Error in the determination of carbohydrates. 2. The existence of a substance which is free of nitrogen and is of a character not usually ascribed to carbohydrates and resistant to the ordinary reactions for such. While the first alternative is not excluded, the writer is inclined to the latter conclusion and expects to continue the investigation along this line.

NOTE.

Improvement in Drying Chambers.—In an ordinary copper drying chamber, or air-bath, the bottom is protected by a false bottom, usually of iron, supported at the four corners by the legs of the chamber. When heated by a burner the false bottom expands and cups, and thus breaks the heat connection with the true bottom, making the chamber more difficult to heat. This trouble may be entirely remedied by riveting the two bottoms in the center with one rivet, leaving the four corners to expand or contract, but still supported by the legs of the chamber. The burner should be placed immediately under the rivet. The writer has used chambers thus improved for some time with great satisfaction. Chambers with the improved bottom may be had of Eimer & Amend, New York. J. L. BEESON.

NEW BOOKS.

THE ENERGY OF LIVING PROTOPLASM. By OSCAR LOEW. Professor in the Imperial University, Japan. 1896. London: Kegan Paul, Trench, Trübner & Co.

After reviewing briefly the theories of the cause of vital phenomena held from the time of Plato to the present, and after giving a short history of the discovery of the cell, the author takes up the characteristics of protoplasm, and especially those by which this substance exhibits phenomena of sensation. This naturally leads to a discussion of the relations of proteids to protoplasm, and consequently to a sharp distinction between physiologically active and dead or reserve proteid matter. He considers that proteids yield the vital phenomena, and that living proteid matter undergoes a chemical change at the moment of death. After briefly reviewing the older theories respecting the constitution of the proteid molecule he concludes with the following: "It appeared to me that more insight into the chemical nature of the proteids

could be obtained by the study of the *formation of proteids in plant cells*. Starting from a series of observations I reached a hypothesis which led me to infer the existences of a labile and stable modification of albumin, as explaining in a more satisfactory manner than the views of Pflüger and of Latham the difference between the proteids of living protoplasm and those of dead."

To get a clew to the formation of proteids he studied the nutrition of lower fungi and phaenogams. Microbes are especially characterized by their great chemical activity—one cell under favorable conditions multiplying in twenty-four hours to more than a trillion new cells. In this process the complex organic substances which serve as food are broken down, and by synthetic processes the protoplasm and other constituents of the plant cells are created. Although different chemical bodies serve as nourishment the same proteids are formed, for otherwise new species would result. He has found that the same species persists whether fed on glycerol, glucose, galactose, acetic or quinic acid; or whether leucin, betain, asparagin or kreatin furnish nitrogen.

From this it must be concluded that proteids are formed from substances so simple that they may be derived from each of these widely differing bodies. Since the simplest compounds which can be utilized by plants for the formation of proteids are methyl alcohol, methylamine, and methyl sulphuric acid, the "starting group must contain only one atom of carbon in the molecule."

"Since methyl alcohol and methylamine as such do not serve for synthetic operations, transformation into a compound capable of condensation must take place, and this can only be formaldehyde, the same substance that forms, by condensation, various kinds of sugars."

Formaldehyde is a poison, but owing to the extreme ease with which it is condensed, and to the fact that certain compounds of this aldehyde are quite harmless, this objection has no great weight, for no molecule remains unchanged for a second.

Bacillus methylicus, a species of microbe, can derive its entire organic nutriment from the acid sodium sulphite compound of formaldehyde as well as the compound of formaldehyde with ammonia. In the case of the nitrifying microbe, which can utilize ammonium carbonate, it is probable that formaldehyde

results from the carbon dioxide through the aid of the hydrogen of the ammonia.

By a similar line of reasoning Loew concludes that ammonia serves as the simplest source of nitrogen.

In regard to sulphur, there is little doubt that this is present in the proteid molecule in a reduced state and consequently sulphur compounds must be reduced to hydrogen sulphide in proteid formation. We may therefore infer that the atomic groups necessary for the formation of the proteid molecule are formaldehyde, ammonia, and hydrogen sulphide.

After discussing the relations of asparagin to proteid formation and decomposition, which has been so many times pointed out by numerous observers, he asks: "How can we explain the transformation of asparagin into albumin?" Asparagin, being a relatively simple compound, while albumin is one of the most complex, the latter must be derived from the former by some transformation which can readily take place. Such a process would be possible if aspartic aldehyde were formed and subsequently condensed.

The formation of albumin from formaldehyde and ammonia he represents as taking place according to this theory in the following way:

I. $$4CH_2O + NH_3 = \underset{\text{Aspartic aldehyde.}}{\begin{matrix}COH & COH\\ | & |\\ CH_2—CH & NH_2\end{matrix}} + 2H_2O.$$

II. $$\underset{\text{Aspartic aldehyde.}}{3C_4H_7N} = \underset{\text{Intermediate product.}}{C_{12}H_{17}N_3O_4} + 2H_2O.$$

III. $$6C_{12}H_{17}N_3O_4 + 12H + H_2S = \underset{\text{Lieberkühn's albumin formula.}}{C_{72}H_{112}N_{18}SO_{22}} + 2H_2O.$$

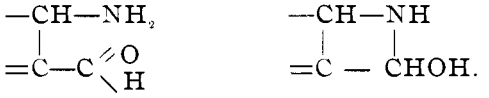
For II it is assumed that condensation proceeds between the aldehyde and methylene groups, while in equation III condensation occurs after the type of pinacone formation, a highly unstable substance resulting, containing twelve aldehyde and eighteen amido groups, which possesses much kinetic energy in the form of motions of the labile atoms.

By atomic migration it would, with the loss of aldehyde characters, become a relatively stable substance, the ordinary albumin.

As evidence of the existence in the living cell of a peculiar active form of proteid, he describes an "active albumin" whose presence in a large number of plants was revealed by the action of dilute solutions of organic bases.

This form of albumin differs from passive albumin by a greater power of holding water in combination; by forming insoluble compounds with certain organic bases; by being coagulated with very dilute alcohol, ether vapor, and dilute prussic acid; and by reducing highly dilute silver solutions.

These differences from passive albumin are ascribed to the existence of active aldehyde groups in the molecule of the active albumin, which by atomic migration become converted into passive groups, as shown by the following formula:



Active. Passive.

The source of energy of living cells he ascribes to the kinetic energy of labile atoms within the proteid molecule and as evidence of this he compares the properties of living protoplasm with labile organic compounds, which are easily changed by heat, acids, or alkalies into stable, isomeric, or polymeric products, whereby contraction takes place and heat is developed. These labile bodies can cause chemical changes in other compounds, those containing labile hydrogen atoms having an especial affinity for oxygen.

Loew's theory of the formation of albumin supplies this necessary labile condition of protoplasm through the proximity of aldehyde and amido groups, for amido aldehydes have recently been shown to be very labile substances. As evidence of the existence of such groups in protoplasm the poisonous effect of substances readily reacting with aldehydes and amides is discussed at length. As aldehydes and amides react upon one another the danger of self-poisoning of protoplasm becomes great, a condition which the author considers as occurring when protoplasm is heated above 50°, its contained albumin being thereby changed from the active to the passive state in the manner indicated in the formula last given.

Coming next to a discussion of the chemical activity of the

living cell he finds the cause of this in the katalytic power of the protoplasm, which power is due to the oscillating motion of the labile atoms of the proteid constituents. It is by means of the energy imparted by these labile atoms that the oxidations occurring in respiration take place and thus this appears as the source of the energy of living protoplasm.

Whatever views the reader may hold respecting this theory and the evidence on which it rests he cannot fail to find much food for thought in the multitude of facts brought together in this volume. The book abounds in references so that a practically complete bibliography of the subject is given, a fact which alone gives the work much value.

THOMAS B. OSBORNE.

TABLES FOR THE DETERMINATION OF MINERALS BY PHYSICAL PROPERTIES, BASED ON THE SYSTEM OF DR. A. WEISBACH. BY PERSIFOR FRAZER. Fourth Edition. pp. 163. Philadelphia: J. B. Lippincott Co. 1897. Price $1.50.

These tables are well printed, the arrangement clear, the various physical properties succinctly, yet accurately, enumerated, and the remarks on blowpipe reactions and associated minerals very well written. There is an unfortunate confusion in the use of the term "*sectile*," which as defined by Dana and used by accurate mineralogists, means that the substance can be sliced into shavings with a knife, but goes to pieces on hammering. Dr. Frazer uses *sectile* in place of Weisbach's *weich*, which is very clearly used as meaning simply *soft*; and again uses the same word in place of the German *mild*, which as used by Weisbach means that the substance is not brittle, but cuts like white china clay or stibnite. The result of this confusion is that the tables sometimes classify a mineral as sectile in one sense, but not sectile in another sense; while the same mineral is not sectile at all according to the definition of Dana!

It would have been far better to have used *soft* in the first case and *mild* in the second, explaining the meaning that word has when applied to minerals, while *sectile* could be reserved for its exact use according to definition.

Aside from these commendations and criticisms, and while acknowledging the tables the best of their kind, the reviewer must record his opinion that "*the kind*" is not the best one. Mineral