this region by similar delays, and their life blood extracted by the polite but very costly exchange of 'gifts.' Monteil had learned a lesson from their experience, and, secreting sufficient means to carry him through, 'played poor.' The consequences were evident in the great privations to which he was subjected for some time after this. At length his opportunity arrives, a caravan is ready to leave. He makes the sheik a series of presents as farewell gifts, which greatly embarrass that individual to properly and adequately return, which was his immediate duty. The tide was turned in his favor, and he got everything he wanted, and thus escaped this new species of danger with safety.

He speaks very caustically of the rotten and shaky condition of the affairs of Bornu, of which state Kukawa is the chief city. It took only a few months for his prediction of the fall of this empire to be verified.

On August 15, a year after leaving the Niger, he starts on the journey to Tripoli. The caravan of 78 camels, 7 horses, *30 men* and *30 slaves* must have presented a fine appearance, and their minds must have been much lighter as they started upon the last stage of their trip. Aside from the discussion of the usual tribulations of the long journey over the Sahara, and a rather pathetic description of the evil works of the 'demons of the desert who lead travelers astray,' nothing novel is given in this part of the book.

On December 10, 1892, he reached Tripoli, where his troubles were over. He was welcomed in France in the most cordial and well-deserved manner. His promotion, his medals and other honors have certainly been well earned, and they grace a hard-working, earnest and modest man. The volume contains much more valuable material than is usually found in a book of travels, particularly when written by one who is rather more of a military man and diplomat than a scientist. W. L.

A Laboratory Course in Experimental Physics: By W. J. LOUDON and J. C. MCLENNAN. Macmillan & Co. 8vo., 300 pp. Price, $1.90.

This book is written by the Demonstrater and the Assistant Demonstrater in Physics in the University of Toronto, and it is evidently designed to meet the special requirements of students in that institution. It is divided into two parts, constituting an elementary course and an advanced course. Part I includes a brief treatment of length-measuring instruments, vernier, cathetometer, spherometer, etc., which is followed by some exercises in density determinations, experiments with pressure and volume of gases and a little about capillarity. The remainder of the elementary course is mostly given to geometrical optics, although there is something of a treatment of photometry and a few exercises in specific and latent heat. The second part treats of acoustics, heat, electricity and magnetism, with a short appendix on gravity and the pendulum. An elementary knowledge of dynamics and the calculus is assumed in the advanced course. In the various experiments described it is generally assumed that a perfectly adjusted piece of apparatus is at hand ready to be set going. The instruments figured and described in the 'acoustics' are from the *atelier* of Rudolph Koenig, and nearly all of the illustrations in the book appear to have been made from perfectly constructed and finished apparatus. It is generally admitted that a large part of the value of the training in a physical laboratory comes from experience in designing, constructing and adjusting apparatus for definite purposes. In no other way can a student so quickly and thoroughly learn the sources of error entering into an experiment, or the methods of eliminating them and in a general way become familiar with the limits of accuracy to which he is restricted. Viewed from this standpoint, such a system as seems to be implied in this book is not to be commended. In fact, it is a little difficult to know under what conditions this book is intended to be used. The authors say in the preface that it owes its origin to the 'difficulty experienced in providing, during a limited time, ample instruction in the matter of details and methods' * * * 'at the present day, when students are required to gain knowledge of natural phenomena by performing experiments for themselves in laboratories.' Although not quite definite, this seems to imply

that students are expected to acquire such knowledge of physics as they get, by the use of this book, and many pages of the text appear to strengthen this view. A decade or more ago it was quite a popular notion that the way to treat physics was to begin, especially if the learners were young children, with laboratory exercises. The student was to find everything out for himself, and all the great truths of physical science were to be rediscovered every day in the secondary schools. No greater farce than this was ever enacted, for it was *seriously* approved and attempted by many of the great masters of pedagogy. It has now joined the host of other abandoned theories, at least as far as those who really teach physics are concerned, and it cannot be assumed that it still survives, or indeed, that it ever existed at the well-known institution from which this book came. It must be, therefore, that the volume is intended to be used as a guide in laboratory practice which supplements text-book and lecture instruction. From this standpoint the text contains much that might well be omitted, for it must almost necessarily have been included in the text-book or lecture work; and, although the plan may, and doubtless does, suit the scheme of instruction and available facilities in the institution in which it was prepared, a wider constituency could be served by assuming fewer perfectly made instruments and throwing the student on his own resources to a greater extent, in the matter of adjusting, designing and assembling the apparatus he is to use.

The Intellectual Rise in Electricity. By Park Benjamin. D. Appleton & Company. 8°. Pp. 600.

In the preparation and publication of this volume Mr. Benjamin has done a work for which all interested in physical science, and especially in electricity, will thank him. In these days few men capable of properly recording the progress of scientific discovery possess, at the same time, the instinct of the historian to a degree necessary for the making of a book like this. Few will deny that a knowledge of the history of a discovery, the circumstances and conditions under which it was made, and particularly the personality of the discoverer, add enormously to the interest of the fact itself and, besides, has its practical value in serving to fix the fact more definitely and more lastingly in one's memory. In the preparation of text-books the historical and biographical inclinations are usually either entirely suppressed or held severely in check and the student who depends on them alone, finds only the cold facts, presented in their logical or scientific sequence and stripped entirely of the charm of personal and chronological relationship. The wise instructor makes up for this deficiency and to him Mr. Benjamin's work will be doubly welcome. In making it an enormous amount of labor has been expended in the consultation of original sources of information, of many ages and many tongues. It is practically a history of electricity and magnetism from the earliest traditions to the end of the last century. But the history of one branch of science is like the history of one nation or one race; it cannot be written alone, and this book of necessity involves a study of the development of all physical science. When one recalls the names that appear, Thales, Aristotle, Archimedes, Roger Bacon, Peregrinus, Porta, Cardan, Gilbert, Galileo, von Guericke, Boyle, Hooke, Newton, Halley, Gray, Nollet, Franklin, together with many others, it becomes clear that in telling their lives one must tell the history of natural philosophy, and the history of natural philosophy is largely a history of the intellectual development of the world. This doubtless suggested to the author the peculiar and rather unfortunate title which he has fixed upon his work. The account begins with a chapter on the earliest traditions relating to the 'amber phenomenon' and to the lodestone, which have always been considered as in some degree related to each other, and a knowledge of which may have existed among prehistoric people. What was known among the Chinese, early Egyptians and Greeks is discussed and the subject is followed in its emergence from the periods of myth and legend or tradition to that of real and fairly authentic history. The discoveries of Columbus are discussed and two excellent chapters are devoted to the work of Gilbert, the real father of the science. The relations of Francis Bacon and Gil-

bert are gone into with considerable detail and a number of important facts brought out which will probably be new to most physicists, who are not likely to have made a critical study of the origin and sources of Bacon's philosophy. Many of them will doubtless feel inclined to rocommend to those admirers of the great chancellor who are trying to prove that he wrote the plays of Shakespeare the desirability of diverting their energies into an investigation of the authorship of the *Novum Organum*.

There is a good account of the founding of the Royal Society of London and of the electrical and magnetic work of Boyle, Newton and Halley.

The concluding chapter is devoted to a presentation of the discoveries of Benjamin Franklin, in which, of course, will be found references to many other contemporaneous electricians.

The work is distinctly a history. No technical preparation is required to read it and it is free from all mathematical or other discussions which might involve difficulty. The style is in the main excellent, but marred occasionally by excessive exuberance and diffuseness. An example of this is found in the several pages devoted to the story of Franklin's kite experiment, a very small part of which reads as follows:

"Quietly Franklin is arranging the silk ribbon and the key. This done he watches the cord close to him. There is no sign yet to guide him. Has he failed? Suddenly he sees the little loose fibres of the twine erect themselves. He has not failed, but the moment has come. Without a tremor he advances his knuckles to the key. And then a little crack, a little spark —the same little crack and the same little spark which he had taken a hundred times from his glass tube—and the great discovery is complete, his name immortal."

As a matter of fact, this kite experiment was quite unnecessary to establish Franklin's claim, which had before been put to the test in France, and Franklin's fame would have been quite as great without it, although unquestionably less picturesque. The experiment was interesting and not without dramatic quality, but, on the whole, a description of it in Franklin's own words would have been more satisfactory.

An Introduction to the Study of Zoölogy. By B. LINDSAY, C. S., of Girton Coll., Cambridge. London, Swan, Sonnenschein & Co. New York, Macmillan & Co. 1895. Pp. xix+356, with 124 illustrations and diagrams. $1.60.

This little volume forms one of the series of 'Introductory Science Text-books,' and is designed, as the author states in the preface, to serve as 'a kind of guide book for readers who are about to begin the study of zoölogy.'

The plan of the book embraces a Glossary, General Principles of Zoölogy (Part I.), Systematic Zoölogy (Part II.), Advice to Students (Part III.), and an index of subjects and of names of genera.

Part I. treats of the distinction between animals and plants, the cell, origin of species, embryology, etc., much in the style of Claus and Sedgwick's 'Text-book of Zoölogy,' whose work apparently forms a basis for this. To the general reader this part will doubtless prove interesting, as it discusses in an attractive manner the biological principles involved in an intelligent study of the animal kingdom, and explains the meaning of many of the terms and phrases so often used but as often not understood. The criticism might, however, be made that the space (114 pages) given to this division of the subject is too large in proportion to that devoted to the systematic portion of the work (190 pages).

In Part II. we have a chapter discussing the principles of classification and, as examples of classification by type, brief descriptions of Amœba, Vorticella, Hydra and the earth-worm. Then follow nine chapters each devoted to one of the Phyla of the animal kingdom; a table of classification with examples of its use closes this part. The concluding part has chapters on 'The Use of Books' and 'Practical Work;' in these the student is referred to some of the standard zoölogical works, and useful hints are given to those who would learn to see and think for themselves.

The design of the book is certainly a good one. Many readers of popular works on animals and their habits, would be glad to learn something more of the relation that these animals bear to others, and of the zoölogical principles as understood at the present day. To

consult a zoölogy full of technical terms and anatomical figures is not usually attractive to the beginner. Given a book that is clear, concise and correct, but not too technical, such a reader would be led further in the same direction and, what is very important, would not have to unlearn.

The question naturally arises, does this book carry out the design? The author has in the main succeeded in writing a very readable book marked by a pleasant and interesting style; yet there are a few places where, through a faulty mode of expression, the meaning is rendered obscure, *e. g.* "Animals develop to a higher point, in which the body layers develop complicated organs, usually go through a larval stage very different in appearance from the adult" (p. 74). Other obscure sentences refer to the germ layers (p. 30), and the openings of the thoracic duct (p. 45).

In the compilation of a brief introductory text-book we can hardly expect to find the pages entirely free from errors; and, while in the main, the author presents a correct statement of our zoölogical knowledge, several errors have found their way into the book. For example, bone is said to be found in the cuttlefish (p. 43), though we find on p. 228 cartilage correctly given. The paranucleus of the Ciliata is confused with the nucleolus (p. 138). On p. 180 the Dendrocœla are stated on one line to be mostly fresh-water forms and a few lines further down to be mostly marine. A similar contradiction appears on p. 186, where we read 'The Entomostraca * * * are mostly fresh-water forms,' while, of the examples given, all are marine. On p. 198 there are two errors: the Chilognatha have 'two pairs of legs on each segment,' and of the thorax and abdomen of insects, it is stated that 'both have the segments completely fused.'

What seems a serious fault in the plan of the systematic part is the defining a group or Phylum by means of types, which are themselves not sufficiently described. Chapter IV. will illustrate this: The Echinoderms are defined as 'animals more or less resembling in structure the sea-urchin.' One who had never seen a sea-urchin would naturally expect to find a figure with which to compare the other forms of the Phylum; but there is none given, and the brief description would hardly serve his purpose. Had there been an anatomical figure and a more detailed description of each of the types selected, the book would be more useful to the ordinary reader.

The chapter on the Cœlenterata is perhaps the most unsatisfactory. The difficult group of the Cnidaria is best understood by treating the simpler Hydrozoa first and then the Scyphozoa; instead we have the arrangement as given by Claus and Sedgwick, and there is, as well, a lack of clearness and definite system. We think the book would have been improved by giving more attention to the Vertebrates. The description of the mammals is mostly confined to a discussion of the teeth, which subject, important as these organs are, is not likely to attract the reader or satisfy him in lieu of some other details which would naturally occur to him in comparing the various orders of mammals.

Notwithstanding the criticism of these, and certain other errors which should be corrected, we believe that the book will prove of value to the reader and, in the hands of a teacher who can amplify and explain, would serve as a good text-book where principles, rather than a detailed learning of systems and names, are desired.

The book is attractively and clearly printed. The text is quite free from typographical errors; we notice only 'infusoriæ' (p. 67), 'Arthropoids' (p. 186), 'fore' for four (p. 267). The numerous cross references are correctly given except that 'fig. 12' should be fig. 121 (p. 299). The 'List of Illustrations' shows, however, careless proof reading, for no less than nine of the figures are referred to the wrong page. In the contents there are two more errors, and we presume that of the original figures No. 133 should be No. 123. W. M. Rankin.

SCIENTIFIC JOURNALS.

THE AMERICAN GEOLOGIST, JANUARY.

Dr. C. E. Beecher presents a sketch of James Dwight Dana, in which attention is called to the varied faculties and broad scientific knowledge of the man, but no attempt is made to give a complete account of his life. Special