

## **Extract of meat / by Baron Liebig.**

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## EXTRACT OF MEAT.

BY BARON LIEBIG,

*President of the Royal Academy of Sciences at Munich.*

1872

err by Dr. Edward Smith, which appeared in the *Times* of October 16th, he reproaches me with several quotations contained in my letter to the *Standard*, which require on my part some vindication.

Dr. Smith says that the passages I have quoted in my letter are "of nutrition," "the small morsel of meat," "tea," are not extracts from any part of his, and he calls upon me to show where I had obtained my (most unaccountable) quotations. My vindication is not a mere denial, and I gladly take this opportunity to state fully the real value of extract of meat to the benefit of the people; the only undertaking of the task is, that in doing so I am not to speak more of myself than I like.

It is quite correct that the above-mentioned quotations have not appeared either in the *Standard*, or in that of the *Times* of London.

They are taken word for word from a paper entitled "The Butcher's Bill," which appeared in the *Saturday Review* of August 31st. This is avowedly based on Dr. Edward Smith's paper, so that any one who took the trouble to read it, must, like myself, have arrived at the same conclusions. Its sentences contained the authentic words of Dr. Edward Smith.

Dr. Smith says, "Let it be clearly understood that at length Baron Liebig is in accord with other scientific men, and that all may adopt his views."

Baron Liebig—'Neither tea nor extract of meat is a nutrient in the ordinary sense,' and all I have accomplished." This does not seem to me that I have now been converted to a new opinion, neither I formerly had not, or which I have now adopted, while the real truth is that all that I have ascertained within the last thirty years on the subject of nutrition is in perfect accord with my teaching. Twenty years ago I taught in my 'Animal Chemistry' that for the preservation of life the food of man and that of animals, must contain one ingredient essential for the formation of blood or of muscle, and soluble in the blood. I have further explained in my 'Researches on the Chemistry of Food,' that the extract of meat, or "beef-tea" or "extract of meat" contains substances called albuminates, as these are soluble and separate when the meat is boiled in water.

In my 'Familiar Letters on Chemistry,' (London Edition of 1851), I said, "In the albumen of this fluid (juice of flesh) we have the substance serving as transition product to the fibrine of flesh, and in the other substances (contained in beef-tea) the matters required for the production of cellular tissue and nerves." From this it will be seen that I never asserted that "beef-tea" or "extract of meat" contained substances necessary for the formation of albumen in the blood or of muscular tissue. I have, on the contrary, designated them as "food for the nerves," in the same sense as common salt is also designated as food, although one cannot always define in which manner it acts usefully.

It cannot, therefore, be said that "I am at length in accord with other scientific men," but that these scientific men, including Dr. Edward Smith, have simply adopted what I have always, and from the very beginning, taught. Based on my own definitions, Dr. Edward Smith informs me that extract of meat is not "food," but a "nervous stimulant." But what is a nervous stimulant? everybody will ask who is not satisfied with a word, but wishes for a definition. We take the constituents of extract of meat in our daily food, just as we take tea and coffee in addition to our food, and nothing can be more undeniable than that these substances produce a certain beneficial effect on all the functions of the body, and also on the process of nutrition. It is clearly not the duty of a scientific man simply to deny these effects, but to find out how great is the share these substances have in the functions of the animal organisation.

Some years ago two physiologists at Vienna attempted to prove, by experiments on themselves, respecting the effect and value of common salt in the process of nutrition, that salt is a luxury and of no value for nutrition and the preservation of health. In matters affecting the alimentation of the people no importance can be attached to such trifling experiments if they are in contradiction to confirmed experiences, and this contradiction will grow in the same proportion the less the experimentalist is capable of observing and rightly interpreting facts.

In order to comprehend the difference between "common food" and "nervous food," as I will call it in order to avoid circumlocution, it must be considered that man has two kinds of work to perform, muscular or mechanical work and brain or nervous work. The one, the muscular work, is under the

dominion of the nerves and the brain.



By "common food" must be understood those substances which serve for the preservation of the temperature and restoration of the machine. Coffee, tea and extract of meat are not suited to these purposes; by their effect, however, on the nerves they exercise a decided influence.

The experiments made with extract of meat in Russia, France and Sweden are what in the scientific world are termed "sham experiments." They are not undertaken to find out that which is not known, but as the result is known beforehand, appear really only to be made with a view to deceive others, and the conclusions drawn from them are simply absurd. It will suffice to describe one of these experiments in order to convince any one who bears in mind that it has been scientifically determined that extract of meat does not contain any substances necessary for the formation of albumen in the blood, and for the restoration of the waste of muscular tissue.

Two dogs of almost equal weight were fed, the one with meat, the other with extract of meat. The former was fed with 400-500 grm. fresh meat, the other with 12½-15 grm. extract of meat (the quantity contained in 400-500 grm. fresh meat). The dog fed on meat flourished, his weight rather increased, while the other fed on extract of meat only, became thin, was attacked with diarrhœa, and would have died if the experiment had been continued. The inference drawn from this experiment is:—Extract of meat is not nutritious, it rather has poisonous effects, causes diarrhœa, and would produce death. That the other dog had likewise consumed 12½-15 grm. extract of meat in the 400-500 grm. of meat without being seized with diarrhœa or feeling any injurious effects, this fact does not trouble the experimentalist, nor does it concern him that a dog weighing from 2 to 3 kilogrammes requires from 40 to 50 grm. of carbon in his food for the process of respiration and to keep up the weight of his body, while 12 to 15 grm. extract of meat only contains 3-4 grm. of carbon.

These experiments, made by Dr. Beljowski, in Moscow, and the conclusions drawn from them, are identical with the French (*vide* 'Moniteur Scientifique Quesneville' 1-15 Dec. 1871). That no experiments have been made in England similar to those in Russia and France proves that English physiologists possess more common sense.

Concerning the standing of Professor Almen, in Sweden, it will suffice to mention here his assertion that "a glass of warm water with a little pepper must produce the same effect as a cup of beef-tea." What sensible physician would venture to prescribe warm water with pepper instead of meat broth to a patient recovering from typhoid fever? Nor in spite of Professor Almen is this done in the Swedish hospitals. Beef-tea is used there in the same cases and for the same purpose as with us.

That in Göttingen extract of meat is generally used in family households and also in that of Professor Meissner, I may venture to affirm.

In order to understand correctly the significance of meat diet and extract of meat, it is necessary to turn one's attention to the difference of the component parts of meat and those of vegetable foods. Meat contains in its albuminates the chief requirements for the renovation of the muscular tissues and for the preservation of lasting muscular action. Those constituents of the meat which are soluble in boiling water take a part in the formation and renovation of the muscular tissues. But by their effect on the

nerves they exercise a most decided influence muscular work wherein meat differs from all other animal and vegetable food.

By the use of meat we consequently obtain two effects, the one (effect on the nerves) perfecting and strengthening the other (muscular action). The prices of other articles of food, even of those containing a considerable amount of muscle-forming material, are much lower than that of meat, and are in proportion to the contents of muscle-forming substance. According to calculations made in my own household, we obtain in 100 lb. of butchers' meat (67 lb. muscle, 12½ lb. bones, 8½ lb. fat, 3 lb. membrane) 13.9 lb. albuminates. In 100 lb. cheese there are from 26 lb. to 30 lb. albuminates, and the liver and brain are likewise richer in albuminates than the same weight of butchers' meat. The blood of animals is richer still in albuminates in proportion to its price. Nevertheless, nobody thinks of placing blood, liver, or cheese fully on a par with butchers' meat.

Vegetable albuminates are still lower in price, and from these is produced in the bodies of animals the muscular food which man consumes. 100 parts of ordinary wheaten flour contain very nearly as much muscular food as 100 parts of fresh meat, but how small is the price of bread as compared to that of meat.

This clearly shows that the instinct of man is covered a difference in the effects of his various foods and that he does not estimate and judge them in proportion to their contents of carbon and nitrogen or of muscle-forming and heat-producing substances, but that he pays a higher price for meat because it contains certain other substances which are totally wanting in other articles of food, and it is these very substances which form the component parts of beef-tea as well as of extract of meat.

These substances, as is well known, impart to meat its peculiar value for nutrition, and constitute the difference between vegetable and animal diet. The difference between the two, therefore, is not based on the dissimilar nature and facility of assimilation of the albuminates contained in the animal and vegetable food, but consists in the fact that meat contains certain elements which are not to be found in cheese, in blood, or in vegetables.

I believe that the researches of Pettenkofer and Voit are calculated to throw some light on the effects of the component parts of extract of meat. In the experiment on the tissue waste of a man in normal condition while abstaining from food, the individual breathing in the apparatus of respiration was left three instances without food with the exception of water, salt (15 grm.) and a little extract of meat (12½ grm., rather less than half an ounce), and with respect to the results obtained the two experimenters say, "The state of health during the privation of food for thirty-six hours was a completely normal one, and according to the assurance of the fast man, he could have borne it longer." This fact explains, I believe, the physiological importance of the soluble parts of meat or extract of meat; they do not serve for the renovation of the machine, but to maintain it by their effects on the nerves during temporary disturbances, even when deprived of their normal action, and it cannot be doubted that this effect which is paid for by the higher price of meat.

London navies who were so richly supplied



man war to construct the railway at Balaclava, also, according to the report of Dr. Baudin, with the greatest astonishment among the English and French soldiers by the extraordinary amount of work they performed, consumed daily in their food from 150 to 159 grm. albuminate.

An agricultural labourer in Upper Bavaria consumes in his farinaceous food, according to the experience and calculations of Professor Dr. H. Ranke, 100 grm., therefore almost the same quantity of albuminate as the English navy; but how extremely different are the working capabilities of the English and Bavarian labourer in reference to the amount of work, *i.e.*, the amount of work accomplished in a given time? and this difference is attained

by the English navy consuming more than one pound of albuminate in the shape of meat, whilst the Bavarian eats meat only on six days of the week. A few slices of bread and butter with milk for breakfast give nutriment enough for a child; an adult, however, has very different work to perform, and therefore increases the effect of his food by the addition of tea or coffee. It is stated in Frankfort-on-Main as a well-known fact that old Mayer Rothschild, the founder of the eminent firm, never despatched any important business at night without having previously taken a cup of strong coffee; and it may be supposed that the celebrated financier derived some advantage from the stimulant effect of the coffee on his decisions, for he was not known to spend a farthing for anything which would not have given him a return.

The albuminate of meat by boiling has been freed from its soluble parts, the remainder, or more correctly the insoluble albuminate in such residue, have no greater nutritive value than the gluten of wheaten flour, which is left after the manufacture of starch. Both soluble albuminate and the gluten are chemically different, and their physiological effect identical things.

When meat exhausted in this way, the extracted albuminate is again added in the shape of beef-tea or extract of meat, it is eagerly eaten by dogs who despise the addition of such addition; in fact, all the component parts of meat which are contained in roast meat are thereby reunited.

As vegetable albuminates are identical with animal albuminates contained in the flesh of animals, it will be perceived that if we add to our vegetable food vegetable albuminates—for instance peas, beans, or even potatoes and rice,—soluble parts of meat such as are combined with the extract of meat, we thereby impart to it the nutritive value which distinguishes meat in reference from other food.

Dr. Gerhard Rohlfs, well known by his travels in Africa, says, in reference to the effect of extract of meat in a letter addressed to me:—"As regards the nutritive value of meat it has proved, particularly to us Europeans in Africa, one of the greatest blessings. I have travelled through the great desert from Tripoli to the Tschad Lake, it was my daily food."

Without any meat I took it in the morning with my coffee, upon biscuits, and this was not only very palatable but it proved a complete substitute for meat. In the evening I made beef-tea, adding a little of the extract to rice, lentils, or kuskuss, or whatever I desired to possess in the shape of vegetables. I have become so accustomed to the extract of meat that I am still obliged to keep it constantly in my

It will be well understood, therefore, that by the addition of extract of meat to our food, we neither economise carbon for the maintenance of the temperature nor nitrogen for the sustenance of the organs of our body, and that therefore it cannot be called "food in the ordinary sense," but we thereby increase the working capabilities of the body and its capacity to resist exterior injurious disturbances, *i.e.*, to maintain health under unfavourable circumstances. Thus an addition of extract of meat to vegetable food forms the only means to make up for a want of meat.

All this taken together gives to these substances, to which also belong tea and coffee, a very high value in the alimentation of our populations, the last and true object of which is the production of working power for mental and bodily work; and it becomes perfectly intelligible why the great historian Macaulay, in his celebrated work, very properly devoted an entire chapter to the introduction of coffee into England as being to some extent connected with modern life.

For our object it is tolerably indifferent with what name the effect of the so-called "Nervous stimulants" is designated.

A few years since agriculturists still considered gypsum, lime, and bone meal to be stimulants for the growth of plants; now we know perfectly well that they are nutritive substances for plants. In modern life men on the whole perform more muscular and brain work than formerly; still the average duration of life of individuals has not decreased but increased, and nobody who takes a comprehensive survey of life can doubt that coffee and tea contribute largely to this end, and that extract of meat properly used is a really good and most useful thing.

In conclusion, it may be mentioned that I have given my ideas on this subject in two treatises, both of which appeared in English scientific journals; the one "On the Nutritive Value of Different Sorts of Food," in the *Lancet* (January, February, and March, 1869), the other in the *LONDON PHARMACEUTICAL JOURNAL* ("The Source of Muscular Power"—September and October, 1870), and I think that no English physician wishing to criticise my opinions should be allowed to ignore these two treatises of mine.

One word more about Dr. Edward Smith. It is a pity that he thinks himself competent to give his opinion on questions of which he cannot be said to have a perfect knowledge. This becomes evident as soon as he touches on chemical subjects. For instance, in a letter to the *Standard* (October 24th, 1872) Dr. Edward Smith declares that beef-tea made of fresh soup meat would certainly contain albumen, etc., and he charges me with "hardihood" for comparing extract of meat with such beef-tea. Dr. E. Smith apparently forgets that the soluble albumen of meat is coagulated by boiling it with water, exactly in the same way as the albumen of eggs, and that, therefore, beef-tea cannot contain albumen any more than extract of meat. Both extract of meat and beef-tea are prepared from the same material exactly in the same manner, and the difference of the former from beef-tea consists simply in extract of meat being beef-tea condensed to the consistency of honey.



The first part of the paper is devoted to a general survey of the literature on the subject of the effect of the environment on the development of the human mind. It is shown that the environment is not only a source of stimulation but also a source of inhibition. The environment can be said to be a source of stimulation in that it provides the individual with a wide range of experiences which are necessary for the development of his mind. It can be said to be a source of inhibition in that it can limit the individual's opportunities for learning and growth. The environment can be said to be a source of stimulation in that it provides the individual with a wide range of experiences which are necessary for the development of his mind. It can be said to be a source of inhibition in that it can limit the individual's opportunities for learning and growth.

The second part of the paper is devoted to a detailed study of the effect of the environment on the development of the human mind. It is shown that the environment is not only a source of stimulation but also a source of inhibition. The environment can be said to be a source of stimulation in that it provides the individual with a wide range of experiences which are necessary for the development of his mind. It can be said to be a source of inhibition in that it can limit the individual's opportunities for learning and growth. The environment can be said to be a source of stimulation in that it provides the individual with a wide range of experiences which are necessary for the development of his mind. It can be said to be a source of inhibition in that it can limit the individual's opportunities for learning and growth.