions of the pedicellariæ of all species, not yet so treated by Mortensen. Special attention is given the Cidaridæ the genera proposed by Mortensen are discussed in detail and a new grouping of the species into ten genera, with five subgenera, is suggested. This is the least satisfactory section of the report, owing to needless and confusing changes in long-established names and to a curious lack of consistency, due apparently to

[2] "Die Echinoiden der deutschen Tiefsee-Expedition." Von Dr. Ludwig Döderlein. Mit 42 Tafeln und 46 Abbildungen im Text. Abdruck aus Wissenschaftliche Ergebnisse der deutschen Tiefsee-Expedition auf dem Dampfer *Valdivia*, 1898–1899. Im Auftrage des Reichsamtes des Innern herausgegeben von Carl Chun, Professor der Zoologie in Leipzig, Leiter der Expedition. Fünfter Band. Verlag von Gustav Fisher in Jena, 1906.

the "personal equation" in the attempt to apply Mortensen's pedicellarian principles. It seems to the present reviewer that distinctions between genera are impracticably fine when degrees of difference in a single microscopical character are their only basis. Döderlein's argument is badly hampered by the fact that his own figures contradict his words. Thus it is said several times in the text that the globiferous pedicellariæ of *Stereocidaris* lack an unpaired end-tooth, but not less than a dozen of the figures given on plates XXXVI. and XXXVII., illustrating the pedicellariæ of Stereocidaris, show such an end-tooth and in some cases it is very conspicuous. The volume closes with a brief review of the geographical distribution of the *Valdivia* Echini; a list of the stations at which Echini were collected, with location, depth, bottom temperature, species taken and number of specimens of each; a bibliography; a register of genera and species, arranged alphabetically (virtually an index); and a table of contents. The list of stations shows that the most interesting hauls were at Station 103, off South Africa, in 277 fathoms, where nine species were taken, and at Station 199 in "Nias-Sudkanal," in 261 fathoms, where six species occurred. Special reference should be made to the illustrations in this report, which are very numerous, but of very unequal merit. All are photographic in origin, save only a few outlines of pedicellariæ. Excepting these few outlines, the text-figures are mostly mere "shadow-pictures," and while some are useful, the great majority are of little value. Of the plates, two (IX. and XI.) are heliotypes and are very good, while the remainder are phototypes on cream-tinted paper and are often very poor. The trouble in many cases is obviously due to the object having been out of focus when photographed, and some important figures are ruined by this inexcusable blunder. Where bare tests are shown, they were seldom carefully cleaned, and the figures are correspondingly unsatisfactory. The numerous microphotographs of pedicellariæ are useful and many are excellent, but a large proportion are aggravatingly indistinct on important points. On the whole, it must be admitted that this report, because of the undue importance given the pedicellariæ for systematic purposes and the many unsatisfactory figures, is somewhat of a disappointment, and does not compare favorably with the previous work of its eminent author.

The first volume of the "Cambridge Natural History"[3] contains six chapters devoted to the Echinoderms, the work of the well-known embryologist, E. W. MacBride. After a brief introduction, the classification to be used is outlined and then the starfishes are taken up, the familiar *Asterias rubens* being used as the type upon which the account of the anatomy is based. This account is very well written, the discussion of the so-called "blood-system" being particularly interesting, though it is quite possible the last word is not yet said on those perplexing structures. Following the anatomical portion are several pages of morphological details where those features in which other starfishes differ from *Asterias* are discussed. The not infrequent defects of these pages are due either to the excusable necessity for brevity, as in the paragraph on "Asexual Reproduction," where statements open to question are made without qualification and much interesting matter is ignored, or to the less excusable lack of acquaintance with a large variety of forms. To this latter cause must be referred the statement that "the families Heliasteridæ and Brisingidæ are characterized by possessing numerous (19–25) arms"; this is an unfortunate half-truth, as the Heliasteridæ have 21–44 arms, while the Brisingidæ have only 8–18. A similar blunder occurs in the paragraph on "spines," where the Echinasteridæ are said to have short, blunt spines, "very numerous and thick set." This statement applies only to the genus *Henricia* and its immediate allies, while the other genera have widely spaced, often very sharp, spines, and in *Acanthaster* (to

[3] "The Cambridge Natural History," Vol. I. * * * Echinodermata. By E. W. MacBride, M.A., F.R.S., formerly fellow of St. John's College, Cambridge; professor of zoology in McGill University, Montreal. London: Macmillan and Co., Limited; New York: The Macmillan Company. 1906. Chapters XVI.–XXI., pp. 427–623, figs. 185–296.

which no reference is here made) are found the longest and most remarkable spines occurring in the whole class. The section on the "Classification of Asteroidea" is thoroughly unsatisfactory and it is particularly annoying that an Englishman should show such a lack of appreciation of Sladen's great work, which despite its defects is certainly the most carefully reasoned and well-grounded classification of starfishes yet published. One is almost inclined to believe that MacBride has never read Sladen's philosophical discussion of the principles of classification in the Asteroidea. The present reviewer dissents emphatically from the principles proposed by MacBride, that "the best method of classification is to take as our basis the different methods in which the demands of the environment have been met," and that "the great differentiating factor in their development must have been the means they adopt to shelter themselves from their enemies";—"One of their chief dangers" "must be regarded as" "assaults by other animals, especially parasites, on their soft and delicate skins." According to these principles, the influence of environment is far more important than heredity, and classification should be based, not on the deep-seated, slowly modified characters, but on superficial externals which are easily modified by changes in the manner of life. It is clear to any one familiar with the great variety of form and external features exhibited by starfishes that "the demands of the environment" have been met in widely different ways by closely related forms, while the converse of this may or may not be true. Moreover, starfishes have comparatively few enemies, after their larval life is past, and certainly are not especially liable to parasites as MacBride assumes. The great majority of species are found more or less exposed on the bottom or, at the most, concealed beneath rocks, and there is not the slightest evidence that the danger from parasites has played the least part in the evolution of the group. In view of his principles, it is not strange that MacBride adopts the classification of Perrier, of which no previous English or American writer has approved, and divides the Asteroidea into five orders, each of which is taken up in turn with its constituent families. The latter are, as a rule, treated very briefly, but the more important are made the subject of many interesting and well-written notes. The chapter closes with a short account of the fossil Asteroidea. The following three chapters deal with the Ophiurans, Echini and Holothurians, respectively, each class being treated in practically the same way as are the Asteroids. The account of the morphology of each class is well-written and very clear, with few mistakes or important omissions. It is to be regretted that the terminology used in connection with the pedicellariæ of the Echini is not that which is now almost universally used by echinologists. Much attention is given the physiological aspects of the structures discussed, and some unconfirmed observations on habits and functions, made by other workers, are accepted apparently without question, even though somewhat improbable. As the classification of the Ophiurans is still very imperfectly worked out, MacBride has done well in following Bell's arrangement, but it is remarkable that the very peculiar genus *Astrophiura*, described by Sladen, is nowhere mentioned, although its obvious resemblance to an Asteroid makes it of great importance in this connection. The classification given for the Echini is apparently original and has much to commend it, particularly its simplicity and the clear-cut groups. Unfortunately it omits the fossil forms (which are, however, discussed in a separate section) and for this and other reasons, it needs some modifications. The classification of the Holothurians is also original, very much so in fact, and it is safe to say will not be adopted by any student of the group, recognizing, as it does, six orders, of which only one contains more than a single family. MacBride gives little heed to either the work or the judgment of Ludwig, the nestor of Echinoderm morphology, and by his use of "Aspidochirota" and his failure to mention the Synallactinæ, he reveals either ignorance or lack of appreciation of recent work on the Holothurians. The chapter on the Pelmatozoa is, at least from a zoologist's point

of view, very satisfactory, and the writer's inclination to the classification of Wachsmuth and Springer for the fossil forms will be generally approved in America. The closing chapter, dealing with the development and phylogeny of the Echinoderms, is very interesting and is almost wholly free from the self-confident assertiveness which mars some of the preceding pages. While the conclusions which are reached as to the steps in the evolution of the type, and as to the interrelationships of the classes, need not always be approved in detail, it must be admitted that the author has made out a good case. The relationship of the Echini and Holothurians is well emphasized, as is the more obvious one between Asteroids and Ophiurans, but the evidence supporting the derivation of Echini from Asteroids is weak and it is difficult to believe that we are at this point on the true line of descent. It seems clear that MacBride has been somewhat unduly influenced by his familiarity with the development of *Asterina gibbosa,* and it is quite probable that his continued researches into the development of species of the other classes will ultimately lead him to somewhat different views from those he now holds. A word as to the illustrations is in order. About one third are original, the remainder being taken from such reliable authorities as Ludwig, Loven, Sladen, Wyville-Thomson, *et al.* Scarcely one is from a photograph, even such forms as *Asterias* and *Astropecten* being represented by drawings. While the diagrammatic sketches showing structure are always clear, and the original ones are particularly good, photographs of *Asterias, Ophiothrix, Echinus, Echinarachnius, Holothuria,* etc., would have been a great improvement on the rather crude sketches given. There are one or two mistakes made in identifications: thus the "Schizaster" figured on page 556 is certainly not *Schizaster,* but appears to be *Brissopsis,* while the *Salenia* figured on page 538 is not *varispina,* but *hastigera,* though this latter mistake is Wyville-Thomson's and not MacBride's. In conclusion, this review may be summed up as follows: the morphological, physiological and embryological portions of the text are excellent, though occasionally marred by an unnecessary dogmatism; the geological references are somewhat less satisfactory; while the ecological and systematic portions, and nearly all the illustrations of entire animals, range from mediocre to poor.

HUBERT LYMAN CLARK

The Principles and Practice of Surveying. By BREED and HOSMER. New York, Wiley and Son.

Of all the subjects taught in engineering schools, surveying, so-called, is one of the least satisfactory, both to the professor responsible for the instruction, and to the outside engineers who later test the value of the instruction in the light of the practical ability realized by those taught. This is doubtless due to two causes; first, on account of the large number of students and the small amount of time given to the subject, there is opportunity for giving to the individual little more than a bare insight into the methods of handling transit and level; and second, the use of those instruments in construction work involves very little of the time-honored methods indicated in the text-books for surveying farm areas and making differential profiles.

That the present methods are unsatisfactory is indicated in no clearer way than by the number of text-books on the subject, each school trying apparently to solve the problem of securing better results by the use of a new text-book which varies from that of some other school in the details of description of instruments or directions for field work.

The volume under review is the result of the experience of two instructors in the Massachusetts Institute of Technology, and embodies their ideas of what should be presented to the student who is taking up the subject of surveying for the first time. It is carefully and logically arranged for this purpose, giving descriptions in detail, emphasizing directions of what is, and what is not, proper procedure, and listing under each instrument and method, "common sources of error" and "common mistakes."

The book itself of 433 pages is divided into

four parts, the first 94 pages being devoted to the description and uses of instruments, the next 224 pages to methods of field work, the next 58 pages to computation, and the remaining 57 pages to mapping and draughting; an arrangement admirably adapted to a clear presentation of the subject. The detail of these four sections is well worked out. For example, in part I., a series of diagrams shows all the types of transit verniers; the Berger top attachment is used to show the theory and operation of the solar compass; the measurement of angles by repetition is explained and the value insisted on; and the tape rod for reading elevations direct, is explained and commended. In part II., the usual methods of land surveying are explained, and many details are given which show the practical experience of the authors. The chapter on Topographical Surveying is particularly satisfactory. The chapter on Mining Surveying is written by Blamey Stevens, M.Sc., of Ellamar, Alaska, and the field and office methods of underground work are carefully explained. In the chapter on leveling, the advantage in accuracy of double rodded lines is carefully pointed out and in the chapter on city work, the simpler methods of running out and recording curves are shown. A brief description of methods of triangulation is also given. In part III., emphasis is laid on the accuracy of computations, on the significance of the number of digits employed and on the proper forms for computation. Models are given in details for land area determinations and for earth volume determinations and these form the chief part of this section. In part IV. are given many hints referring particularly to surveying draughting, such as the use of water colors for ready-made inks, the checks on field work made possible by a critical study of the plot, and methods of finishing and filing drawings.

The usual tables complete the volume, which is probably as satisfactory a text-book under present methods of technical school instruction in surveying as can be written.

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Scientific Journals and Articles

Bird-Lore for May–June opens with "A Sketch of the Thrushes of North America," by Jonathan Dwight, illustrated by a colored plate and maps of distribution. B. S. Bowdish furnishes an account of "The Rose-breasted Grosbeak"; and Emma E. Drew tells of "Some Bird Acquaintances," made while confined to an invalid chair on the veranda of an Adirondack cottage. A list of 140 species observed from such a restricted point of observation shows what may be done right at home. The Educational Leaflet, by Mabel Osgood Wright is devoted to "The Baltimore Oriole" and the section devoted to "The Audubon Societies" shows that, thanks to these same societies, laws for the protection of birds are gradually being enacted throughout the United States.

The Bulletin of the Charleston Museum for May is mainly devoted to a "Synopsis of the Bird Records of the Natural History Society for the year 1906."

The preparation of an index to the first twenty-five volumes of the *Astrophysical Journal* is now under consideration. If sufficient support is secured, the index will be issued during the autumn of 1907, at a price of $1.50 or $2.00.

Societies and Academies

The American Chemical Society. New York Section

The last regular meeting of the session of 1906–07 was held at the Chemists' Club, 108 West 55th Street, on June 7.

The following papers were presented:

F. D. Dodge: "Methyl Salicylate, Natural and Synthetic."

K. George Falk: "Ignition Temperatures of Mixtures containing Carbon Monoxide" and "Autoxidation of Organic Compounds: Review."

C. M. Joyce,
Secretary