minds free from prejudice in such matters; and, when you hear any method of treatment, which has been tested by experience, assailed by arguments which are absolutely inconsistent with one another, let me, slightly altering the scriptural injunction, say, "Go thou and do *otherwise*."*

MALIGNANT TUMOURS AND PARASITISM.

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AT a meeting of the Pathological Society, I expressed the opinion that, not improbably, many of the malignant tumours are due to the presence of micro-organisms; in other words, that malignant tumours are of parasitic origin. The theory of parasitism, applied to tumours, has during centuries been more or less popular with surgeons; for in no other way can some of the most complicated processes of malignant tumours be so well explained, as by assuming that the tumours or their elements are parasitic. But of late years the parasitic theory has been discredited by the discovery that the elements of even the most malignant tumours are derived more or less directly from the natural tissues of the body, and that they differ only in degree, and, perhaps, in certain properties which they have acquired from the natural elements. It is quite clear, therefore, that the view, formerly maintained, that malignant tumours are actually parasites is incorrect. But the recent discoveries of micro-organisms, and of the part they play in relation to certain diseases, have led me to consider whether the theory of parasitism may not again be applied to malignant tumours, with this difference, that the tumours are no longer now conceived to be the parasites, but to contain them. I am perfectly aware that all the evidence which can at present be adduced is only indirect or circumstantial; for, so far as I am aware, no parasites have yet been proved to exist in the malignant tumours of the human subject. But there are two, if not three, directions in which circumstantial evidence may be employed.

First, there is the resemblance of the processes of malignant tumours to those of certain diseases which are due, or are reputed to be due, to micro-organisms.

Thus, the group of infection-tumours,[1] which have lately been attributed to the action of micro-organisms, contains examples of growth which resemble in their processes many of the malignant tumours. Of these diseases, tubercle is so closely allied, in some of its important properties, to sarcoma and carcinoma, that it is difficult to discover any essential difference between many cases of tubercle and many cases of sarcoma and carcinoma originating in the same part of the body. Virchow, in a masterly summary of the characters of tubercle,[2] has admitted this similarity, and has expressed the opinion that tuberculosis is a malignant tumour-disease. Infiltration of surrounding parts, affection of the neighbouring lymphatic glands, dissemination in other organs and tissues, are the characters which are common to malignant tumours and tubercle. Certainly, the small size of tuberculous tumours, the frequency with which they are associated with inflammation, and their tendency to caseation, distinguish most cases of tubercle from most cases of malignant tumour. But large tuberculous tumours, with which neither inflammation nor caseation is associated, are not by any means unknown. During the past few years, actinomycosis,[3] which was formerly regarded as a sarcomatous disease, has been added to the number of the infection-tumours, chiefly, if not solely, on account of the discovery in the large tumour-masses of what appears to be a micro-organism. Until this discovery, actinomycosis appeared to be a sarcomatous disease, as surely as any other well recognised sarcoma of the lower animals.

Second, in order to explain the glandular affection and dissemination of malignant tumours, the presence of an infective agent has been assumed by many pathologists.

This agent has been supposed to be cells, or nuclei of cells, derived from the primary growth. It has been thought to be a fluid; and more than once, of late years, the term seminium has been employed to denote this unknown infective agent. Many reasons render it improbable that the infective agent, or seminium, is, in all instances at least cellular: the large size of the cells in some carcinomata, for example; and the fact that neither cells nor nuclei, both of which are easily recognisable, are discovered in the blood or lymph. Reasons equally strong may be adduced against the theory that the infective agent is a cancerous fluid; among them are the large dilution to which such a fluid would be subjected, and the probability that general dissemination would be produced by a cancerous fluid quite as often and as early as glandular affection.

Evidence has of late been forthcoming which leads to the belief that the infective agent or seminium is, perhaps, molecular or granular. Clauzel[4] has shown that blackish and brown granules occur in the blood, the urine, and the vomit, of persons who are suffering from disseminated melanotic cancer. These granules are found in the colourless corpuscles and serum of the blood, and in epithelial cells in the vomit.

Chlorosis, or green cancer, a round-celled sarcoma, characterised by its green colour and rapid dissemination, is said to contain, either in or between the round cells of which the growths consist, large numbers of minute and highly refractile molecules.[5]

Gussenbauer,[6] in an excellent paper on glandular affection, attributes the infection of the tissues of the lymphatic glands to the presence of vast numbers of molecules derived from the primary disease. These molecules, according to the author, are easily distinguishable from the fatty molecules contained in cancer-cells. They are very small, rounded, and pale, and do not take up the staining fluid well. They are found in the lymph-paths, in the reticulum, in the lymph-cells, in endothelioid cells and muscle-cells. In glands secondarily affected by melanotic sarcoma, the molecules are, for the most part, of the typical melanotic colour. To Gussenbauer, these molecules are the fructifying germs (*befruchtende Keime*), the seminium of the carcinoma or sarcoma.

The molecules described by Clauzel, Hubert, and Gussenbauer may, of course, be merely products of degeneration of cells of the individual tumours, or of the tissues in which they grow. They appear, however, to differ in certain respects from the degeneration-products, as has been shown. Their abundance; their appearance, not only in cells, but in other structures; their occurrence in the fluids during the dissemination of melanosis, render it not improbable that they are in some way connected with the dissemination, or are, indeed, the means by which the disease is disseminated through the body. The size and shape of the molecules induce one to advance one step further, and to wonder whether they are the individuals, or, perhaps, the spores, of a tumour-micro-organism. The manner in which they penetrate into the interior of cells and other solid structures favours this view. And the colour of the tumours in chlorosis and melanosis may be, perhaps, explained on this hypothesis better than on any other, for the colour-producing properties of certain of the micro-organisms are now well-known.

Third, certain circumstances relating to the localities in which malignant disease is prevalent, may perhaps have some bearing on this question.

Mr. Haviland[7] has shown that the mortality from cancer is highest in those districts which are high and dry, and geologically composed of non-retentive soils.

In his *Statistische Mittheilungen über den Brustkrebs* (Breslau, 1879), Dr. Arthur Henry, speaking of the endemic and telluric conditions which appear to influence the occurrence of cancer of the breast in the region around Breslau, says that it is a striking circumstance that in the Upper Silesian mountain-works the disease is exceedingly rare.

A still more singular circumstance has lately been noted by Dr. Hesse, who relates that the men who work in the cobalt-mines of Schneeberg are subject to lympho-sarcoma affecting primarily the lungs.[8] The disease attacks men who have been working in the pits for a certain number of years, and few escape when the term of years has been reached. The persons, on the other hand, who reside in the neighbourhood of the pits, but are not employed in them, are not more liable to primary malignant disease of the lungs than are

* In a recent contribution to a contemporary, Dr. L. Kay-Shuttleworth of San Remo states: "I was much struck with the fact that, in the great majority of cases, where carbolic inhalations were used with an oro-nasal inhaler in sufficient quantity, a great diminution in the number of bacilli took place; and that, though from time to time fresh crops appeared, these, when the inhalations were continued, regularly but gradually diminished, both in frequency of occurrence and in the relative number of bacilli." These valuable observations of Dr. Kay-Shuttleworth accord with my own experience and that of many other observers who have diligently and carefully followed this method.

[1] The infection-tumours include leprosy, lupus, syphilis, tubercle, glanders, and actinomycosis.

[2] *Krankhaften Geschwülste, Vorles.* xxii.

[3] Virchow's *Archiv*, Band lxxxiv, p. 303; *Breslau. Ærztl. Zeitschr.*, 1880, No. 12.

[4] *Thèse de Paris*, 1874. *See* Schmidt's *Jahrbücher*, 1880, Band clxxxv, s. 100.

[5] *Archiv der Heilkunde*, 1878, Band xix, s. 129 (Hubert).

[6] *Zeitschrift für Heilkunde*, 1881, Band ii, s. 17.

[7] *Journal of the Society of Arts*, No. 1367, vol. xxvii, 1879.

[8] *Archiv der Heilkunde*, Band xix, p. 160; and Eulenberg's *Vierteljahrschrift*, Band xxx, p. 296, Band xxxi, p. 102.

persons in mountain-districts generally. Dr. Hesse has described some cases of this disease, with details of the microscopical and other characters of the tumours. If, as I have assumed, malignant tumours depend on the presence and development of micro-organisms, the low, damp, close, and warm localities are those in which such organisms might fairly be expected to thrive, while the high, dry, and open situations are just as little favourable to their development. The cobalt-pits of Schneeberg, perhaps, contain a tumour-organism which enters the body with the air, but requires for its development and complete action frequent and long contact with the lung-tissue, with such favourable conditions as those afforded by advancing age, etc.

There are, of course, several important objections to the acceptance of the parasitic theory; and since the subject should be regarded in a thoroughly impartial manner, it is only fair to state the chief of those which have occurred to me. Some of them may be easily met, but others are exceedingly difficult to explain away.

In the first place, although scrapings and sections of tumours have been examined during half a century, no tumour-organism has yet been discovered, or at least recognised. To this the answer is, that all our knowledge of the relations of micro-organisms to disease is only a few years old, and that the micro-organisms of the infection-tumours have quite recently been discovered. Because tumour-organisms have not yet been discovered, it by no means follows that they do not exist.

Again, the growths produced by organisms at present known, exhibit for the most part a simple round celled or adenoid structure; and I am not aware of any micro-organism which produces new growths of epithelial structures, or new growths of so singular and complex a structure as that found in many specimens of malignant tumour. If these tumours be produced by the action of micro-organisms, the organisms must act not only upon tissues of many different kinds, but with an influence weakened by being shared with that exercised by the mother-tissue. To explain the resemblance of the secondary tumours to the primary growth, this same influence of the mother-tissue must be again invoked; the micro-organism excites the growth of a tumour, but becomes itself so far infected by the influence of the mother-tissue that, whatever tissues it afterwards affects, it is compelled to transform into a structure resembling that of the primary disease.

Malignant tumours are not, so far as we know, contagious or inoculable. But, in truth, all our experiments—and they are very few and incomplete, are far from conclusive on this point. The inoculability of tubercle has only lately and with difficulty been established; its power of infection or contagion has not yet been clearly proved. Nevertheless, we are gradually coming to believe that tubercle is due to the presence of a micro-organism. It is probable, if tumours be inoculable or contagious, they are so only under very peculiar and favourable circumstances.

The inheritance of malignant tumours can scarcely be explained on the assumption that they are due to parasites. The inheritance of malignant tumours is supported by evidence which, at first sight, seems incontrovertible, and by men of the first rank as thinkers in our profession. Certain doubts have, however, of late arisen regarding the influence of inheritance; and, if we exclude those cases in which cancer has attacked a large number of individuals of the same family, the general statistics of inheritance will not bear a minute scrutiny. On this subject, Mr. Haviland deserves attention.[9] He suggests that, if whole families were to migrate from the low-lying grounds in the proximity of rivers to high dry sites, we should not hear so much of the hereditary character of cancer. "We never," he says, "hear of ague being hereditary. Father, son, and grandson have ague one generation after another whilst living in an ill-drained fever-district; but send them to the hills, and their plague disappears; so may it be with the mother, daughter, and granddaughter afflicted in their lives with cancer, whilst living from generation to generation under the same climatic conditions, on the same geological site, and on the banks of the same seasonally flooded river."

Again, it may be objected that malignant tumours occur primarily in organs and tissues which are distant from any surface directly connected with the exterior; that, for instance, they grow deep down in the substance of the muscles, in the intermuscular septa, and in or upon the bones. There need, however, be no difficulty in comprehending that organisms, minute and active as the bacilli and bacteria, may be conveyed by the blood to any vascular tissue, and even traverse the structures between the vessels.

Among the facts most difficult or impossible to explain on the theory of parasitism, are the relations of malignant tumours to age. There are, of course, many reasons why certain organs and tissues should be more subject to disease during adult life than during childhood: the organs of generation, for example. But there is no conceivable reason why the epithelium of all parts should be almost exempt from cancerous disease in persons under twenty-seven or thirty years of age, and no reason why the connective tissue of the testis should be more subject to sarcoma in children under ten and in adults over thirty-five than at any other period of life. Neither parasitism, nor any other commonly accepted theory of malignant disease, offers an explanation of these and similar strange features in the life-history of malignant tumours.

[9] *Loc. cit.*

ON THE PRINCIPLES OF THE CONSTRUCTION OF CHAMBERS FOR INHALATION IN DISEASES OF THE LUNGS.

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THE comparative inefficiency in diseases of the lungs of the methods of inhalation now in use, by means of oral and oro-nasal inhalers, by the vapour of hot water and by steam and air sprays, renders it very desirable that other and better means of inhalation should be devised and employed.

It appears to me that the most effective and natural method of inhalation which can be adopted is by a chamber, the air of which is charged with the antiseptic or other medicament which it is desired to employ. So far as I am aware, no such chambers have yet been devised and constructed; the reason, no doubt, being the apparently insuperable difficulties which have hitherto been presumed to stand in the way. Attached to some few of our hospitals there are, indeed, what are called "inhalation-chambers," but these can scarcely be said to deserve the name; they are, for the most part, simply chambers supplied with steam, in which a number of persons are enabled to inhale medicated steam-sprays at the same time and in the same apartment.

The following are the conditions and principles of the construction of a true inhalation-chamber. First, the dimensions of the chamber should be moderate, and in some cases even small; and this because of the difficulty there would be in charging with medicaments a very large space, and also on account of the great quantity of the drugs which would be required for the purpose. Secondly, the fireplace to the chamber should be closed, and the inlets and outlets to it should be only those of ordinary and moderately well-fitting doors and windows; and this because, if the air of the room were rapidly changed, of the difficulty in keeping the air charged to any given extent, and of the great waste of material which would take place. It will be well, however, that every chamber should be provided with one or two small outlets, to enable those inhaling to get rid of the used or foul air emitted during expiration; the air of the chamber itself being thereby maintained in a state of greater purity. For this purpose, nothing more would be necessary than a piece of elastic tubing furnished with a covering for the nose and mouth. Thirdly, the temperature of the room should be kept at about 19° Centigrade = 66° Fahrenheit; this regulation of the temperature is requisite, in order that the volatilisation of the substances used should proceed at one fairly uniform rate. Fourthly, the air of the room should be somewhat humid, the degree of humidity being ascertained by means of wet and dry bulb thermometers; a moderate but not too great an amount of moisture in the room is desirable, since it promotes evaporation.

I now come to consider the means whereby the air of the chamber is to be charged with suitable medicaments; this hitherto has been the one great difficulty, the solution of which, beyond the employment of large steam or air sprays, so far as I know, has not yet been rationally attempted; at all events, it has not been successfully carried out.

It occurred to me that, if any substance possessing even a feeble volatility at ordinary temperatures were dissolved and spread over a very large surface, the amount of the substance which would become volatilised would be in proportion to the quantity taken, the extent of the surface exposed, the temperature of the chamber, and the amount of the moisture therein contained.

To test this point, 50 grammes of carbolic acid (= 771 grains) were dissolved in water, two Turkish towels being saturated with the solution and exposed to the air of a room at a temperature of