with tabular matter and with mathematical discussions. Dr. Hann has very wisely reduced his tabular matter to a minimum, and has devoted an appendix to the consideration of the more important physical theories which involve mathematical treatment. A few of the shorter and simpler formulæ only are included in the general text. By this arrangement the text is unencumbered, and the reading becomes easier and pleasanter. None of the modern text-books of meteorology, of which there are many, attempt to cover the field which Dr. Hann has so successfully covered. Hence no comparison of the new 'Lehrbuch' with these text-books is desirable, or even possible.

There is clearly no need to outline the contents of such a book as that now before us. Throughout, in the arrangement of the contents, the treatment of each subject, and the selection of the references, the hand of the master is clearly seen. If we were to single out one chapter which is likely to be of the most general interest to meteorologists at the present time, it would probably be that dealing with the theory of extra-tropical cyclones, a subject in the discussion of which Dr. Hann has taken a very prominent part, he being a strong advocate of the dynamic theory of the origin of these disturbances. In this country, Mr. H. H. Clayton, of Blue Hill Observatory, and Professor F. H. Bigelow, of the Weather Bureau, have made interesting contributions to this discussion. An excellent summary of the main facts in the case is given, and the position of the author is made clear by the statement (p. 586): "Es soll also hier die Ansicht vertreten werden, dass es zwar atmosphärische Störungen und damit Wirbelbildungen mannigfachen Ursprunges giebt, dass aber die Hauptursache derselben, namentlich aller grösseren und langlebigeren atmosphärischen Wirbel, in den Störungen der grossen atmosphärischen Zirkulation zu suchen sein dürfte."

Americans may well take satisfaction in noting the frequent references made by Dr. Hann to the work of Mr. H. H. Clayton and of his associates at Blue Hill Observatory, and also to that of the Weather Bureau. For a book of the size of this 'Lehrbuch' there are comparatively few illustrations in the way of charts and weather maps. Since the publication of Bartholomew and Herbertson's new 'Atlas of Meteorology,' however, there is not much need of introducing charts into text-books of meteorology, especially when the books are of such a grade as the present one. There are four half-tone views of clouds; one of lightning; two of hail-stones, and one of a waterspout. This waterspout is the one which occurred off the southern coast of New England on August 19, 1896 (see SCIENCE, N. S., Vol. IV., 1896, p. 718). Isothermal, isanomalous, isobaric, wind and rainfall charts are included.

It is seldom that a reviewer has so pleasing a task as that involved in writing a notice of Hann's 'Lehrbuch der Meteorologie.' The book is a masterpiece. R. DEC. WARD.

A Manual of Determinative Bacteriology. By F. D. CHESTER, Delaware College Agricultural Experiment Station. N. Y., The Macmillan Co. Price, $2.60.

Systematic bacteriology is the *bête noir* of the bacteriologist. The amount of confusion which exists in literature regarding the description of species is hardly conceivable. The descriptions are found scattered through an extensive literature; they are sometimes verbose and extended, and at other times brief and insufficient. Anything which looks toward a simplification of this complex problem will always be received with relief by bacteriologists.

The work of Professor Chester is a somewhat modest attempt to give a little assistance in this realm of confusion. It does not pretend to be a study of systematic bacteriology, but rather, as the name indicates, of *determinative* bacteriology. The author has endeavored to collect all species of bacteria which have been sufficiently described for even moderately satisfactory determination, and to arrange these within the limits of one medium-sized book in such a way that they can easily be found. By the use of artificial analytical keys, based upon simple, but important characters, the bacteria which the author includes in his list have been classified into easily distinguishable groups.

The amount of labor which has been involved in the collection and tabulation of these numerous species, about 800 in all, is very great.

Inevitably, also, the work is very uneven. Professor Chester has been obliged to use as his data the descriptions published by the numerous bacteriologists, and inasmuch as these descriptions vary so widely in their accuracy and in the extent of the details given, there is considerable difference in the completeness of the descriptions of species listed. But this, of course, cannot be laid to the fault of the author, but rather to the incompleteness and irregularity of the original descriptions.

Two phases of this work are of especial value, and bacteriologists will owe a debt to Professor Chester for introducing them. The first is the substitution of a new, descriptive word for the long, frequently verbose descriptions which have been widely used by bacteriologists. The single word 'arborescent' is quite as descriptive as the long phrase commonly found in bacteriological descriptions. A careful study of the essential characters of colonies, gelatin growths, etc., has enabled Professor Chester to select a comparatively small number of words which are distinctively characteristic, and which can almost always be used in place of the long paraphrases. This makes it possible to reduce the length of descriptions and to give them in the form of terse sentences, with a few characteristic adjectives. The work of describing species is thus immensely simplified. The second important addition is the arrangement of analytical keys. This, in itself, is one of the most important phases of the work. By the use of these analytical keys it is quite easy to trace any unknown species of bacterium very quickly to its proper place in Professor Chester's list, and then, by further study of a few carefully drawn descriptions, to determine whether the unknown species corresponds with any of those previously described. It is hardly necessary to emphasize the immense value it will be to bacteriologists to have all the known species of bacteria systematically arranged and traceable by means of a skilfully devised key. In these two respects the work of Professor Chester will be of the utmost assistance to bacteriologists.

The author adopts Migula's classification, based upon flagella, and this inevitably makes a part of the arrangement of species uncertain. A large majority of the descriptions of bacteria in literature contain no reference to flagella. In many cases, therefore, Professor Chester has been forced to infer the presence or absence of flagella, and to classify the organisms to a certain extent in this way by guesswork. Without attempting to criticise the value of a classification based upon flagella, one cannot but deplore the fact that the classification must be based upon characters so difficult to determine. Most bacteriologists are more interested in the physiological aspects of bacterial action than in their structure, and it will be a long time before the students of bacteria will become so familiar with microscopic methods as to be able to describe the distribution of flagella. For species described in past years, and for those described by many bacteriologists for years to come, we must expect that the distribution of flagella will be a subject not attended to with sufficient accuracy to make possible a grouping of the species according to Migula's classification. At all events, in this determinative list of Chester's many of the species are classified without any knowledge of their flagella, and their arrangement into groups, as Professor Chester has arranged them, is, in many cases, therefore, a pure matter of inference.

One other point may raise more criticism. The author has taken the liberty to give names to unnamed species. Where an author refers to a bacterium by number, Chester has given it a name. The original author will, therefore, frequently quite fail to recognize an old friend under a new name. The use of synonyms and a good index of names, however, relieve some of the difficulties arising from this wholesale use of new names.

It is, of course, inevitable that in a work of this sort there will be some omissions. Each bacteriologist who is particularly well acquainted with a certain group of bacteria will, naturally, be able to look through the treatment of Professor Chester and find many points to criticise. Each specialist will, doubtless, find some omission and be inclined to differ with the author in regard to the proper relationship of the species. This, however, is inevitable and does not at all detract from the usefulness

of the work. The work is at best a provisional one, and one which will require constant modification and perfection in future years. On the whole, the work is of a high character and must hereafter form a part of the library of every bacteriological laboratory.

H. W. CONN.

Das Wirbelthierblut in Mikrokristallographischer Hinsicht. Von DR. H. U. KOBERT, mit einem Vorworte von PROFESSOR DR. R. KOBERT. Stuttgart, Ferdinand Enke. 1901. Pp. 118, mit 26 in den Text gedruckten Abbildungen.

The reviewer does not recall any monograph since Preyer's 'Die Blutkrystalle' (1871) which presents the literature on the crystalline derivatives of the blood in the manner of this little book. In view of the medico-legal importance of the microchemical methods for the detection of blood, Dr. Kobert has given in detail numerous directions for obtaining various blood-pigment derivatives in crystalline form; many of these have originally been suggested by the well-known pharmacologist and physiological chemist, Professor R. Kobert of Rostock, to whom the author—his nephew—is largely indebted. While the monograph is intended for physicians and chemists rather than for the crystallographer, purely chemical methods of examination are only considered incidentally. Each chapter concludes with an historical summary of the literature on its subject. Among the topics treated are hemocyanin, in connection with which the reader may now consider the very recent paper by Henze (*Zeitschr. f. Physiol. Chem.*, XXXIII., 370), arterin and phlebin, to prove the independent existence of which (in distinction from oxyhæmoglobin and hæmoglobin) the author devotes considerable space; methæmoglobin and similar compounds; hæmatin and hæmin, with many (in part unpublished) data regarding the so-called Teichmann's crystals; hæmochromogen, of the crystals of which several photomicrographs are reproduced and form a useful addition to the usual text-book description; hæmatoporphyrin, melanins, serum-proteid crystals, hæmosterin and a few other crystalline derivatives.

Dr. Kobert's monograph may properly be studied in connection with Schulz's 'Die Krystallisation von Eiweissstoffen' (reviewed in SCIENCE of November 1, 1901), which likewise deals with the blood proteids.

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SCIENTIFIC JOURNALS AND ARTICLES.

The Popular Science Monthly for December has for its first article 'A Mechanical Solution of a Literary Problem' by T. C. Mendenhall, this being the noting of the relative frequency with which words of a given number of letters occur in the writings of various authors as compared with Shakespeare. The results were plotted in curves, and the curve derived from the plays of Marlowe was almost identical with that derived from the plays of Shakespeare. Sir Robert Giffen discusses 'The Importance of General Statistical Ideas,' showing the application of Statistics to the solution of such questions as the probable increase of population, food supply, commerce or manufactures. R. T. Glazebrook describes 'The Aims of the National Physical Laboratory of Great Britain' and under the title 'Cement for a Modern Street' S. F. Peckham treats of the progress that has been made in the manufacture of good cements. In 'The Influence of Rainfall on Commerce and Politics' H. Helm Clayton shows that there is a certain periodicity in years of abundant rainfall and consequent plentiful food supply and general prosperity. The political party which chances to be in power during these seasons of plenty assumes the credit for them which is really due to weather conditions. William L. Poteat tells of 'Lucretius and the Evolution Idea' and D. T. MacDougal briefly describes 'The Sensory Mechanism of Plants.' Finally, under the caption 'The Reception of the Origin of Species,' we have a reprint of some of the more noted reviews which appeared shortly after the publication of that work.

Bird Lore for November–December completes the third volume of this magazine, and contains the index for the past year. The number comprises 'Recognition Marks of Birds,' by Ernest Seton-Thompson; 'A Bird of the Season,' by