jun., read his paper on this subject in the Surgical Section at the Dublin Meeting, that hospital surgeons in general have taken up the question in earnest, and have put to the test the advantages claimed for this over the usual operation. I have not myself yet performed the inguinal operation in any case of cancer; but there are doubtless many gentlemen present who will give us their experiences, and so will enable us to form a judgment upon its merits.

I am bound to confess that, having opened the descending colon in the left loin 103 times, I find it in some respects an unsatisfactory operation. Now and again it is not unattended with difficulties; but I have never found these insurmountable. In stout persons it will sometimes be found that the bowel is in front of the anatomical line; in the thin and wasted, the empty gut may have dropped down, as it were, so as to form an attenuated cord by the side of the spine. In these cases the peritoneum may require to be opened; and in others an opening may be unintentionally made. With cleanliness and care in avoiding the introduction of putrescible material, there need be no fear of inserting the finger freely within the cavity of the abdomen in search of the truant bowel, and the accidental wound need not so much interrupt the even tenour of the operation. It has happened to me more than once to have opened a tightly distended colon and the peritoneal cavity by the same incision, and to have become suddenly conscious of the accident only during a copious flow of liquid feces over the entire wound; and yet I am not aware that any disastrous effects have ensued. The tightly distended bowels secure an accurate closure of the wound, and I have always taken care to second this by seizing the cut edge of the colon with forceps and dragging it to the surface. It is not on account of the difficulties we sometimes encounter, or of the accidents which cannot always be avoided, that I am dissatisfied with this long established operation; neither is it because of the high mortality which undoubtedly attends it when undertaken for relief of complete obstruction, a mortality which I am prepared to show arises more from the circumstances preceding the operation than from the operation itself; but rather because of its failure in a number of instances to secure that complete diversion of the feces which it is intended to bring about, and because of a tendency to a gradual stenosis and even closure of the opening, on the one hand, or of unmanageable prolapse of the bowel on the other, which in a not inconsiderable number of cases detracts materially from the comfort to be derived from a perfect operation.

It is claimed for inguinal colotomy that, when rightly performed, there is no possibility of feces finding their way beyond the opening in the groin, that the removal of a portion of the free border and the kinking of the bowel secure a continued patency of the artificial anus, and that prolapse may be effectually prevented by the use of a properly constructed truss. If these claims should prove to be well founded—and the examples I have seen in London, in Leeds, and in Newcastle would seem to support them—the chief drawbacks of colotomy will have been removed. The lumbar opening will continue to be preferred when the disease is so high up as to render it uncertain if an inguinal opening will enable the bowel to be reached, and probably also in cases of great distension where an immediate opening for relief of obstruction is imperative. Not long ago a man, whose colon I had some months previously opened, returned in a condition but little, if at all, improved by the operation, which had wholly failed to prevent the dribbling of feces through the rectum, although the artificial opening had remained patent as at first. To his complete relief I performed the operation of colectomy. The colon, having been cleared from its attachment to the lumbar opening, was dragged outside and completely divided. Having then temporarily secured the upper end with an encircling ligature of silk, so as to prevent the escape of feces, and given it in charge of an assistant, I first dealt with the lower portion, and finding it empty, I was able at once securely to close it by stitching with fine silk its invaginated wall in such manner as to oppose two serous surfaces throughout the entire circumference. Thus safeguarded against any back flow of its contents, the distal end of the bowel was dropped into the abdominal cavity. The upper open end was then stitched all round to the edges of the lumbar wound, and in this way the whole of the contents of the bowel were perforce discharged through the lumbar opening.

How far this operation may be safely undertaken as a primary proceeding we have not sufficient evidence to show. Should it prove on trial to be not more fatal than the ordinary method, it is clear that by its means we shall more completely accomplish

the chief end we seek to attain—namely, the diversion of the intestinal contents through the loin, and the detaching of the diseased rectum from the alimentary canal. It has been proposed, indeed, and even, I believe, essayed to accomplish, the removal of the cancerous bowel through the lumbar or inguinal opening, and that such a procedure may, in exceptional instances, be warranted, I can well conceive; but for the present our choice of operation in cancer of the rectum would seem to lie between proctectomy as performed from the anal extremity on the one hand, and some form of artificial anus on the other.

AN ADDRESS

DELIVERED AT THE OPENING OF

THE SECTION OF PATHOLOGY AND PHYSIOLOGY.

At the Annual Meeting of the British Medical Association, held in Leeds, August, 1889.

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ON THE NATURE OF CONSTITUTIONAL SUSCEPTIBILITY TO DISEASE.

GENTLEMEN,—In opening the Section of Physiology and Pathology it is fitting that I should recognise the close relationship between these two branches of science. The methods and leading principles of physiology have, with great advantage, been extended to pathology, and through pathology to practical medicine and surgery. We are apt to think that this is a special characteristic of recent times, but we must not forget that in the work of our great master, John Hunter, this combination was exemplified in the highest degree. Not only is his work largely physiological, but in his marvellously full and suggestive lectures on the Principles of Surgery, it is only after a prolonged discussion of the fundamental principles of physiology that he goes on to the principles of disease. It is, I think, matter for congratulation that, following John Hunter's example, modern pathology does not confine itself to pathological anatomy, but recognises that the processes of disease occur in living animals, and are to be investigated from the physiological as well as from the anatomical standpoint.

MISUSES OF PATHOLOGICAL TERMS.

It must be recognised that pathology has made great advances in modern times. It follows from this that the meanings and uses of terms must have undergone considerable changes in the course of years, and that confusion is liable to occur between the older and more recent uses of these terms. This applies especially to terms which imply theories or views, because as the views change the terms either become obsolete or else linger in some indefinite sense, to the confusion of the minds of men. On the other hand, a term which expresses some great fact of fundamental importance must remain, although the attitude towards the fact and the interpretation of it may undergo alteration. I propose to-day to take up in this aspect one of the expressions belonging to the latter class, but before I do so let me give two examples of the former.

The term "lymph" in its pathological use is, I believe, a Hunterian expression. Hunter's "coagulable lymph" was primarily the fibrin which forms when the blood coagulates. He says that the blood separates into the coagulable lymph, the serum, and the corpuscles. It is well known that Hunter ascribed very special powers to the coagulable lymph, regarding it as the vehicle of the living principle of the blood. What we now regard as dead fibrin was to him the most active and vital matter in the body. Hunter regarded the new formation of tissue as brought about by this lymph, so that even the extension of a scirrhus cancer to the axillary glands, for example, was by the passage of the coagulable lymph from the tumour in the mamma. Our views of all this have entirely changed, but the term unfortunately remains, and is used, especially by surgeons, in what I cannot but regard as a loose and misleading way. Thus, not only is the fibrinous exudation of acute inflammation called lymph, but the connective tissue

which, let us say, unites the various abdominal organs together in cases of tubercular peritonitis, is also called lymph. It would be a great advantage, I think, if the word were banished from our nomenclature. It is interesting in the history of pathology, but like some of the creeds of our ancestors, had better be left as a historical monument.

There is again the expression "deposit," which is somewhat frequently in use. We hear about "tubercular deposits," and "cancerous deposits," for example, as if there were some tubercular or cancerous substance brought to the part and laid down there. Now, it ought to be remembered that tuberculosis and cancer imply the new formation of tissue, and not a deposition from the blood. It is true that in the case of tuberculosis and syphilis the specific morbid agent is brought to the part and laid down there; but the actual tubercular or syphilitic lesion arises by growth of tissue, and the specific morbid poison may, having done its work, disappear, leaving the visible lesion as a piece of new formed tissue. In the case of cancer, the whole process is one of a preternaturally active growth of tissue, something very different from a passive deposition. The influence of the Hunterian idea of the coagulable lymph is visible in this expression also, and it is perhaps an evidence of the abiding influence of a great mind, that even his errors possess so much vitality. I think, however, that it is time to cease speaking in this loose sense of deposits, when the real process is an active one of growth.

NATURE OF CONSTITUTION AND CONSTITUTIONAL.

Passing however from this, the subject which I have thought might profitably engage us here is one having wide general relations, and therefore suitable to such an address as this. I refer to the subject of Constitutional Susceptibility and Constitutional Disease. These expressions refer to fundamental facts in connection with disease, and are not likely to go out of use. I believe, however, that considerable confusion exists as to the bearing of the facts, and consequently in the use of the words. It will be recognised, for example, that in common language a certain contradiction in meaning is assumed between constitutional and local, as if they were mutually exclusive of each other. This assumption, in my opinion, is a mistaken one, and it arises from want of due care in distinguishing between constitutional susceptibility and constitutional disease. I hope in the sequel to show that constitutional susceptibility is, at least in many cases, strictly local.

The constitution of the body has been defined as "its particular frame or temperament," and as "the inherent structure and powers of the organism." We recognise differences of constitution in different individuals, that is, differences in the inherent structure or frame. For the most part these differences are within the normal anatomical and physiological limits, and these constitute the *differentiæ* by which one individual is distinguished from another. It is very pertinent to our subject to consider what are the characteristics of these normal constitutional differences. If we look closely at them they will be found to consist in varieties in the local construction or action. As the bodily frame is composed of a vast aggregate of minute parts, it is variations in these minutiae which constitute the differences in the frame as a whole. This is recognised in common language when we say that a particular shape of head, or gait, or cough, is constitutional.

Many of these peculiarities are inherited, and it is, again, a fact which will be recognised as fundamental that the constitutional is very frequently the inherited. In an address published about eighteen months ago¹ I endeavoured to show that inheritance does not determine merely vague general characters and susceptibilities, but definite local peculiarities of structure and function. We may say here that the bodily frame or constitution, while built on a general plan, is subject to variation in a multitude of local details, and that these variations are frequently matters of inheritance. It is these chiefly which constitute the *differentiæ* of constitutions.

It is now my object to inquire how such constitutional differences affect the incidence of disease, and in order to this I must make some reference to the causation of disease.

In the causation of disease we recognise two elements nearly always at work, one internal and the other usually external. The one we name predisposition or susceptibility, and the other we designate the determining cause. For the most part susceptibility is constitutional; it belongs to or is inherent in the bodily frame, and in many cases it is inherited. Differences in susceptibility

depend on differences in constitution, and these differences, although frequently congenital, are in some cases acquired, the constitution being altered by the circumstances of life. Constitutional susceptibilities, we may infer, will be correlated to a multitude of local peculiarities in structure or function, and it may itself be due to some definite local speciality.

It will be seen already that the normal constitutional peculiarities are for the most part local, and that constitutional susceptibilities to disease may also be local. When we speak of tendencies or susceptibilities to disease, therefore, local and constitutional are not inconsistent, but are, as I hope to show, for the most part associated. It is otherwise when we come to the actual manifestations of disease. A disease is constitutional when it affects the bodily frame as a whole, and it can only do so when it either contaminates the blood or, by acting on the nervous system, interferes with the functions of the body as a whole. It is, I think, by confusing constitutional susceptibility and constitutional disease that the former is generally regarded as excluding the idea of a local seat.

CONSTITUTIONAL SUSCEPTIBILITY OF ORGANS, AS THE LIVER AND LUNGS.

I think it will assist us in comprehending the meaning of constitutional susceptibilities if we notice that each of the individual organs of the body has a constitution as well as the body as a whole. The constitution of an organ will be its inherent nature, and will include its structural and physiological peculiarities. Now, the various organs show the most interesting peculiarities in their susceptibility to disease, and these differences in susceptibility are inherent in their constitution.

Let me take first the liver as an illustration of what I mean. The liver is exposed, perhaps more than any other organ, to the attacks of disease. Any solid granular matter which may be present in the blood is liable to be deposited there. It has been shown by experiment, for example, that when vermilion granules are introduced into the blood, they are to be found in large numbers afterwards in the liver. In the condition of melanæmia, also, where there are numerous granules of black pigment in the blood, there is a deposition of this pigment pre-eminently in the liver. This seems due to the fact that the capillary circulation in the liver is unusually slow. The blood before it reaches the liver has already traversed a set of capillaries, and, arriving at the liver by the portal vein, it is at a greatly diminished pressure and rate of speed. It follows from this that in all diseases in which solid granules are present in the blood the liver is likely to be the seat of deposition. There are two kinds of solid matters which, when they are deposited in an organ, may lead to disease, namely, microbes and cells from malignant tumours. In regard to both of these, the liver shows great differences of susceptibility.

Take first the case of tuberculosis. It used to be said that the liver is very rarely the seat of tuberculosis, and this is in a sense true, but it is not because the tubercular bacillus is not frequently carried to the organ and deposited there. I am prepared to say that probably in a large majority of cases of tuberculosis, whatever the locality of the disease, the liver is infected with the virus. In general tuberculosis, where the bacilli are present in large numbers in the blood, the liver is the seat of enormous numbers of miliary tubercles. Again, in phthisis pulmonalis there are nearly always a considerable number of tubercles present. I have frequently examined the liver in such cases, and I can say that in this disease, although frequently the tubercular process is, so far as naked-eye appearances are concerned, confined to the lungs and the related mucous membranes, such as the larynx and intestines, yet that microscopic examination commonly reveals the presence of many minute tubercles in the liver. The bacilli pass in comparatively small numbers into the blood from the primary seat of the disease, and are, as we might expect, deposited in the liver. They obviously find, however, that the liver is inimical to their growth. They produce the typical miliary tubercles, but there is apparently no considerable multiplication of the microbes, and so we have small isolated tubercles, which usually show the various appearances of degeneration. According to Baumgarten, the giant cell and the other constituents of the tubercle proper are the direct result of the action of the bacilli; and, according to the very beautiful observations of Metschnikoff, these cells endeavour to inhibit the further development of the bacillus, and in some cases succeed. They seem to be successful in the liver, so that the tubercles scarcely ever form in this organ considerable masses such as we find in the lungs and in the brain, and are seldom even

¹ *Lancet*, January, 1888.

large enough to be visible to the naked eye. I might venture on the paradoxical statement that the liver is probably more frequently than any other organ the seat of tubercles, but is scarcely ever the seat of tuberculosis. I would say that the liver is constitutionally inimical to the tubercular bacillus, and is constitutionally almost insusceptible of tuberculosis.

Contrast with this the relation of the liver to syphilis. Here also we have a virus in the blood, and I think we may infer that it is a microbe. At any rate, we have sufficient evidence that it is commonly deposited in the liver, and it evidently finds there a congenial seat. I suppose there is no organ in the body which is so frequently the seat of syphilitic gummata as the liver. This organ has apparently a constitutional susceptibility to this disease.

Then in regard to tumours, we know that the liver is very frequently the seat of secondary cancer. It is so not only when the primary tumour is in the intestinal canal, but also when it is in external parts, provided that the tumour elements get into the blood. These are usually carried to the liver by the portal vein, and are not only deposited in the organ, but evidently find it a highly congenial seat, so that they grow, as a general rule, with a riotous luxuriance. Every pathologist must have been struck with the fact that a small primary cancer in the stomach or intestine may give rise to an extraordinary secondary growth in the liver, so that this organ is increased by many pounds in weight, and its tissue almost replaced by cancerous tissue. We may say that the liver has a constitutional susceptibility to cancerous growth when once it is implanted, although in itself indisposed to primary cancerous development. Primary cancer of the liver is almost as unusual as secondary cancer is common.

The lungs present, in regard to the three diseases mentioned, an almost precise converse to the liver. It is obvious that these organs are a very congenial seat for the tubercular bacillus. Not only are these microbes frequently deposited in the lungs, but they grow vigorously there, and usually produce continuously extending effects. I was peculiarly struck with the contrast in a case of general tuberculosis in which both lungs and liver were affected. The bacilli had been implanted in both in great profusion, but in the liver they had apparently, even thus early, to a large extent died out. The bacilli are always difficult of detection in the liver, and they were so in this case; but in the lungs they had grown with extraordinary vigour, and had done so to a large extent in the lung alveoli, so that when the lung was prepared in the ordinary way so as to stain the bacilli red with fuschine, the alveoli looked, with the low power of the microscope, as if filled with red matter. There was an almost pure culture of the bacilli in the alveoli.

In direct contrast with this is the case of syphilis. The extent to which syphilitic lesions occur in the lung is still regarded by some as undetermined, but by all it is admitted that they are exceedingly rare. So far as my experience goes, I have only seen one unequivocal case of syphilis of the lungs and one doubtful one. In the unequivocal case there were gummata similar to those so frequently seen in the liver, and which were present also in that organ.

Cancer in the lung occupies a somewhat similar position to tuberculosis in the liver. The lung is not infrequently the seat of cancerous infection by the elements of cancerous tumours being carried to the organs, but they seldom grow to any considerable extent. I have seen several cases which presented somewhat peculiar features. The cancerous elements had evidently reached the lung by the pulmonary artery, but they had not developed to any considerable extent in the lung tissue. They had rather passed into the lymphatic spaces of the lung, so that outside the branches of the pulmonary artery the perivascular spaces were seen to be occupied by cancerous growths. These were also present in the lymphatics of the general connective tissue. The cancerous growth in the lymphatics beneath the pleura produced an appearance as if these vessels were injected, the lobules being mapped out by the white tissue in the lymphatics of the interlobular septa.

I think we may infer from the facts already adduced that the constitution of the lungs and liver respectively are such as to render them very variously susceptible to certain morbid influences. I want now to make the further observation that there are marked differences in susceptibility in the same organs in different individuals. We have seen that in man the liver is very inimical to the tubercular process, but it does not seem to be so in at least some animals. In bovine tuberculosis, for example, pearl nodules

are commonly present in the liver, and they generally grow to the usual dimensions of those in other parts. In many other animals also, tuberculosis manifests itself very markedly in the liver.

But even amongst men the liver presents very marked difference in its susceptibility to disease. The tropical abscess of the liver is no doubt due to the implantation of the microbes of supuration in the substance of the liver. I do not here go into the question of the connection of this disease with dysentery, but we must infer that these microbes find entrance to the body through some breach of surface, and probably by the intestine. What I want to point out particularly is, that Europeans in India are much more susceptible to the disease than natives. I owe the knowledge of this fact to my friend, Dr. David Wilkie, of Simla. From the statistics of the European and native armies from 1877 to 1886, it appears that while the death-rate from dysentery was nearly the same in both races, namely, 1.33 in Europeans, and 1.25 in natives per 1,000 men, the death-rate from hepatitis, or abscess of the liver, was more than eight times as high amongst Europeans as amongst natives, the figures being 1.45 and 0.17 per 1,000 men respectively. This peculiar and interesting fact implies a constitutional peculiarity, which may be related to racial differences, or be due to modes of living, and particularly to the differences of diet. In any case we have a congenital or acquired difference in the constitution of an organ determining an extreme difference in susceptibility to a particular form of disease.

It may be well at this point to take up, for a moment, the question as to the explanation of such constitutional differences in organs as those which I have been referring to. What is it that makes the liver of man peculiarly inimical to tuberculosis, and peculiarly susceptible to cancer and syphilis, and what is it that makes the livers of some men so much more susceptible to the pyogenic microbes than those of others? I believe that we are to look for an explanation in the action of the living cells of the organ. Tubercles in the liver have their seat in the connective tissue of the organ, and it looks as if the vicinity of the proper hepatic cells prevented the multiplication of the bacilli. In man there is comparatively little connective tissue in the liver, and this may possibly account for the slight growth of the tubercles, the connective tissue being, in some animals at least, more abundant. In all the diseases which I have mentioned the morbid process involves the multiplication of living cells, the cells which constitute the microbes in tuberculosis and syphilis, the cancer cells in cancers. The natural living cells of the part enter into contest with the morbid cells, and in some cases are capable of controlling the latter, whereas in other cases they are not. We may suppose that the issue of the contest depends on the inherent powers of the respective living structures. So far as the organs of the body are concerned these inherent powers are involved in the constitution of the organs.

SENILE CHANGES IN ARTERIES PRODUCE A CONSTITUTIONAL SUSCEPTIBILITY TO ATHEROMA AND ANEURYSM.

With a view to the further illustration of my subject, I shall now refer to senile changes in relation to constitutional susceptibility. Take first the normal senile changes. We recognise that baldness and greyness of the hair are, in a certain sense, the natural results of accumulating years. They are due to atrophy, the one of the hair follicle, and the other of the pigment. But what variations are shown by different individuals in the age and degree in which they occur? We recognise here constitutional peculiarities, and we are familiar with the fact that these are in a very high degree hereditary.

Turning to susceptibilities to disease, I believe that senile changes constitute a very important element in the commoner diseases of arteries. Atheroma of arteries and aneurysms, arising as these do for the most part from atheroma, are conditions in which we can distinctly trace the two elements in the causation which I alluded to at the outset of this address. These are diseases of middle life and old age, that is to say, senile changes in the arteries constitute the predisposing cause or susceptibility, but the determining cause is the impact of the blood on the wall of the artery. This is evident from the fact that atheroma is commonest where that impact is greatest, namely in the aorta. It is not common in arteries of comparatively small calibre, but there are two situations in which it frequently occurs even in small vessels, and these are situations where the impact of the blood is apt to be greater than in other arteries of a similar size. The

coronary arteries of the heart, coming off directly from the aorta, are exposed to a high blood-pressure, and they are very often atheromatous. The arteries of the brain also, coming off as the anterior and middle cerebral do from a large artery which passes up directly from the aorta, are presumably exposed to unusual blood-pressure, and they are very frequently affected with atheroma. Perhaps also the soft character of the brain substance, causing the arteries to be less supported than most others, may have to do with the frequency of atheroma here. In this disease, then, the changes of constitution in the arteries consequent on many years of activity induce a condition which renders the tissues of these vessels incapable of resisting, as before, the effects of the blood-pressure. This change of constitution we may infer to be a diminished vitality in the living structures forming the walls of the vessels. That it is so is almost demonstrated by the fact that atheroma is often associated with a condition of the middle coat, which implies greatly diminished vitality, namely, calcification of the muscle cells of that coat. Before a living structure allows of the deposition of lime salts in it, it is already so much reduced in vitality as to be almost dead.

Now it is interesting to observe that these senile changes in the constitution of arteries are subject to very great variations in different individuals, and in like manner the occurrence of atheroma varies, both in the age at which it occurs, and in its extent. This is of great importance when we consider what an important part this disease plays in causing death in old people. A large proportion of the deaths in the latter part of middle life and in old age are from hæmorrhage or softening of the brain, presenting itself in the various forms of apoplexy, paralysis, and brain weakness. These conditions of the brain mostly depend on atheroma of the arteries, and so we may say that the tendency to death is greatly influenced by the occurrence or the premature occurrence of the senile changes which render the arteries susceptible to atheroma. The constitutional condition of the arteries as regards vitality of their tissues in advanced life exercises thus a very important influence on the duration of life. I may venture to say that the constitutional powers of the heart and of the arteries are the principal factors in determining longevity. The ability of the heart varies greatly in different individuals, and survival when attacked by an acute disease will largely depend on the power of the heart to resist the debilitating influence of the morbid agent. If a man passes through middle life and has escaped from acute diseases, or has survived them, then the condition of his arteries is probably the most important factor in determining his chances of life. It is thus that the local constitutional peculiarities of the vascular system influence the duration of life. These constitutional conditions, like others, are largely the subject of inheritance, which thus again is seen to determine local peculiarities.

CONSTITUTIONAL SUSCEPTIBILITY TO TUBERCULOSIS.

I might further illustrate the principles which I have been endeavouring to enforce by other examples, but I turn now to two diseases concerning which considerable confusion exists, as I think, in regard to their relations to the constitution—I mean tuberculosis and cancer. I have already referred to the difference between constitutional susceptibility and constitutional disease. In what I have already said there has scarcely been any possibility of confusion between the two terms, as the illustrations have been selected in order to exhibit the nature of constitutional susceptibility. We have seen that it is in these cases related to local characteristics. In the case of tuberculosis and cancer we have a more difficult subject, chiefly because in these diseases we have to deal both with constitutional susceptibility and constitutional disease. It is, I think, because of this that many men find it difficult to conceive of a constitutional susceptibility to tuberculosis or cancer being a purely local condition. I want to make it apparent that the constitutional susceptibility is local, and that it is only a constitutional state that may be secondarily induced which is general.

Let us take first the case of tuberculosis. We recognise in this disease in the most prominent way the influence of the two factors in the causation of disease to which I have alluded. There is the definite determining cause, the tubercular bacillus, but there is, in most cases at least, the pre-existing susceptibility. While everyone is exposed to the determining cause, it is only the susceptible who succumb. This susceptibility to tuberculosis is constitutional, and in many cases it is hereditary, although the mode of life may determine an acquired susceptibility.

If we look closely at any tubercular disease we shall find that,

in man at least, it is always, to begin with, local. So far as I can see, there is no evidence that the tubercular bacillus multiplies in the circulating blood. What happens is that when the microbes gain entrance to the body they are deposited somewhere. If they get leave to lie, there is the contest between them as living cells and the living cells of the tissues. In the liver the hepatic cells, as we have seen, are able to control the microbes; so also are the living tissues generally in most people. But if the bacilli are implanted in an organ which is constitutionally incapable of dealing with them, then they multiply. The person has a constitutional weakness, as it is said, and the local propagation of the bacilli is allowed. This local implantation may be in various places, the commonest being the lungs, the lymphatic glands, the bones, the brain, the testicles, and the kidneys.

I do not think it is likely that there will be, usually, in the same person, a local susceptibility in more than one situation. It is sometimes said that tuberculosis of the lymphatic glands or scrofula, is seldom associated with phthisis pulmonalis, but I know of no actual observations on this point. I should expect that inherited susceptibility would be entirely local, and that it would determine one or other of the local manifestations.

But tuberculosis, wherever its seat, usually produces constitutional manifestations, fever, emaciation, frequently amyloid disease. It does so, not necessarily or usually by the bacillus passing into the blood, but rather by the evolved products doing so. I think it may be said that whatever their seat, the bacilli do not produce tuberculosis by their mere presence, but rather by the poisonous principles which they evolve. These are probably alkaloids, and are soluble in the juices of the body. They are diluted by the fluids, and in this form may be carried away from the local seat, and pass on into the blood. I believe that it is the presence of these products in the blood which is the main cause of the fever and other constitutional phenomena. We are to remember also that the occurrence of tuberculosis may lay open the way for the absorption of other foreign products, especially in the case of the lung. The cavities formed in phthisis contain variously decomposing matters, and the products of these may be absorbed. Then, also, necrosis of the pleura often leads to an acute pleurisy, which in many cases is, I believe, a septic pleurisy, and this is a cause of fever. It is apparent to my mind that these constitutional symptoms are the result of the local disease.

An important point comes up here. The local tuberculosis is a focus of infection, and although it is only exceptionally that it gives off bacilli in such numbers as to constitute a proper acute general tuberculosis, yet, from the evidence in regard to the liver which I have already adduced, it would appear that in most cases a few bacilli are being occasionally shed. In cases where a local susceptibility exists in other organs besides the primary seat, we should expect to find that a secondary tuberculosis would be established. It is even possible that the constitutional state induced by the tuberculosis might increase the susceptibility of some organs, or even create it. As a matter of fact, we sometimes find such a local tuberculosis in a second organ. I do not refer to the direct extension of a tuberculosis, say from the lungs to the larynx and intestine, which are so common, because in that case the bacilli in the sputum applied to the larynx, and, by swallowing, to the intestine, are so numerous that, without any special susceptibility, these structures become affected. I refer rather to the occasional occurrence of tuberculosis of the kidney, peritoneum, brain, bones, etc. In my *Lectures to Practitioners on the Pathology of Phthisis Pulmonalis*, published last year, I refer to some of these conditions, and make the statement that in a series of cases observed by me, local tuberculosis of the kidney occurred as a complication of phthisis pulmonalis to the extent of about 3 per cent., and that tubercular peritonitis occurred in a somewhat similar percentage. These observations were made almost entirely in adults, but I am inclined to think that the organs of children show a much greater susceptibility to tuberculosis than do those of adults. When tuberculosis exists in children it is not uncommon to find, in addition to the primary disease, let us say in the lungs, a tuberculosis in bones, kidneys, and elsewhere, but seldom or never in the liver. In this way what Weigert has called a chronic general tuberculosis is established, this condition being nothing more than a series of local tuberculosis. This condition, occurring as it does mostly in children, would indicate either that their organs are more susceptible than those of adults, or else that in them the bacilli find their way in larger numbers into the blood. It is possible that in the growing tissues the blood vessels are more easily penetrated by the bacilli than in the mature tissues of adults.

There is still another matter which rather complicates the position in regard to tuberculosis. I believe that tuberculosis in man is always, to begin with, a local disease, and is preceded by a local susceptibility, but in some cases at least a general want of vigour in the body as a whole—a general constitutional weakness—precedes and apparently determines the local weakness. It is natural that any local constitutional weakness should be emphasised by a general deterioration of the health. On the other hand, it must be admitted that there are persons who show such a pronounced proclivity to phthisis pulmonalis that they are attacked in spite of an apparently robust condition of the general health. These are chiefly cases of inherited susceptibility, in whom also the local susceptibility is sometimes shown to be very great by the rapidity with which the disease extends.

CONSTITUTIONAL NATURE OF CANCER.

When we come to the question of constitutional susceptibility to cancer, we encounter many difficulties, partly because the causation of cancer is exceedingly obscure, and partly because till late years the delimitation of this form of disease was very indefinite; partly also, as we shall see, because in the process itself there are involved somewhat contradictory phenomena. As the constitutional nature of cancer is a matter of great consequence, it may be well, even at the expense of a little extra time, to look some of these difficulties in the face, and endeavour to formulate the position.

Cancer, in modern pathology, means a malignant epithelial tumour. The multiplying epithelial cells take origin from the existing epithelium, but do not respect the normal bounds, growing into and penetrating the underlying and surrounding tissues. The tumour hence takes origin in epithelium or epidermis, and its seats are the skin, mucous membranes or canals, and epithelial glands, to which may be added as rare situations the cavities of the brain, the pleura, and the peritoneum. The cancer always begins in a definite local centre, and spreads from that. It is, I believe, a fact of universal application that, however widespread may be the ultimate extension of the growth, it is all to be traced more or less directly to the primary local nest, the secondary tumours being in all cases grafts from the primary one². This relation to the primary tumour is frequently evidenced by the structure of the secondary ones, as these usually imitate very closely in their details the special characters of the original growth. It will be seen from this that cancer is primarily in all cases a local growth, and in speaking of susceptibility this must be taken into account.

I have mentioned that cancer consists in an excessive growth of epithelium, but it is a curious and apparently contradictory fact that it occurs most frequently when the natural forces of the body may be supposed to be diminishing. It is a disease mainly of the latter half of life, and it occurs with particular frequency in organs which undergo a specially early senile involution—the mamma and the uterus. The disease thus connects itself with senile changes, in this respect presenting some analogies with atheroma. There is, however, this distinction, that cancer is not common in advanced life, being rather a disease of vigorous middle or later life.

In regard to the connection of cancer with senile changes, a very ingenious explanation has been suggested by Thiersch, to the effect that the overgrowth of epithelium may be due to a falling off in the resistance of the neighbouring tissues rather than to an excessive vigour of the epithelium. The epithelial tissues are, as a rule, peculiarly active all through life, multiplying so as to make up for the losses by desquamation or secretion. Under normal conditions the multiplying cells are restrained from penetrating downwards by the active underlying structures, chiefly the connective tissue. If this activity diminishes then the epithelium may take advantage of this circumstance and assume malignant characters in its growth. I do not think this is a sufficient explanation of all the facts, but it seems not improbable that it enters into the somewhat complicated problem. There is no doubt that the seat of a cancerous tumour has a great deal to do with the vigour of its growth. A cancer which grows slowly in the wall of the stomach, for example, sometimes grows with extraordinary vigour when transplanted to the liver. It is very possible therefore that the condition of the tissues underlying the epithelium may have an important bearing on the origin of the tumours.

We have, then, two possible forms of constitutional susceptibility to consider, namely, an excessive tendency to growth on the part of the epithelial tissues, and a diminished power of resistance in the underlying structures.

The latter condition, due in many cases to senile changes, will very frequently be local. I have already alluded to the fact that organs, such as the mamma and the uterus, which undergo a senile involution at a specially early period, are prone to cancer. It is as if the constitution of the organs, as altered by the process of involution, rendered them specially susceptible. We have also such facts as the occurrence of epithelioma in cicatrices, indicating that the existence of an imperfect connective tissue instead of that of the true skin renders the part specially susceptible to cancer. Again, the history of many cancers of the stomach, for example, is that of a prolonged dyspepsia. This implies a chronic inflammation of the stomach and a new formation of dense connective tissue in its wall. We may suppose that this change in the constitution of the wall will, as in other cases, render it unduly susceptible. The same applies to cancer of the lip and of the scrotum, induced, as they generally are, by special irritations. In so far, therefore, as senile or inflammatory changes in the underlying connective tissue influence the causation of cancer we may suppose that their action is local.

When we turn to the other factor the relations are scarcely so definite, this factor being a tendency to excessive activity in the epithelial structures. The cancer depends on a local manifestation of this tendency, but the tendency may itself be either general or local. We have seen that senile changes in arteries, although they may be extensively present, lead to the occurrence of atheroma only in certain localities. We may suppose in the case of cancer that there may be either a general or a local tendency to excessive growth of the epidermic or epithelial structures, which comes into effect as the cause of cancer when other causes coincide. There are several facts in connection with the diseases of the skin which indicate that the epidermis as a whole may present special constitutional susceptibilities. One of the most interesting of these is the disease ichthyosis, in which the epidermis presents an excessive or peculiar growth. The constitutional character of this is shown by the very striking manner in which it is transmitted by inheritance. We may suppose then, in some cases, a special tendency in the epidermis as a whole, or in the epithelium of the alimentary canal as a whole, towards cancerous development. We should expect such a tendency to be inherited. Whether it may exist both in the epidermis and in the epithelium, and whether it may extend to the epithelial glands, is much more problematical. The position of inheritance in the causation of cancer might be expected to throw some light on this subject. We should expect, if the tendency is confined to the epidermic structures on the one hand, or to the epithelial structures on the other, that when a cancer is inherited its situation would only vary from one locality of these structures to another, as from one part of the skin to another, or one part of a mucous canal to another. These are points, however, which I do not think are sufficiently elucidated, especially in view of the great divergence of opinion which exists in regard to the influence of inheritance on the causation of cancer.

There is one thing, however, which I may mention in regard to the constitutional tendency of the epithelium to the development of cancer—namely, that amongst the epithelial glands great differences of susceptibility apparently exist. The hepatic cells, for instance, I believe, very seldom, if ever, give rise to cancerous growths, the rare primary cancers of the liver taking origin rather in the ducts than in the parenchymatous cells. In contrast with this is the frequency of cancer in the mamma.

I am conscious that much of what I have been saying in regard to cancer is vague and unsatisfactory, but it is what has occurred to me, on looking closely at the facts, as the only possible modes in which constitutional susceptibility can exist. I have thought it worth while to formulate these considerations, because I am aware of an undercurrent of belief in a vague general constitutional susceptibility which disappears when we look at the facts.

The belief in a general constitutional susceptibility is associated in the minds of some with the frequent recurrence of cancer after removal, as if this were evidence of an ineradicable tendency to cancer. I believe this to be an entirely mistaken view. I am convinced that, except in the very rare case of the coexistence of two primary cancerous tumours in the same person, all cancerous growths are directly connected with the primary local tumour.

² See an exposition of this view by the author in a discussion on cancer, in the Pathological and Clinical Society of Glasgow, *Glasgow Medical Journal*.

When a cancer recurs, it is because some part of the growth has been left in. The recurrence is in the neighbourhood of the original tumour, or in the connected lymphatic glands—this itself indicating a direct connection with the primary tumour. When we consider that a cancer consists of vigorously growing epithelium, which has a special tendency to propagate into the lymphatics, and so to send offshoots or grafts into parts around, we can scarcely be surprised that complete eradication is so difficult. When once the epithelium has broken bounds, and has been transplanted to parts which may be more favourable to its growth than its natural site, then it will frequently be impossible to determine the limits of its extension.

I have said so much as to the constitutional tendency to cancer. The determining cause is frequently stated to be a local injury or irritation. Such injury or irritation may produce changes in the connective tissue such as I have already referred to, and it is possible that the coexistence of the two factors already considered may determine the occurrence of the disease. It is possible also that injury or irritation, while damaging the more inert connective tissue, may stimulate the more active epithelium.

I need hardly add that cancer frequently induces a very serious constitutional state, leading on to a fatal issue. The so-called cachexia is, however, a secondary result of the cancer. This is manifest enough in the case of external cancers. We are familiar with the fact that cancer of the mamma or of the lip or larynx frequently shows itself in persons of robust general health, and that the constitutional decadence is often the result of a long struggle between the vigorous vitality of the individual and the inroads of the disease. The cancer leads to these effects by ulceration, by using up the nutritious material of the body in its growth, and by extending to parts which are important in the economy. There is the important distinction in these secondary effects from those in tuberculosis, that, as cancer is not associated with a specific microbe, there are no poisonous alkaloids evolved, and there is consequently no fever, as a rule. In the case of internal cancers, which are concealed from view, the constitutional effects may be manifest before the local cancer is discovered. It is not infrequently the office of the pathologist to find a large and old ulcerating cancer of the stomach, whose existence had by no means been certainly distinguished during life.

CONCLUSION.

The subject on which I have entered is an exceedingly wide one, and I am only controlled in my efforts to expound it by considerations of time and space, as well as of your patience. I had intended, for instance, to enter more particularly on the subject of immunity to certain diseases, as determined by constitutional susceptibilities, a subject already hinted at in speaking of the susceptibilities of the liver, and a subject also which has received much elucidation in my mind from the interesting observations, already referred to, of Metschnikoff, and of the no less remarkable investigations of Pasteur into the nature of certain vaccines. I must however conclude my remarks, but before doing so I may, in a sentence or two, sum up the deductions which appear to me to follow from what I have adduced.

The constitution or frame of a man or animal is made up of a multitude of local items, each of which is liable to variation in structure and function within normal limits. These variations form the *differentie* of species and of individuals, and they are generally subject to inheritance. Susceptibility to disease varies greatly in different men and animals, and this variation is correlated to the structural and functional peculiarities which determine the differences of constitution. The individual organs of the same animal show very different degrees of susceptibility to certain diseases, as is shown by the relations of the liver and lungs of man to tuberculosis, syphilis, and cancer. In different individuals of the same species of animal, also, the same organs, such as the lungs or liver, vary greatly in susceptibility to disease. Finally, as such diseases as tuberculosis and cancer are, in man, primarily local, susceptibility to them must be related to local constitutional peculiarities in the situations primarily attacked.

THE Calcutta Jubilee Fund has made over 20,000 rupees to the local Dufferin Hospital, and a further balance will shortly be devoted to the same object, thus exhausting the fund.

NATIONAL PENSION FUND FOR NURSES.—Mr. W. Rathbone, M.P., and Mr. Jonathan Hutchinson have become Vice-Presidents of the National Pension Fund for Nurses, and Dr. Broadbent has been elected a member of the Council.

AN ADDRESS

DELIVERED AT THE OPENING OF

THE SECTION OF OPHTHALMOLOGY.

At the Annual Meeting of the British Medical Association, held in Leeds, August, 1889.

By ANDERSON CRITCHETT, F.R.C.S.ED., M.A.CANTAB.,
Senior Ophthalmic Surgeon to St. Mary's Hospital.

ON THE TREATMENT OF IMMATURE CATARACT.

GENTLEMEN,—When the history of the nineteenth century comes to be written in its entirety, the phenomenal growth of scientific knowledge will, I doubt not, be placed upon permanent and honourable record; and, although it represents only a small unit amidst the multitude of the sciences, I think I may venture to claim for ophthalmology that it has not "lagged reluctant in the race."

It is indeed almost impossible for us at the present time to conceive the difficulties which were encountered and successfully overcome by the pioneers of ophthalmic surgery. When we remember the wonderful results which they achieved although unaided by the ophthalmoscope, by any accurate knowledge of optics, by cocaine, by the galvano-cautery, or by the numerous instruments of precision which we now possess, we must indeed marvel, as did the Israelites of old when the mighty giant was laid low by a sling and a stone.

Time has, alas, robbed us of most of those who commenced their labours in that, which we may perhaps term the pre-ophthalmoscopic, period, and it seems difficult to realise that our honoured friend, Professor Donders, who presided only a year since with so much native dignity and urbanity over the International Ophthalmic Congress at Heidelberg, and whose mental and physical vigour gave promise of days extended beyond the ordinary span, now lives but in the cherished memory of a noble and beneficent career. He has left us the example of a blameless life, devoted not alone to abstract scientific research, but also to the practical development of those great discoveries in optics which have conferred such lasting benefit upon mankind; of him we may indeed say with truth "*Vir nullâ non donandus laurâ*."

And now with reference to the work which lies immediately before us, I feel I may congratulate this Section upon the very interesting list of papers which we are promised, and which will, I doubt not, be the cause of much profitable discussion.

I will not intervene at any length between you and so appetising a mental feast, but I desire briefly to allude to a subject the importance of which is, I think, becoming more and more recognised by ophthalmic surgeons; I mean the best method of dealing with immature cataracts. Each one here present must, I feel sure, have met with numerous cases where not a little hardship has been endured, not only by the individual sufferer, but also by those who are dependent on him where the patient is the bread-winner, when cataract has become so far advanced as to seriously interfere with the pursuit of any occupation, but is not sufficiently mature to render an operation justifiable. A few years since the outlook for such a patient was exceedingly gloomy, for the ophthalmic surgeon, influenced by most worthy and conscientious scruples, could only advise postponement till a more convenient season, which sometimes occupied many years in its advent, until at length hope repeatedly deferred became supplanted by despair, and the unfortunate patient too often drifted into the hands of some unscrupulous charlatan, who robbed him of his already diminished resources under the cover of specious promises which could never be fulfilled. Within the last decade great practical advances have been made in several directions towards a solution of the difficulty, and we may broadly divide the recognised operative methods into two classes—that which deals with the immature cataract by immediate extraction, and that which involves an artificial ripening of the lens before its removal. Amongst those who are adherents to the first-mentioned plan I may mention Mr. Tweedy, Mr. Couper, and Dr. McKeown. More than eight years since, at Moorfields, Mr. Tweedy removed an immature cataract from a respectable artisan, who had to no slight extent forced his hand by declaring that, if no surgical aid could be afforded him, he must enter the workhouse and remain there till the eye was ready for an operation. Referring to