III. "Experiments on Food; its Destination and Uses." By William S. Savory, Esq., F.R.S. Received May 1, 1862.

(Abstract.)

The experiments which are related in this paper refer to the destination of food and its uses.

Abundant, nay, superfluous evidence has been furnished to prove that no one principle of food will alone suffice for nutrition; but clear and unequivocal evidence is still wanting to show how far each principle of food is essential to life and health, provided all else save that one be sufficiently supplied. This is a very different question.

Again, ever since Liebig's famous classification of food into plastic or nutritive and respiratory or calorifacient, some most important questions in connexion with it have engaged the attention of physiologists. Amongst them are these:—

Is any food destined to the production of heat without being concerned in the repair of the tissues—that is, is any portion of the food directly burnt in the blood?

Is any portion of albuminous food directly calorifacient, that is, burnt in the blood without forming tissue?

This last question has more recently assumed another form, viz. what is the source of urea? Is it derived wholly from the metamorphosis of tissues, or directly to some extent from the blood? In other words, does any portion of nitrogenous food undergo a directly retrograde metamorphosis into urea, carbonic acid, and water?

The experiments were performed upon rats* and a hawk. The animals were fed upon different diets, and the experiments may be divided into three classes accordingly. In one class the diet was a non-nitrogenous one, consisting of equal parts by weight of arrowroot, sago, tapioca, lard, and suet; for this mixture was found upon analysis to yield only ·22 per cent. of nitrogen. In another class the diet was a nitrogenous one. It consisted of lean veal from which every visible particle of fat had been carefully removed. This yielded upon analysis only 1·55 per cent. of fat. In the third class the diet was a mixed one. It consisted of a combination of the two former diets.

* Rats were chosen as subjects for these experiments because they are omnivorous and will readily feed on almost any kind of diet. Moreover from their size they are very convenient to manage.

The weight, temperature, and general condition of the animals were especially noticed, and in some cases the urine was collected and the amount of nitrogen it contained determined.

From these experiments the following conclusions are drawn :—

Nitrogenous materials are not only calorifacient, but, at least under some circumstances, sufficiently so to maintain alone the requisite temperature.

It is in the highest degree probable that, under certain circumstances, nitrogenous materials may prove directly calorifacient without forming tissue.

Non-nitrogenous substances are, at least under some circumstances, directly calorifacient without entering into the composition of tissue of any kind.

While non-nitrogenous food only is taken, all the nitrogen which is excreted in the urine, and more, may be accounted for by the disintegration of the original tissues, without assuming that any fraction is assimilated from any other source.

While life cannot be maintained without nitrogenous food, even though every other kind be abundantly supplied, death in this case being due to loss of tissue, life and even health and the normal temperature can be maintained, at least for a long period, upon a diet almost exclusively nitrogenous, with proper inorganic substances in which there exists only a small fraction of non-nitrogenous matter. Such a minute proportion of fat must be but a poor representative of non-nitrogenous food.

Moreover in these experiments some of the rats sustained a loss of weight considerably above 50 per cent.

The difference in this respect between former experiments and mine may be, perhaps, in some measure accounted for by considering the immediate cause of death in the former ones. Chossat satisfactorily showed that the subjects of his experiments died from cold. In my experiments, the animals being freely supplied with calorifacient food, this cause of death was for a while averted, so that time was allowed for a further disintegration of tissue.

When their temperature is maintained from external sources, or when they are freely supplied with calorifacient food, warm-blooded animals may die rather from waste than loss of temperature, as perhaps is the case with cold-blooded animals when they are starved.

Lastly, in these experiments the significant fact appeared, that while the weight, strength, and general condition of the animals varied very widely under the different diets to which they were subjected, no considerable fluctuation was observed in their temperature. Even the slight variation from time to time recorded seemed rather to result from other causes than to depend directly on the food.

IV. "On a New Series of Compounds containing Boron." By Dr. Edward Frankland, F.R.S. Received May 15, 1862.

(Abstract.)

This paper contains the full details of the author's researches on boric ethide—a body partially described by Mr. B. F. Duppa and the author in the 'Proceedings of the Royal Society,' vol. x. p. 568, and also their extension to the homologous compound containing methyl.

Boric ethide combines with ammonia with great energy; if a few drops of boric ethide be passed up into a dry eudiometer filled with mercury, and dry ammoniacal gas be then admitted into the same tube, each bubble of gas collapses with a shock like that produced by a bubble of steam projected into cold water. The analysis of the body thus formed leads to the formula

$$NH_3 + B(C_4H_5)_3.$$

Ammonia boric ethide is a somewhat oily liquid possessing an aromatic odour and an alkaline reaction. It cannot be distilled, except *in vacuo*, without decomposition. Carbonic acid has no action upon it, even in the presence of water, but other acids decompose it instantly and liberate boric ethide. Exposed to atmospheric air, ammonia boric ethide scarcely absorbs a perceptible amount of oxygen, even after the lapse of several hours.

The author considers boric ethide to be formed from boracic ether and zincethyl by the substitution of the ethyl in zincethyl for the oxygen in boracic acid,

$$\underbrace{2B\left\{\begin{matrix}O\\O+3\begin{matrix}C_4H_5\\C_4H_5\end{matrix}\\O\end{matrix}\right\}O_2}_{\text{Boracic ether.}} + \underbrace{3Zn_2\left\{\begin{matrix}C_4H_5\\C_4H_5\end{matrix}\right.}_{\text{Zincethyl.}} = \underbrace{2B\left\{\begin{matrix}C_4H_5\\C_4H_5\\C_4H_5\end{matrix}\right.}_{\text{Boric ethide.}} + \underbrace{6\begin{matrix}C_4H_5\\Zn\end{matrix}\Big\}O_2}_{\text{Ethylate of zinc.}}.$$