4. With a three-and-one-half-inch Goerz doublet of thirty-three and one half inches focus (used during the previous expeditions of 1896, 1900 and 1901), attached to one of the automatic movements, sixty-three fine pictures of the corona were secured during the 186 seconds of totality. Some of these show the coronal streamers to exceptional length.

5. Sketches of the corona were made with the usual results.

6. Observations of the shadow bands were begun at least ten minutes prior to totality. The bands were wavering and narrow, moving faster than one could walk and at right angles to the wind, their length with it. They were observed to wax and wane five times during the interval of observation preceding totality. These observations have been communicated in detail to Mr. Lawrence Rotch, of Blue Hill and embodied in his exhaustive study of this phenomenon.

Computed Traces and Totality-Durations of the Total Solar Eclipses of the Twentieth Century: Professor DAVID TODD and R. H. BAKER, Amherst College, Amherst, Mass. Read by title.

A Possible Extension of the Theory of Envelopes: Professor L. G. WELD, State University of Iowa, Iowa City, Ia.

(*a*) In the equation $f(x, y, \alpha) = 0$, representing a family of loci, by giving to α, first an increment and then a corresponding decrement, each of magnitude $\Delta\alpha$, solving the resulting equations for the coordinates of the point of intersection and, finally, letting $\Delta\alpha \doteq 0$, there will be obtained

$$x' = \phi(\alpha), \quad y' = \psi(\alpha).$$

These equations define a point of the envelope of the given family of loci and eliminating α between them gives

$$F(x', y') = 0,$$

the equation of the envelope.

The point (x', y'), determined as above, may be called the tracing point of the locus, that is, the point which, for the moment, is tracing the envelope. It was shown in the paper, by way of illustration, that the tracing point for the envelope of the family of ellipses,

$$\frac{x^2}{\alpha^2} + \frac{y^2}{\beta^2} = 1, \quad \alpha + \beta = c,$$

is the Fagnagni point.

(*b*) The inverse of the above notion was next developed with reference to the right line, viz.: A point on the line

$$\frac{x}{\alpha} + \frac{y}{\beta} = 1,$$

being assigned at will, to find the functional relation between the intercepts,

$$\Phi(\alpha, \beta) = 0$$

(*i. e.*, the law governing the motion of the line), in order that the given point may trace an envelope and, finally, to obtain the equation of the envelope. The required relation is given by either of the differential equations,

$$x' = \phi(\alpha, \beta) = \frac{\alpha^2}{\alpha - \beta\dfrac{d\alpha}{d\beta}}, \quad y' = \Psi(\alpha, \beta) = \frac{\beta^2}{\beta - \alpha\dfrac{d\beta}{d\alpha}}.$$

In general both equations will be needed in order to determine the constants of integration. Having thus obtained the function Φ, which is, in effect, the tangential equation of the envelope, the equation in rectangular coordinates readily follows.

Several examples applying the principles were presented and its application to other families of loci was suggested as a promising field of investigation for the amateur mathematician.

LAENAS GIFFORD WELD,
Secretary.

SCIENTIFIC BOOKS.

Die Schule der Chemie. Erste Einführung in die Chemie für Jedermann. Von WILHELM OSWALD. Zweiter Teil. Die Chemie der wichtigsten Elemente und Verbindungen. Braunschweig, Friedrich Vieweg und Sohn. 1904. Price, bound, 8 Marks.

This little book will be of service to two classes of people: to schoolboys of ten to fifteen years, for whom it was primarily intended, and to teachers. It is doubtful if the average American schoolboy would be attracted by the method of presentation, even in an English translation, though it would be an interesting experiment to try and we should be glad to hear of the results. But every teacher will find the book worthy of a most careful reading. Professor Ostwald has selected with very great care that material which appears to him most fundamental and most interesting for the beginner in chemistry and he has secured a clearness and accuracy in presentation which deserve very high praise. In both directions teachers will find here a mine of useful suggestions.

The author follows, of course, his well-known attitude toward the atomic theory. He is too good a teacher not to recognize and make use of the 'hypothesis' for didactic purposes, but he evidently does this because of the hardness of chemists' hearts and wishes he could escape the necessity. This dislike for the theory sometimes betrays him into inaccurate statements or false reasoning. Thus on page 38 he explains that the formula of sulphuric acid is written with two combining weights of hydrogen, because otherwise we should have to write $HS_{\frac{1}{2}}O_2$ and 'the rule has been laid down that fractions of combining weights shall never be written.' He neither gives a reason for such an arbitrary rule nor does he explain why a combining weight of 16 might not be given to sulphur and the formula written HSO_2. It is not, of course, essential that these matters should have been explained at this point, but so misleading a reason should not have been given.

On page 42, in answer to the question, 'Are not the atoms, then, just as certain as the natural laws?' the author replies, 'Not at all, for natural laws are not based on an arbitrary assumption, as is the atomic hypothesis, but they express definite relations between quantities which can be measured and proved.' In this statement he appears to overlook the fact that the natural laws are all based on two assumptions: first, that phenomena repeat themselves with absolute uniformity under the same conditions and, second, that simple relations exist between the quantities which we measure. Each of these assumptions is arbitrary and neither can be proved. They differ from the assumptions which lie at the basis of the atomic theory in being more simple but not in their fundamental nature. To illustrate: We believe in the law that the atomic heats of the elements are equal because many similar simple relations have been found and we assume that a simple relation exists here also, though we can not prove it and are well aware that the deviations from the law are very far in excess of the experimental errors in the measurement of the quantities involved. The assumption here is clearly an arbitrary one and is based on far less satisfactory evidence than that almost infinite variety of phenomena which form the basis for our assumption of the existence of atoms. The writer of this review does not claim that the existence of atoms has been proved, but he does claim that the truth of natural laws is also not proved, and that while natural laws and the atomic theory differ greatly in the complexity of the phenomena on which they are based, they do not, philosophically speaking, differ in their fundamental nature.

On page 48 he suggests the term 'molar weight' in place of molecular weight. This would be very unfortunate in English since the word molar is used by us in a quite different sense.

On page 112 we find the erroneous statement that 'sulphuric acid is bibasic because it contains two combining weights of hydrogen.'

On pages 82 and 139 it is stated that every transformation or reaction produces the less stable form of an element or compound. Professor Ostwald seems to accept this law as a sort of axiom without attempting to give any reason for it. It appears to the writer of this review as closely related to Berthelot's erroneous law that every chemical reaction takes place with the evolution of the maximum amount of heat. Both laws are based on a desire to explain chemical reactions by a

simple consideration of the energy relations involved. If the law were true, all reactions which give oxygen at ordinary temperatures should give it in the form of ozone. The fact that some such reactions give ordinary oxygen while others give ozone is doubtless connected, in some cases, at least, with the structure of the reacting compounds as well as with their inherent energy. And no one has thus far told us how a satisfactory account of matters connected with chemical structure can be given without the aid of the atomic theory.

One hesitates to criticize a book of such surpassing excellence and one destined to be so very useful. But those very qualities which have made Professor Ostwald so much beloved by all of his acquaintances and which have given him such an extraordinary hold on his students, seem to lead some of them to accept almost without question everything which he writes and it seems right that a divergent view should sometimes find expression.

WILLIAM A. NOYES.

SCIENTIFIC JOURNALS AND ARTICLES.

The American Naturalist for February contains articles on 'The Unity of the Gnathostome Type,' by Howard Ayers; 'Old Age in Brachiopoda—a Preliminary Study,' by H. W. Shimer; and 'The Habits of *Necturus maculosus*,' by A. C. Eycleshymer. Dr. Ayers concludes that the Marsipobranchs are true Gnathostomata and that the only living Acraniate is Amphioxus. Dr. Shimer's article gives a summary of the principal characters that accompany old age in the brachiopods and includes many illustrations of typical examples besides presenting suggestions as to their origin and meaning. Professor Eycleshymer discusses the habits of *Necturus* at some length, giving much new and interesting information in regard to its nests and breeding habits. We quite agree with him that any specimen over a foot in length is unusually large.

The University Bulletin, University of Michigan, for December, 1905, contains the report of the curator of the museum. Mr. Adams is to be complimented upon having accomplished much with a small expenditure of money and on having done much by collecting, and rearranging and labeling the museum collections, to promote its efficiency. The chief accessions were 131 skins of mammals, representing 23 species, and 298 birds of 111 species.

Colorado College Publications, Science Series, No. 46, is devoted to an annotated list of 'The Mammals of Colorado,' by E. R. Warren. This contains a very considerable amount of information compressed into a few pages and is accompanied by a bibliography.

The Quarterly Record of Additions to the Museum of Hull, England, is an excellent device for economical and extensive publication. Objects of interest are described in the *Eastern Morning News,* electrotypes made of the articles, and each quarter these are combined and issued in pamphlet form as one of the museum publications.

SOCIETIES AND ACADEMIES.

THE BIOLOGICAL SOCIETY OF WASHINGTON.

THE 412th regular meeting was held on February 17, 1906, with Vice-president Palmer in the chair and thirty-two persons present.

Professor Paul Bartsch presented a paper on 'Variation in the Shell of *Goniobasis virginica,* with an Outline for Breeding Experiments.' He described and illustrated with lantern slides the wide differences among individuals of this species. Collections from the vicinity of Mount Vernon in tidewater subject to an occasional slight salinity are constant in form. Those from the Shenandoah at Harpers Ferry likewise show little variation, though plainly recognizable from the Mount Vernon representatives of the species. About Washington the shells show extreme variation. Intergrades everywhere exist and the subspecific groups all run together. Without attempting to account for these variations, experiments were proposed calculated to throw light on the subject. These consisted substantially in transplanting the local forms and studying their progeny under the new conditions. In the Shenan-