patient's admission, in consequence of the pressure to which it had been subjected.

A small quantity of brandy and water was administered upon the completion of the operation, and shortly afterwards the following draught:—

R Tincturæ opii mxxv; ætheris chlorici mxv; aquæ ʒiss.

8 P.M. Reaction had taken place in the limb; and the foot was now warmer than the left. The skin was hot; pulse 156.

January 28th. He had had no unfavourable symptoms; pulse 120. The right foot was still the warmer.

R Tincturæ ferri sesquichloridi mx; aquæ ʒi. M. Fiat haustus ter die sumendus.

January 29th. He vomited this morning, after taking the iron; but, in other respects, he was doing well. Pulse 106.

January 30th. The wound was dressed this morning. It looked healthy; there was a free secretion of laudable pus. The sponges were removed, and the edges of the wound were brought together by long pieces of the water-strapping pretty tightly applied, the flannel bandage being replaced as before.

February 1st. The wound was looking very healthy. The ligature which was placed on the small artery came away. He was ordered to have some fowl for his dinner.

February 3rd. The lower of the two ligatures placed around the femoral artery came away this morning; that above was still firm. The wound was looking as healthy as could be.

February 5th. The ligature on the proximal end of the artery came away to-day (tenth day). The wound continued to look perfectly healthy; the man was gaining strength and colour, and ate two chops, and took a pint of porter daily.

February 9th. Both feet were of equal temperature; but some oedema of the limb still remained below the wound. The flannel bandage was still applied from the toes to the groin. He complained of some numbness of the foot.

February 20th. The wound was almost healed. Some numbness of the foot still remained, and he complained of occasional pain going up to the groin; but in other respects he seemed perfectly well. He was walking about this day for the first time.

February 25th. He was discharged at his own request, looking and feeling quite well; but he had a small sore on his right heel, caused by pressure while lying in bed.

REMARKS. The above case is of very great interest, from the great difficulties which it presented in the way of conservative treatment, and the success which attended a bold and judicious effort to preserve the limb. The case is further of the greatest importance, as being an example, and one almost free from doubt, of a wound implicating both the main vessels, but in which gangrene was not present, and in which the circulation was carried on probably through the wounded vein, the opening being defended by the pressure of a bandage.

The only possible source of doubt which occurs to us is, that it is just within the bounds of possibility that the large venous stream which gushed out from close beside the wound in the artery might have proceeded from a large vein divided close to its entrance into the femoral; but this is highly improbable, since the vein does not usually receive any such branch in Hunter's canal; and the appearance and situation of exit of the stream of blood led Mr. Holthouse to the confident conclusion that the vessel implicated was really the trunk of the vein.

Original Communications.

ON THE CAUSES OF PULMONARY CONSUMPTION.

By JAMES TURNBULL, M.D., Physician to the Liverpool Royal Infirmary.

It is a most difficult matter to appreciate rightly the influence of the various causes which are known to have an effect in the production of tubercular disease of the lungs. In various systematic treatises they are fully set forth, but as the different causes act in combination with each other, it is by no means easy to discover how much of the injurious influence of any single cause is due to itself separately. The inquiry is, however, a most important one, as it has a direct practical bearing on the prevention and treatment of the disease. In carrying it out with a view to these practical objects, I shall confine myself as much as possible to the investigation of those causes, the influence of which can be appreciated with some degree of exactness, and proved by reference to statistical facts, such as

those recently brought to light by Dr. Greenhow's Papers (*Parliamentary Papers relating to the Sanitary State of the People of England*, 1858), and the Report of the Army Commissioners.

Hereditary Transmission. This is an important predisposing cause of the disease, which is constantly forcing itself on the attention of those engaged in the treatment of pulmonary disease. When we consider how few persons there are who have any exact knowledge of the causes of death of even their near relatives, and that many are willing to conceal, even from themselves, the existence of any hereditary taint, it is not surprising we should find that those who have investigated this subject, numerically, have made statements, as to the influence of hereditary transmission, which are widely different. It would appear to have been transmitted in about 24½ per cent. of the cases admitted at the Brompton Hospital for Consumption; and out of 1,000, analysed by Dr. Cotton, the influence of hereditary taint was proved in rather more than one third. I have observed that the liability to tubercular disease is transmitted in two distinct modes, which may sometimes be observed separately, but are much more frequently seen acting together. One of these is the transmission of the constitutional tendency to the disease, which, if manifested in infancy or childhood, does not show itself so often in the lungs, but in tubercular affections of the brain or its membranes, or tubercular deposits in the glands or the bones, or in scrofulous ulcerations, and affections of the eyes, etc. Along with the constitutional tendency, there is often combined the other mode of transmission, which is a local weakness; a weakness, for example, of the lungs, which in early life, in those free from the constitutional taint, may give a liability to bronchial, and other simple affections of the lungs; but which, if combined with the tubercular taint, is apt, at a later period, to produce the development of consumption, if the individual be exposed to the exciting causes.

It has been stated that the father most frequently transmits the disease to the sons, and the mother to the daughters; but I believe that when one parent only is tainted, the disease is transmitted, in very nearly an equal ratio, to both sexes of the offspring. The liability to the disease is of course immensely increased when it is derived from both parents—a fact so well known to Insurance Companies, that most of them reject such lives, even though there may be every appearance of health in the individual. When a parent is actually affected with tubercular disease of the lungs, the tendency to the disease must necessarily be greatly increased in the offspring, and tubercles sometimes exist at birth even, when the mother is consumptive. I have had many opportunities of observing how it has fared with infants born of tubercular mothers; and, where the disease has been in an active condition, I can scarcely recall an instance in which they have not been cut off within the first two years. Though they have often had an appearance of health, it has seldom been retained long, and they have frequently died from convulsive attacks within a few months after birth, or during dentition.

Sex. It would seem that females are more liable to consumption than males. The number of women that died of this disease in England and Wales, was 26,986 in 1849; and the number of men 23,312. The proportion of men, however, who die of other pulmonary diseases is greater than that of females, and it would seem that whilst men are more liable to acute pulmonary diseases, women are more subject to chronic tubercular affections. That this greater liability does not arise simply from difference of sex, but from the habits, occupations, and more sedentary life of females, is proved by the fact that in many districts and towns, the relative proportions is reversed, the male death-rates, from pulmonary diseases, exceeding the female. In many instances, too, we shall see that the cause of this may be traced to the fact of the women being employed in some branch of manufacture, the prejudicial influence of which may thus be very correctly estimated.

In London, the male death-rate from pulmonary diseases is 758; the female being only 593; and it can also be shown that consumption is more common amongst the men than the women. At the Brompton Hospital the proportion of male patients is 61 per cent., to over 38 per cent. of females. There is the same preponderance of consumption in the male population of most of the large towns where the females are not engaged in some kind of manufacture which has a disturbing influence. On the other hand, there are many towns and districts where the females are largely engaged in such manufactures as silk, lace, cotton, and straw plait, in which we find the female pulmonary death-rate much higher than the male rate, and it can be shown that, in almost every instance, such

increase is due to consumption, proving that in-door occupations have an injurious influence. Above thirteen per cent. of the females in Cheshire are engaged in the silk and cotton manufactures; and the female death-rate exceeds the male in the proportion of 593 to 558. In the towns of Leek and Macclesfield, where the silk manufacture is carried on, it greatly exceeds the male death-rate. In Leicester and Nottingham, where a large proportion of the female population is employed in manufactures, the female mortality from pulmonary diseases exceeds the male; in the former, in the proportion of 549 to 488, and in the latter, in the proportion of 542 to 435.

There are also some small country towns where many of the females are engaged in such sedentary occupations as lace making, in which a manifest increase is thus produced in the mortality from pulmonary diseases amongst the females. Towcester is one of these, in which the male pulmonary death-rate is 475; whilst the female is no less than 573. Here we have not only a reversal of what is common throughout England and Wales, but it has also been ascertained that the excess of pulmonary diseases in the females occurs in adult life, and that it is produced by consumption.

Dr. Greenhow has found that in purely agricultural districts the female is higher than the male pulmonary death-rate, and he has also found, from comparing eight of the most healthy districts with eight of the most unhealthy, that in the healthy ones the female mortality is one-eighth more than the male, the reverse being the case in the unhealthy ones. From the first of these facts we may infer that in agricultural districts the men are employed in healthful out-door occupations, whereas there is something injurious in the habits of the women, or in the dwellings; and from the second fact shewing that the insalubrious influences act most on the men in the unhealthy districts, we must infer that these influences are connected with their employments and habits, and do not arise exclusively from unwholesomeness of the dwellings.

Town Influences. It has been ascertained by Mr. Neison that the agricultural labourer is the longest lived of all classes of the community. He is not the best fed, clothed, or housed, but the one condition in which he differs from all other classes is the amount and variety of exercise he takes in the open air. On the other hand, it is a well ascertained fact that the duration of life is curtailed by residence in towns, and it now appears, also, that there is no class of diseases in which a more decided increase is produced by town influences, than those of the lungs; amongst which consumption stands preeminent. In fact the relation between the pulmonary death-rate and the amount of consumption is so close that we may take the pulmonary death-rate as a sufficiently accurate means of judging of the prevalence of consumption. Glendale, in Northumberland, is the healthiest country district in England, and it is also the one in which there is the smallest number of deaths from pulmonary diseases. The number is 216 per 100,000, annually, and the comparison between this and the number in London, which is 675, gives us a vivid idea of the effect of town influences, which are even more powerful in the towns of Manchester, Liverpool, and Bristol, the rates of which are still higher.

Dr. Greenhow has made a comparison between eight urban districts, where the greatest number of persons die annually of pulmonary diseases; and the eight rural districts where the numbers are smallest; and the difference, which furnishes an accurate and comprehensive means of judging of the pernicious effects of town influences, is thus seen to be very great. The rate of the urban, or unhealthy districts, embracing Liverpool, West Derby, Manchester, Salford, Chorlton, Birmingham, Blackburn, and Leeds, is 811; whilst for the rural, embracing Bootle, Bülth, Easington, Garstang, Glendale, Haltwhistle, Houghton-le-Spring, and Romney Marsh, it was 322. We see here that pulmonary diseases are no less than two and a half times more numerous in the unhealthy town districts than in the healthy rural ones. The rate for all England and Wales standing between these two rates at 552.

The effect of town influences though always apparent is by no means uniform. This is at once seen in comparing the death-rates of Bristol and Hull. Though the total deaths in Hull, from all causes, exceed those in Bristol,—and these two seaports are not materially different in respect to size and density of population—we find that there is a wide difference in the amount of pulmonary disease, which in Bristol, the healthiest town in other respects, is at the rate of 851, and in Hull only 556. This proves that there is no fixed relation between the size of towns and the prevalence of pulmonary disease, or between the general and the pulmonary death-rates.

It has also been shewn by a comparison between the pulmonary death-rates, and the density of the population of these towns, and those of Gravesend and Ipswich, that there is an absence of definite relation between the population density and the pulmonary death-rate. Whilst, therefore, town influences, which must embrace impurity of the atmosphere from smoke, the unhealthy emanations always existing in crowded localities, imperfect ventilation of houses and factories, and the more sedentary occupations of an urban population, are injurious, there are other circumstances affecting the inhabitants of some towns besides these, which require further and more minute investigation.

To the influences already mentioned, may be added the effect produced by the absence of the physical and mental stimulus afforded by variety of scene, and especially by rural prospects, the weariness caused by the monotonous character of many occupations; and not least, the cares and anxieties of life; all of which are causes which, it has been justly observed, help to swell the catalogue of illness and add to the register of deaths in great cities.

Occupation. Those occupations which call for much exercise in the open air are the most healthy; whilst, on the other hand, we have seen from some of the preceding facts, that in-door occupations have a direct and obvious tendency to cause consumption.

The relative influence of in-door and out-door employments on this disease, may be still further shown by reference to the statistics of the Brompton Hospital for Consumption; 63 per cent. of the male patients admitted followed in-door employments; only 30 per cent. out-door occupations; and the remainder mixed employments. All the females were engaged in in-door employments. Dr. Cotton has calculated, from his own experience, that consumption is five times as frequent in those engaged in in-door work as in those employed in active out-door pursuits.

Those employments are most injurious which have an effect in restraining the function of respiration, by preventing the free action of the muscles of the chest, and hence one reason of the prevalence of the disease to so great an extent among tailors, shoemakers, printers, milliners, and clerks.

Dr. Greenhow has furnished some statistical data which assists us in estimating the effects of certain kinds of manufacturing occupations. He states that the pulmonary death-rate is usually excessive in towns where both males and females are largely employed in the manufacture of textile fabrics; but that the difference in mortality of the sexes is rarely great.

The pulmonary death-rate is high in all the large cotton manufacturing towns; and that factory labour tends to generate consumption is conclusively shown by the fact that though the pulmonary mortality of Manchester is lower than that of Liverpool for the whole period of life; it is, during adult life, greater in Manchester, in both the sexes, than in Liverpool.

The effect of the silk manufacture in producing a high rate of female pulmonary mortality in Leek and Macclesfield, and of the lace and other kinds of manufacture in raising the female above the male death-rates in Nottingham, Leicester, and other places, has been already adverted to.

The influence of the woollen manufacture on those engaged in this kind of occupation requires more particular notice, as it would seem to be not only less injurious than others, but to produce, through the action of the oil used in many of the processes, a positively beneficial effect upon the health, and which, it has been affirmed, is prophylactic against scrofula and consumption. Dr. Greenhow states that with the single exception of Leeds, where other kinds of manufacture of a more or less pernicious nature are carried on, the mortality in the districts of the woollen manufacture is rather below what prevails in the cotton and silk districts. In Bradford, which is a woollen district, the pulmonary death-rate is 607; whilst in Preston, an exclusively cotton district, it is 722. It is, however, in the woollen factories of Scotland that the prophylactic effect of this kind of employment has been more particularly observed, and to Dr. Simpson is due the credit of making known this fact, and tracing the cause to the beneficial operation of the oil used in some of the processes.

Dr. Simpson has collected the concurrent testimony of many medical men, practising in the woollen districts of Scotland, on this subject, and I condense, from his paper, the remarks of Dr. Dyce.

With reference to the extreme rarity of consumption among the wool-mill girls, this is a fact with which all here have long been familiar, so much so that seldom or ever is a consumptive

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. Hæmatus 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