yield Prussian blue, nor affect nitrate of silver. The venous blood produced no change in the drop of nitrate of silver, even after long exposure. To guard against deception in this test, which is *too* delicate, if any test can be so, and in particular, against exhalations from the stomach liquid, or any other fumes of the laboratory, a drop was placed over distilled water by the side of the others; it remained unchanged, like that over the venous blood. I therefore think myself warranted in stating the arterial blood, and the fluid from the brain, as well as the contents of the ileum, to contain a distinct, though very slight trace of hydrocyanic acid; the venous blood none.

“ WILLIAM WEST.

“ Highfield House, near Leeds.
June 28, 1845.”

It was extremely desirable to ascertain if the opinion so commonly entertained of the speedy decomposition of hydrocyanic acid after death, be correct or not. The following note with which I have, since the above account was written, been favoured with by Mr. West; will decide this question.

“ I have distilled a portion of the contents of the stomach, at this time twenty-three days after the poison had been taken, and find the smell, the precipitate with nitrate of silver, and the prussian blue precipitate. All these are produced, apparently, in the the same degree as at first. This case is, therefore, opposed to the common notion of rapid decomposition of the acid.”

(*To be continued.*)

RESEARCHES ON THE COMPOSITION OF THE BLOOD IN HEALTH AND IN DISEASE: A MEMOIR PRESENTED TO THE ACADEMIE DES SCIENCES, PARIS, Nov. 18, 1844.

By A. BECQUEREL, M.D., and A. RODIER, M.D.

(Translated from the *Gazette Médicale de Paris*, by EDGAR SHEPPARD, Esq., M.R.C.S.)

(*Continued from page 433.*)

IV. *Diminution in the proportion of globules contained in 1000 grammes of blood, and characterising the general state to which, in later times, the term anæmia has been given, is frequently observed in disease, either as an essential characteristic, as a complication, or as a consecutive phenomenon.*

For some considerable time the name of anæmia has been given to this general state, of which chlorosis is in some degree the type, (although it also shows itself, to a less extent, it is true, in other diseases,) and of which the principal characteristics are pallor of the tissues, inactivity of the digestive functions, palpitations, dyspnœa, a *bruit de souffle* in the carotids, and frequently in the heart, &c., &c. It was, moreover, admitted, although in a vague manner, and rather from hypothesis than from real facts, that in such cases there was a diminution in the number of the

globules. This was the state of knowledge on the subject when MM. Andral and Gavarret clearly established, that anæmia resulted from a diminution in the quantity of globules normally contained in the blood—a diminution which may be produced in various ways. Before entering further into the result of our researches on this head, we must say that the term anæmia given to this state is far from being correct. Its etymology expresses a diminution in the total quantity of the blood, and it is only by a far-fetched and forced signification that this expression has been employed to designate the general state which results from the diminution of the globules.

But however this may be, in henceforth avoiding the employment of the term in the same sense as used by modern authors, we shall rapidly sketch the principal characters of this general state: and first, setting aside the diminution of the globules, which is produced by the mere fact of the development of disease, and by reduced diet, and which may with justice be considered as the first stage of the state we are describing, it may be laid down as a fact, that a slight diminution of the proportion of the globules manifests itself externally by the following symptoms:—The skin is white and pale, although it is not uncommon to observe a slight redness of the cheeks, particularly when any plethora exists. The strength of the patients is diminished, and they are fatigued by the least exercise; they complain of palpitations, of dyspnœa, increased by walking or going up stairs; a *bruit de souffle* exists in the carotids, sometimes on both sides, at others on only one, and then more frequently on the right than on the left. Not unfrequently also there is a *bruit de souffle* of the heart, the pulsations of which are stronger, accelerated, and extending over a greater surface. The digestive functions are feeble, and often accompanied by gastralgia; there is also constipation. If this state is met with in women, (which is more commonly the case,) there is derangement of the uterine functions, menstruation becoming less profuse, irregular, and frequently even completely suppressed. Lastly, various nervous disorders may likewise show themselves. With this general state, characteristic of a diminution of the globules, genuine plethora,—an overloaded state of the circulatory system, may exist, and then the symptoms just described may be combined with weight and heaviness in the head, cephalalgia, vertigo, tinnitus aurium, heavy sleep, broken by painful dreams, occasional somnolence by day, and attacks of heat in the head. The countenance is of a pale rosy colour, turgescient, and frequently shining; the pulse is more developed, sometimes even very hard; there is a sensation of heat and throbbing in the chest; and occasionally hæmorrhages, particularly epistaxis, are observed.

If, on the contrary, instead of there being an excess, the mass of blood thus impoverished in globules is diminished, emaciation and flaccidity of the muscles, paleness, and an air of suffering manifested in the countenance, may be especially noted; the sense of weariness is greater; the strength is more appreciably diminished; there is greater dyspnœa; and the palpitations are more marked and readily excited, with a smaller and more feeble pulse, and more frequent syncope; and there is no tendency to the production of hæmorrhages.

Such is the general state, or rather, such are, according to us, the three general states, (preservation, increase, or diminution of the normal mass of blood,) which we are in the habit, in these later times especially, of comprising under the term *anæmia*, and which may be observed—1st, in chlorosis; 2nd, in consequence of repeated blood-lettings, and profuse hæmorrhages; 3rd, after a considerable loss of any fluid,—diarrhœa, fluxes, or inexhaustible suppurations; 4th, in consequence of lead poison in the system, and intermittent fevers of long duration; 5th, in convalescence, from severe affections which have debilitated and exhausted the patients; 6th, in ill-fed persons, or those who have long lived upon the same kind of aliment; 7th, in those who dwell in a moist and unhealthy locality. Of all these states chlorosis is almost the only one in which plethora may be noticed; in the others there is rather *anæmia*, in the genuine sense of the word.

These points being well established, we may now give the mean composition of the blood in a certain number of cases of this description, developed in consequence of very different causes, and presenting as a common characteristic a continued or intermittent *bruit de souffle* in the carotids—a *bruit* which, from the researches of MM. Andral and Gavarret, is necessarily produced, whenever the globules undergo a certain degree of diminution. Further on we shall discuss the question, whether a *bruit de souffle* can exist, without any decrease of the globules.

The following is the mean result of thirty-five analyses of blood:—

MEAN COMPOSITION OF THE BLOOD IN THIRTY-FIVE CASES, WHERE THERE WAS CONSIDERABLE DIMINUTION OF THE GLOBULES.

	Mean:
Density of blood deprived of its fibrine..	1047.4
— of serum	1017.1
Water	822.
Globules	94.7
Albumen	68.
Fibrine	3.5
Extractive matters and free salts	8.
Fatty matters	1.806
Seroline	Variable.
Phosphorated matter	0.633
Cholesterine	0.110
Soap	0.992

IN 1000 GRAMMES OF CALCINED BLOOD.

Chloride of sodium	3.5
Soluble salts	2.4
Phosphates	0.545
Iron	0.366

It should in the first place be observed, that in all these cases there was a positive indication of the necessity of blood-letting, from the repletion of the circulatory system, and a genuine plethora, characterised as has been stated above. This is the explanation of the blood-lettings which we have made in these somewhat numerous cases, and of those performed by MM. Andral and Gavarret in similar ones, which have been made the subject of unjust criticism. We should, moreover, add, that in all the cases which we have met with, the greatest relief has been invariably experienced by the patients who have undergone depletion.

But be this as it may, the following results may be obtained from comparing the mean of this table with that of the normal state:—

1st. There is a considerable diminution in the density of the blood deprived of its fibrine, which is explained by the diminution of the globules.

2nd. A preservation of the density of the serum, owing to the albumen not being appreciably diminished.

3rd. A very marked diminution in the proportion of the globules.

4th. A slight increase of the fibrine, (3.5, instead of 2.2.)

5th. A slight increase of the fatty matters; increase of the phosphorated fatty matter; no change in the cholesterine; diminution of the animal soap; no change in the chlorides and soluble salts; slight increase of the phosphate of lime; diminution of the iron, owing to that of the globules.

It must, nevertheless, be observed, that these means are not to be considered as absolute; for, between the slight diminution of the globules due only to disease, and the most characterised *anæmia*, there are numerous degrees. The table indicates the mean results only—not the extremes.

We conclude then that the word *anæmia* ought to be restricted to cases in which there is actual diminution of the total mass of the blood,—a diminution, it is true, which is nearly always accompanied by a decrease of the globules. It is thus that in the last stage of phthisis and of cancerous affections, there is probably a coincidence of the two states,—diminution of the mass of the blood, and also of the number of the globules. From our observations, we are led to the conclusion that in most cases where there is considerable emaciation, there is not only a reabsorption of the fat contained in the cellular tissue, but also a diminution of the total mass of the blood, and genuine *anæmia*. This proposition is however only probable, and cannot be mathematically demonstrated.

V. *The development of a phlegmasia determines some remarkable modifications in the composition of the blood, consisting especially in an augmentation of the proportion of the fibrine normally contained in this fluid.*

The phlegmasiæ constitute a well defined class of diseases, having a distinct place in our nosology. Till recently, it was generally admitted that their essential characteristic was the development of an inflammation in one of the principal organs of the economy, an inflammation, moreover, which was grouped with other symptoms, and which gave to the disease a name: it was known that in most of the phlegmasiæ a whitish production, to which the name of buffy coat was given, and which was justly considered as indicating an excess of fibrine in this fluid, formed itself on the surface of a clot of blood drawn from a vein.

Our knowledge had arrived at this point when MM. Andral and Gavarret, in their admirable researches on the blood, proved by the weight of the fibrine, in a precise and incontestable manner, the existence of another fundamental characteristic of the class of phlegmasiæ,—a characteristic not less essential than the local lesion, and which consists in the augmentation of the quantity of fibrine normally contained in the blood. This fundamental characteristic, thanks to those distinguished physicians, is become an incontrovertible fact, which our experiments, without any exception, have confirmed. Let us examine, however, the general results which we have obtained

and see if with this essential characteristic there are not some other modifications of quantity in the principles of the blood,—modifications, perhaps, unimportant, but, nevertheless, not the less real.

In order to arrive at this object, we have constructed a table of means, containing the general result of a certain number of well-characterised phlegmasiæ developed both in the male and in the female. A remarkable difference exists between the two sexes.

MEAN COMPOSITION OF THE BLOOD IN THE
PHLEGMASIÆ

	Men.	Women.
Density of blood deprived of its fibrine	1056.3	1054.5
— of serum	1027.	1026.8
Water	791.5	801.
Globules	128.	118.6
Albumen	66.	65.8
Fibrine.....	5.8	5.7
Extractive matters and free salts	7.	7.2
Fatty matters	1.742	1.669
Seroline	0.020	0.024
Phosphorated matter	0.602	0.601
Cholesterine	0.136	0.130
Soap	0.984	0.914

IN 1000 GRAMMES OF CALCINED BLOOD.

Chloride of Sodium	3.1	3.0
Soluble salts.....	2.4	2.7
Phosphates	8.448	0.344
Iron	0.490	0.480

In carefully examining this table, and comparing it with the means of the normal state, in the male and female, we arrive at the following conclusions:—The phlegmasiæ are diseases which exercise an influence upon the whole organism, and which manifest themselves by various phenomena. From this circumstance alone, and the mere fact of the development of disease, if the first law which we have established is exact, the blood ought to undergo a certain number of modifications analogous to those which we have demonstrated. It is sufficient, in fact, to cast our eyes over the table, and to compare it with those which we have given, as expressing the mean composition of the blood in the state of disease, to convince ourselves that, with the exception of these principles,—the fibrine, cholesterine, and albumen, the other elements are absolutely the same in quantity.

Two principles are augmented—the fibrine and the cholesterine; one is diminished—the albumen. The first and the most important is the fibrine, the general mean of which may be represented by 6. This number, however, varies much, and its variations may be comprised between 4 and 10; a result also obtained by MM. Andral and Gavarret. The increase of the fibrine is in direct relation to the extent and intensity of the phlegmasiæ, to its influence on the general state of the organism, and particularly to the febrile disturbance to which it generally gives rise. It is a fact, too, which is coincident with the development of the phlegmasiæ, and accompanies it, but which never precedes it. This, at least, is most probable, though we are not able from positive calculations and facts to affirm it to be incontestable. The augmentation of the fibrine takes place, whatever may be, in other respects, the composition of the blood and the proportion of its other principles: thus, the fibrine may be represented by a very elevated figure, when the

globules, on the contrary, are much diminished in quantity. Its increase is much more observable in acute than in chronic phlegmasiæ.

Blood-letting has little influence on the fibrine, which decreases with the disease, rather than with the means employed to combat it. Its increase in the blood is usually manifested by the formation of a buffy coat on the surface of the clot, which is at the same time more dense than in the normal state; or, if the buffy coat is not formed, by the presence of more or less numerous whitish striæ, especially existing near the superior surface of the clot, and announcing as well as the buffy coat, the excess of fibrine in the circulating fluid.

After what we have said, it may be seen that there is in the phlegmasiæ a coincidence of two remarkable modifications,—an increase of the fibrine, and a diminution of the albumen. In endeavouring to account for these two facts, the following explanation naturally suggests itself:—

Of late some remarkable investigations have led us to the belief, that albumen and fibrine are one and the same body, or, at least, that fibrine is derived from albumen. Now, may not the augmentation of the fibrine in the phlegmasiæ be explained by the transformation of the same quantity of albumen—a transformation which may easily take place, since they have both the same chemical composition? The numbers alone can answer this question. It is required to know whether the total of the increased fibrine and diminished albumen in the phlegmasiæ is equal to the total of the albumen and fibrine in the normal state? These two principles together amount to 71.5 in healthy man; 72 in woman. But in taking these two quantities, and adding them together,—in the phlegmasiæ, we obtain in man 71.6, and in woman 70.5,—the former being almost the same, the latter differing a little. These results, then, would seem to confirm our opinion. But, be that as it may, it is only an hypothesis which we suggest, and we should be sorry to lead any one to believe that we consider it to be the expression of what really takes place.

Independently of the augmentation of the fibrine, there is another principle, the proportion of which is also greater,—the cholesterine, the quantity of which is almost double that of the normal state. We have already seen it increased by the mere fact of the development of disease. But here, the increase is still greater, and it is difficult to discover the cause. May it not be said, that in the phlegmasiæ the regimen is still more rigorous, perhaps, than in any other maladies, and, consequently the biliary secretion more diminished; which would give rise to a greater concentration of cholesterine in the blood? We do not affirm this to be the case, but shall content ourselves with merely mentioning it, without entering into any definite explanation.

Though in every phlegmasia, the fibrine is notably augmented in quantity, it does not necessarily follow that this is the only class of diseases in which such augmentation occurs. We have, in fact, found that in pregnancy and chlorosis, this principle is greater than in the normal state; the absolute excess, though inconsiderable and inferior to that of the phlegmasiæ, is not less constant, and therefore ought to be here mentioned.

VI. *The proportion of fibrine normally contained in the blood may diminish, and, perhaps, even its physical properties undergo a change, in a certain number of circumstances, which may be classed in two categories:—1st., intoxications; * 2nd., an unwholesome and insufficient diet. This diminution, however, does not necessarily take place.*

1st. We understand the expression—intoxication, in its most extended sense, comprising the following morbid states:—typhoid fever, camp fever, the plague, yellow fever, and intermittent fevers. It is probable that in these diseases the blood is primarily changed by the introduction of a foreign principle, a special miasm. We also comprise in it the eruptive fevers, manifestly due to the entrance of a contagious principle or virus into the circulating fluid: such are variola, rubeola, scarlatina, acute glanders, &c., purulent infection,—that is to say, the alteration of the blood usually caused by its admixture with pus. Lastly, the intoxication arising from foreign matters directly introduced, or from their absorption into the blood, the bites of venomous animals, &c.

In all these various cases, when the disease is well characterised, and when it has attained a certain degree of intensity; when, increasing in severity, the fatal termination approaches, the blood is frequently modified. At first it undergoes that change to which it is liable, from the fact of disease being developed, viz., a diminution of the globules. But it may experience another alteration. The fibrine, in fact, has a tendency to diminish in quantity. Nevertheless, this diminution does not necessarily take place, even when the disease is very severe; and, moreover, *cæteris paribus*, the fibrine may be noticed at one time to preserve its normal proportions; at another, to have diminished a little; at another, considerably. In typhus fever, for example, to which our attention has been particularly directed, we have seen, in some very severe cases of an adynamic form, the fibrine sometimes remain normal, sometimes diminish; and the same has happened in much less serious cases, and where the cure was speedy.

We have noticed also in some perfectly healthy individuals the fibrine to be very low, (1.; 1.2; 1.5; 1.8,) while in many bad cases of typhus it was much more elevated.

It follows hence, that in admitting the possibility of the fibrine being lowered under the influence of severe diseases, we do not yet know the conditions which regulate this modification.

It sometimes happens that the diminution of the fibrine coincides with two well defined general states; one is the dynamic state, the other a tendency to the production of hæmorrhages. This tendency is in proportion to the degree of diminution of the fibrine, so that the loss of blood is very variable.

2nd. We have placed in a second category cases in which an unwholesome or insufficient diet may cause a diminution of the sanguineous fibrine. It is, indeed, beyond a doubt, that under the influence of these con-

ditions, scurvy, or analogous affections, (*purpura hæmorrhagica*,) may be developed. Under such circumstances, the small number of analyses hitherto made by chemists, tend to prove that the quantity of fibrine in the circulating fluid is notably diminished.

VII. *When a secretion is either suspended, or merely diminished, it often happens that a certain number of principles which enter into its composition, are concentrated in the blood, and consequently may there be found in variable quantities.*

Two important facts, the one already known, and discovered by MM. Dumas and Prevost, the other by ourselves, and which we shall presently develop, are confirmatory of this law, in support of which some new facts will also probably be hereafter brought forward. The above-mentioned physiologists, in some very interesting experiments, tied the ureters in various animals, and thus suppressed the urinary secretion. The analysis of the blood of these animals presented a remarkable quantity of urea, whilst previously, this principle, which probably existed there, could not be found in appreciable quantity. The urea being no longer eliminated by the kidneys, was thus concentrated in the blood.

This remarkable physiological fact is capable of important applications in human pathology. Thus there are some cases where, in consequence of the suppression of the urinary secretion, (suppression of urine dependent on very various causes,) severe symptoms are observed to supervene, an adynamic state is developed, a fever called urinary is produced, and even death may take place. In cases of this kind, ought we not to inquire if these symptoms are not due to the concentration of urea in the blood? We only suggest the probability of such an occurrence, for we do not know that any experiments have been made to verify the opinion.

It has been thought that this excess of urea in the blood should be found in another series of cases. Thus it has been admitted that in Bright's disease this principle diminishing in the urine, becomes concentrated in the blood, and ought to be discoverable there. The opinion on which this hypothesis is founded, is, however, not correct, and the experiments which have been made in order to verify it, are probably not more so. Thus, in many analyses made by one of us, and by a very experienced chemist, M. Quevenne, chief *pharmacien* to the Hôpital de la Charité, we have not discovered this excess of urea. In various manipulations, it is true, we have obtained a crystallised residue; but this was also found in the blood of every other individual, and it is probable that it was formed by a mixture of the various salts of the blood. It certainly contained no urea, at least in the cases which have fallen under our observation.

The second confirmation of the law which we have laid down, is the consequence of a fact already enunciated in treating of the influence of regimen and disease on the composition of the blood. Every time that the biliary secretion is suppressed or merely diminished, the quantity of cholesterine normally contained in the blood increases, and its degree of concentration becomes more and more considerable as the biliary secretion becomes more diminished. This, for instance, is what takes place under the influence of reduced diet, especially if it is accompanied by consti-

* This is one of those peculiar and significant expressions which cannot be rendered into anything but its literal English equivalent: it means, not what we usually intend by the word—alcoholic intoxication, but rather that which arises from the inhalation of the various poisonous malarial.

[TRANSLATOR.]

pation. In cases of icterus, with suspension of the biliary secretion or excretion, announced by the want of colour in the fæces, the cholesterine is even more concentrated, and we have found it three or four times greater than in a state of health. When we come to treat of this disease, we shall give the results of these calculations. If icterus, on the contrary, accompanies a more abundant secretion of bile, which is more rare than the preceding case, the cholesterine is not increased; it either remains normal, or diminishes. We have also observed some facts of this kind.

VIII. *The albumen of the serum diminishes in a considerable manner, under three particular circumstances, which are: Bright's disease, certain affections of the heart with dropsies, and severe puerperal fevers.*

We shall content ourselves here with only mentioning this law, and recur to its development when we come to consider the diseases in particular, merely observing that the facts which we possess upon this subject are not sufficiently numerous to enable us to establish it in a definite manner.

(To be continued.)

ON MYOPIA AND PRESBYOPIA.

By WILLIAM WHITE COOPER, Esq., F.R.C.S.,

Senior Surgeon to the North London Ophthalmic Institution, &c.

Considering the frequency of myopia, and the inconvenience it causes to those who suffer from it, sufficient attention has not, in my opinion, been paid to its causes, its varieties, and the treatment applicable to each. As a general rule, it is considered sufficient when a person complains of being near-sighted to recommend him to pay a visit to an optician, and be provided by him with such glasses as will suit the case. Although, perhaps, in the majority of instances such advice would be good, there is a description of myopia in which it would be decidedly injurious.

The distance at which such objects as small print can be distinctly seen varies somewhat in different individuals, but from ten to twelve inches may perhaps be regarded as the average. From seven to eight inches is probably the nearest distance of distinct vision: when objects are habitually brought nearer to the eye than this, the person may be considered to be short-sighted. I may here mention, that the reason myopic individuals can see better by bringing objects near to the eye, is as follows:—In myopia, the rays of light being concentrated to a focus before they reach the retina, pass on and form a confused and indistinct image upon that membrane. It is a law in optics, that the nearer an object is brought to the eye the more divergent are the rays flowing from that object, and in proportion as they diverge, so is the point at which they combine to form a focus more distant; consequently an image, which at ten inches would be formed before the retina, will be thrown back upon it by the lengthened focus, if the object is held at the distance of only four inches, and so a distinct image be afforded.

When young persons are near-sighted, the phenomena generally arise from too great a convexity either of the cornea, or possibly of the crystalline lens, so that the rays are too much refracted, and are brought

to focal points too soon. But there is another affection which has been passed over without sufficient notice, namely, the loss of power of adapting the eyes to distant objects, from long exertion of the organs upon near objects. That a power of adjustment to distance exists in the eye, cannot be doubted; indeed, any one can convince himself of it by the following simple experiment:—Let him fix his eyes upon this page, or any other near object, for a minute or two, then let him suddenly raise them, and look at some object at the distance of twenty or thirty feet. For the space of half a second he will not be able to see it distinctly, but will be conscious of a change taking place in the eye; and as this is wrought, the object will become distinct. After regarding it for a time, let him look again at the page, and the same momentary confusion, followed by distinctness of vision, will be observed. If, then, a person is constantly employed in reading, microscopical observations, or other pursuits requiring long-continued and close application, he will become, I believe, not strictly short-sighted in the usual acceptance of the term, for he does not hold objects nearer to the eye than usual, but will find that he discerns distant objects less and less distinctly. The explanation of which is, that the eyes being exercised so much at the focus for near objects, lose the power of adjustment to the focus for distant objects. If this person resorts at once to glasses, he will unquestionably obtain relief, but the disease will become confirmed by the eyes having supplied to them, by artificial means, that power which is properly inherent in them, but which has been lost by disuse.

Under these circumstances I would recommend that such persons abandon their studies, or other pursuits, which have caused the mischief; that they should go into the country, and there exercise the eyes as much as possible upon distant objects—shooting, marking game, &c., strengthening the body and the eyes at the same time, by which means the general health will be improved, the system invigorated, and the defect in the eyesight gradually diminished.

In the selection of glasses for cases to which they are appropriate, the greatest care and judgment are required to choose just that particular power which will enable the person to see objects clearly, and yet without the slightest sensation of fatigue to the eyes. The glasses employed in myopia are double concaves, and each side should be accurately ground to the same amount of concavity. In the first instance, those of the lowest power, or in other words, those in which the curves are portions of the largest spheres, should be employed; and so long as these enable the person to distinguish the outlines of objects distinctly at about forty or forty-five feet, he should not have recourse to a higher power; for if he rashly increases the power, or if he begins with too high a number, he will find that he cannot go back, but that the eyes continually crave for a still further increase; whereas by selecting in the first instance proper glasses, and remaining satisfied with the assistance they afford, the individual may go on for many years without finding it necessary to increase the power.

Single eye glasses are very injurious, as by throwing a greater amount of labour upon one eye than on the other, the one is strained, whilst the other has not its due share of exercise. Between the ages of forty-