

as to the training of our children it would be achievable in the very next generation, for surely, if a generation can be reared to reverence a stick or a stone, an inanimate idol, and this or that grotesque religious system, it can be reared also to love and reverence man.

One paragraph more and I have done. We hear of the evolution of morals or of language or of religion, of the printing press, of the locomotive, of the bicycle, and so forth. In the popular mind, and, I fear, even in the minds of some scientific men, this evolution ranks as a process of the same order as the evolution of a plant or animal. Evolution means unfolding, and, therefore, the word is perhaps correctly applied to the bicycle, etc. But there is this essential difference between a living being and the bicycle: The former is the progeny of a parent; the latter is not. So also the language of to-day is in a figurative sense only the progeny of the language of the former times; the morals of to-day have, in a figurative sense only, descended from those of yesterday. All these things are human inventions, and belong not to human evolution, but to what has been called evolution in the environment. The so-called 'Social Evolution,' of which we have lately heard so much, is therefore a myth from the biological standpoint. As I have said, and as I wish to iterate and reiterate, neither the altruistic feelings in particular, nor morals in general, nor anything of the kind, has undergone evolution in man. What has undergone evolution is his enormous power of acquiring characters, these among others. G. ARCHDALL REID.

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SOME RECENT OBSERVATIONS ON THE INFLUENCE OF THE THYROID GLAND ON METABOLISM.

IN an article by Professor Chittenden, published in *SCIENCE*, June 25th, a summary

is given of what was then known regarding the influence of the thyroid gland on metabolism. Since that time a valuable contribution to our knowledge has come from Bernhard Schöndorff, published in *Pflüger's Archiv für Physiologie* (Band 67, p. 395). He finds that, contrary to previously received notions, the feeding of thyroid glands or iodothylin to an animal does not invariably stimulate proteid metabolism. Further he finds that the loss of weight so often observed under such treatment is due mainly to an increased combustion of the body-fats, and that the increased excretion of nitrogen through the urine observed by Voit and others is not necessarily due to an increased proteid metabolism, but to an increase in the excretion of urea and allied bodies which are known to exist pre-formed in the tissues in considerable quantities.

The investigation was carried out on a dog of 55 pounds weight. It was kept in a suitable cage, and its food so regulated that under ordinary conditions the animal remained at a constant weight and in nitrogenous equilibrium. The thyroids were administered for the most part in the form of dry tablets prepared by *Borroughs, Wellcome & Co.*, of London, but sometimes fresh or dried sheep's thyroids were given either alone or with the tablets. At first the dosage was ten of these tablets administered with the daily food. Within a few hours the animal's weight began to fall, and at the end of twenty-three days it had lost nearly two and a half pounds. During the first eight days the nitrogen also showed a minus balance; that given off in the urine and feces amounted to 32 grams, while the food contained only 31 grams. During the next fifteen days, however, there was a plus balance. Evidently these results point to a largely increased consumption and elimination of non-nitrogenous material, and in the light of previous researches Schöndorff attributes them to an increased combustion

of the fats. But they throw very little light upon the proteid metabolism.

For the succeeding twenty-four days the dosage was raised to twenty tablets a day. The effect was unmistakable. The nitrogen eliminated was 4% in excess of that contained in the food. The loss of weight amounted to 2.25 kilos, or nearly five pounds, and at the close of the period the animal was so thin that its ribs and pelvic bones showed plainly. When, however, the nitrogen loss (in all 30 grams) is multiplied by the figure 30, which Pflüger has shown to represent the ratio between the proteid tissues and their nitrogen content, it is evident that the albuminous waste can account for only three-sevenths of the total loss of weight. The other four-sevenths (in all three pounds) must have come from the fats, which implies an increase of combustion to the extent of 43%. The violent panting of the animal points to the same conclusion; while the loss of nitrogen shows that, just as is the case during prolonged hunger, when the supply of fat has been reduced to a certain limit, the system falls back upon its proteids to meet the demands caused by iodothyryn.

At this point the administration of thyroid tablets was stopped, and contrary to the statements of some observers, that iodothyryn has a considerable after-effect, the nitrogen balance became positive immediately and the body weight increased rapidly.

When the animal had again attained its normal weight, the investigation was repeated. Twenty tablets a day were administered. The animal's weight fell a pound a week. For the first few days the nitrogen in the excreta exceeded that in the food by 8%. But the daily analyses showed that by the twelfth day nitrogen demand and supply were again in equilibrium.

At the end of two months, however, the weight ceased to fall. The tablets were

discontinued for a week, and the weight rose one and a half pounds. On administering the tablets again for two weeks the weight fell one and a half pounds, but the nitrogen maintained a steady plus balance.

From these facts Schöndorff concludes that in the case of an animal at a uniform weight and in nitrogenous equilibrium iodothyryn causes an increase of combustion and a consequent loss of weight. So long as the store of fat is above a certain limit proteid metabolism, however, remains unaffected; the temporary minus balance of the body's nitrogen is due to an increased elimination of urea and similar substances which existed pre-formed in the tissues; but when the fats have been reduced below a certain limit the proteids are likewise attacked. Throughout his investigations, however, Schöndorff assigns all the effects produced to the iodothyryn contained in the ingested thyroids. He accepts the prevailing opinion of physiologists, that the iodothyryn isolated by Baumann is the full physiological equivalent of the gland, and at no time during the research was the pure substance administered in place of the glands. Yet experiments by Dr. Edm. Wormser, published in a later number of Pflüger's Archiv (Band 67, p. 505), seem to show that the thyroid itself or an aqueous extract of the gland possesses a physiological activity (at least when fed to animals whose thyroids have been removed) far in excess of that exhibited by pure iodothyryn. Similar results have been obtained by A. Schiff, who has been working at this question simultaneously, though quite independently. (Wiener Klin. Wochenschr. 1897, p. 277.) Schiff, however, states that different preparations of iodothyryn vary considerably in the extent of influence they exert, but he asserts that no preparation shows a physiological activity at all comparable to that of the gland itself. If later researches verify these observations they

will prove that, as Wormser claims, iodothyryn is not the only active body secreted by the thyroid, but that some other substance must act with it in order to perform all the functions of the gland.

Wormser's experiments were carried out upon dogs whose thyroids had been carefully removed. The animals were fed with various preparations made from thyroids as well as such artificial compounds as sodium iodide and iodo-casein, and the influence of these substances, in preventing or lessening the tetanus and other symptoms resulting from the operation, was noted.

The first animal experimented upon was fed with dry thyroids for twenty days after the thyroidectomy, and during this time its condition showed nothing abnormal. On the twenty-first day the dry thyroids were replaced by iodothyryn in such quantity that the iodine content equaled that of the previously administered glands. Two days later the animal was seized by a violent tetanus. The dry thyroids were again administered, and the dog recovered in a few hours. The glands were again replaced by iodothyryn, and the animal died within thirty-six hours. This experiment was repeated three times with iodothyryn prepared from sheep and pigs by both of Baumann's methods, and the results agreed perfectly.

Iodo-casein, an artificial compound, has been found efficacious in reducing the size of a goitre. When this substance was administered to dogs whose thyroids had been removed, the intensity of the tetanus seemed to be reduced, but death nevertheless ensued. Similar experiments were tried with sodium iodide, and with the albuminous material precipitated from a sodium chloride extract of the thyroid gland by acetic acid. These results, however, were entirely negative.

Wormser notes, however, that throughout these investigations he found young animals far more susceptible to the evil effects of

thyroidectomy than fully mature or old animals, while the appearance of tetanus and other symptoms was delayed by a milk diet, but hastened by one largely composed of meat.

Finally, in summing up the results of his experiments, Wormser points out that the thyroid itself or an aqueous extract of the gland is far more potent physiologically than any substance yet isolated from the gland or artificially prepared, and that therefore no one substance can account for all the functions of the thyroid.

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THE ENZYMIC FERMENTS IN PLANT PHYSIOLOGY.

FERMENTATION, as a general term, covers many of the most important processes in chemistry. Fermentations are of many particular kinds, each depending more or less distinctly upon some specific ferment agent. This makes it convenient to classify the fermentation processes according to the correlated ferment agents. Thus we have yeast fermentation, bacterial fermentation, enzymic fermentation and the like.

The ferment agents, and, following them, the fermentation processes, may be roughly thrown into three classes: (1) Those belonging to the lower orders of fungi, like yeast. (2) Bacteria, like those present in the 'mother' of vinegar, or in the souring of milk. These two classes are often called organic ferments in distinction from the next. (3) Unorganized, or soluble ferments, or enzymes, like diastase, pepsin and ptyalin. The knowledge of these enzymes is mostly of very recent development, and is still fragmentary and generally unsatisfying. They have been best known as they occur in the animal digestive juices. The students of animal physiology have been used for some years to point out the presence of ptyalin and diastase in saliva, of pepsin and trypsin in the gastric juice, and