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MEMOIR ON THE DIGESTION AND THE ASSIMILATION OF AMYLACEOUS AND SACCHARINE MATTERS.*

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(Translated for the *Provincial Medical and Surgical
Journal*.)

In this memoir I shall continue the exposition of my researches on the digestion and assimilation of amylaceous and saccharine matters, in contact with the alkalies contained in the animal fluids; but before making known the entirely new results which I have obtained, it will be right to recal here some facts already recorded in a memoir before presented to the Académie des Sciences—facts which form the point of departure of all my researches on this Chemico-Physiological subject.

1st. Glucose, dextrine, &c., do not by themselves exercise any action in reducing the deutoxide of copper; these substances only acquire this property after having been chemically influenced by alkalies.

2nd. The assimilation of saccharine and amylaceous matters can only take place under the influence of the alkalies contained in the vital humours.

3rd. And as a consequence of these propositions, diabetes does not consist, as has hitherto been said, in a saccharine transformation within the viscera, but rather in a mal-assimilation of sugar from a deficiency or absence of alkalies.

I have established this theory, not only by chemical experiments, but also by clinical observations, which have shewn its entire correctness, in proof of which I have brought forward the case of a diabetic patient cured according to my method of treatment.

At the commencement of the present work, I would recal to mind, that the essential basis of the alimentation of animals is constituted by three very distinct groups of substances,—albuminous matters, fatty matters, and saccharine matters; that these alimentary substances are not all of them immediately capable of being assimilated, and that in order to become so they must remain for a longer or shorter period in the gastric and intestinal cavities, and there undergo, by the intervention of the fluids contained therein, a kind of liquefaction, or of fermentation,—a chemico-physiological process to which we give the name of digestion.

Notwithstanding the labours of Reaumur, Spallanzani, Leuret and Lassaigne, Tiedemann and Gmelin, Eberle, Deschamps, &c., it is incontestable that the

chemico-physiological study of these three groups of alimentary substances is far from being equally advanced. It is, indeed, generally admitted, that albuminous substances are capable of assimilation only by the assistance of the gastric juice, which by its acid causes these azotised matters to swell up, and by its pepsin, a genuine ferment, produces their liquefaction,—a phenomenon analogous to the action of diastase upon starch, and that fatty matters become capable of assimilation by the intervention of the bile. For the feculent and saccharine matters nothing positive is ascertained; it is with difficulty that some scattered observations—some hypotheses without foundation—are met with, capable of throwing any light upon the question.

It is this blank which I have endeavoured to fill up, and I have had more success in my labours than I could have dared to anticipate; for by the discovery of the active principle of the saliva—a principle perfectly resembling diastase, and like it, capable of being isolated, I am enabled to give the explanation of the phenomena of the transformation of amylaceous cellular substances into saccharine matters.

The transformation of amylaceous substances had already been shown by some authors:—Tiedemann and Gmelin were the first to discover that in a dog, starch, at the end of five hours, was converted into sugar and into starch-gum, dextrine. Leuchs has shown that starch reduced into starch-paste, (*empois*), and heated with fresh saliva, becomes liquid in the space of some hours, and is converted into surgar; and further, that this effect is not produced either by ptyalin, mucus, or albumen, but only by the saliva. Sebastian has confirmed the discovery of Leuchs, and has established that starch digested with saliva loses its property of becoming blue with iodine, in the same manner as when treated by an alkali. In the latter case the blue colour is restored by the addition of an acid, but not in the former. These facts have also been observed by Schwann, who asserts that pepsin does not exert its digestive action upon all aliments, that it acts only upon albumen and fibrin, the caseous matter and the gluten being digested by the free acid of the gastric juice, and the starch by the saliva which mingles with this juice.

Finally, I must not omit to recal here that the action of the saliva on amylaceous substances has been long known, as is shewn by the use which is made of it in China, in the preparation of bread, and in India, in the fabrication of spirituous liquors.

After this brief summary of the actual state of our knowledge, I proceed now to bring forward my new

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researches, which tend to shew that all the hydro-carbonated substances belonging to the family of amylaceous or cellular matters, can only undergo the phenomena of assimilation in so far as they are capable of being decomposed by the weak alkaline solutions contained in the vital humours, whether immediately, as glucose, dextrine, and sugar of milk, or mediately, as cane-sugar, cellulose, and starch. These latter must in the first place undergo transformation in the animal economy; the cane-sugar into glucose, the cellulose and the starch into dextrine or glucose, whilst the hydro-carbonated matters, which are neither capable of being fermented nor decomposed by weak acids or diluted alkalies, such as cellulose, lignin, and mannite, escape in man the digestive and assimilative actions, or, in other words, the chemical inter-visceral reactions which preside over the entire process of nutrition.

I.—HYDRO-CARBONATED SUBSTANCES IMMEDIATELY DECOMPOSABLE BY THE ALKALIES OF THE BLOOD, OR HYDRO-CARBONATED SUBSTANCES IMMEDIATELY CAPABLE OF ASSIMILATION.

Glucose, grape-sugar, sugar of fruit, sugar of fœcula, diabetic sugar.

It has been hitherto supposed that glucose had great affinity for oxygen, and that it was to this property its power of reducing certain metallic oxides, and particularly the deutoxide of copper, was owing; but I have satisfied myself, by a long course of experiments, that this organic principle does not in itself possess any reductive power, and that this power is only communicated to it by certain substances, and especially by free or carbonated alkalies, which have the property of transforming the glucose into ulmin, into kaliglucosic acid, into formic acid, and other products, and that it is especially to this latter acid (the formic acid,) that the reducing action ought to be attributed. The following are the facts on which the foregoing proposition rests:—

1. When a mixed solution of glucose and of sulphate of copper is boiled, there is no reduction of the salt; but if while the mixture is in full ebullition, potass or soda, in proportion more than sufficient to cause a change of the base, to saturate the sulphuric acid, and to form the sulphate of potass or soda, be added, the deutoxide of copper in contact with the glucose modified by the potass or the soda immediately undergoes reduction, and passes to the state of protoxide—a reduction which does not take place when the potass or the soda has not been employed in excess, so as to produce all these reactions.

2. When a solution of glucose in water holding in suspension perfectly pure hydrate of the deutoxide of copper, is heated, this latter is not at all affected by the saccharine solution; but if a few drops of a fixed alkali, whether free or carbonated, be poured into the boiling liquid, there is an immediate decomposition of the deutoxide of copper into protoxide.

3. Let a mixture of water, glucose, and hydrated oxide of copper be divided into two equal parts; if to one of these parts a little free or carbonated potass or soda be added, in the space of some hours there will be complete reduction of the deutoxide of copper by the alkaline glucose, even without heat—a reduction which does not take place by the pure glucose. It

should be added, that the presence of the oxygen of the atmosphere is not in any way concerned in this curious reaction, as I have convinced myself by numerous experiments, the chief only of which are here related.

Exp. 1. Some glucose was boiled in distilled water for a long time, and when I had ascertained that the saccharine solution was as free from air as possible, it was introduced into a stoppered phial previously heated, and immediately stopped, care being taken that no air-bubbles were included. After the cooling was completed, I dropped into the bottle a fragment of caustic potass, and a fragment of deutoxide of copper, both deprived of air by previous fusion, and then shook the phial until the solution of these two bodies was completed; the reduction of the oxide of copper soon took place.

Exp. 2. The preceding experiment was repeated, but instead of adding the potass and the sulphate of copper after the cooling, these two bodies were introduced into the phial whilst the saccharine liquor was boiling; the reduction of the deutoxide of copper was in this case instantaneous, that is it took place immediately the sulphate of copper was dissolved.

Exp. 3. Finally, in another experiment I introduced under an inverted receiver, filled with mercury from which the air had been expelled by boiling, a small quantity of glucose in solution, then some solution of potass freed from air and holding the deutoxide of copper suspended; the reduction of this last was quickly completed, and took place as rapidly as if the experiment had been performed in contact with the air.

These facts establish that, contrary to the opinion of MM. Bouchardat and Sandras, the oxygen of the air has no effect in the decomposition of hydro-carbonated matters under the influence of alkalies.

Sugar of milk and dextrine behave themselves in the presence of alkaline solutions exactly in the same manner as glucose.

As a consequence of these experiments I have been led to lay it down as a principle, that all hydro-carbonated substances, such as sugar of grapes, starch-gum or dextrine, &c., do not undergo assimilation until after they have been transformed by the alkalies of the blood into new products, into kali-saccharic acid, into ulmin, and into formic acid—a body very powerfully endowed, as I have before said, with deoxidizing properties. The following considerations are adduced in support of my opinion:—

1. The passage of glucose into the urine of individuals in whom all the fluids take a neutral or even acid character, (diabetic patients.)

2. The diminution of glucose in the urine of diabetic individuals, and even the complete disappearance of this substance under the influence of alkaline treatment.

3. The want of colour of the urine and fecal matters in the same patients, arising from the non-formation of ulmin, a substance which, in the normal state, tends to give colour to these two excrementitious products.

4. The expulsion in the urine of a yellow ferrocyanide of potassium, when it is the red ferrocyanide which has been taken internally, showing that a reducing action has taken place within the animal economy. This effect is probably due to the products resulting

from the decomposition of glucose by alkalies, and particularly by the formic acid.

5. The formic acid and the other deoxidating bodies produced, according to my views, during the ingestion of amylaceous and saccharine substances, exercise a salutary reducing effect, the genuine counterpart of respiration, or, in other words, of respiratory oxygenation; thus, the absence of these compounds in the blood of diabetic patients, produces a noxious disturbance in their circulation, arising from an oxygenation over and above that of the protein elements which this fluid contains.

6. Finally, formic acid combined with soda has been detected by MM. Bouchardat and Sandras in the blood of man and of animals three hours after they had eaten sugar in considerable quantity.

(To be continued.)

SUGGESTIONS TOWARDS THE ADOPTION OF A PLAN FOR THE ADVANCEMENT OF PRACTICAL MEDICINE AND SURGERY.

By THOMAS HUNT, Esq., Herne Bay.

(Read at the first Anniversary Meeting of the South-Eastern Branch of the Provincial Medical and Surgical Association, held at Ashford, Wednesday, June 24, 1846.)

The first avowed object of our Association is the collection of useful information, tending to the advancement of medical and surgical science. This end we have hitherto been endeavouring to accomplish, chiefly by the publication of original essays, hospital reports, and cases occurring in private practice. Much has been done in this way, but perhaps much more may be accomplished by enlisting the services of *men who do not write*; but like their modest prototypes in the wilderness, are content to—

“Waste their fragrance in the desert air.”

Many of our best provincial surgeons are unfortunately *not* writers, yet, nevertheless, men of observation and reflection; and their experience, however valuable, is liable to be lost to the world at their decease. There is no calculating how many important discoveries have been already buried beneath the clods of the valley. Men, who by their talent, character, and influence, have moulded the opinions and guided the practice of large rural districts, have too often been removed from the sphere of their labours, leaving behind them nothing but traditional recollections—vague and vanishing—of the principles and practice which made them ornaments to their profession and blessings to society. It is with difficulty I can resist the temptation of naming one or two individuals, as illustrations of this remark; but I feel assured that the memories of all who are present, will readily suggest some respected names of men, the memorials of departed worth, known little beyond their respective localities, whose reputation still lingers over the scenes of their former labours; but who have left behind them no other monuments of their greatness. And, doubtless, there are living men (and I know that this room will furnish specimens,) of equal power and attainments, who would at least willingly and promptly respond to direct and definite enquiries on any

question of experience, addressed to them from a respected source, who yet, in the absence of such a motive, may never record their views. Many are too busy, some too diffident, a few perhaps too indolent, while others are deterred by a positive inaptitude to the use of the pen. John Hunter himself, whom but to name is to revere, was *no writer*; and who shall tell how much we have lost by this misfortune?

It has occurred to me, that our weekly periodical might be made the medium of certain definite enquiries, addressed to all our members on any given question, and the statistical results of their replies might be published in our annual volume of “Transactions,” and there collated and compared with whatever practical information on the same subject might be gleaned from the periodicals during the last year or seven years; and thus we might settle some disputed point, or discover some new principle. This would be a beginning, and by degrees, the system might be extended over the whole profession, through the National Association or any other respected medium.

Success in one department would soon encourage the attempt in others, and the time might come, when by this simple arrangement, many of the important practical questions which now agitate and vex the profession, might be quietly and permanently settled. I am aware of the formidable difficulties which must present themselves on the very threshold of such an undertaking; but, if only the majority of my brethren who are now present will consent to put their hands to the work, I do not despair of something important being accomplished.

The details I leave for future discussion. My present object is to sound the feelings of this Branch of the Association, and collect the opinions of the Members of the South-Eastern District, on the practicability of the plan; and I will trespass no longer on your valuable time.

CASES IN THE HOSPITAL PRACTICE OF T. M. GREENHOW, ESQ., SENIOR SURGEON TO THE NEWCASTLE-ON-TYNE INFIRMARY.

(Reported by Mr. C. J. GIBB, House Pupil.)

SECONDARY SYPHILIS.

CASE I.

Patrick Lagay, aged 36, a labourer, admitted May 22nd, with a foul ulceration of the throat; a copious eruption of syphilitic acne and lepra over the back and shoulders; an extensive crop of condylomata over and between the nates, and severe nocturnal pains, of the shins particularly; health affected, but no great loss of flesh. Had indurated chancres four months ago, healed by mercury, and became affected with secondary symptoms by the help of uncleanness a few weeks ago.

To use the warm bath frequently, and to have the lead lotion with laudanum to the nates, with a nitric acid gargle to the throat; to take ten grains each of Dover's powder and rhubarb every night, and drink a pint of the compound decoction of sarsaparilla, with fifteen grains of the iodide of potassium daily; and to have mild diet.

28th. Improving in every respect.

June 6th. Health good again; sleeps well; eruption