ing will often soon kill. A second bleeding often destroys a patient very quickly.

In healing wounds which are near joints, particular attention should be paid to the motions of the parts; for if they are not frequently moved while healing, they will acquire such rigidity and stiffness as frequently impede motion. This ought more especially to be attended to, if there is much loss of substance, for the rigidity will be proportionably great. Parts while forming will, if frequently moved, adapt themselves to that motion; therefore, the lungs are frequently united to the pleura by long threads; these probably form while in a ductile state.

Penetrating wounds.

These wounds may be divided into two kinds; such as simply enter the cavities of the thorax or abdomen, and those by which some part contained in the cavity is injured. Penetrating wounds of the abdomen, attended with injury of its different contents, have been very well explained by authors, therefore nothing will be said of them here.

Wounds of the lungs, merely as such, I do not think mortal; for I have known many instances where balls have passed through the lungs, and all the patients have recovered. In these cases there is little hæmorrhage, adhesion takes place between the lungs and pleura surrounding the wound, excluding the general cavity from exposure, suppuration follows, and they heal up with little inconvenience to the patient. Gun-shot wounds of the lungs do much better than those made by cutting instruments; this probably arises from the former being attended with little hæmorrhage, and from the wounds remaining open for some time, which prevents any ill consequences arising from extravasated fluids being retained in the chest.

If the lungs are wounded with a cutting instrument, there is greater danger than in the former case; for the hæmorrhage which is always considerable in such wounds, will extravasate into the general cavity, if there are no adhesions. The external opening generally heals up very soon, and the extravasated blood, if in a small quantity, will be absorbed, but if the quantity should be very large, it frequently brings on great mischief, from compression of the lungs. The symptoms are great lowness, with a load in the breast, difficulty in breathing, a quick and hard pulse. In such a case, the sooner the operation for empyema is performed the better, for if the blood coagulates, it will be difficult to remove it.

Captain Muller received a wound with a small sword under the left breast; after the accident he vomited (if it may be so called) a large quantity of blood, but this entirely ceased after the second day; adhesions had probably taken place in the cells of the lungs surrounding the wound, which prevented his spitting of blood; however, the large opening of the lungs into the thorax still continued to throw blood into the cavity, which might be from the thorax, acting as the valve of a pump every time he inspired. He frequently sweated very profusely, therefore he had no hardness of his pulse or dryness of the skin. Wounds of vital parts are generally attended with a dry skin.

He could not lie on the sound side, that suffocating him; nor on the diseased side, from the pain which it gave him; therefore he could only

lie on his back. He had opium given him in small quantities which relieved him, expectorants were joined with it. It was recommended to be given in larger quantities by me, but that was overruled by the physicians, who feared that it would lock up the chest too much; the operation was strongly urged, but that was also overruled. The difficulty of breathing gradually increased for about five weeks, at the end of which time he died of a sudden kind of suffocation. On opening the body, the left side of the chest was found filled with fluid blood, adhering to the sides of the pleura; it appeared coagulated, but this was probably lymph thrown forth from the pleura, and coagulating immediately from its extravasation. The lungs were very considerably collapsed, quite sound and remarkably firm, having the wound in them unhealed. It is found by experience, that it is much the best, in general, not to amputate on the field of battle; however, there may be some instances where it may be right. If, for instance, there is copious hæmorrhage from a shattered limb, it may be better to amputate it at once, than go in search of the vessel by repeated incisions, for by that means a larger cut surface may be made than by amputation. Amputation produces a quicker and more violent inflammation than more extensive mischief done by a gun-shot would occasion.

Mr. Adair has observed to me, that those patients who had their limbs amputated on the field of battle very rarely recovered, whereas those who were left until the inflammation had entirely ceased frequently did well.

LECTURE

ON THE

CONNEXION BETWEEN LIFE AND MATTER

IN

THE SERIES OF ORGANIZED BEINGS.*

By M. DUMAS,

PROFESSOR OF CHEMISTRY AT THE FACULTY OF MEDICINE, PARIS

(Concluded from p. 493.)

Hydrogen.—We have already seen how plants decompose carbonic acid, fix its carbon, and form with it the greater part of their substance; in the same way they decompose water, and fix the hydrogen for the purpose of forming certain products. This has been clearly shown by the experiments of M. Boussingault, on the vegetation of plants in closed vessels, and still more clearly by the formation of oils which are so frequently found in certain parts of plants, and are so rich in hydrogen; the latter must be derived from water, inasmuch as the plant receives no other substance containing hydrogen.

The substances thus formed from the hydrogen of water, minister to various functions in plants; they form those volatile oils which protect them from insects; those fatty substances which envelope seeds and furnish heat by combustion, when

* This highly interesting lecture formed the concluding discourse of M. Dumas to a series of lectures on organic chemistry. We are indebted to the *Journal des Débats* for it.

the seed begins to generate; those waxy materials clothing leaves and fruit, and rendering them impermeable to water. But these different functions are merely accessory, and hence the combinations of hydrogen are less frequently met with in the vegetable kingdom than those of carbon and water.

Nitrogen.—Every plant fixes a certain quantity of nitrogen, derived either from the atmosphere or the earth; it seems, however, probable that the nitrogen is fixed under the form of ammonia, or nitric acid. Mr. Boussingault has demonstrated, that some plants derive most of their nitrogen from air; while others, as wheat, draw it exclusively from manure; this is a most important distinction to farmers, for it shows them that they should commence the cultivation of land with those vegetables which derive their nitrogen from air; fatten with them animals, for the purpose of procuring manure, and then employ the latter for such vegetables as obtain their nitrogen from manures.

One of the most important problems in agriculture, then, is the means of obtaining nitrogen cheaply. About carbon, the farmer need not trouble himself; nature provides this abundantly in air and rain; but the azote of atmospheric air, and the ammoniacal salts contained in rain water, do not always suffice; most plants, the culture of which is a matter of importance to man, require an additional quantity of nitrogen, and this is supplied through the manure, by which their roots are surrounded. This, as we all know, is the chief expense attending cultivation, the main obstacle that the farmer has to overcome; but modern chemistry has arrived at a point which induces me to hope that the discovery of a chemical manure, containing abundance of nitrogen, is not far distant.

M. Schattenman, M. Boussingault, and M. Liebig, have directed attention to the influence of ammonia in manures containing nitrogen, and some recent experiments show that the nitric acid of the nitrates also merits particular attention.

But what is the use of this nitrogen, which seems to be so necessary to plants? M. Payen has partly explained this to us, by showing that all the organs of a plant are primarily formed by an azotic matter, analogous to fibrin, which subsequently unites with the cellular, woody, or amylaceous tissues; this matter is never destroyed, but always exists as the fundamental part of the plant, serving as the rudiment for its various organs; it likewise produces the caseum and the fluid albumen contained in the coagulable juices of plants. Fibrin, albumen, and caseum, then, exist in plants, and present a very curious analogy with ligneum, starch, and dextrine; the fibrin, like the ligneous matter, is insoluble; the albumen coagulates under heat like starch; the caseum, like dextrine, is soluble; they are neutral substances, like the non-azotic analogous matters, and play as important a part in the vegetable kingdom as the latter do in the animal world. Besides, as the union of carbon with water, or one of its elements, produces these non-azotic substances, so the azotic neutral substances are produced by a combination of carbon and ammonia with the elements of water. Forty-eight atoms of carbon, six of ammonia, and seventeen of water, form, or are capable of forming, fibrin, albumen, and caseum. From what has been said, it is manifest that nitro-

gen is of great importance to vegetables, since it contributes to the formation of fibrin, or rudiment of their organs, and the production of albumen and caseum, with which so many plants abound.

Ashes.—The vegetable kingdom is traversed by an immense quantity of water; this evaporates from the surface of the leaves, and abandons the salts which it held in solution. The ashes of a plant are formed of these salts, which are evidently derived from the earth, and return to the same source after the death of the vegetable. The forms in which the salts are deposited, are extremely various; one of the most common is the pectinate of lime.

We have already seen how vegetables merely transmit fluids and gases in the absence of light; how they decompose matter, carbonic acid, and oxide of ammonia, under the influence of solar light; but at certain periods they act in quite a different manner. When a plant is about to fecundate or flower, to develop a bud, or germinate, instead of absorbing solar light, and decomposing carbonic acid, it consumes carbon and hydrogen; in other words, assumes the chief characteristic of animal life. And here we may notice a very remarkable circumstance; while the vegetable (wheat, barley, &c.) is germinating, it produces heat, carbonic acid and water, in considerable quantities; the starch of the grain is first converted into gum, then into sugar, and finally disappears under the form of carbonic acid; if a potato germinate, its starch is converted into dextrine, the dextrine into sugar, and the sugar into carbonic acid and heat; hence it would appear that plants produce heat through the medium of sugar.

Such being the case, it is impossible for us not to be struck by the following coincidences:—Fecundation is always accompanied by the development of heat; in the sugar-cane, the sugar which had collected in the stalk, disappears after the plant has flowered; the beet-root contains sugar up to the period of flowering, but subsequently not a trace of sugar can be found in the root; the same occurs in the carrot, parsnip, and turnip; thus, at certain seasons, and with the aid of certain organs, the plant assumes the functions of an animal; like it, consumes carbon and hydrogen, and generates heat. While so doing, however, it destroys the whole of the sugar which it had collected, for sugar, or starch converted into sugar, seem to be the materials from which vegetables derive the heat necessary for the accomplishment of many of their functions; and if we observe how instinctively animals, and even man, select those parts of vegetables in which sugar and starch are collected, it appears probable that these substances minister to the same end in the animal kingdom, that is to say, are consumed, and furnish the heat which is generated during respiration.

To sum up what we have said. In their ordinary state, vegetables obtain from the sun, heat, light, and chemical rays; from the air they receive carbon; from water, hydrogen; from ammonia, nitrogen; and from the earth various salts; with these different substances they fashion organized bodies which accumulate in their tissues: so far, then, the vegetable is a mere agent of production; but when, for certain purposes, it becomes an agent of consumption, it immediately fulfils the same functions as an animal. The latter, we

know, forms an apparatus for combustion, which is constantly discharging carbonic acid, and in which carbon is incessantly burning; this is the most constant character of animal life; it exists in all classes of animals, for it is immaterial whether the acid exhaled from the lungs or skin.

Animals burn hydrogen as well as carbon; this is proved by the constant disappearance of oxygen during respiration; they are constantly exhaling nitrogen. I insist particularly on this latter point, because some writers assert that a certain quantity of azote is absorbed during respiration, but this is more than doubtful; the exhalation of nitrogen is the constant phenomenon; we derive none of this gas from atmospheric air, from which we merely abstract sufficient oxygen to form carbonic acid with carbon, and water with hydrogen. But in addition to the nitrogen which is exhaled, a certain quantity passes off by the urine. M. Lecanu has shown that each individual passes daily with the urine fifteen scruples of nitrogen; the latter is discharged under the form of ammonia: and here I cannot avoid directing your attention to the simple manner in which nature accomplishes her designs.

If we furnish the air with nitrogen, for the purpose of supplying vegetables with a necessary material, it follows that we should likewise furnish ammonia, a substance so necessary to the existence and development of most vegetables. The urinary secretion furnishes this quantity of ammonia, which is distributed to the air and earth. But the urinary organs of an animal would be destroyed by contact with ammonia or its carbonate; hence, nature excretes the substance under the form of urea.

Urea is a carbonate of ammonia, but the carbonate has lost sufficient oxygen and hydrogen to form two atoms of water; deprived of this water, carbonate of ammonia becomes urea, a neutral, inactive substance, which passes through the urinary apparatus without causing any mischief; when the urea has been discharged and exposed to air, it undergoes fermentation, recovers the two atoms of water, and is reconverted into carbonate of ammonia—a volatile substance, and therefore ascending into the air—a soluble one, and therefore taken up by rain-water—distributed from earth to air, and from air to earth, for the purposes of vegetable life. But one point more is necessary to complete this sketch. Urine contains a trace of albuminous or mucous matter, which, when exposed to air, becomes an agent of fermentation, and converts the urea into carbonate of ammonia. Hence, from the lungs and skin we furnish carbonic acid, water, and nitrogen; with the urine, ammonia; these are the constant and necessary exhalations of an animal, and these are precisely the substances which vegetables require.

If we now ask whence come the carbon, hydrogen, and ammonia, which animals supply to plants, the answer is, from their food, and this leads us to consider digestion in a much simpler manner than has hitherto been done. If we admit that animals do not produce any organic matter, but assimilate it, or destroy it by combustion, the mysteries of digestion disappear, and are reduced to the simple function of absorption, during which, soluble matter passes into the blood, insoluble matter to the chyle.

Besides, the object of digestion is evidently to

furnish the blood with materials necessary for the production of the twelve or fifteen scruples of carbon, (or their equivalent in hydrogen,) which we burn every hour, and the scruple of ammonia hourly discharged by the lungs, skin, and urine.

Hence, amylaceous substances are converted into gum and sugar; saccharine substances are absorbed; fatty matters are subdivided, and carried by the vessels to certain depôts of combustible material. Neutral azote materials, as fibrin, albumen, and caseum, pass into the chyle.

From this it appears that an animal receives and assimilates, nearly unchanged, neutral azote substances, fatty matter, and saccharine, or amylaceous substances, all of which he finds ready formed in the animals or plants that constitute his nutriment; he assimilates or destroys organic matter which has already been formed, but he creates none. Digestion, then, introduces ready-made organic matter: the animal assimilates that portion which contains azote and burns the rest.

But if animals are unable to produce any organic matter, do they possess the curious property of generating heat without a waste of matter? You have seen the contrary, when the experiments of MM. Dulong and Despretz were under discussion. I am firmly convinced that animal heat is exclusively derived from the respiration; that it is proportionate to the carbon and hydrogen consumed; that the analogy between an animal and a steam-engine is closer than we could have thought possible; in both we find combustion, heat, and motion, three phenomena dependent on, and proportionate to, each other.

Thus you see that in this point of view the animal machine becomes simple and easily understood; it is a thing intermediate between the vegetable kingdom and air, drawing its entire support from the first, and rendering all its excretions to the second.

Need I recall to your memories the theory of respiration which we have adopted? Venous blood dissolves oxygen, and gives out carbonic acid; it is arterialized without furnishing a trace of heat; but under the influence of this oxygen the soluble materials of the blood are converted, as MM. Mitscherlich and Fremy have shown, into lactic acid; the latter is converted into lactate of soda; the latter, by a process of combustion, into carbonate of soda, and this last is, in its turn, decomposed by a new portion of lactic acid.

The true phenomena of respiration consist in this slow but continued process of combustion. The blood is oxidized in the lungs, but animal heat is produced in all the capillaries of the body, where the combustion of carbon is constantly going on. One more remark on this subject, and I have done.

To ascend to the summit of Mont Blanc, the traveller employs two days; during this time he consumes 300 scruples of carbon; were a steam-coach employed to carry him up, it would require from 1,000 to 1,200 scruples to effect the same object. Hence, considered as a machine which derives its force from the carbon which it burns, man is three or four times more perfect than our best steam-engines. Our engineers, then, have still much to do, before they can equal the living model; but the numbers which we have just mentioned indicate an identity of principle be-

tween both machines, especially when we reflect on the unavoidable loss of power in steam-engines, and the wonderful manner in which such loss is avoided in the human machine.

Let us now conclude by a summary of what we have said.

From the aboriginal atmosphere of this globe three grand divisions have been formed; the present atmosphere, the vegetable kingdom, and animals.

Between these three masses a constant interchange of matter goes on. Matter descends from the air to vegetables; from the vegetable kingdom it passes to animals; and from the latter it ascends to the air, whence it originally came.

Green plants constitute the grand laboratory of organic chemistry; with carbon, hydrogen, nitrogen, water, and oxide of ammonium, they construct the most complex and varied organic substances.

From the rays of the sun they receive the chemical force necessary for this production of organic matter.

Animals assimilate or absorb the organic matters which vegetables produce; they alter them gradually, they destroy them. Some new organic substances may be formed in the organs of animals, but in all cases they are more simple, more near the elementary state, than those which they have received. They gradually decompose the organic substances furnished by the vegetable kingdom, and resolve them into carbonic acid, water, nitrogen, and ammonia, that they may be in a condition to return to the air.

In burning or consuming these organic substances, animals produce a quantity of heat, which radiates through all space, and replaces that absorbed by vegetables.

Thus, whatever the air yields to plants, plants yield up to animals, and animals, finally, restore to air—an eternal circle in which life revolves, but where matter merely changes place.

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WE were induced last week to call attention to the manifesto professedly put forth by the deputation from the British Medical Association, and chiefly with the view of pointing out the singular misconceptions into which the deputation had been led by the reserve, we suppose we must designate it, maintained by one of the members of that body towards his colleagues. We should not have thought it necessary again to allude to this document, but for the reason that it is addressed to a highly respectable and intelligent association, and that it contains some other misconceptions on the part of the writers or writer, by which it is desir-

able that the members of the body referred to should not be misled. The deputation, somewhat after the manner in which a distinguished statesman of the early part of the seventeenth century memorializes himself on the events of his own life, profess to give an account of their proceedings at the York Meeting, and instead of reading, your excellency thought thus, and your excellency acted thus, we are here instructed that Dr. Hall doubted the policy of proceeding to one line of action, and that Dr. Webster ridiculed the idea of waiting for another. One remarkable difference, however, we perceive in the autodoxology of Drs. Hall and Webster, and the autobiography of the Duke de Sully. The statesman communicates, to himself, information with which he was already well acquainted; the deputation report, professedly for the instruction of others, proceedings with the tenor and the import of which their memories would seem to be but imperfectly charged.

With the manner in which the report is drawn up, however, we should not have interfered, had it not been intimately connected with the insinuation of certain inferences, which are far from being authorized by what actually took place at the meeting. One specimen we brought under the notice of our readers last week; we now reproduce, from Dr. Webster's own journal, the account given of Dr. Webster's individual proceedings. "Dr. Webster did not oppose the adoption of the memorial to government, though he expected no good to result from it: it was so much time wasted to apply to the present ministry; and from a correspondence he had had with Sir Robert Peel, he very much doubted whether he could or would entertain the question during the coming session; if so, he feared that no measure would be obtained which could be satisfactory even to his friend Dr. Barlow, and his colleagues of that association. After an interview which the conference had with the three corporations, he ridiculed the idea of *waiting for their reforms*, or expecting anything from their advent. He alluded at some length to the official reply of Sir H. Halford from the College of Physicians, and to the opinions expressed by Mr. Guthrie and Mr. White, that the College of Surgeons was perfectly immaculate in its constitution and actions; that it was a pure college of surgery, and that it had nothing to do with medicine, midwifery, or pharmacy. He then noticed the changes contemplated by the corporations, who had evidently united their strength to preserve and extend their exclusive privileges, and thought that, after the late resolutions of the Worcester council in favour of these bodies, (which, however, had not been responded to,) some declaration of the reform principles of the asso-