great scientific labour for the benefit of after ages. His ruling passion was a desire to benefit his fellow creatures, and to unveil all the mysteries of organization and life, to develop and explain, for the advancement of medical science, and for the instruction and benefit of mankind. We can fancy him meditating intensely upon the subjects of his constant researches, and directing his ardent glance into all parts of the animal economy, struck with admiration and delight at the wonders thus revealed—determined, if possible, to find out the great secret of life, and convinced in his own mind that the beauty and harmony thus unfolded must be regulated by some great power, analogous to that animating principle supposed by the poet to direct the mighty order and movement of the universe described in those noble lines in which he ventures to deduce animal life from the same great source.

“In the midst of life we are in death.” On the 16th of October, 1793, Mr. Hunter rose at break of day, as was his custom, and repaired to his dissecting room, where he was soon joined by some of those zealous and industrious students whom he liked to have about him. Having succeeded to his satisfaction in accomplishing a most difficult piece of minute dissection, he was in high spirits, and as he went down to breakfast, gaily repeated some lines of a Scotch song, a thing very unusual—“It was,” says my informant, his faithful friend, whose eyes filled with tears as he mentioned it, “the song of the dying swan.” Mr. Hunter left his house in perfect health, and, after making some professional visits, repaired to a meeting of the governors of St. George’s, where he was seized in the board-room of the hospital, and being conveyed to an adjoining apartment, fell dead in the arms of one of his friends. It was on the same day, and nearly at the same hour, that the unfortunate Queen of France was murdered on the scaffold. The lovers of science were struck with consternation and dismay at the discovery of their unexpected loss. The loss seemed to them irreparable. But the bright genius lives again, in the ample stores of knowledge he has left behind him, in his numerous writings, and in the great monument of his labour, which is the pride and ornament of this College—published, explained, enlarged and illustrated since his death, and thus rendered far more useful than they had been during his life. The luminary of Anatomy and Physiology was not extinct. It had descended below the horizon, but rises again with greater brilliance to shed its bright influence over ages yet unborn.

“So sinks the day star in his ocean bed,
And yet anon repairs his drooping head,
Then tricks his beams, and with new spangled ore
Flames in the forehead of the morning sky.”

(Great confusion mixed with applause and hisses.)

SOME
EXPERIMENTAL RESEARCHES
TENDING TO
DISPROVE THE EXISTENCE OF PROTEIN.
By BARON LIEBIG,
PROFESSOR OF CHEMISTRY, GIESSEN.

ON THE SUPPOSED BINOXIDE OF PROTEIN.

ACCORDING to Bouchardat, if moist fibrine be immersed in water acidulated with a two-thousandth part of hydrochloric acid, the fibrine speedily becomes gelatinous, and on continuing the action of the dilute hydrochloric acid, a solution is obtained, which is turbid. This turbidity appears to arise from a slight admixture of a fatty substance. That portion of the fibrine which is thus soluble in hydrochloric acid, Bouchardat designates by the term ALBUMINOSE, the insoluble part by that of EPIDERMOSE.

Mulder states that this experiment was repeated by Herrn Von Baumhauer. The solution of fibrine in dilute hydrochloric acid Baumhauer precipitated by means of carbonate of ammonia, and treated the precipitate with alcohol. After drying, the precipitate yielded on analysis,—

	1		2
Carbon . .	53.64	. .	55.62
Hydrogen .	6.88	. .	6.73
Nitrogen :	15.88	. .	—
Oxygen . .	23.64	. .	—

M. Mulder concludes, from these experiments, that “the albuminose is a product of the oxidation of protein, which, no doubt, is formed by the action of the atmospheric oxygen upon the matter formed and dissolved by the hydrochloric acid. It is binoxide of protein = C₄₀H₆₈N₁₈O₁₄”

We have of late been so overwhelmed with descriptions of substances, which, although greatly differing in their properties, yet, according to their analyses, must be considered as oxides of protein, that I was very desirous of convincing myself, by experiment, of the existence of at least one of them.

I have found, that if we are to understand by the designation, *binoxide of protein*, a substance which contains no sulphur, the substance investigated by Baumhauer cannot belong to such a class of bodies as oxides of protein, since the whole amount of sulphur present in fibrine exists unaltered in this new substance.

In the first place, I have observed that the atmosphere and its oxygen have no share in the solution of fibrine in hydrochloric acid. If moist fibrine is allowed to become gelatinous in dilute hydrochloric acid, and the mixture copiously diluted with water, and immediately afterwards filtered, before the solution has taken place, the presence of lime and potass may be detected in the filtered fluid. If the fluid be exposed to the protracted action of a higher degree of heat so as to effect the solution, and a portion of this heated to boiling, with an excess of potass, the subsequent neutralization with acetic acid gives rise to a copious evolution of sulphuretted hydrogen, and a drop of acetate of lead produces in it a black precipitate. Upon solution of fibrine in dilute hydrochloric acid of the above given strength, therefore, the sulphur remains combined with the other elements of the fibrine. If this solution of fibrine in hydrochloric acid (the albuminose of Bouchardat) is mixed with a solution of common salt, sulphate of soda, or nitrate of potass, the mixture coagulates, forming a caseous or albuminous mass, which may be washed with a solution of common salt, the fluid which runs off, containing common salt, contains no longer any perceptible traces of lime or phosphoric acid: these two substances are, however, contained in the precipitate. The fluid contains no oxygen compound of sulphur, and gives no reaction of sulphuret of potassium when boiled with potass ley. But, according to Mulder, the albuminose of Bouchardat is binoxide of protein; were it so, the precipitate ought to contain neither phosphate of lime nor sulphur; but on dissolving it in potass ley, and boiling, and adding, subsequently, salts of lead, a black precipitate of sulphuret of lead is produced, and the action of acid produces an evolution of sulphuretted hydrogen.

This substance is, therefore, not a binoxide of protein.

ON THE PRESENCE OF SULPHUR IN THE NITROGENOUS CONSTITUENTS OF PEAS.

Mulder says, p. 307 of his “Physiological Chemistry”—“According to Rochleder, legumine and caseine stand in close affinity to one another, and differ only in their respective reactions with acetic acid. Rochleder made his analysis, however, not with legumine, but with proteine prepared from legumine. He dissolved legumine in concentrated potass ley, filtered the solution, and precipitated the filtrate subsequently with acetic acid. This is no longer legumine, but proteine, free from sulphur, and contaminated with an extraneous substance, the admixture of which lowers the proportion of nitrogen and carbon by about one per cent. The composition of legumine, therefore, is unknown. Rochleder states legumine to contain a certain proportion of a substance insoluble in potass and in ammonia, and, moreover, an admixture of sulphur. The latter statement is incorrect with regard to legumine obtained from almonds and peas, since this contains free sulphur.”

If, with MM. Dumas and Cahours we call legumine the nitrogenous substance which these chemists prepared from almonds, this legumine differs from the body prepared from the beans which Rochleder analyzed, not simply in as much as the former is soluble in acetic acid, whilst the latter is insoluble in this menstruum, but, moreover, in this, that the legumine prepared from almonds contains eighteen per cent. of nitrogen, whilst that prepared from beans and peas contains only 15.78 per cent. of this element. If fibrine, albumine, or caseine, are dissolved, as Mulder states, in moderately concentrated potass ley, and the solution is subsequently neutralized with acetic acid, the precipitate produced is *not* proteine free from sulphur, as Mulder believes. I, myself, have examined a solution of this kind, and I found that it does not turn black when mixed with solution of sugar of lead, and consequently contains no sulphuret of potassium, and also that acetic acid evolves no sulphuretted hydrogen from it. If the white precipitate produced by the addition of acetic acid to the solution is washed and subsequently dissolved in potass, and the solution is then boiled, the addition of a drop of solution of sugar of lead im-

parts an inky tint to the fluid, owing to the formation of sulphuret of lead. The precipitate, consequently, is *not* proteine. This deportment, therefore, does not warrant the conclusion that the substance which Rochleder analyzed was sulphate of proteine.

If soaked and finely-bruised peas, stirred into a thin paste with ammoniated water, be passed through a filter, and the filtrate be precipitated with acetic acid, the precipitate produced subsequently dissolved in potass ley, and the solution boiled, supersaturation with an acid will give rise to a copious evolution of sulphuretted hydrogen, and the addition of salts of lead will produce a precipitate of sulphuret of lead.

The nitrogenous constituent of the pea, to which I assigned the name of vegetable caseine, is, therefore, not free from sulphur, as Mulder maintains. That this substance does not differ in composition from other nitrogenous and sulphuretted vegetable substances is sufficiently proved by the simple fact that peas contain everything requisite for the formation of the blood, and consequently for the sustenance of life. If the nitrogenous constituent of the pea were free from sulphur, how could it form blood, fibrine, and albumine? It is my opinion, moreover, that the mode of formation of proteine requires a new and more searching investigation. I have not succeeded as yet in producing a non-sulphuretted substance possessing the composition and properties of the so-styled proteine, according to the data and instructions given by Mulder.

Might it please M. Mulder to give a minute and circumstantial description of his process.*

LECTURES

ON

PLETHORA AND ANÆMIA,

AND ON

SOME FUNCTIONAL DISORDERS DEPENDENT UPON THE STATE OF THE BLOOD.

DELIVERED AT THE LIVERPOOL NORTHERN HOSPITAL, SESSION 1845-46.

BY JAMES TURNBULL, M.D.

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Varieties of plethora and anæmia in relation to vascular fulness and quantity of globules.—Researches of Andral and Gavarret; of Becquerel and Rodier.—Excess of globules the fundamental character of plethora.—Symptoms of the sthenic and asthenic forms.—Treatment.—Composition of the blood in anæmia.—Structure of the red globules.—Effects of diminished excretion upon them, &c.

THE variations which the blood undergoes in quantity when the balance between the processes of assimilation and excretion is disturbed, exercise upon the health an influence scarcely less powerful and important than the increase or diminution of some of the constituents of this fluid. From these causes arise many of the functional disorders which we so commonly meet with, such as palpitation of the heart, some forms of indigestion, giddiness, and various nervous affections. The terms plethora and anæmia have been in use from the earliest times; the former, to denote increase of the quantity of blood above the ordinary standard—the latter, its diminution below this point. More recently, Andral has made use of these terms in a different sense; and instead of applying them to mere increase or diminution of the volume of blood in the system, he has employed them to signify rather the elevation or fall of the quantity of globules in this fluid above or below the standard of health.

Though physiologists have estimated the weight of blood in the vascular system at twenty-five or thirty pounds on an average, there is no way by which we can ascertain the

variations which it undergoes in weight or in quantity. We know, however, that the total quantity, as well as the relative proportions of its solid and fluid parts, are constantly varying slightly; but that as long as such variations are within the limits of health they are only trifling, as a constant reciprocal action is maintained between absorption and excretion; so that if a large quantity of fluid be quickly introduced into the blood through the medium of the digestive organs, an almost immediate effect is produced upon the skin, the lungs, the intestines, the liver, or the kidneys, which organs thus become the safety-valves of the circulation, (as they have been termed by Dr. Copland,) and relieve the system from the injurious, and otherwise not unfrequently fatal, effects of excessive vascular fulness. Continued disturbance of the balance between absorption and excretion produces more permanent effects upon the constitution and quantity of the blood, subjects which have been very fully investigated analytically by Andral and Gavarret, and still more recently by Becquerel and Rodier. Previous to the researches of Andral it was believed that in plethora the blood was rich in fibrin and globules, and the correctness of this view as regards the increase of the globules seems to have been sufficiently proved by his observations, though Becquerel and Rodier are opposed to the opinion of their quantity being augmented. Believing, therefore, that Andral is correct in regarding the increase or diminution of the quantity of globules as more the fundamental conditions of the blood in plethora and anæmia than the simple increase or diminution of its whole amount, I shall make use of these terms in reference to the proportion of globules more than to the quantity of blood. We should, however, observe, that the increase of the amount of blood which occurs in vigorous persons, in the sthenic form of plethora, is generally accompanied with increase of the globules, while diminution of the quantity of blood is for the most part attended with diminution of the globules, most causes which diminish the quantity of blood having also the effect of lessening the proportion of globules. From this it is evident that the amount of the circulating fluid and the proportion of globules are so connected that they could scarcely be considered apart from each other. If, however, we regard the rise or fall of the globules above or below the average of health as constituting the fundamental conditions in plethora and anæmia, we may have two varieties of each rising out of the increased or diminished amount of fluid in the vascular system. Thus we may have plethora with increase of the globules relative to the other constituents, and plethora without relative but with absolute increase. Again, we may have anæmia—that is, diminution of the globules—along with diminution of the quantity of blood in the vascular system; and we may have anæmia with vascular fulness. This last variety would constitute a form of plethora if we were to use the term in reference to vascular fulness only; and, indeed, this variety so nearly resembles asthenic plethora, that the diagnosis cannot always be easily made. We shall also have occasion to observe, that in the early stage of chlorosis there is sometimes vascular fulness from retention of the fluid part of the blood, and that this has a tendency to induce anæmia by interfering with the interchanges which take place between the fluid of the globules and the liquor sanguinis. The impossibility of estimating the quantity of blood in the vascular system, and of fixing in individual cases the healthy proportion of globules, prevents us from being able to prove the existence of each of these varieties from examination of the blood, but their presence may be sufficiently ascertained from observation of the degree of redness or pallor of the surface, in conjunction with the degree of turgidity of the tissues and the fulness of the vessels, and from physical examination, by the stethoscope, of the veins and arteries. We can also conceive the possibility of another form of anæmia besides these existing—viz., where the proportion of globules to the other constituents of the blood remains natural, but where the total quantity in the system is diminished. It is probable, however, that such a state scarcely if ever occurs, as most of the causes which permanently reduce the quantity of blood have also the effect of lessening the proportion of globules.

Composition of the blood in plethora.—Andral examined the blood in thirty-one individuals, who had well-marked symptoms of plethora. The quantity of fibrin was within the limits of the healthy proportion, though somewhat below what he has adopted as the average, the quantity being 2.7 in the cases of plethora, and in health varying between 2.5 and 3.5 in 1000 parts of blood. The organic matters of the serum did not vary materially from the ordinary proportion. He

* Dr. Laskowski, who is at present engaged in the Giessen laboratory, in investigating the supposed products of the desulphuration of caseine, albumine, and fibrine, by caustic potass, has made a series of experiments with the precipitates produced by neutralizing the potass solution of caseine, albumine, or fibrine, with acetic acid: he dissolved these precipitates in solution of potass and kept the fluid in ebullition for several hours, and yet the subsequent neutralization with an acid gave rise to the evolution of sulphuretted hydrogen; the same was the case when the precipitate had been fused with dry caustic potass, and even with precipitate, which, upon ebullition with potass ley, and addition of a drop of solution of sugar of lead, yield no precipitate of sulphuret of lead. It may not be without interest to remark here, that the oxide of caseine of Prout (not the leucine of Mulder) contains sulphur. I have convinced myself of this by actual experiments made with a small portion of this substance, for which I was indebted to the kindness of Mr. Walter Crum.—J. LIEBIG.