ever, shows that the results of oxygen absorption and carbondioxide elimination as determined by the Benedict calorimeter and the Zuntz apparatus are identical. There is therefore no doubt that the preeminent feature of the apparatus used by Benedict is the calorimetric determinations.

The authors find that the average heat production for fifty-five subjects during waking hours is 97.1 total calories, 1.52 per kilogram of body weight, and 49.2 per square meter of body surface, per hour. These records are 35 per cent. above the requirements in sleep. Further experiments showed an average requirement of 17.8 additional calories when a subject undressed, weighed himself and dressed again. An important generalization is that the pulse rate is more or less parallel to the total metabolism.

This book suffers very greatly from a fault that has pervaded the publications of the Nutrition Laboratory, both at Boston and at Middletown, and that is that the new discoveries are not sharply defined as separate from well-known facts. This fault occurs in Benedict's splendid monograph on "Inanition" where the one new fact, the quantitative determination of the amount of glycogen oxidized on the first and second days of fasting is passed over without emphasis.

The authors make the following statement: "A striking series of experiments has demonstrated very clearly that a change from a diet poor in carbohydrates to one rich in carbohydrates is accompanied by a considerable retention of water by the tissues of the body." This however is not an original observation, having been noted by Bischoff and Voit, fifty years ago.

The world owes a great debt to the work of the Carnegie Nutrition Laboratory and its forerunner in Middletown, which no one can gainsay. Criticism is offered in the spirit of Pflüger who held it to be the mainspring of every advance and the Altmeister adds, "deshalb übe ich es."

GRAHAM LUSK

The Elements of the Theory of Algebraic Numbers. By L. B. REID. New York, The Macmillan Company. 1910. Pp. xix + 454.

The title of this book is misleading, as it treats of no algebraic numbers other than quadratic; it can not be said to present even the elements of the theory of algebraic numbers. The author devotes 150 pages to the elementary congruencial properties of rational numbers and 300 pages to quadratic numbers. In view of the intimate relations between quadratic forms and the numbers and ideals of a quadratic field, the omission of an account of quadratic forms is certainly a serious defect in a book having the aims of the present one.

In a review of a book of the character of the present text, one has only to discuss questions of pedagogy. The author desires to bring out a closer relation between rational numbers and quadratic numbers. This he accomplishes by complicating the elements of rational numbers with the unnecessary machinery of quadratic numbers! We find on page 91 Wilson's theorem stated in the form

$$r_1 r_2 \cdots r_k + 1 \equiv 0 \pmod{p}, \quad k = \phi(p),$$

where $r_1, \cdots, r_k$ form a complete set of residues modulo p, a prime. A similar unnecessary complication is met on page 105. Positive and negative primes p are used, so that one must face $\phi(p) = |p| - 1$.

On page 247 the "introduction of the ideal" should read introduction of ideals. After stating formally theorem A and devoting fifteen lines to its proof, the author informs us that the "theorem therefore fails." Similarly, on pages 250–251, theorems are formally stated and later shown "not to hold in general." This peculiar style of pedagogy is decidedly a novelty to the reviewer. It may at least serve to put the reader on his guard as to the fallibility of "what is written in the book." In the present instance the reader may be prepared for the actual error in the theory as presented on page 316, where the author makes a general theorem depend upon an equation which he has earlier proved only for a few special cases. His single reference is to the case of Gauss's field of complex integers $a+bi$. Several errors appear on page 376; in the line below (2) and that above (3), m must be replaced by m_1; while the use of $\rho_1, \rho_2, \cdots$ for $\delta_1, \delta_2, \cdots$ is merely an oversight. At the bottom of page 255 the author speaks of introducing ideals into a number field.

Many of the proofs employed by the author in his case of quadratic fields are mere substitution of 2 for n in the standard proofs on algebraic fields of degree n. In one place he says: "This proof could have been somewhat simplified had greater use been made of the fact that the realm under consideration was quadratic, but it seemed desirable to give the proof in a form at once extendable to realms of any degree." The reference is to his three-page proof that every quadratic field has a basis! Now the real justification of a special treatment of the quadratic field lies in the fact that particularly simple proofs may be given and the reader made acquainted with an important example without the algebraic difficulties inherent in the general field. The above remarks will serve to show how the author has filled 300 pages with properties of quadratic number, without entering upon a discussion of the class number, characters, genera and other important topics on quadratic numbers.

In the matter of references the author has been particularly unfortunate. In a book barely entering upon the threshold of the theory, a scarcity of references would have been entirely justifiable. But to give hundreds of references to a certain report on the subject (excellent although it be) and to completely ignore the literature and not even mention the names of the discoverers of the theorems is against all scientific traditions.

L. E. DICKSON

SPECIAL ARTICLES

THE RELATION OF COLLOIDAL SILICA TO CERTAIN IMPERMEABLE SOILS

THE interpretation of recent soil bacteriological studies upon the Truckee-Carson Irrigation Project at Fallon, Nev., is in many cases difficult because of the impermeability to irrigation water on certain shortly defined areas. These impermeable areas support practically no crop growth, although the soil is very similar to that of the good areas in appearance and soluble salt content. During the past two years it has been my belief, based upon rough estimations of the silica that could be washed out from samples of soil from good and poor spots upon the United States Experimental Farm at Fallon, Nev., that at least in some instances the permeability and impermeability bore some relation to the occurrence of silica in a colloidal condition. Certain peculiarities of the behavior of soil samples from good and poor spots toward colloidal silica have been noted in the laboratory. These facts are only indirectly connected with our soil bacteriological studies and seem of themselves of sufficient interest to warrant publication at this time.

The following is a brief summary of laboratory results which seem to confirm the theory that in certain soils impermeability is associated with the occurrence of colloidal silica:

One-gram samples of good soil shaken in ten cubic centimeters of carefully dialyzed colloidal silicic acid of specific gravity of 1.0108 coagulates in from three to eight hours at 28° C.

One-gram samples of bad soil similarly treated not only do not coagulate the silica but hold it in a colloidal condition even after the check tube of pure silicic acid has coagulated.

The mixing of small quantities of calcium chloride, calcium sulphate or dilute acids with samples of bad soil before their addition to the silicic acid enables them to coagulate the tube of colloidal silicic acid in as short a time as that necessary for samples of good soil.

The treatment of samples of bad soil with calcium chloride, calcium sulphate, or dilute acids destroys their impermeable character, in some cases enabling water to percolate through them as rapidly as in the case of good soils.

In these experiments it has been found that the two essentials are, first, a high degree of purity of the colloidal silicic acid; and,