

the general circulation as sugar, and thence escaping as waste material with the urine. It is only gradually, and as the result of lifelong attention devoted to the subject, in association with unceasing laboratory work, that the knowledge has been acquired upon which the new doctrine is based. Much help has been afforded by the teachings of experience in connection with diabetes; and while these are absolutely irreconcilable with the old doctrine upon which physiologists have been relying, they, in the most complete manner, fall in with and give support to the new one. The subject is fully considered in my work on "The Physiology of the Carbohydrates," published in 1894; and it will only be requisite here to enter into sufficient detail for the comprehension of what is being spoken of.

The carbohydrates, as we know, are susceptible of being transmuted from one to the other by increased and decreased hydration. Ferments and chemical agents move them in the former direction, and the operation is one that we have the power of inducing at will. Transformation in the latter takes place to an unbounded extent in the living world, but if we exclude a few special instances of laboratory achievement, we have not the power ourselves of bringing it about. The first influence exerted on ingested carbohydrate is by the ferments of the alimentary canal, which hydrolyze and carry the insoluble into a soluble form and thus prepare for absorption. On being absorbed the carbohydrate is brought within the sphere of influence of living matter. In the villi, which constitute the seat of absorption, there are active cells with which the absorbed carbohydrate falls into close relation, and subsequently it permeates the cellular structure of the liver, which thus, as it were, stands in a position to exert a supplementary action, and to complete before the general circulation is reached, whatever may have escaped completion in the villi.

Now, by the agency of protoplasmic action, or the power possessed by living matter, carbohydrate is (1) transmuted to a lower form of hydration; (2) transformed into fat; and (3) synthesized into proteid. All these operations can be definitely shown to take place in the simple cell-organism of yeast as the result of the power with which its protoplasm is endowed, and the power here represented is nothing more than the common property possessed by protoplasm in general of both kingdoms of nature. While ferment-action hydrates and breaks down, protoplasmic action dehydrates and builds up; and it is by the influence of this latter power, I contend, that carbohydrate naturally becomes disposed of in the system, instead of by ferment-action leading to the production of sugar that is fictitiously assumed to undergo oxidation while traversing the systemic capillaries.

Between the seat of absorption and a point short of the general circulation being reached by the portal stream of blood, I say, we have to look for the disposal of the carbohydrate derived from our food, and it is by the exercise of protoplasmic power that what occurs is brought about. Ferment-action has performed its office within the alimentary canal in putting the carbohydrate matter, if it should be in a form to require it, into a fit state for absorption. If the disposal is completely accomplished, no sugar is left to reach the general circulation, and if none reaches the general circulation there is none to reach the urine. This repre-