so, however, as there are numerous additions, and, what is most notable, the plan of the work in one particular differs radically from that of the larger and more complete volume. The original series from which this is derived is intended to serve as a laboratory guide, and must be used in connection with some good text-book. The present volume is so written as to be available as both a text and a laboratory book, but it will probably be found more useful as a working handbook, and as an adjunct to a well-prepared text. The explanations of principles are invariably good, but not always sufficient, the necessities of the case requiring a degree of condensation sometimes incompatible with great simplicity. In common with the other members of the family to which it belongs, the book has great merit. In the beginning there is an introductory chapter on fundamental measurements and measuring instruments; there is next an excellent chapter on electrostatics, but which will appear to be somewhat long to some American teachers whose ambition seems to be to reach the dynamo-machine in the shortest possible time; then follows a chapter on magnetism; and the remainder of the book is devoted to voltaic electricity, electrical instruments, and measurements. There is an appendix, which, besides some additional practical hints to teacher and pupil, furnishes a price-list of instruments and materials needed for the laboratory and laboratory workshop, and complete plans, drawn to scale, of three recently established school laboratories. These will be of great service to those contemplating such additions to their school equipment; and the book, as a whole, can be strongly recommended to all interested in the advancement of elementary instruction in physics.

Among a few defects of minor importance may be mentioned the strict adherence, peculiar to English authors, to the concave mirror and scale for galvanometer and other purposes, omitting the consideration of the plane mirror and telescope method, which is often much better and much more available than the other. Taken in connection with the other series by the same authors, the title of this volume is unfortunate, and likely to lead to considerable confusion in making orders, references, or quotations.

The New Astronomy. By SAMUEL PIERPONT LANGLEY. Boston, Ticknor. 8°.

"I HAVE written these pages, not for the professional reader, but with the hope of reaching a part of that educated public on whose support he is so often dependent for the means of extending the boundaries of knowledge.

"It is not generally understood that among us not only the support of the government, but with scarcely an exception every new private benefaction, is devoted to 'the Old' Astronomy, which is relatively munificently endowed already; while that which I have here called 'the New,' so fruitful in results of interest and importance, struggles almost unaided.

"We are all glad to know that Urania, who was in the beginning but a poor Chaldean shepherdess, has long since become well-to-do, and dwells now in state. It is far less known than it should be, that she has a younger sister now among us, bearing every mark of her celestial birth, but all unendowed and portionless. It is for the reader's interest in the latter that this book is a plea."

The purpose of Professor Langley's book, as well as the charming style in which it is written, are so well set forth in his brief preface, that we have quoted it entire, as above. Supplemented with the clear statement of the opening pages, that the prime object of the old astronomy has been to tell us *where* the heavenly bodies are, while the new endeavors to tell us *what* they are, the reader has at once a clear idea of the scope and aim of this most interesting book. Though not written for the professional astronomer, none such can read it without interest and profit, even if for nothing more than as an excellent example of how to present his hard facts in a pleasing and attractive dress; while every intelligent reader will be pleased not only with the manner of presentation, but with the matter presented; and so plain and easy is the pathway made, that the unprofessional reader has little idea of the months and years of patient investigation — much of it the author's own — which have made these plain and easy statements possible. Rarely, too, or rather never before in an astronomical work, have engraver and publisher so happily united in giving a literary gem so beautiful an artistic setting. The first chapter especially, on 'Sun-Spots,' is rich in beautiful drawings from the author's own pencil while at Allegheny; and those who recall the wonderful frontispiece of Professor Young's excellent work, 'The Sun,' will desire to feast the eye upon the large number of equally fine drawings in the present work. Printed at the University Press of John Wilson & Son, Cambridge, Mass., and upon paper so heavy that the only drawback is the reader's constant fear that he has turned three or four leaves at once, the whole is a beautiful specimen of the bookmaker's art, and a gem which every educated man should possess.

We can only notice in the briefest way the contents of the eight chapters of the book. The first four are given up to the Sun (and after reading them we think the reader will join with us in a request to the compositor to set this with a capital *S*). Chapter I., under the title of 'Spots on the Sun,' treats of the photosphere, and contains reproductions of those beautiful drawings by the author which we have already mentioned. The second chapter, treating of the chromosphere and corona, naturally draws largely upon government eclipse-reports for its illustrations. While many of the latter cannot lay claim to much artistic excellence, they are useful as illustrating very forcibly the difficulties attending the ordinary attempts to sketch the corona during the two or three minutes of a total eclipse, and the need that photography should supplant most of these except for the telescopic detail of the inner corona, which is too fine for the photographic plate, and for the extreme outer limits, for which the eye is much more sensitive. The interesting drawings of hydrogen-clouds and outbursts above the sun's photosphere are naturally nearly all from the works of Young and Tacchini, who have done so much in this field. Right here, in connection with all the illustrations of the book, we would heartily commend the pains taken to indicate the original author or source of every illustration used, either directly under it or in the text close by. This is a matter in which some careless or unscrupulous authors and editors need a sharp lesson.

Chapters III. and IV. are devoted to the sun's energy, and are the most interesting and instructive in the book. Space will not here allow us to note the exceeding number of interesting features dealt with, and we imagine that the author must have felt overwhelmed in trying to deal at all fully, even in forty-seven pages, with the wealth of important phenomena resulting from the outflow of solar energy. We cannot refrain, however, from noting the author's striking experiment of comparing solar radiation directly with the 'pour' of molten steel from a Bessemer 'converter,' — our hottest known source of artificial radiations on a large scale. The result showed that the solar surface, even after being dimmed by absorption in its own and the terrestrial atmospheres, gave out, foot for foot, at least eighty-seven times as much heat as the surface of molten steel, and was more than five thousand times as bright.

In speaking of the exhaustion of the coal-fields, our source of power, the author gives a striking picture of the fair green England of three hundred years ago as compared with its present smoky skies and soot-blackened surface, where the whole island throbs with the coal-driven engine, and the waters are churned by the swift steamer; and then, in the *rôle* of prophet, he unfolds the future of a few hundred years, when almost certainly the 'all-beholding sun' will send his beams "through rents in the ivy-grown walls of deserted factories, upon silent engines brown with rust, while the mill-hand has gone to other lands, the rivers are clean again, the harbors show only white sails, and England's 'black country' is green once more! To America, too, such a time may come, though at a greatly longer distance." And the fourth chapter closes with the following striking paragraph: —

"Future ages may see the seat of empire transferred to regions of the earth now barren and desolated under intense solar heat, — countries which, for that very cause, will not improbably become the seat of mechanical and thence of political power. Whoever finds the way to make industrially useful the vast sun-power now wasted on the deserts of North Africa or the shores of the Red Sea will effect a greater change in men's affairs than any conqueror in history has done; for he will once more people those waste places with the life that swarmed there in the best days of Carthage and of old Egypt, but under another civilization, where man no longer shall worship the sun as a god, but shall have learned to make it his servant."

The four remaining chapters are devoted to the planets and the moon, meteors, comets, and the stars. All equally interesting with the opening chapters, they deserve equal mention, but space forbids. Suffice it to say that they bring our information of new discoveries in these interesting fields up to date; some beautiful reproductions of the photographs of stellar spectra, taken at the Harvard College Observatory, being among the latest important additions to our knowledge of stellar constitution.

In conclusion, we hope that this excellent work of Professor Langley may go far towards its avowed object in arousing an interest in the new, not *versus*, but to an equal degree of importance with, the old astronomy. There can be no question that it is of as much importance to mankind to-day to know *what* the heavenly bodies are, as *where* they are; and the endowments to obtain men and apparatus (the former more scarce, and the latter more complicated and perhaps expensive) with which to answer the first question should be forthcoming. In the report, some years ago, of the National Academy of Sciences, upon the importance of moving the National Observatory to a new site, the establishment of a physical observatory under government auspices was recommended. This is directly in the line of the purpose of this book, and we trust that the latter may be one of the active factors in bringing into being, under government auspices, an observatory wherein the spectroscope, bolometer and galvanometer, polariscope, and photometer, with the rapid photographic plate as the adjunct of all, may stand on an equally important footing with the meridian-circle and the equatorial with only filar-micrometer attached.

NOTES AND NEWS.

THE latest results of the work of Prof. Josiah P. Cooke and Mr. T. W. Richards give as the atomic weight of oxygen, 15.869 ± 0.0017. This is from a paper presented at the American Academy of Arts and Sciences March 14.

— Hartleben's great atlas, 'Die Erde in Karten und Bildern,' is now well advanced. So far, twenty numbers have been issued. The maps are good lithographs, clearly drawn, well lettered, and not overcrowded with names. They serve admirably the purpose of the general reader. The accompanying text is profusely illustrated, and contains numerous views, costumes, etc. The physical geography is now complete, and is followed by a succinct geography of Europe. The price of the whole atlas is only $14.75.

— In *Science* of March 9, p. 121, 1st column, 29th line from bottom, for '90 mm.' read '65 mm.'

— In *Science* of Feb. 24, p. 96, 1st column, last line, for '108' read '118.'

LETTERS TO THE EDITOR.

Unusual Dermal Ossifications.

IN examining the collection of *Testudinata* in the Yale College Museum, I found in specimens of *Testudo Leithii*, Günth., dermal ossifications, which, so far as I am aware, have never been described.

Each fore-limb of this small tortoise is furnished with a well-ossified shield, which covers the anterior and inner part of the limb. This shield is composed of suturally united ossicles, covered by scales, and corresponding in number to the large scales on the fore-arm. Each ossicle is smooth on the inner side, and elevated into an eccentric tubercle on the outer side.

This condition seems important for the explanation of the origin of the carapace and plastron of the *Testudinata*, and supports my view on this point published elsewhere (*Zool. Anzeiger*, Nov. 22, 1886).

There can be no doubt that this peculiar shield of the fore-foot originally consisted of small, free ossicles. Probably different stages of this condition will be found, if these parts are carefully examined in the *Testudinidæ*.

The elemental form of the carapace was, there seems to be little doubt, exactly the same. There appeared at first distinct ossicles in the skin. With further development in this direction, these ossifications touched each other, forming a closed shield, the single elements of which were connected by suture.

As soon as this shield became connected with the endoskeleton. it found a support, many of the sutures disappeared, and the elements of the shield were disposed according to the arrangement of the endoskeleton.

In the above way the costal plates were developed. The ossicles, finding a support on the ribs, co-ossified with them and with each other.

The plastron has developed in the same way. The basis of the plastron probably consisted of dermal ossifications, generally called 'abdominal ribs.' By the increase of these dermal ossifications, the 'abdominal ribs,' the clavicles, and interclavicle were absorbed, forming a solid shield, in which the clavicles and interclavicle were transformed into epiplastron and endoplastron.

The oldest condition of the plastron of the *Testudinata*, therefore, was solid, and not pierced by fontanelles.

The oldest known representative of the *Testudinata*, *Proganochelys* (G. BAUR, 'Ueber den Ursprung der Extremitäten der Ichthyopterygia,' in *Bericht über die xx. Vers. des Oberrhein. Geol. Vereins*, Stuttgart, 1887, pp. 17, 18), from the triassic of Württemberg, confirms this opinion.

Embryology has nothing to say in this regard. The whole plastron (with exception, perhaps, of the epiplastron) is of dermal origin, and has nothing to do with the endoskeleton; but the ontogenesis of the exoskeleton is of no value for phylogenesis.

There are many authors (especially Cope and Dollo) who think that the representatives of the *Dermochelydidæ* (*Sphargididæ*), *Dermochelys* de Bl. and *Psephophorus* v. Meyer, are original forms; and Cope has created a peculiar group, '*Athecæ*,' for these and some allied genera (*Protostega*, Cope; *Protosphargis*, Cap.).

I cannot agree with this opinion, but consider these forms as the most specialized of the sea-turtles.

One group has developed from a form of *Testudinata* with well-developed carapace and plastron, by dissolution of their elements, into single ossicles, connected by suture (*Dermochelys*, *Psephophorus*). The other group has developed from a form of *Testudinata* by rudimentation of the costal plates (*Protostega*, *Protosphargis*).

The enormous *Chelonia Hoffmanni*, Gray, which has the costal plates very little developed, and the marginals very slender, shows characters between the *Cheloniidæ* and *Protostegidæ*, especially *Protosphargis*, and must rank as a different genus, which I propose to call '*Allopleuron*' (the generic characters are, costal plates, even in the adult, very little developed, covering only one-half of the rib; marginals very slender).

There have never been found mosaic-like dermal ossifications, neither in *Protostega* nor in *Protosphargis*. The plates considered by Professor Cope as probably belonging to the carapace belong to the plastron. The marginals have not disappeared, as in the *Dermochelydidæ*, but are present; those of *Protosphargis*, described by Capellini as probably phalangeal bones, resemble very much these elements in *Allopleuron*.

Sea-turtles have probably been developed at different times and in different localities, in the same way as the gigantic tortoises. The species of the Galapagos Islands are not directly related to those of the islands round Madagascar. Both have originated from two different stocks, — the first from some form of the American continent, the second from some one of African type.

G. BAUR.

New Haven, Conn., March 4.

End of the Swindler.

IT will give undoubted satisfaction to his many victims to learn that the 'swindling geologist,' whose depredations have been so frequently noted in your columns, has been lately convicted of stealing a number of microscopic objectives from the University of Cincinnati, and sentenced to spend five years at hard labor in the Ohio Penitentiary. He was sentenced under the name of O. L. Syrski, but admitted having pursued his calling under a variety of *aliases*, such as Taggart, Vasile, Ellison, Cameron, Douglas, Strong, Lee, Arundal, and Lesquereux. A valuable microscopic objective, found in his possession, awaits identification by the owner.

CHAS. H. GILBERT.

Cincinnati, March 9.