SCIENCE

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THE SUPPRESSION OF CONSUMPTION.

WE have in consumption to deal with a disease that causes upwards of 60,000 deaths every year in the United Kingdom; and it is estimated, on the basis of three invalids for each death, that about 200,000 persons suffer from it within that period. This disease pervades all ranks of society, from the mansion of the rich to the cottage of the poor, and it attacks in its course childhood, youth, maturity, and old age. Can we suppress consumption,—a disease that has so wide an area of distribution, and that possesses such a fatal character? I have come, after due and careful investigation of the subject, to the conclusion that we can. The issue here raised is of immense importance. It is a question of life or death for hundreds of thousands; and I earnestly request careful consideration of the evidence I shall adduce in support of the case, which, I say, not only completely justifies, but also necessitates, the conclusion that we now have it in our power to suppress consumption. And I would at once note the fact that there is no essential reason why that should not be accomplished. Man is not born to die from this disease, and, in fact, from four-fifths to six-sevenths of the race do not. We have unquestionable evidence that consumption has been completely recovered from, that a considerable reduction in its amount has been effected in some cases (for example, among prisoners), that it has been arrested for longer or shorter periods, and that persons with the signs of the disease have been able to completely escape from it:[1] consequently we must sooner or later ascertain the means by which that has been effected, and then we shall apply that knowledge to the prevention and cure of this disease.

What is the cause of consumption, and how does it operate in the production of the disease? The authorities have from time to time propounded theories that were said to give satisfactory information on these points. I take as examples of these theories the following:[2] climate, a certain height above the sea-level, cold, change of temperature, impure air, night air, carbonic acid, bad or insufficient food or clothing, dyspepsia, the non-assimilation of fat, diathesis, disease of the nerve-centre, cough, catarrh, bronchitis, pneumonia, pleurisy, dampness of the soil, inheritance, the *Bacillus tuberculosis*, etc., and ask, Does any one of them afford adequate information on these points? Submit them to critical examination, and the answer to this question is an emphatic negative;[1] for they either have no foundation in fact, or have for their basis conditions that, on the one hand, occupy so wide an area of distribution that they include within their sphere of action a large number of persons who have never shown any signs of the disease, and, on the other, are so limited in the field of the disease that they are only found associated with a greater or less number of its cases, and consequently can afford no adequate explanation of its cause and mode of operation. So obviously, indeed, is this the fact, that I shall only note a few of them in passing, and then examine in detail the important, because it is popular, theory of Koch.

Is consumption limited to, or even more prevalent in, any particular climate? No: the disease is co-extensive with the civilized world. Truly, consumption is more prevalent below than above certain altitudes, but within the same limits the vast majority of the human race is living free from the disease. Further, while on the one hand consumption is found at high altitudes, as in Madrid and in certain cities in South America, on the other it is unknown in certain tribes inhabiting districts below the sea-level in Asia. To cold and change of temperature has generally been assigned an important place. That is an error; for in cold climates, as in Canada, Sweden, and such places, as well as in the classes most exposed to cold, there is little consumption, and in the severe winter of 1854–55 more men died from it in the barracks at home than in the camp before Sevastopol; and a similar argument may be held with regard to the causal influence of change of temperature.

The majority of those who breathe impure air, night air, or who have bad or insufficient food or clothing, etc., do not get consumption; and the same fact holds good for the diseases that are alleged to produce it. What an appalling amount of consumption there would be if every one who had a cough, or who caught a cold, became consumptive! Dampness of the soil is another alleged cause of this disease, but in the cases cited in proof of that theory drainage was not the only factor that was present. We know that as parts of Lincolnshire get drained, ague disappears, and consumption takes its place; and we have the same fact in America and in Switzerland.[2] There was the least consumption in the most wet department of France. Consumption

[1] Sydenham, Walshe, Laennec, Heitler, Roger and Boudet, Ewart, Friennd, Fuentes, Blake, Herman Weber, Cruveilhier, Pollock, Austin Flint, Fuller, Stokes, etc.

[2] Williams, Fuchs, Murrhy, Bouilland, Scot-Allison, Briquet, Boyle, Baudeloque, Bucheteau, Shephard, MacCormac, Ruehle, Herard and Cornil, Bouchardat, Bennett, Hutchinson, Brakenridge, Dobel, Lebert, Lugol, Allbut, Roberts, Memeyer, Clark, Williams, Broussais, Grisolle, Buchannan, Bowditch, Thompson, Cotton, Roberts, Koch, etc.

[1] Louis, Hanot (Jaccond's Dictionary), Andrew, Pollock, Ziemssen.

[2] Haviland, Kelly, Green (U.S.A.), Damaschind.

is comparatively rare in pure wet, undrained districts, and a majority of consumptive patients have not been subjected to the influence of dampness of the soil. The theory of the inheritance of consumption is still generally accepted, although no evidence has been adduced in its support. At birth the child of consumptive parentage has the same type of chest, the same proportion of chest-girth to height, as that possessed by children of healthy parents, and there are no means of distinguishing the lungs of the one from those of the other. The fact that some of the children of consumptive parents subsequently themselves suffer from this disease is not evidence that consumption was transmitted from the parents to those children. A large number of children, even where both parents have died from consumption, remain absolutely free from it.[1] Is it so unreasonable to expect the conditions that produced the disease in the parents will later on repeat the process in those of the children that are submitted to their action, that we must resort to a pure hypothesis for an explanation of those facts? The theory is only alleged to account for a small part of the cases of consumption, and we cannot accept an hypothesis where we already have a reasonable explanation of the subject.

I pass now to the theory that the *Bacillus tuberculosis* is the cause of consumption, and I ask, What evidence is there to prove this theory? Koch[2] experimentally introduced the bacillus into a number of animals, some of which were invariably attacked by consumption, others had a greater or less liability to it, and the remainder were totally free from the disease. We have to examine the successful experiments. They were made upon animals that were most liable to "spontaneous" consumption, and their value rests upon the fact that the animals that were not inoculated were found healthy. Now, Koch himself noted, that, if these animals were kept too long before they were inoculated, they also became diseased. So there was only a difference of time between the inoculated and non-inoculated animals that became consumptive, and consequently the value of the so-called "control" evidence entirely disappears.

What produced consumption in the non-inoculated animals? According to the theory, the inhalation or other introduction of the bacillus. Just so; but where is there any evidence of that? The previous experiments do not prove that the bacillus can produce consumption, and to offer that explanation is to assume the precise point the experiments were intended to prove.[3] Further, these animals were subjected to the conditions of confinement. What effect did those conditions produce on the animals? Koch ignored them and their effects, and by so much vitiated his conclusion, even if that conclusion had been otherwise established. The bacillus, its containing medium, or the changes effected, were evidently powerfully irritant; and it would indeed be surprising if, when introduced into animals so liable to consumption and subjected to the conditions of confinement, the disease were not both more rapidly manifested and of a more extensive character. Therefore Koch's experiments do not in any way warrant the inference he has drawn from them; and once again a great discovery has had its true import temporarily overshadowed by a misinterpretation of its real significance.

How does this theory accord with the known facts of the case? Tubercles in various stages, young and adult, are found in which there are no bacilli, while in the same specimen caseous tubercles may be present containing bacilli.[1] There are cases of consumption in which the bacillus is absent both during life and *post-mortem*.[2] The physicians, clinical clerks, nurses, *post-mortem* room attendants, and those who clean the wards of consumptive hospitals, are not attacked by the disease.[3] Patients suffering from bronchitis, pneumonia, etc., occupy beds adjoining consumptive patients for long periods, but they do not become consumptive. The friends of patients who regularly visit them in these institutions do not get it. Some wards at Brompton had their ventilating-shafts stopped, but no attack of consumption followed either in the patients suffering from other chest complaints or in the attendants.[4] These institutions are not centres from and around which the disease spreads. Yet here are the most favorable conditions for its rapid and unquestionable propagation; and we have only to substitute small-pox, scarlet-fever, or any of the infectious diseases for consumption in the above conditions to realize what must happen if it were an infectious disease. And so widely is this bacillus distributed, so tenacious is it of life, and so constantly are we, especially when suffering from respiratory diseases, exposed to its action, that on the assumption of its potency it is impossible to account for the comparative smallness of the number of consumptives.

We pass from these contradictory and most unsatisfactory theories to the consideration of one that is both in strict accord with and capable of affording an adequate explanation of all the known facts of the case. The theory my investigations have led me to hold may be stated as follows: that consumption is the direct result of the reduction of the breathing surface of the lungs below a certain point in proportion to the remainder of the body, and is solely produced by conditions that tend to reduce the breathing capacity.

I have experimentally produced consumption by these conditions. On one occasion I took a well-developed chest, and gradually submitted it to conditions that tend to reduce the breathing capacity, and at the same time, so far as possible, placed impediments to the performance of compensatory action by other organs. At first there was a reduction of the chest-girth, a wasting of the muscles, a loss of the range of extension, the well-known change in shape, and increased frequency of breathing. This was soon associated with catarrh, pain in the chest, steady loss of weight, and hectic; and the process was continued until I was satisfied that consumption was well established. Then I induced compensatory action by other organs, and submitted the lungs to conditions that tended to develop them. This was followed by great relief in the chest symptoms, which eventually completely disappeared, by a restoration of the general health, a return to the normal weight, a change in the

[1] Thompson.

[2] Report of Koch's Experiments (British Medical Journal), Watson, Cheyne, Spina (*Sutler*).

[3] Cadeal and Malet's Experiments (British Medical Journal), Brown-Sequard's Experiments (Lancet).

[1] Klein.

[2] Spina, Sir Andrew Clark.

[3] Pollock, Cotton Andrew.

[4] Pollock.

shape of the chest in an opposite direction; and I continued the process till the chest had regained its full development and there was sound health. Each step in the experiments was carefully verified, the same sequence of events was invariably observed, and I have both traced the presence of these conditions and watched their progress in many cases of consumption.

We can at any time watch the direct production of consumption by the constant inhalation of small particles of various substances in strong healthy men who have been brought up in the country, and we know the disease has been produced in this way for generations. Masons, builders, wool and cotton manufacturers, quarrymen, cutlers, file-makers, earthenware manufacturers, etc., supply a large contingent to the mortality from consumption.[1] Occupations that are carried on in small, crowded, or badly ventilated rooms, where the respiratory functions are impeded, or those in which there is a long-continued cramped position of the chest, have long been notorious for the production of consumption. We have examples of this in the case of Manchester warehousemen, drapers, tailors, shoemakers, watchmakers, printers, clerks, and students.[2]

The army supplies us with a practical demonstration of the direct production of consumption by such conditions. Each recruit is specially examined with reference to consumption, and three months after he has entered the army he is again examined, when, if any indication of the disease be found, he is at once dismissed the service. These men are placed under the supervision of skilled medical officers; their food, clothing, and home are assured them; they are in the prime of life; and any illness they may have is at once attended to. Yet, notwithstanding this doubly certified freedom from consumption, and these great advantages, the loss to the army from this disease is much higher than that of the worst district in England. During the six years 1880-85 there were, on an average, 1,330 admissions into hospital, 263 deaths, 215 invalids sent home from abroad, and 474 invalids discharged the service. Army medical authorities[3] are agreed in attributing this "generated" disease to the conditions of army life; and of these they attach most importance to the large amount of time spent in impure barrack air, compression of the chest by clothing, etc., alcoholism, sentry go, and specific disease, or, in other words, to conditions that tend to reduce the breathing capacity.

We have in confinement[4] another practical demonstration of the direct production of consumption by conditions that tend to reduce the breathing capacity. Prisoners, orphans, and the insane formerly suffered terribly from this disease. At one time the mortality of the white prisoners of New York from consumption was three times that of the population, and the mortality of the black was double that of the white prisoner.

In the so-called "inherited" consumption there is yet another sad example of the direct production of the disease by such conditions. Look, on the one hand, at the conditions under which these children are brought up from birth, at the early age at which the disease appears, at its greater frequency in the daughters of consumptive mothers, and, on the other, at the plain evidence of the effect of these conditions that is seen in the arrested or retarded development of their chests.

Strong healthy countrywomen, who were accustomed to work in the fields, went to Paris, wore stays for the first time, and furnished the majority of Louis' patients. Tall men, who in proportion to their height are small-chested, and narrow-chested men, are notorious for their great liability to the disease. The association between repeated injury to the lungs by certain diseases and consumption has attracted the attention of most observers. We know that our cities are the chief centres of consumption, that the main tendency of city life is to reduce the breathing capacity, and that men who have been brought up in the country supply the majority of its victims. We also know that in the country such tendencies dominate the sphere occupied by the women who are liable to this disease, and that the female mortality exceeds that of the male.

Further, we have the same relationship between these conditions and consumption in the animals under our control. Many investigators have produced consumption in animals by strict confinement.[1] Wild animals kept in the great national menageries, cows stabled in cellars underground in large cities, and our own domestic pets, alike become its victims. And where is there a case of consumption, experimental or not, in which such conditions were absent?

I have carefully sought in vain for the record of such a case. Now, if the interpretation that has been placed upon these facts is true, then we shall find ample evidence of the action of those conditions in the disease itself. They tend to reduce the breathing capacity: consequently their effect must be a progressive reduction of the breathing surface of the lungs, and that is precisely what we have. Long before we get the so-called signs of the disease, we have a progressively lessening chest capacity, that goes[2] on to the end. I have shown, I trust not too briefly, that conditions that tend to reduce the breathing capacity can and do produce consumption, and that they are the dominant factors of, and co-extensive with, the field occupied by this disease. Let us now glance at the dominant conditions of the field in which consumption is unknown: for there are still places in Asia, Africa, and America in which there is no consumption; and in some of these the inhabitants have no word for the disease, and do not know what it means. Travellers inform us that these people spend the whole of their lives in active exercise in the open air, that they hold themselves erect, bearing the weight of their shoulders on the spine, and that their chests are broad, deep, and freely movable. And there is no record of consumption being found in animals in their wild state.

But this area of freedom from consumption is being steadily diminished by the introduction of civilization,—that is, of conditions that tend to reduce the breathing capacity,—and that is invariably speedily followed by the first appearance

[1] Lombard.
[2] Supplement to Registrar-General's Report, 1870-80.
[3] Parkes, Aitken, Welch.
[4] Taennec, Cruveilhier, Peter.

[1] De Musey, D'Arboval, Rayer, Bricheteau.
[2] Hutchinson, Stokes, Ransome, Graham, Balfour.

of the disease. The native races of America were free from consumption till they came in contact with Europeans, and began to adopt their habits and mode of life; and the amount of this disease actually present in the American Indians has recently been shown to correspond with the extent of their civilization.[1] So, also, were the South Sea Islanders, the Maories, the New Britons, and the natives of the African coast. The same process is now marking the progress of civilization among the natives in the interior of Africa, Asia, America, and New Britain. We have the same sequence of events in the great mortality of the dark races that settle in our cities and large towns; and in civilized countries the classes that were formerly free from consumption, for example, mountaineers and our own Highlanders, are now being attacked by the disease, as the direct result of a corresponding change in their habits and surroundings.

What is the mode of operation of the conditions that tend to reduce the breathing capacity in the production of consumption? In a true state of health the lungs have a sufficient breathing surface, not only to perform their ordinary functions, but also to meet within certain limits any extra demand that may be made upon them. When they are subjected to conditions that tend to reduce the breathing capacity, they lose this power of adjustment to their external conditions, and subsequently become unable to effect the whole amount of those interchanges that constitute their ordinary function. That part of those interchanges that is not effected by the lungs, being necessary to meet the ordinary requirements of the body, will be at once added to the work normally performed by one or more of the other organs; and, so long as this compensatory work is accomplished without causing a disturbance of their functions, a temporary adjustment will have been effected, and there will be no obvious disturbance of the general health. But unfortunately these conditions continue in active operation, there is progressively increasing reduction of the breathing capacity, and consequently there comes a time when this compensatory work is not effectively performed by other organs, and there is either a greater pressure of work thrown on the lungs, or over-activity of one or more of the other organs, indicated by some mode of disturbance of the general health.[2] The imperative demand for the effecting of these interchanges causes in the parts least able to meet it, as a rule the apices, the phenomena of irritation, which is, as we know from the experimental production of tubercles by irritation,[3] manifested by tubercular change. Each point of these morphological changes produces a further reduction of the lung capacity, and by so much becomes an addition to the forces that increase the inequality between the amount of lung available and the amount of work it has to perform; and so there is more irritation of the lungs, and more work thrown on the other organs, disturbing their functions and deranging the general health. Further, as the foci of morphological change multiply by reason of the progressive increase of the conditions that produce them, there is increased pressure and lessened supply of nutrition, accompanied by local congestion; so that they become deprived of nutrition, necropsis takes place, and eventually cavities are formed. Hence there is more and more work thrown on the other organs, causing increasing disturbance of their functions, and consequently more and more disturbance of the general health, till first one organ and then another becomes so greatly deranged that the so-called complications of the disease are produced; and this process goes on till at last neither lungs nor the other organs are together able to effect those interchanges without which life cannot continue.

Glance for a moment at the course of consumption when viewed in the light of this interpretation of its nature. Instead of its "uncertain and mysterious" advent, its "protean" forms and "chameleon" changes, we now see before us a perfectly natural succession of events, whose *raison d'être* order of sequence and relationship to each other can be laid down with exactitude. We have, in the first place, the lowered or arrested vital capacity progressively decreasing, associated with a progressive decrease or arrest of the size and extent of movement of the chest, the wasted or non-developed muscles, the sloping shoulders, and the changing shape of the thorax. At a certain point in this course there appear occasional, and then frequent, indications of increased activity of one or more of the other organs; there is increasing liability to "catch colds," and increasing difficulty in getting rid of them; and there are signs of the derangement of the general health and increasing weakness, accompanied by indications of lung irritation and implication. This may be followed by a period of rest; there has been a temporary adjustment between the work to be done and the work effected; and in common parlance the patient has been "patched up," if he is under treatment. Then the area of lung implication spreads, the signs of lung irritation become more marked and troublesome, the general functions are greatly deranged, the appetite fails, the body-weight seriously decreases, hectic is present, and the patient's rest is disturbed. This also may be followed by a period of rest, a balance having been effected between the work now required and that accomplished. And these periods of attack and rest go on, the attacks increasing and the rests disappearing, until so much destruction has been effected that the body is no longer able to resist the disease, and death terminates this unequal combat..

Whatever condition of man's habits, mode of life, and surroundings has a tendency to reduce the breathing capacity is a potential cause of consumption; and it is an active cause in its production, unless and until its action is counteracted or compensated. It is evident that we have not to deal with the mere temporary or accidental presence of such conditions, but with those only that have a continuous or permanent character. We may consider these conditions from the point of view of whether their tendency is expressed by disuse of the lungs or by their forcible compression or injury. The most important place in the former must be assigned to the rapidly decreasing amount of muscular exertion we require to make in order to supply ourselves with those things that are necessary for our daily wants, owing to the increasing facilities for obtaining them afforded us by means of machinery and railways. This

[1] Rush (Philadelphia), Science (New York).

[2] Pollock, Hanot (Jaccond's Dictionary), Ruehle (Ziemssen's), etc.

[3] Wilson-Fox, Sanderson, Simon, Cohnheim, Frankel, etc.

lessened demand for muscular exertion to obtain our necessaries creates an inability and distaste for exertion to obtain those things that are not necessary; and, as there is a consensus of opinion on that point, it comes to be considered "not the correct thing" to perform any of those acts that require such exertion. Who carries any thing that he can have sent, or walks when he can ride? Who does not now ride in a closed carriage in preference to performing the journey on horseback? An obvious effect of this change is to increase the time spent in houses, manufactories, and offices, and consequently to greatly decrease that spent in the open air. Not only does man spend much more time in his habitation, but also those habitations have materially altered in character. Our sleeping apartments are no longer open to a thatched roof, our doors and windows are made to fit more accurately, and for the wide, open fireplace of our fathers we have substituted the modern grate, which appears to be kept closed on every possible occasion. In a word, the resources of civilization have been used to obtain as much difference as possible between the air in which we now pass the greater portion of our lives and that we have to breathe when out of doors. Whatsoever part of the twenty-four hours is spent in a house is so much time during which the movement of the lungs is impeded, for while there we are generally either sitting down or reclining; and both positions tend to reduce the breathing capacity, the latter more than the former. Also, as there is little muscular exertion in the house, there is a lessened production of heat, for which artificial heat is substituted; hence the great difference between the temperature of the rooms and that of the external air, the great sensitiveness to a lower temperature, and the fear of catching cold. This fear of cold leads to active measures being taken to prevent cold air entering the rooms, and consequently to bad ventilation. And this hyper-sensitiveness to cold tends either to keep us in-doors during the colder months of the year and on those days during which the temperature is lower than usual, or to induce us to so overload the body with clothes when we do go out that free movement of the lungs is impeded.

The habit of stooping, whether brought about by the shape of the chairs (they are admirably adapted for that purpose), by the habit of assuming a so-called easy position, by muscular disuse and consequent weakness, or by poring over books from the nursery through the whole course of modern education, tends to materially reduce the breathing capacity. Very efficacious in the production of chest reduction is the universal custom of both sexes to have their clothes made to exactly fit the body at a period of rest, and thereby effectively preventing any but the most limited movement. Does not this custom effectually check any tendency to movements that would necessitate more than ordinary, tranquil breathing? And have we not enforced this habit by penalizing its breach as indicating a want of *savoir vivre*? Fashion dictates the size and shape of our clothes, and our bodies have to and do conform thereto. A beautiful example of this is seen in the hideous distortion of the lower part of the chest produced by wearing a corset, that never, never is tight. The compression thus produced is one of the most powerful causes of consumption in young girls and women; and obviously whatever produces either forcible compression of the chest or direct injury to the lungs is a cause of consumption. And when we look at the position such conditions hold in civilization, at the advances that are being made by man's increasing knowledge of the operations of nature, and his application of that knowledge to his own purposes, and at the progressive increase of such tendencies, then we see that in consumption we have one of the processes by which an adjustment is being made between the body and the work it has to perform under the changing conditions of advancing civilization, by the removal of those who have a body in excess of that work, and that the survival of the so-called fittest is thereby effected.[1] G. W. HAMBLETON.

[To be continued.]

HEALTH MATTERS.

Cookery of the Poor.

A FACULTY of social science has, it is stated, been instituted at the University of Brussels; and Professor Berger, a Belgian authority in chemistry, has given a course of lectures on alimentary chemistry. In the first of them he came to the academic conclusion that it was possible to determine with precision the quantity of nutritive elements indispensable for the reparation of the power of a working-man, and consequently the amount of money necessary for purchasing this quantity, and that therefore, when the other primary wants of a working-man were determined in the same way, the minimum of salary could be fixed with scientific accuracy. Questions of taste, digestibility, and prejudice are, however, apt to be ignored in calculations of this kind; so that, although of value as a basis of information, they are far from having the practical use which their authors ascribe to them. The knowledge of the housewife and of the cook, and a familiar acquaintance with the habits and surroundings and tastes of the laboring classes, are necessary to give reality to such calculations. An excellent example of what may be done in this way is furnished in the able and interesting chapters on the subject in the popular little handbook of domestic economy issued by Messrs. Cassell & Co., and largely used in board schools, entitled "The Making of the Home," written by Mrs. Barnett, of St. Jude's, Whitechapel. The same subject is treated with great technical knowledge and power of sympathetic feeling for the poor in her chapter on "Our National Defences," in the joint essays by herself and the Rev. S. A. Barnett, in the well-known collection of essays entitled "Practicable Socialism." The subject is one in which medical men, skilled as they are in the physiology of food, and accustomed to deal with the poor both in family life and in public institutions, might give great aid. That which the working-classes greatly need is instruction in the art of braising, or slowly stewing at a low heat, combinations of meat-scraps and of vegetables. Any thing more toothsome and nutritious than the vintagers' *pot au feu*, which, says a correspondent of the *British Medical Journal*, "I lately tasted in the Medoc during the gathering of the grapes, cannot well be imagined. It was so delicious that a supply of it was ordered into the château for mid-day lunch, and it was voted by acclamation worthy of a *cordon bleu*. It was made with leg of beef, onions, carrots, cabbage, and the like, and poured smoking into bowls over slices of thin bread. What a lesson it conveyed to our managers of soup-kitchens, and what a meal for our harvesters!"

Schmerz-Freude ("Pain-Joy").

The Berlin correspondent of the *Therapeutic Gazette* states that Professor Leyden presented to his class at Charité a young lady affected with "schmerz-freude." "It is a pity I cannot translate that name for you, for 'pain-joy' would convey no meaning to you. The patient, as the professor explained, belonged to that class of hysterical women who not only experienced no pain during an operation, but, on the contrary, had a morbid desire to

[1] Pritchard, Lamarck, Darwin, Spencer.