endency met with among the wool-mill girls. Any one accustomed to see the women of the cotton and wool mills, can generally tell, from their appearance, to which mill they belong. The cotton-mill girls are generally, though healthy looking, pale, and bleached; whereas the wool girls are rosy and fat. He also states that it has been customary, when any young girls have been noticed whose looks indicated delicacy, to recommend them to change the mill, and that a remarkable effect has often been noticed from a few weeks' work in the wool mill; from the pale, pasty look, they have become healthy and plump. Dr. Simpson states that the great difference and peculiarity in woollen as compared with cotton mills, consists in the fact, that while the hours, the occupation, etc., are much the same in each, in the woollen mills a very large quantity of oil is used, and the bodies of the workers are brought, in various ways, freely in contact with it. It is, I believe, in this one item that the great difference between cotton working and wool working consists; and it is to this material, the oil, as freely used in some of the processes of the wool factories, that the operatives themselves, universally, and, as I believe, properly, attribute the salutary nature of their occupation. He has also pointed out that the degree of exemption among the operatives is by no means equal in all the processes of the manufacture, but is regulated by the more or less oily nature of the department of work in which they are engaged.

[To be continued.]

Gulstonian Lectures

ON

FEVER AND INFLAMMATION.

DELIVERED BEFORE THE
ROYAL COLLEGE OF PHYSICIANS, LONDON,
1859.

By WILLIAM ADDISON, M.D., F.R.S., Fellow of the College.

LECTURE I (concluded).

VI.—THE CORPUSCLES OF BLOOD, IN THE PERFORMANCE OF THEIR NATURAL FUNCTIONS, CONTAIN AND EXCRETE MATTER WHICH IS POISONOUS TO THE BRAIN.

Blood is distributed by arteries; it returns by the veins. There is a great difference between arterial and venous blood. This difference is, for the most part, if not entirely, referable to the corpuscles. The red colouring matter is contained within them, and the bright colour which is communicated to blood by oxygen, as well as the dark shade which is induced by the transmission of carbonic acid through it, are the actual shades of colour which we see in arterial and venous blood. Venous blood is necessary to the well-being of the liver, and also to the normal function of the lung; but, should venous blood be transmitted by arteries to the brain, it is well known that symptoms of poisoning begin.

No suggestion for the recovery of drowned persons has been attended with so much success as the "Ready Method" of the late Dr. Marshall Hall. The principle, therefore, upon which his method is founded, may probably be accepted as true.

"During the circulation," he says, "the oxygen inhaled by respiration unites with the carbon of the blood, forming carbonic acid, which is exhaled in its turn by respiration, except in cases where the respiration is suspended, as in drowning and other forms of apnoea. In apnoea, the carbonic acid retained in the blood poisons it; and the organs, beginning with the brain and spinal centre, are in their turn poisoned by this blood-poison. The circulation," he goes on to say, "without respiration, is a blood-poisoning process; respiration is a de-poisoning process. By respiration, the carbonic acid poison formed during the circulation is eliminated from the blood, and evolved from the system."

The consumption of oxygen and the formation of carbonic acid stand in a direct ratio with the number or amount of the blood-corpuscles, and with the number of respirations made in a given time. It is well known that the alteration of colour from arterial to venous, which blood undergoes by circulation, is an alteration which takes place *within the corpuscles*; also, that the re-arterialisation of blood by respiration involves a change in the corpuscles. It must be, then, that the qualities acquired by blood during circulation, and discharged by respiration, are qualities of the corpuscles, inasmuch as the

change of colour, which denotes the change of quality, is observed in the corpuscles. When, therefore, symptoms of poisoning arise from the circulation of venous blood through the brain, the poison must be concluded as contained within, and as generated or produced by, the corpuscles.

Urine is a fluid separated from the blood by the kidneys; and urine contains a substance which, when applied to other tissues than those of the kidney, will act as a poison. Sir H. Halford met with five instances of suppression of urine in the course of seven-and-twenty years practice, and in every instance the patient died from poisoning of the brain. It is but reasonable to infer that urea, which is separated in large quantity from the blood by the kidneys, should be a product of the metamorphosis of a substance of an invariably uniform composition.

"Amongst all the higher classes of animals," says Dr. Simon, "and many of the lower, in the most varied forms of existence, and under the most opposite kinds of food, we find urea and uric acid, or one of the two, as a constant secretion of the kidney. It seems opposed to all reason to imagine that, in animals as different in structure as they are opposite in their habits of life, and under every possible variation of circumstances, these fixed and definite compounds should be products of the metamorphosis of the plasma. It is easy, however, to conceive that the corpuscles which, although different in their form, are similar, if not identical, in their chemical constitution, in the blood of all animals, should yield similar products as the result of their metamorphosis."

If this reasoning be admitted—and it is urged with much force and perspicacity by Dr. Simon—it follows that urea, or a nitrogenous substance represented by that compound, and withdrawn from the blood by the kidneys, is an excretion of the corpuscles discharged into the plasma. Hence carbon or carbonic acid is an excretion of the blood-corpuscles discharged at once into the atmosphere; whilst urea is an excretion discharged into the plasma, and withdrawn therefrom by the action of the kidneys. Both these substances, if unduly retained in the blood, act as poisons to the brain; and we must conclude that the corpuscles of blood, in the performance of their natural functions, generate matter which is poisonous to the brain. Hæmaturia within the corpuscles, if not discharged by respiration, and other excretions, if retained in the plasma, are poisonous.

The properties of the corpuscles, then, substantiate the argument drawn from a consideration of the properties of the plasma, as to the necessity for holding the two parts of the blood distinct, pathologically as well as physiologically. The corpuscles are independent organisms, and the plasma is the fluid in which they swim. The properties of the one are very different from the properties of the other.

VII.—RELATIONS OF DIET TO THE PLASMA, AND OF AIR TO THE CORPUSCLES.

The normal constitution of the blood is preserved by diet and respiration. The alimentary canal and the lungs are the only two channels by which outward material substances are received into the interior of the body. Both have reference to the blood; diet, or food and drink, to the replenishment of the plasma; air to the nourishment of the corpuscles. The alimentary canal is, as it were, the coarser way by which substances are received into the body; whereas, in the structure of the lung, everything is fashioned with special reference to the admission of aerial elements into immediate contact, as it were, with the highest elements of the circulating fluid—the corpuscles of the blood.

As the plasma is subjected to a continuous change and consumption during the nutrition of the body, it becomes a matter of necessity that it should also receive a continuous supply. This is afforded to it by the chyle. Chyle is derived from substances received into the stomach—food and drink; it mingles with and augments the bulk of the plasma; and it is from the plasma that the red corpuscles derive part of their nutriment. There is, therefore, a more intimate relation between diet and the fluid of the blood, than between diet and the corpuscles; that is to say, any substance or poison entering the blood from food or drink must first enter and mingle with the plasma, before it can come into contact with or affect the corpuscles. But the case is different as between the corpuscles and the atmosphere.

From the peculiar distribution of the capillaries, and from the extreme thinness of the walls of the pulmonary air-cells, the blood-corpuscles are brought in the lungs into almost immediate contact with the air, and with the substances contained in

solution in the air. The absorption of air through the humid membrane of the air-cells of the lungs is facilitated by the immense extent of surface presented, over the whole of which a thin stratum of blood-corpuscles is simultaneously exposed to the atmospheric influence. The permeability of moist membranes by fluid and gaseous substances is a well known fact; dark or venous blood, inclosed in a moist bladder, and exposed to the air, soon assumes the arterial tint.

"I asked Mr. Boulderson," says Bishop Heber, in his *Narrative of a Journey through the Upper Provinces of India*, "if it were true that the monkeys forsook these jungly forests during the unwholesome months. He answered, that not only the monkeys, but everything which has the breath of life, instinctively desert them from April to October. The tigers go up to the hills; the antelopes and wild hogs make incursions into the cultivated plains; and those persons, such as dāk-bearers and military officers, who are obliged to traverse the forests in the intervening months, agree that not so much as a bird can be heard or seen in the frightful solitudes; yet during the time of the heaviest rain, while the water falls in torrents, and the cloudy sky tends to prevent evaporation from the ground, the forest may be passed in tolerable safety. It is in the extreme heat, and immediately after the rains have ceased, in May, the latter end of August, and the early part of September, that it is most deadly. In October, the animals return. From the middle of November to March, troops pass and repass; and, with common precaution, no risk is apprehended."

This may be an extreme instance, but it is one of a very numerous class. It is well known that miasms or poisonous substances are diffused through the air, and that they exist in a very concentrated form at certain times, in particular localities. To enter in detail upon this topic is quite unnecessary. The question which arises upon the view we have taken of the constitution of the blood—of the relations of diet to the plasma, and of air to the corpuscles—is, whether the contagious fevers to which aerial poisons give origin are to be referred to the plasma or to the corpuscles.

VIII.—THE CORPUSCLES OF THE BLOOD HAVE A PROPERTY OF RESISTANCE AGAINST INJURIOUS AGENTS; THEY ARE NOT DISORDERED OR DISTURBED BY EVERY QUANTITATIVE CHANGE IN THE PLASMA.

First, as respects symptoms of poisoning through articles of diet, or through substances taken by the stomach, in food or drink: the poison enters the plasma, mingles and circulates with it. Through the plasma it must reach all, but it may affect injuriously one only of the parenchymatous organs: for example, mercury the salivary glands; opium the brain; strychnia the spinal marrow; digitalis the heart; and so on of many other poisons which exhibit their action according to the affinities of the different parenchymatous organs for particular poisons. In all these examples, the symptoms begin in, and may be limited to, some local parenchymatous organ, notwithstanding the general distribution of the fluid which contains the poison. It cannot be disputed that the same poison does not act equally upon all the parenchymatous organs, though all may be exposed to its presence. Some suffer derangement; others do not. And if, to account for these special phenomena in one organ only, we introduce the doctrine of affinity or predilection, we must also allow to those parenchymata which escape a measure of indifference or resistance. This teaching holds a prominent place in chemical philosophy. Affinities and resistances are as often argued of inorganic as of organic or living bodies.

The corpuscles of blood are quite as much a group or community of independent organisms as are the special elements of the liver, brain, or kidney; and, if the elements of one parenchymatous organ can remain indifferent to or resist the injurious action of a poison circulating in the plasma whilst the elements of another are suffering from it, it is not unreasonable to infer a similar property of indifference or resistance in the corpuscles of blood. We have frequently tried the effect upon the corpuscles of substances which, if present in the plasma, will poison the brain or nervous centres, such as solutions of prussic acid, morphia, and strychnia; and we find they produce no other or more effect upon them than so much water.

But, without relying upon experiments of this kind, we take the general principle, and argue for the blood-corpuscles the same kind of properties as is allowed to other cellular elements to the elements of the parenchymatous organs. And we say the blood-corpuscles may resist the action of, or be indifferent to, sundry matters in the plasma, which may nevertheless be

producing disorder in some local parenchymatous organ. Let it be observed, the argument does not assume that poisons which first affect the brain or other local organ, will not affect the corpuscles also, if in sufficient or overwhelming quantity; but only that there are many substances which, being present in the fluid of the blood in small quantity, will affect its qualities injuriously in relation to a parenchymatous organ before sensibly disturbing the corpuscles.

Secondly, as respects poisoning of blood through miasms in the atmosphere; it is here to be observed, that the poison is received through the lungs, where the corpuscles are brought into contact with the air, and with the things in solution in it; and where, moreover, as has been shown, the physiological function performed is one specially between the corpuscles and the air. The change which blood undergoes in the lungs is specially a change in the corpuscles.

Through diet, and through the atmosphere, elements of blood-disorder may enter. Through the former the plasma or fluid, through the latter the corpuscles, are first affected. The qualities of the plasma undergo numerous limited changes, from diet, and from various other substances received through the stomach. But it does not follow, necessarily, that the corpuscles must suffer a disturbing change in consequence thereof. They have, up to a certain extent, a property of indifference, non-affinity, or resistance; and therefore maintain their normal constitution and function under various limited alterations of the fluid in which they swim.

On the other hand, from contact of the blood with poisonous substances in the atmosphere, the corpuscles, by reason of the special function of respiration, may be the first part of the blood to suffer disorder; whereupon their disordered condition is reflected upon the plasma, because this fluid is the depository of their excretions. That is to say, from errors in diet, or from poisonous substances taken by the stomach, the blood may be deteriorated in one only, and that the least important of its parts—namely, the plasma; whereas, from poisonous substances in the atmosphere, blood may be deteriorated, commencing with the corpuscles. And, as it cannot be denied that a poisonous quality in venous blood is referrible to the blood-corpuscles, so therefore the question arises, whether pathological poisons—if we may so call them—the virus of small-pox, and other contagious poisons, are not also to be referred to the corpuscles of the blood; and, should this proposition be established, the physical difference between the two parts of the blood rises into great importance.

Let us briefly recapitulate the physiological facts upon which we shall rely in our future discussion of phenomena of fever and inflammation.

The corpuscles of the blood are independent organisms, swimming in the plasma, deriving from it and from the air, materials suitable to their growth and functions, and discharging into it and into the air, the matter of their excretions, namely: carbon, or carbonic acid, into the air, and a nitrogenous compound, or urea, into the plasma. Depurating organs, located at various points of the circulation, withdraw from the plasma the matters which, if retained in it, would injure its qualities or composition, and the elements of the different depurating organs have different or special affinity for different substances in the plasma. We have dwelt specially on the change which the corpuscles experience in their colour by exposure to the air in the lungs, and upon the poisonous quality they acquire if the normal change is not effected; and we have shown that these bodies, if they take or select from the plasma and from the air materials suitable for their maintenance, must have, in common with other cellular bodies, a property of indifference, or resistance to some extent, against deleterious substances.

As respects the plasma, or fluid of the blood, we have noticed the close relation between it and articles of food or drink through the chyle. Substances received into the stomach in diet and poisonous substances taken in the same way may be speedily detected in the secretions, therefore the plasma must be a fluid of variable composition: and its relatively inferior position to the corpuscles was argued from these facts, and from the treatment of cases of cholera in 1832, by large quantities of a saline injection, thrown into the blood.

The conclusions at which we have arrived are:—

That changes in the qualities of blood from errors in diet, or from poisonous substances taken through the stomach, commence in, and may be limited to the plasma; whereas changes in the qualities of blood, from poisonous substances dissolved in the air and inhaled by the lungs, may commence in the corpuscles. In the latter case both parts of the blood

become disordered, not simultaneously, but in succession; the corpuscles first and then the plasma.

These conclusions are not strained to the support of any favourite theory. The great physical difference between the fluid and the corpuscles of blood; the absolute manner in which the fluid depends upon diet, food and drink; the contact of the corpuscles with the atmosphere in respiration; the change in their colour and properties which ensues; the matter poisonous to the brain which arises within venous corpuscles; the action of the depurating organs upon the plasma, exhibiting special affinities;—all these are received doctrines of physiology, or flow logically from them; and we make them the basis of a therapeutical doctrine in blood-diseases, distinguishing between the fluid and the corpuscles.

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FREE TRADE IN PHYSIC.

WHAT is the meaning of a term very frequently employed—"Free Trade in Physic"? Generally, the term free trade is employed to signify the absence of any restrictive duties on the production or importation of any article; so that the article in question comes into the market unfettered by any charges save those of its production and of its carriage to the market. How is this signification applicable to the article under consideration?

The article which we have to consider—physic—means medical and surgical skill, and moral integrity. These we may lay down as essential elements of the article; but it will command a higher price if it be combined with good general education and gentlemanly address, which are the finish and polish of the article. And, to constitute free trade in physic, we can conceive nothing more required than that this article be submitted to the public, who should be left free to choose what they want for themselves, paying the market price.

Well, but is not this already so? In small country places, indeed, there is often no choice in this matter; but it is so too as concerns the butcher and baker of the village; and we have just as often heard complaints of the dictatorial conduct of the only butcher, as of the only doctor. And it is just as open for a new doctor to set up as for a new any one else who ministers to the wants of the community; and if the country folks cannot have a second opinion in their illness, without sending to a distance, and paying extra for it, still this is no more than they have to do when their wants exceed the simple resources of the shop of the village. Practically, in this sense of the term, there is now the freest trade in physic.

If the demand for free trade in physic mean anything, then, it means something more than that people shall be at liberty to choose their own doctor; for, as the law and custom stand now, they really may have any one whom they like, of whatever dignity, and of whatever creed, from the President of the College of Physicians to the humblest herb-doctor, by paying the market price. And no one is so humble, but has perfect liberty to take up any branch of the profession he likes. The license to practise will most assuredly follow the acquisition of the necessary knowledge; and the highest dignities in an aristocracy of science are open to all alike who will be at the pains to enter the freest of all competitions.

The only meaning to be attached to the term in question is,

that the article itself shall be different. The public are free to choose, and now they generally choose the article with the stamp upon it, though the article without the stamp is to be had, and, indeed, only wants remunerative patronage to be indefinitely multiplied; only a doubt will occur, at the most trying time, as to whether this is the real article. Free trade in physic, to be something which does not exist now, must be the removal of all distinction between the carefully got up article and the thing which goes by its name. Let us briefly consider what would be the result of the abolition of this stamp, still to use the same phraseology; and what this stamp really signifies.

And, first, of the real object of the stamp, which is assumed to be protective of physic.

We are free to go to whatever shop we like for most things of daily use. Things which we understand we get anywhere; things which we feel are beyond our knowledge we trust to some one else to get for us, or we get them from some particular maker whose name is a guarantee that the article is good of its kind, to whom, moreover, we may complain in case of any fraud. Few of us, for instance, could assay our teaspoons; but we buy them on the faith of the Tower mark, by which the article is avowed as coming up to a certain standard. We can judge of the fashion, and finish, and workmanship ourselves; but we need the stamp to attest that of which we are no judges. Such, and no higher if you like it, are the functions of the various medical licensing bodies. They stamp the article as it passes through their hands, before it goes out into the market, to attest that it possesses a certain value.

Next let us see what would probably ensue on the entire rejection of this distinctive mark, if each one were compelled to get his knowledge where or how he could, or allowed to do without it altogether; and calling himself or herself what they liked, were invited to sell their services to the best customer uninfluenced by law.

The first effect of the abolition of legal recognition of all the present licensing bodies, and the titles which they confer, would probably be a vast increase in the number of bodies conferring titles, and some little confusion in the public mind as to which of these bodies were, and which were not, to be trusted. This point settled, the next result would probably be a number of actions for obtaining money on false pretences, on the plea of membership of the well-reputed Colleges, which would thus receive oblique testimony of the estimation in which they were held both by the public and by those who sighed in vain for the stamp of their approval, unless actions of this kind were interdicted as opposed to free trade. For it may be laid down as certain, that the diploma of a well-reputed Board would be coveted by those entering into practice, and required by the public seeking advice, whether or not the law required or acknowledged these diplomas. Some, doubtless, would practise without them; but the majority would, without doubt, still obtain them as now.

Assuming that all the educational arrangements went on as they do now, it is almost certain that the mere abolition of the legal rights of the licensing bodies would not affect the general relations of the profession, in the first instance, in any more important way than what has been just now sketched out as probable. On the education of medical men, however, such a proceeding would probably after a while act very injuriously,