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On the Use of Nitrogenized Food in Fever and Wasting Diseases, Especially in the Form of Peptonized Beef Powder (Mosquera's Beef Meal.)

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Nitrogen, as aptly remarked by the late Dr. J. Milner Fothergill, is the characteristic element in most explosive and force-generating compounds from gunpowder to nerve-substance. It certainly is the essential chemical component in the class of foods which is universally recognized by physiologists as the special suppliers of energy to the human frame. But this class of alimentary substances (commonly known as *proteids*, on account of their high rank among nutritive agents, or *albuminoids*, because albumen is taken as a type of the class) has a more important mission than that of merely supplying material for metabolism possessed of a high coefficient of energy; they are preëminently the tissue-building and tissue-restoring foods. They supply the elements which by the living cell are appropriated and converted into bioplasm, thus affording the means of generating new cells and cell-products, and of replacing effete structures. They are so essential to growth and development that the name of "plastic aliments" was given to this class by Baron Liebig, the pioneer among physiological chemists of this century.

From the earliest times to which medical records can be traced, clinical observation and experience have sanctioned the use of animal food—in the form especially of broth (jusculum or pulmentum)—as a restorative in wasting disease and during illness or prostration from any cause, where it was considered desirable to introduce nourishment in a form easy of assimilation and capable of promptly invigorating the bodily powers. The flesh of various domestic animals has been used for this purpose, though probably beef, being the most convenient, was the most frequently employed.

In fact, beef infusion, bouillon, or beef tea, as it is popularly termed, a generation ago was regarded with such extravagant esteem that it threatened to become a fetish. As soon as sickness was announced in the house, the good-wife would, of her own accord, proceed to administer potions of this rather insipid beverage to the invalid, as a sort of formal notice to the family that he was on the sick list; perhaps also with a vague hope, by the sacrifice of a libation, of propitiating the lares and penates, so as to bring about in some mysterious way, his early restoration to health. This practice generally received the full approval of the attending physician when he was called in. Possibly his knowledge of dietetics in disease did not extend beyond a favorite formula for making the beef essence or beef tea, which he delivered with such a magistral air that it is not surprising that its details were received with reverent, almost superstitious, attention and scrupulously obeyed, while the weightier matters of sanitary law were too often sadly neglected. Although this practice in some families still survives, there are at the present day few physicians of any standing in the profession who cling to the traditional beef-tea, or regard it as possessing much actual food value. The iconoclast and scoffer have done their work. Both chemist and clinician now assert that the meat infusion, as ordinarily made, by boiling, contains only some of the

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salts of the meat, flavored with osmazome, the albumen, rendered insoluble by heat, being precipitated and left behind in the strainer. In other words, beef tea, thus prepared, represents a very small percentage of the actual nutritive material contained in the meat. Fothergill contemptuously declared that in chemical composition it resembles urine, and implied that it did not possess much more value as food. Its only recognized worth was thought to be its slight stimulating effects upon the stomach and circulation. Moreover, Lauder Brunton claims that, even when carefully made at a lower temperature, so as to retain some peptones, it is really injurious when taken in large quantities. He raises the question whether "the products of muscular waste, which constitute the chief portion of beef-tea or beef-essence, may not, under certain circumstances, be actually poisonous?"* His fear of peptone poisoning was apparently based upon the results of experiments made by Albertoni and by Schmidt-Muelheim, which demonstrated a fall of blood-pressure, stupor, and fatal convulsions, following the introduction of peptones into the veins of dogs. In a case, reported by Brunton, of a man who had drunk a large quantity of beef-tea at a draught upon an empty stomach, peptones were found in the urine, thus demonstrating their passage through the blood unchanged. In this case the serious results predicted apparently did not occur, or they would have been recorded as being of more interest than the mere existence of peptonuria. It is not improbable that the untoward results in the laboratory experiments might be attributable to other causes. They might, for instance, be due to accidental contamination with ptomaines, which are prone to appear in peptone preparations after standing a while, owing to the almost inevitable presence of micro-organisms, which in them find a most favorable culture medium. (Here we have a hint not to keep broth standing exposed to the air, but to make small quantities at a time, and use while fresh.) Some such explanation must be true, since no one has seen similar serious results following the administration of well-made broths, even when comparatively large quantities have been taken, as in the case just cited. Brunton, it is true, speaks of the possibility of bad results, and believes that he has seen some ill effects, but his large experience appears to offer no actual instance of abnormality more marked than the case of peptonuria mentioned.

There was an old notion, which requires a brief consideration, that in the treatment of fevers, or diseases attended by fever, animal food was especially injurious, although it was known that in this state the nitrogen excretion is largely increased. Huppert and Riesell, some twenty years ago, in their researches into nitrogenous metabolism, apparently afforded the first scientific basis for this belief. They assumed that their experiments conclusively established the fact that, after the free administration of albuminoids to febrile subjects, more nitrogenous products of metabolism were excreted by the urine than with the diet poor in albumen. Following these authorities, many believed and taught that "in fevers not only can no nitrogenous equilibrium be established by any supply of nitrogenized food, but that the withdrawal of albuminoids from the body and the disintegration of its structure are still more accelerated."† Many clinicians, however, refuse to accept this dictum, which was destined to be soon overthrown by the experiments or Immermann, whose results were confirmed subsequently by Bauer and Kunstle. The last named investigators examined the question from the clinical standpoint in a typhoid fever patient, whose food and excreta were daily analysed, and the amount of nitrogen in each carefully determined and recorded. Without dwelling upon the details they conclude that it may now be accepted as proven, that "by the supply of albuminous food to a fever patient a saving of albumen in the body may be effected; for, though the excretion of nitrogen is increased, the loss of the same element from the body is

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* "On Disorders of Digestion," London, 1886; p. 247.

† "On the Dietary of the Sick and on Dietetic Methods of Treatment." Prof. Bauer: Ziemssen's 'Hand-book of Treatment," New York, 1885, p. 208.

reduced." In other words, the nitrogen excretion does not increase proportionately with the increased supply in the food. At the same time, ' it should be observed that the diet did not consist of pure albuminates, but of mixed food, rich in nitrogen, though containing also fat and carbo-hydrates as well as albumen.*

In many acute disorders, where the course of the disease is brief, the patient may have sufficient nourishment stored up in his tissues to support life until convalescence occurs, so that, in such cases, a low diet will suffice, and food becomes of secondary importance. On the contrary, in prolonged cases of disease, especially where the patient is weak and not well nourished, a regular supply of easily assimilated food becomes of paramount importance. From physiological laws, to which brief reference has been made at the beginning of this paper, nitrogenized aliment is necessary in order to supply the elements needed for the building up of tissues; and this is especially the case when there has been increased metabolism and destruction of albuminates, the result of increased temperature. Starchy foods fail to supply the plastic principles required to restore the tissues to their normal condition.

The principal articles for the sick which contain nitrogen are meat, eggs and milk, or casein and albumen in some form or other. From these various nutritious articles of food are made, such as milk punch, egg and milk, broths, and various combinations, such as consommé with egg, custards, meat juice with milk, etc. In order to make the casein more acceptable to delicate stomachs and weak digestive organs, milk may be partly peptonized by the use of digestive ferments before administration; if fully peptonized, the taste of the milk becomes disagreeable and bitter. By this method, the question of nutrition in some trying cases, has been much simplified and the results have been more successful than any hitherto obtained. In the same way meat may be partially digested, and beef-tea, made by the cold method does, in fact, contain a considerable proportion of peptones, and is made correspondingly more nourishing and valuable.

A new and very promising food product has just been brought to this country. It is in the form of a fine meal, made of desiccated beef, prepared in a novel manner. Some years ago Débove, of Paris, called the attention of the profession to the usefulness of powdered beef in his method of forced feeding (gavage), and described a process for preparing it. Various forms of powdered meats have been brought forward at different times, but they failed in nutritive value, as they largely consisted of insoluble matters. The beef-meal of the Mosquera Food Co., of Venezuela, however, is manufactured on a new principle; its projectors have solved the problem finally, by treating fresh, lean beef with a digestive agent before desiccating it.

A word may here be said with regard to the method of making the beef-meal, and the agent used in partially peptonizing the meat. It was about ten years ago that Prof. Wurtz, of Paris, isolated from the juice of the Carica papaya, or Pawpaw plant, a principle resembling pepsin in its action upon albuminoids, converting them into soluble albumoses and peptones. This substance, which he named "Papain," is now comparatively well known, and it has been used for cases of weak digestion, and also for its softening effect upon the false membranes, as a local application in diphtheria. It has recently been discovered that this valuable property of digesting meat and of converting albumen into peptones is not peculiar to the Pawpaw, but is exhibited also by some other plants. It is especially manifested by the Pine-apple and allied plants of the Bromeiaceæ.

In the preparation of the Mosquera-Julia beef-meal the juice of the Pine-apple plant is utilized with very excellent effect. The advantages of employing a vegetable digestive principle rather than animal pepsin (and especially the usual kind of pepsin) are very obvious:

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* Bauer, *loc. cit.*

the superiority of the former over the latter needs no discussion from either an æsthetic or antiseptic point of view. It is a matter of considerable importance that the ferments of vegetable origin are entirely free from the forms of pathogenic bacteria, which are liable to be found contaminating animal pepsin and pancreatin.

The Mosquera-Julia beef-meal, therefore, differs essentially in its mode of preparation from all other powdered meats, and the resulting product is correspondingly superior. Other powdered meats consist largely of indigestible fibre, and have a disagreeable odor and taste; this, on the contrary, is largely soluble and is odorless, and has a pleasant taste; it is entirely free from the bitterness that generally attends preparations made with digestive ferments of animal origin. It represents all the constituents of fresh meat in highly concentrated form, predigested with pine-apple juice, as previously stated.

Containing, as it does, less than ten per cent. of water, it will be seen that Mosquera's beef-meal, with the exception of this small percentage, is composed of nutritive matter, nearly half of which is in a readily soluble form; the other half easily convertible into soluble products by the digestive juices, as may be determined by testing samples of the insoluble matter with solutions of pepsin and hydrochloric acid, and with alkaline solutions of trypsin.

Lean beef, according to Dr. Letheby, has the following composition:

Nitrogenous or albuminoid matter	19.3	per cent.
Fat	3.6	"
Saline matters	5.0	"
Water	72.0	"

From these figures it is evident that Mosquera's beef-meal contains more than four times the amount of albuminoid matter present in average lean beef; but the real difference in nutritive value must be considerably greater than this, since at least one-half of the proteid matter of the beef-meal is in a readily assimilable form, and, furthermore, the preparation contains about three times as much fat. Another notable feature in this preparation, which distinguished it from other predigested albuminous foods, is the absence of all objectionable taste and smell. The bitter, or other disagreeable taste of ordinary peptone preparations, is, as before stated, wholly wanting in this product. This is a very important point, since by its aid a highly nourishing broth can be made at a moment's notice, which can be taken with relish by the sick or well.

Without dwelling upon individual cases, I would state that I have found the beef-meal especially serviceable in relieving prostration and the effects of fatigue, in elderly persons, in the form of the broth just mentioned, and nicely seasoned. Also, in the intestinal disorders of the aged, it serves to support life and sustain strength, without taxing the digestive functions, already enfeebled by disease and physiological decay. In cases of pulmonary phthisis I have seen good results in keeping up the vital powers and in aiding the struggle against the deadly progress of the disease. I would especially mention the use of the broth, seasoned with pepper or capsicum, in cases of alcoholic excess, drink craving and delirium tremens. Here the stomach rejects ordinary food but does not rebel against the hot broth, in moderate quantities, repeated at short intervals. In all cases of fever, where beef-tea was formerly employed, the strength of the patient can be maintained much better with such an easily assimilated preparation as this. As insisted upon by Graves, the delirium and other nervous symptoms of fever are often due to weakness caused by want of nourishment; in truth, he states, in one of his clinical lectures, that he had seen many fever patients starved to death. This is not the practice at present. Since Graves's time we have learned to feed fevers, and the change, which is largely the result of his teachings, has been very much in favor of patients. The chief problem of how to obtain animal food in easily assimilable form seems at last to have been solved. Moreover, by the judicious use of broths made with Mosquera's beef-meal

it will be found that the necessity for a resort to alcoholic liquors is of rarer occurrence, owing to the absence of the so-called indications for stimulants.

In cases of infantile prostration or debility, following bowel disorder, it becomes necessary very often to stop the administration of milk and substitute some other form of nourishment. In such an emergency the strength of the little patient can be supported by mixing Beef-Meal with rice water or albumen water, and the patient kept upon this exclusively, for days at a time. Many cases of rickets are due to insufficient nourishment in early life. The mother's milk may not be sufficient in quant yitor of good quality, or the artificial food may be given too much diluted. In such cases good immediate results may be obtained and future difficulties averted, by a more generous diet, and especially by an easily assimilated nitrogen-containing aliment, such as Beef-Meal. Of course, there are other ways of administering this valuable nutriment, than those I have mentioned, which will suggest themselves to the mind. It may be dusted on bread, a little sandwich made with it, or it may be mixed with almost any other article of food, such as coffee, or chocolate, of which children usually are very fond. Finally, it would form a highly useful addition to nutritive enemata in cases where feeding by the rectum is deemed advisable; it may also be introduced, as in the method followed by Débove, by gavage, using a stomach pump or soft rubber tube.

If the beef-meal is kept up to the present standard of quality, and by more extended experience is found to fully accomplish all that this preliminary note appears to warrant us in expecting from it, I believe that the terms used in this communication will be found to come short of its actual value in the sick room. I can only say that while under trial in hospital and private practice for some months it has proved in my hands highly satisfactory, and has entirely superseded the old forms of beef-tea and broth in cases in which they were formerly considered indispensable.

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Alimentation in Therapeutics.

This is a subject of paramount importance to the practitioner. The management of pyretic and wasting diseases, especially the continued fevers, phthisis, certain forms of anæmia, etc., has ever been a puzzling problem, since the indications point strongly to the ingestion of nourishment rather than of drugs, or at least that the latter should be relegated to a relative and secondary position. It was recognition of this that led Debové to advocate forced alimentation, which to this hour is supported by such eminent therapeutists as Yvon, Weiss, Dujardin-Beaumetz, and others, under the name of *gavage*.

In the low forms of fever, typhus and typhoid for instance, we have to do with the incubation and evolution of a specific poison, and the effort made by Nature for its neutralization and elimination. The latter is chiefly combustive, whence the pyrexia, to support which the reserves of the organism are first drawn upon, and when exhausted, the economy is laid under contribution as a whole:—Therein is the secret of the rapid emaciation, cerebral anæmia, nerve exhaustion, torpid digestion (owing to depleted secretion), "blocked emunctories," etc., etc., as well as the high temperature; consequently any form of therapeusis that has not for its primal object the restoration and renewal of the supply of force in consonance with waste and demand, as well as the neutralization and elimination of the morbific element, is necessarily incomplete as well as illogical.

We are accustomed to speak of the "course" of disease, a term that imperfectly indicates the period that intervenes the onslaught of the poison and the beginning of convalescence, or, in lieu of the latter, fatality. In fact, however, it measures merely the limit of the conflict between Nature and the morbific element, and consequently the value of the resources of the combatants. Reserve vitality (force), and imbued force (medical and alimental therapeutics), are the resources of the economy—the defence; while the opposing factor is the multiplication of the invading organisms, with (sometimes) new accessions from without. If the reserves of the defence are sufficient, combustion continues until the invading germs are consumed, or expelled, the latter depending upon the forcing of the strategic ground (the emunctories) that was seized at the onslaught. In how far, in each instance, the morbific element may derive succor from the individual economy, becomes oftentimes a moot pathological physiological conundrum.

Phthisis and other wasting diseases, differ from the pyrexias only in that the onslaught, instead of being general, is insidious, specific, and more strategetic, the foe becoming intrenched before pronounced hostility is manifested. The vitality of the organism is at low ebb ("predisposition"), hence is taken at disadvantage, and possibly, in greater degree forced to contribute to the sustenance of the invaders. Indeed, the reserve resources are sometimes exhausted by the latter ere their presence is suspected. The warfare may not be as vivid as in the pyrexias pure and simple, but the ultimate is more certain, even though prolonged and remote. Here the problem of supply and demand is even more important than in fevers.

The renewal of force depends upon the maintenance of the normal function and activity of the circulation. It is through this source alone that the primal elements of the organism can be secured and utilized. Of these, nitrogen and carbon are in greatest demand, inasmuch as the phenomena of nutrition depend upon their chemical interchange, along with the co-operating influences of oxygen, hydrogen, and certain salts. Nitrogenous foods alone are capable of being converted into the albumin and fibrin of the blood, and thus assimilated by the tissues; such are partially heat-giving also, though chiefly indespensable to the evolution of force by the building up and restoration of

muscle and nerve material. For these reasons animal food possesses the greatest economic value, *i. e.:* They are both nitrogenous and carbonaceous, while the carbo-hydrates are heat giving alone.

In the alimentation of disease, so essential to furthering the conflict between Nature and morbidity, the nitrogeno-carbonaceous foods are imperatively demanded. In seeking among substances of this class for those most suitable, but two have been found to meet in anything like just proportion the requirements, viz.: Animal flesh, and the product of the udder (milk). The latter presents, perhaps, the best graduated proportions of nitrogen and carbon, but unfortunately, in spite of the theoretical demonstrations of utility, its digestion is somewhat complex, requiring the co-operation of certain alimentary secretions that are too often in abeyance or wholly lacking, when it is transformed into an irritating mass; further, it is always a varying and variable product, even as obtained from one animal, and with the beginning of convalescence especially, is apt to become highly repugnant. The conservation of the force expended in excretion during a milk diet, represents a large percentage of vitality.

Of the former, beef usually obtains the preference. Beef "teas" and "essences" were long supposed to represent in suitable proportions the greatest supply of soluble nitrogen and carbon, but recently the fallacy of these claims have been made apparent, though the value of beef-fibre, *per se*, remains universally acknowledged. In consequence, raw beef minced or powdered has been suggested, and highly extolled as an easily assimilable aliment, especially in connection with gavage, but is open to two serious objections: First.—The danger of breeding certain pernicious intestinal parasites: Second. —The cases wherein such would be of highest utility, theoretically, are those in which the secretions are "locked up"—a crude mode of giving expression to the fact they have been diverted elsewhere to serve as fuel in the evolution of vital force. Obviously, then, it is pernicious to force digestion with a view of securing assimilation, as the labor can be but imperfectly performed, since the already depleted and weakened digestive functions must be taxed beyond their resources (ability and vitality:—It is poor economy to "rob Peter to pay Paul." One measure, however, remains, viz.: The conservation of energy by compensation, or in other words, employing predigested aliment. This is what Fochergill terms "helping a lame dog over the stile."

There has been some prejudice evinced toward predigested food, arising from the fact the ferments employed are of somewhat unsavory animal origin, and popularly deemed the products of a form of decomposition; again, the gain in assimilability is obtained at the expense of palatability. Recent researches have, however, shown that certain vegetable forms, notably the class Bromeliaceæ (of which the familiar pineapple is an example), yield ferments of like physiological activity, and to which no exception can be taken even by the most fastidious; and these a Venezuelan chemist, Dr. Vincenté Marcano, has succeeded in utilizing, in connection with beef preparations, in a way to dispose of all objections, and at the same time increase the nutrient value of the latter at least six-fold; assimilability and palatability are still greatly enhanced. The practical value of this discovery as related to therapeutico-economics and dynamics, can scarcely be over-estimated, since by it the hitherto unassimilable products of animal tissue food—those nitrogenous elements usually excreted as waste—are rendered available, whereby a minimal digestion may be made to secure a maximum transformation of nourishment into vital force; or, to be more explicit, by the treatment of beef or other animal fibre whereby it is transformed into albumose and peptone—the latter a dialyzable substance,—and the addition of the ferment of the pineapple, an attractive and palatable product is secured that is *absorbable* as well as assimilable in the highest degree, even in the presence of minimal digestive activity, while the nutritive value (power of increasing force) is sextuply increased.

If the cause of each individual case of phthisis could be traced, the disease would be

found primarily due to improper and insufficient alimentation. At the same time the problem of cure is to secure sufficient force through alimentation to sustain the economy until it can in the conflict win the victory over the morbific element. The same is in no inconsiderable degree true regarding fevers and other acute states arising from specific and systemic poisoning. As already noted, it is lack of vital force that constitutes a "predisposing diathesis," since no germ can obtain lodgment in soil unfitted for its sustenance and propagation. "At present, the usual preparation of food"—to quote Dr. Frederick J. Knight before the 1890 session of the Climatological Association—"is so bad that after one has found out the class of nutriment a patient requires, it is well-nigh impossible to secure it to him." It was recognition of this that led to the advocacy of forced alimentation by means of meat powders, a procedure that almost universally obtains in foreign hospitals; but gavage, though theoretically perfect, is practically productive of little good, since the amount of nourishment available is but little in excess of ordinary meat fibre, minus a depleted digestive power and divested function, including the force necessary to remove the superfluous (insoluble) portions of the aliment. The question of maintaining the equilibrium in a conflict with disease, and at the same time restoring forces of Nature that are weakened by diversion, is an exceedingly intricate and complex one. It is a well-known physiological axiom, that to overtax an already deficient function is to deplete it still further, and weaken the reserves of which that function forms a part. While this was understood by the early advocates of gavage, the trust and hope was that by some unknown process Nature, who is ever elastic in her methods, might somehow make the deficiency good.

Sr. Vincenté Marcano, however, by his discovery, which has passed the experimental stage and become a demonstrable fact, swept away the intervening doubt by producing a food that while more than sextuply enhanced in nutritive value, is at the same time practically self-digesting, and likewise absorbable, fifty per cent., nearly, thereof being dialysable; further it permits of admixture in all proportions with all forms of sustenance—fluids, carbohydrates and salts. This corollary may be most emphatically substantiated by employing in rectal alimentation, where nutrition is accomplished by absorption (as differentiated from digestion) purely.

The manufacture of beef-meal by the Marcano process has recently passed into the hands of the Mosquera-Julia Food Company, expressly organized for this purpose. A late production, to establish its absolute value, was submitted to analysis, when it was found to exhibit a total of nutriment available for the production of force (proteid or albuminoid matter) of nearly eighty per cent. As ordinary beef contains but 21.39 per cent. of proteid or albuminoid matter, of which but one-half ordinarily ingested is available for the production of "force"—being excreted as waste—the relative value as compared with Mosquro beef-meal is in round numbers, as 11 to 80. Allowing for possible variation in the product, we may modestly estimate Mosquera Beef-Meal as at least six times the value of ordinary beef fibre.