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THREE LECTURES ON CANCER OF THE SCROTUM IN CHIMNEY- SWEEPS AND OTHERS.

Delivered at the Royal College of Surgeons of England.

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LECTURE II.—WHY FOREIGN SWEEPS DO NOT SUFFER FROM SCROTAL CANCER.

THE last lecture was employed in showing that sweeps' cancer of the scrotum is a disease which is almost unknown in the large European countries and in the United States of America; that there is no reason to believe that it is becoming less frequent than formerly in this country; to a discussion of the general characters of the disease and of some peculiarities which it presents; and, finally, to proving that the tissues of the scrotum are peculiarly indisposed to cancer unless they are prepared for its occurrence by the work of sweeping chimneys or in some special manner.

Now, what is there in the trade of the sweep which renders him so liable to cancer of the scrotum? The evil influence might of course lie in the clothes of the men, in their generally dirty habits (apart from any special influence of soot), in customs connected with the use of their tools and consequent exposure of the scrotum to accident and injury. But the general opinion of all those who have thought carefully on the subject is that the evil influence lies in some special effect produced by the soot, and the evidence which is brought to bear upon the subject is to confirm this opinion.

First, there is such negative evidence as is afforded by the immunity from cancer of the scrotum enjoyed by men engaged in the various employments in which the whole body, including the scrotum, is dirty and grimy from morning till night—coal porters, dustmen, miners, and the like. The clothes of these men are rough, dirty, and often torn. Their tools and the manner of using them are just as likely to rub and injure the scrotum as are the tools of sweeps; yet they are not liable to cancer of the scrotum.

Secondly, there is the positive evidence of the action of soot afforded by the cases in which squamous-celled carcinoma has occurred in other parts of the body than the scrotum. Two such cases at once recall themselves to the memory of those who are versed in the literature of soot-cancer—the case of the gardener who day after day strewed soot about his garden to protect his plants against the slugs, and whose hand and forearm, amputated on account of extensive epithelioma, are in our hospital museum at the present day. The case is related by Sir James Earle in his edition of the works of Pott (III, 182). The second is also a case of cancer or soot-wart removed from the hand of a woman by Mr. Cusack.¹ She with her two sons carried on the business of chimney-sweeping, and was day by day occupied in handling soot, so that her skin became impregnated with it.

And, thirdly, the condition of many parts of the skin in chimney-sweeps, which is well described by Sir James Paget² in these words: "Scaly or incrustated small warts.....are very common in chimney-sweeps. In many of them, even when

they are thoroughly cleaned, the whole skin is dry, harsh, dusky; and, before operation for the removal of scrotal cancers in them, it is a common question whether one or more warts or scaly patches near the chief disease should be removed with it. Nor are such warts confined to the scrotum; they may exist on every part of the trunk and limbs, and I have seen sweeps so thick-set with them that a hundred or more might have been counted."

Of the precise manner in which soot acts in relation to the development of cancer there may be several opinions. For instance, whether the soot contains within itself some cancerous element, or whether it directly induces the occurrence of cancer in the tissues of the scrotum, acting as an exciting cause, or whether it merely prepares the tissues of the scrotum for the occurrence of cancer, acting as a predisposing cause.

The very nature of soot renders it highly improbable that it contains within itself a cancerous element, even in suspension. And the facts which have been recorded of the special liability of the scrotum to cancer are wholly opposed to the acceptance of such a theory. If the soot contained within itself a cancer element we should expect cancer to occur in many different parts of the surface of the body, particularly in those parts which exhibit marked pathological changes of the kind described by Paget, particularly also in those parts where the soot is apt to collect, and from which it is difficult to dislodge it, as between the toes, in the folds of the groins, around the anus, and the like; and particularly in the parts which may be said to be predisposed to the occurrence of skin cancer, such as the lower lip and face. The many years, also, during which sweeps are exposed to the contact of soot before they are attacked by cancer may be taken into consideration.

Nor is it probable that the soot directly excites the occurrence of cancer in the tissues of the scrotum. It appears to have the power of exciting various changes, such as those described—dryness and harshness and duskiness, and the formation of warts and scaly patches. But it is highly probable that here its influence ceases. Only one of many sweeps who are thus affected by the soot suffers from cancer, and only one or two spots out of many parts of the body which are the seat of these surface changes become cancerous.

Everything leads to the belief that the effect of the soot is merely to prepare the tissues of the scrotum for the occurrence of cancer, and the preparation is, in part at least, evident to the eye and touch in the coarse changes which have been described. Of the manner in which the soot acts as a preparative, whether by its mechanical or its chemical influence, it may, I think, be further argued that the evidence is strongly in favour of the latter. All that has been said of the immunity from cancer of men in other callings which expose the scrotum to the continual effect of mechanical irritants may be repeated here, and it must be admitted that many substances, such as coal dust, are, owing to their form and hardness, likely to be far more irritating than soot.

Now, here we have a curious kind of experiment which has been conducted before the eyes of surgeons for at least one hundred years, and which continues to be conducted year by year upon the human body, namely, the repeated application of a chemical substance, or of a mixture of chemical substances, to a particular part of the integument, which is not at all predisposed to cancer, with the effect of rendering it pre-eminently disposed to the occurrence of cancer in a certain number of the persons experimented on.

With some of the conditions complied with in these experiments we are familiar. For instance, we know that the soot which contains the chemical substance is actually applied to

¹ *Dublin Journ. Med. Scienc.*, xxi, 137, 1847.
² *Surgical Pathology*, ii, 464, 1853.

the surface of the scrotum and allowed to remain there for many days at a time without being disturbed even by an attempt to remove it by washing, for the majority of the sweeps in the large towns only take a complete bath once or at the most twice a week, and the soot is often so imbedded in the folds of the scrotum that it is impossible to clear it out completely. In most of the men it is probably rubbed into the integument by the clothes, not merely laid upon the surface.

The disease is scarcely capable of being produced in boys, although the formation of scaly patches and warts has been frequently noted on the scrotum of boys employed in chimney sweeping. Pott, indeed, speaks of the subjects of the disease being young and for the most part in good health at the time they were attacked. But he gives no details of cases in really young subjects, and Earle, who gave a much more detailed account of the disease in 1823, says that it rarely attacked persons under 30 years of age, and that the majority of the patients he had seen were between 30 and 40 years of age. In its relation to age, then, it appears to adhere to the rule of surface-cancer generally, namely, that it is a disease of adult age, and particularly of mature adult age. At the same time, I am inclined to believe that there is probably a larger proportion of cases of the disease occurring in young men than is usual. Earle goes on to say: "I have seen three instances between 20 and 30 and only one at the age of puberty." Seeing that he regarded the disease as one of comparatively rare occurrence, this is probably a decided percentage of the total number of patients which had come under his notice. The ages of the twenty-nine chimney-sweeps admitted into St. Bartholomew's Hospital in the last twenty years with this disease varied from 25 to 65:

From 25 to 30	...	...	...	...	2
" 30 " 35	...	...	...	...	2
" 35 " 40	...	...	...	...	2
" 40 " 45	...	...	...	...	5
" 45 " 50	...	...	...	...	10
" 50 " 55	...	...	...	...	4
" 55 " 60	...	...	...	...	2
" 60 " 65	...	...	...	...	2
Total	...	...	...	...	29

It will be seen that there were six patients under the age of 40, two of them under the age of 30. If these figures be compared with the age statistics of squamous-celled carcinoma (epithelioma) generally, the proportion of cases in young men will appear large. Epithelioma of the lower lip in men under 40 years of age is very rare. Of 80 cases of epithelioma of the tongue, only 2 of the patients were under 30 years of age, and in these 2 the age was 29. Of 54 cases of cancer of the oesophagus, only one occurred in a patient under 35 years old, and not one in a person under 30 years of age. Perhaps the influence of soot as a preparative of the tissues for the occurrence of cancer is even more apparent when the ages of the 29 sweeps are compared with the ages of all the 39 patients who were under the care of the hospital during the period of twenty years. There were only 7 of the whole 39 who were under 40 years of age, and 6 of these 7 were chimney-sweeps.

Of the length of time during which the contact of soot must be continued before the tissues of the scrotum are sufficiently disposed to the occurrence of cancer, it is difficult to form a just conclusion. Even in these days, when the use of "climbing boys" is practically unknown in this country, the contact with soot begins at the age of 16 years—many years, therefore, before the general predisposing influence of age in the development of skin cancer begins to be exercised. There is, however, one observation which may serve to show how rapidly soot can prepare the integument of another part of the body than the scrotum.

Sir James Earle, in the case of the gardener already referred to, gives a careful description of the manner in which the man's wrist and hand became affected by the cancer. It is as follows: "He said he was a gardener; that about five years before (in 1800) he was employed in a garden at Lowlayton, in Essex; that in the spring of that year he was engaged about two hours every morning to strew soot on the ground round the young and tender plants, to preserve them from the slugs; that he carried the soot in an old garden pot, which hung on his left hand by a handle over the top, while he strewed it with the right. About this time he conceived the wart commenced near the knuckles, and continued not very troublesome all that year; the next spring he was again employed to distribute soot; the wart was then increased and ulcerated, and continued growing worse all that year. The spring following he again used soot in the same manner; the sore then spread and grew

larger, which made work of any kind very difficult to him." In this case the patient was, at the time when the soot was first applied, 45 years old, and the manner in which it was applied was, as if by design, to induce the occurrence of cancer. The first year the soot was rubbed into the skin by the handle of the garden pot in such a manner that it induced the occurrence of a wart. The second year it was rubbed into the wart until ulceration was produced. And the third year it was rubbed into the ulcer, which, if not already cancerous, soon became so.

To assist us in the discovery of other conditions which are essential to the success of these experiments, we may obtain information of various kinds (1) of the reasons why the chimney-sweeps of other countries do not suffer from cancer of the scrotum; (2) of the immunity from cancer enjoyed by persons engaged in kindred employments; (3) of the liability to cancer of the scrotum of persons engaged in other employments.

A part of the last lecture was devoted to proving the truth of the general impression that the sweeps of foreign countries are not liable to cancer of the scrotum, but no reasons were put forward to account for the immunity enjoyed by foreign sweeps. English and foreign authors are generally agreed that two circumstances have chiefly, if not entirely, served to account for the liability of English sweeps—first, the general use of stone coal throughout this country; secondly, the employment of "climbing boys" in the sweeping of chimneys. How far are these theories borne out by actual fact?

In considering the fuels burnt in this and other countries for the purpose of heating dwellings, it will be convenient to divide them into those which are coal and those which are not coal. Under the first heading may be placed (1) anthracite or smokeless coal, (2) hard coal or stone coal, (3) brown coal, and (4) coke. I have separated the anthracite from the hard coal arbitrarily for my purpose, because the combustion of anthracite is, I believe, infinitely more perfect than that of hard coal, and, consequently, not only furnishes less soot, but probably a soot of a different quality. The brown coal corresponds with what is known as "lignite" in this country. Under the second heading fall (1) wood, (2) peat, and (3) wood charcoal. And it must be understood that I am speaking only of the fuel employed in large towns and cities, for we have really little or no knowledge of the occurrence of scrotal cancer in the country sweeps of Great Britain, much less in the country sweeps of foreign countries.

In England hard or stone coal is the staple material employed for the purpose of heating houses. Anthracite is scarcely used at all, and the brown coal of the Continent is practically unknown. In the United States, anthracite, wood, and mineral oil are chiefly used. In Holland, peat, wood, coke, and some hard coal. In France, wood and charcoal are generally employed, but a good deal of hard coal is used in the northern towns. In Germany and Austria, brown coal and wood, but in the north of Germany hard coal and peat are also largely employed. In Switzerland, I learn from Professor Kocher, to whom my thanks are again and again due, that the houses of Bern are heated almost always by the burning of wood and turf (peat), and this is also the case in Bale, where the burning of hard coal is very unusual. In Italy, wood, coke, and charcoal are employed, but very little coal. Dr. Young, who resided many years in Florence, and who now lives in Rome, told me that in Rome it is seldom necessary to light a fire for personal warmth, even in the winter months; but in Florence, wood, coke, and charcoal were much employed.

The machinery in which these various fuels are consumed is as follows: In England, the open grate, except in the kitchens, where the grate has of late years given way slowly before the kitchener. In the United States, the houses are very often heated by a furnace and an apparatus for carrying steam to all parts of the building. Open grates are, however, employed, but wood is almost always burned in them. In Holland stoves are generally employed. Small basins containing peat are frequently used in the summer months for cooking. Open grates are the exception. In France, stoves are very largely used, but one meets with many open grates in the hotels, and in these wood is usually burned. *Chauffepieds* are much used in France and Holland and other European countries. In Germany and Austria the well-known stoves are almost invariably seen. If open grates are used, they are usually supplied with wood. In Switzerland, also, the houses are generally heated by means of stoves. In the north of Italy stoves are used. In the towns more south large pans and pots of charcoal are often seen in the rooms and the people keep themselves warm by means of their *scaldini*, vases of earthenware with a handle and containing a small quantity of smouldering charcoal.

The preceding statements are largely the result of personal observation, supplemented by conversations and correspondence with the inhabitants of the various countries. They are not intended to be exhaustive, but to give a general and sufficient account of fuel burned and of the manner in which the combustion is carried on for the purpose of this inquiry. They result in showing clearly that England is the only one of these various countries in which hard or stone coal is generally used, and that it is the only one of them in which open grates are universal. Consequently, that we, in this country, not only burn hard coal, but that we burn it in such

a manner as to produce the largest amount of soot, for the combustion in open grates is for the most part very inferior to that in stoves.

Thus far, then, inquiry served to confirm the truth of the theory of the evil influence of the soot of hard coal in the production of cancer of the scrotum. And I discovered a singular confirmation of it in a speech by Dr. Baum, of Göttingen, in the course of a discussion in the year 1874, in which he said:—"In Hanover we formerly employed nothing but wood for heating, and only began about ten or twelve years ago to use stone coal; and formerly we never observed cases of cancer in the scrotum. For the first time last autumn, a patient from Celle came with a cancer of the scrotum as large as a two-thaler piece. . . . That is the first case of chimney-sweeps' cancer which I have known actually to occur in Germany."

German sweep's costume

Valuable as this occurrence undoubtedly was, I could not shut my eyes to the fact that it was in the year 1873, some eighteen years earlier, and during that long period the consumption of hard coal in the north of Germany has continued and probably increased. Under these circumstances, cancer of the scrotum in sweeps ought to have become sufficiently common to have been noticed by the principal operating surgeons in the large towns on several occasions, at least. Finding that Dr. Baum was dead, I wrote to Professor König, of Göttingen (the town in which Dr. Baum had resided), and to Professor von Esmarch, of Kiel. I explained the whole matter and the reason of my writing to them, and received from Professor König the following reply, which I will translate:

"During the period of my clinical work in Göttingen (from autumn, 1875, to the present time, January, 1890), in spite of the great increase in the clinical material; in spite of the fact that Hanover, Westphalia, a great part of Hesse and the pro-

vince of Saxony, send us their unusual surgical cases, so that the number of new growths for operation is very large, no case of chimney-sweeps' cancer has occurred." Professor von Esmarch wrote in a similar strain: "Although a great deal of stone coal has been used here for heating, yet the chimney-sweeps' cancer does not occur, presumably because the chimney-sweeps for the most part do not themselves ascend the chimneys, but sweep with a brush which they let down from above." Professor von Esmarch was evidently under the impression that it is still the custom in this country for the boys to climb the chimneys, hence this remark.

These letters and other information which I received from various persons determined me to pursue the matter farther. And I looked around to see whether there were any country or large part of a country in Europe in which there existed conditions resembling those found in England. Belgium at

Belgian sweep's costume.

once struck me as a favourable field for investigation. The country is small, and there are very few really large towns, but it is thickly populated, and it produces a large quantity of hard coal, which is burned in the country; while its position with relation to Great Britain and the north of Germany is such that the importation of hard coal from these countries is carried on to a considerable extent. In order to discover whether coal is employed for the heating of dwellings, whether it is the staple material used for that purpose, in what form it is employed and other similar matters, I sent an assistant to the Low Countries in the autumn of 1889. Of Holland I shall say but little, because I really have no reliable information regarding the occurrence of chimney-sweeps' cancer in that country.

In Belgium, Antwerp with its 200,000 inhabitants, Brussels with 174,000 inhabitants, Louvain with nearly 40,000, Liège with nearly 140,000, and the smaller towns of Seraing and

Mechlin were visited. In all of them stone coal was found to be the staple material for house heating, although wood, coke, and charcoal were also employed, and *brquettes* made of coal sweepings. Further, although stoves were used in some houses and public buildings, a vast number of open grates with such flues as are built in this country were used, especially in the largest towns, so that it is perfectly correct to say that the heating of houses is largely effected with similar fuel and in a precisely similar manner to that employed in England. The chimneys of private houses are obliged by law to be swept once, but are more commonly swept twice, in each year.

There was very little difficulty in obtaining this information and some other information of value, to which I shall again refer, but I found the greatest difficulty in discovering any reliable facts on the occurrence of cancer of the scrotum in chimney-sweeps. The only observation with which I was acquainted was contained in a paper³ by Dr. Zoude, of Tournai, who had met with a case of cancer of the scrotum in a chimney-sweep in the civil hospital at Antwerp. Dr. Zoude judged it useful "to report it, so much the more because many old practitioners were obliged to admit that they had never seen a case." And, in his further remarks, he says, "It adds a case to the small number of those which the annals of science possess as having been observed in our country." But this was written in the year 1841, fifty years ago, and it was by no means certain that the conditions of heating houses were the same then as now.

Our London medical libraries did not contain any Belgian textbooks of surgery, and I learned from Dr. William Blanc, of Brussels, that there are not any textbooks of surgery by Belgian authors. He spoke of the country as cosmopolitan, and said that the students read French and German works for their examinations, nor could I find any statistics of the patients in the hospitals of Brussels, Antwerp, and Liège such as are published in this country.

I had been so fortunate as to make the acquaintance of Professor de Roubaix, of Brussels, while he was on a visit to London in the summer of 1889. His long experience as a hospital surgeon and teacher of surgery in the University of Brussels made his opinion most valuable, and I sought it by letter. His answer was: "In reply to your letter I can say that, for my part, I have never met in my long experience with chimney-sweeps' cancer. Some colleagues attached to the hospitals of Brussels have assured me that they have not, any more than I, seen it."

Not content with this, Professor de Roubaix wrote to three gentlemen: Professor von Winiwarter, of Liège; Dr. Gallez, of Châtelet, in the neighbourhood of Charleroi (Member of the Academy of Medicine); and Dr. Urbain, in large practice in the Borinage. Immense quantities of coal are burnt in all these places. Not one of these gentlemen had met with a case of cancer of the scrotum in a sweep, and the disease was so rare generally that the coal miners did not suffer from it. Dr. Gallez's reply deserves particularly to be translated. He said: ".....For thirty-three years I have practised in the vicinity of Charleroi. A register, kept regularly by myself, shows at the present time a figure of 28,020 cases treated among coal miners and *metallurgistes*. I still await the first case of cancer of the scrotum. Nor have I seen it in my foreign and workman *clientèle*. And, what is more, I have never heard speak of it among my *confrères* during this long period of years." Professor de Roubaix also informed me that no regular and serviceable statistics were kept in the hospitals at Brussels which could be useful to me on this matter. I have to thank the learned professor again and again for the interest and trouble he took in my research.

Thinking over the question of Belgium, of the size of the towns, and of the small number of chimney-sweeps in them compared with the number in London, it occurred to me that one or two cases a year in three such towns as Antwerp, Brussels, and Liège, with a total population of rather over half a million of inhabitants, would be as many as one could reasonably expect. If ten cases had occurred in all the hospitals of the three towns in the course of as many years, I should then have thought that the disease might be comparatively as frequent in Belgium as in London. Although one or two of the hospital surgeons in each town might not have

met with the disease, other surgeons practising in the same town and serving the same hospitals might have met with an occasional case. In order to obtain further information, I determined to visit Antwerp and Brussels and gather from as many of the surgeons as possible their experience, expecting—and, indeed, almost hoping—that I might hear of a sufficient number of cases to prove the equal liability of Belgium with this country to sweeps' cancer.

Antwerp possesses two hospitals, the Elizabeth and Stuyvenberg, each of which contains about 200 surgical beds. The former is officered by Dr. Dewandre and Dr. Desguin, the latter by Drs. Ceuterick, Willems, and Schoonen. From all these gentlemen, and particularly from Drs. Desguin and Schoonen, I met with the greatest civility. Curiously enough, the first surgeon on whom I called (Dr. Schoonen) at once told me that he had operated on a chimney-sweep for cancer of the scrotum in the previous year. The patient was a man of 50 years of age, in whom the disease had commenced as a wart. The operation had not been performed in the hospital, but at the house of the patient. This was the only case which he had seen. Dr. Dewandre, in the course of twenty-five years' hospital practice, did not remember ever to have seen a case of cancer of the scrotum in a chimney-sweep. Dr. Desguin, in the course of eight months' hospital, and thirteen years' civil, practice in the town, thought he had seen two or three cases of cancer of the scrotum, but he was quite sure that not one of the patients was a chimney-sweep, nor could he remember any case of cancer having occurred in a sweep. Dr. Ceuterick, who had been more than forty years attached to the Elizabeth and Stuyvenberg Hospitals, could only distinctly remember one case, that treated by Dr. Schoonen in the preceding year. He thought he might have seen other cases, but could not remember when or where. Dr. Willems, with an experience of twenty-five years' hospital and civil practice in the town, thought he might have seen a case. He thought it possible the disease might occur, but that it is excessively rare. There were no statistics in either of the hospitals. The combined experience of the five surgeons to the hospitals of Antwerp, an experience extending from a few months to forty years in individual instances, gave then one case of cancer of the scrotum in a chimney-sweep for certain, and, in addition, indistinct impressions of other cases which might have happened in the course of many previous years.

Brussels has also two hospitals, the St. Jean and the St. Pierre. I visited the former under the conduct of Dr. Thiriar, a very active and excellent surgeon, who had about seventy surgical beds under his charge. He told me he had never seen a case of cancer of the scrotum in a chimney-sweep, and appealed to his *chef de clinique*, Dr. Duprez, who, in the course of several years spent in his wards, had never observed a case. I called on Dr. Tirifahy, professor of surgery in the university and a hospital surgeon of very long experience. He said he had seen chimney-sweeps' cancer, but very very rarely; and, he added, that he had found cancer of the scrotum generally a very rare disease. By his advice, I visited Dr. Edouard de Smet, professor of diseases of the skin to the St. Pierre Hospital, who was at once much interested in the subject, but who had never met with a single case of cancer or wart of the scrotum in a sweep. Dr. Thiry, for many years surgeon to the St. Pierre, and practising chiefly in diseases of the urinary organs, in which his experience is very large, told me he had seen cases of cancer of the scrotum, but not often, and never in a chimney-sweep. At the St. Pierre itself I saw Dr. Charon, a surgeon of a good many years' standing, who told me he had never met with a single case of cancer of the scrotum in a sweep. The experience, then, of five surgeons in Brussels—Professors de Roubaix, Thiriar, Tirifahy, Drs. Thiry and Charon—all of whom were in the prime of life or advanced in years, and had been for many years engaged in the service of the two hospitals, could not furnish a single case of cancer of the scrotum in a chimney-sweep, and only one of them, Professor Tirifahy, had any recollection of ever having seen the disease. Dr. Edouard de Smet, with his special experience of diseases of the skin, which might not improbably have brought persons suffering from scrotal warts or cancer to him, was equally unable to recollect ever having seen the disease.

Both in Brussels and Antwerp I questioned the sweeps

³ Arch. de Méd. Belge, vi, 255, 1844.

themselves of their knowledge of cancer, and particularly of cancer of the scrotum as a trade disease. Not one of them had ever heard of such a thing. The difference in this respect between the English and the foreign sweeps is very striking. The former are perfectly cognisant of the special danger which they incur in respect to their calling.

Professor von Winiwarter's experience as a hospital surgeon in Liège was of eleven years' duration, and those who are acquainted with his excellent work on cancer,⁴ in the wards of Professor Billroth, will at once recognise that it would be impossible for so careful a surgeon to have overlooked a case of such a disease as sweeps' cancer.

In place then of receiving information of occasional cases of cancer of the scrotum in chimney-sweeps, sufficient to lead to the belief that the disease is not so rare as the first letters I had received implied, I was only able to obtain definite information of one single case in the course of years, that which had occurred in 1889 in the town of Antwerp. And the answer of four-fifths of the surgeons whom I interrogated was, not that they saw the disease from time to time or very rarely, but that they had never seen it in the whole course of their hospital and civil experience. Two of the oldest surgeons, one in Antwerp, the other in Brussels, whose experience in hospital practice was of from forty to fifty years' duration, had some indistinct recollection of having met with the disease, but could give no account of any case in point except that which had occurred in Antwerp in the previous year.

In the face of all this negative information, it was impossible to withstand the conclusion that chimney-sweeps' cancer is practically unknown in Belgium, a country in which cancer generally is sufficiently common, as we learn from papers in the various Belgian medical journals and archives, and from the work of Dr. Bougard,⁵ in which the climate and the general conditions are sufficiently like our own; in which the fuel used and the manner of using it almost precisely resemble our own, and in which there appeared every reason to expect that the disease would have been observed with at least tolerable frequency.

How could this exemption from cancer of the Belgian and North German sweeps be explained? After the exclusion of such factors in the production of the disease as have been dealt with, it seemed very difficult to solve the problem, and I could only imagine that there must be some conditions in the lives of these foreign sweeps which differed very largely from those of our English sweeps, but I had really no knowledge on the subject. In order to obtain it I visited or sent a messenger not only to North Germany and Belgium, but to several other European countries, and gained further information from persons inhabiting those countries. Before giving the results of these investigations, it will be well to describe generally the dress of the English chimney-sweep, and as much as I have discovered of his habits and customs.

The ordinary journeyman sweep wears a loose jacket of some thick and strong material, such as moleskin, a waistcoat often of the same material buttoned down the middle like an ordinary waistcoat, but generally short and seldom tight-fitting, trousers which are often made of moleskin, which either button down the front or are provided with a flap, and which are loose around the legs. The trousers are usually kept up by means of a leather belt around the waist. A coarse shirt is worn over the body, and sometimes drawers are worn. But, in the summer especially, this is the exception. The man wears an ordinary cap upon his head, and round his neck is often loosely wound a wollen comforter or large neckerchief. His feet are covered, but not always, with socks or stockings, and a pair of old boots. His clothes are nearly always loose-fitting, if they can be called fitting at all. His coat and even his waistcoat (which he does not always wear) are frequently open, and the front of his shirt admits the air and also the soot to his body. In addition, his clothes are frequently torn, and sometimes large gaps are seen in them, through which dirt of every kind can reach his body. The sweeping of the chimneys is almost entirely accomplished by means of brushes, hand-brushes for the flues and brushes set on long jointed handles for the longer chimneys. In sweeping, the man stands below so that the soot descends and falls in greater or less quantity upon him. But he may also mount to the roof, in

order to be sure that the brush has swept the chimney thoroughly. Sometimes an iron ball attached to a long rope is let down from above in cases in which there is special difficulty in sweeping with a brush. The sweeping of chimneys commences very early in the morning, so that the sweeps are some of the earliest risers in the community. But the work is for the most part over in the afternoon, often at a very early hour. Most of the sweeps then take off their sweeping clothes, wash their hands and faces, and sometimes the upper part of the body as well. The whole body is seldom washed more than once, or at the most, twice a week. I have, however, been informed by the daughter-in-law of a sweep, that the "old man" was very clean and had a bath all over every night after his work. But this, so far as I have been able to ascertain from the men or their families, is a great exception to the general rule. The houses of the sweeps and the rooms in which they live are often extremely dirty; the more so because the business of sweep is not infrequently conducted in the same house for two or more generations. The dirt was so great in some of the rooms which I have visited that, in spite of the care and politeness of the people, I found it difficult to stand without soiling my clothes with soot-dirt. The trade is generally considered to engender thirst, and the men are a good deal addicted to strong drinks. Boys are no longer permitted to ascend the chimneys in this country. Indeed, they are not allowed to commence the learning of the trade until they are sixteen years of age. The law against the employment of climbing boys was passed about 1840, and within a few years of that date these boys had practically ceased to be employed. I have quite lately heard it said that boys can still be hired for the purpose in special cases. I can only say that, in the course of my wanderings and inquiries, I have never come across a boy-sweep, and have never seen or heard anything to make me believe that this is possible. And, when there was a question of filling a hole in one of my own chimneys, I was informed that one of the men would have to make the best of his way into the chimney.

In the autumn of 1889 my messenger visited many of the Belgian towns, and I went myself to Antwerp and Brussels in the following spring. A few examples will serve to give an idea of the conditions which prevail generally through the country.

At Mechlin a young sweep in his working clothes was carefully examined. He was clad in a kind of coarse linen. His dress consisted of a loose Garibaldi blouse, with long sleeves which were tied tightly around the wrist, and provided with a hood which was adjusted when he actually swept and tied closely round the neck. The blouse was tucked inside the trousers, which were fastened with a belt tightly round the waist. From the knee downwards he wore gaiters, and over his leather boots were tied "wings" at the ankle. The trousers buttoned down the front. In Antwerp, in the house of a master sweep, I saw two of his journeymen clad in precisely the same fashion. The door of another house—that of M. Jansen, in the Dambrugge Straat—was opened by his daughter, a dressmaker; the mother was an accoucheuse. She said the father was 62 years old and very healthy. As it was a busy time he was taking a little nap after his dinner. She said he wore coarse linen clothes; under them either a shirt or his ordinary clothes, according to the season of the year. The sweeping clothes were washed, but not with the other clothes, which went to wash. Every day after his work he was in the habit of taking off his working clothes and washing himself. The house was very tidy and comfortable. At the house of a master sweep in Brussels there were several sweeps, young men, seemingly in good health and strong. They wore the same blouse with a hood as the sweeps at Mechlin and Antwerp. The blouse was made of coarse linen. The trousers were not all of the same material, for two of the young men wore a coarse woollen stuff. The woman said that the journeymen slept in the house and were obliged to keep themselves clean because clean beds were provided for them. They washed down to the waist every day after work; but some were cleaner than others in this respect. In the Chaussée de Louvain we visited the house of M. Blareau. The room into which we were shown was very clean, and there was there a young journeyman sweep in his working clothes. Blareau was engaged in making a suit of brown holland sweeping clothes, blouse with hood and

⁴ *Beiträge zur Statistik der Carcinome*, Stuttgart, 1878.

⁵ *Études sur le Cancer*, Brussels, 1882.

trousers of the same material. He told us he always made them himself. They were washed every week; some of them were actually hanging on a line in the room to dry. From Blareau's we went to the house of M. Paniels in the Rue Croix-blanc. Neither the master nor his wife were at home, but a young daughter showed us into a dwelling room, the window of which served to display several sweet stuffs—for a little shop of these things was kept by them. Everything was very clean. She showed us a blouse with hood attached, and said her father wore two of them every week; he also wore leggings; and she showed us what we had not previously seen—a piece of clean stuff which her father and all other sweeps there wear over the lower part of the face when they sweep. She demonstrated the manner of wearing the cloth so as to cover the mouth and nose of the wearer. The machines used by the Belgian sweeps are a brush similar to that used in this country, but with a weight in the middle, a broom, a cord, sack, and shovel. In the Brussels Directory there were the names and addresses of twenty-four *ramoneurs-jurés*. We found that it was possible to employ other sweeps than these men; but if a fire occurred in the chimney of a house the last receipt of the *ramoneur* was required, and only that of a *ramoneur-juré* was recognised. In some towns a holly-bush is used for the cleansing of the flues from soot, as it was formerly used in this country.

Of the habits of the sweeps, so far as personal cleanliness is concerned, I believe I am correct in saying that the general custom is to wash down to the waist daily, and to wash the whole body from head to foot once, or at the most twice, a week.

As I was unable to go myself, I sent to the north of Germany during September of last year, and the information obtained was most satisfactory. Hanover, Hamburg, Kiel, and Göttingen were visited. In the first two towns hard coal is generally burned not only in the factories, but for the heating of dwellings; it is brought there from Westphalia, Belgium, and England. In the last two a great deal of stone coal is also burned, but in addition peat and wood. Stoves are used in the dwelling houses of all these towns, and there are few open grates. But the kitchen chimneys are often climbed by the men.

In Hanover a master sweep, Herr Fricke, was visited. He lived on the third floor of a tall house in a small street. The living-rooms were exceedingly clean. The journeymen washed after their work was over in a small room, where there were three or four wooden tubs. They stood in the tubs, and washed with warm water, soap, and even soda, from head to foot every day. The clothes in which they swept consisted of a coat and trousers made of a stout kind of cloth, to which they give the name of "English leather." During sweeping the feet are naked, the trousers fit not very closely, and are not tied around the ankles. They button down the front, and are fastened at the waist by a strong leather belt, and the knees are protected by stout leather patches. The coat also buttons down the front. It fits pretty closely at the neck, and the sleeves, which fit close at the wrists, are made to fit still closer by tying them with tape. The bottom of the short coat is tucked inside the trousers, so that the trouser-belt knits it close around the body. A small skull-cap of coarse linen is worn on the head, and over this a hood, which covers the head, neck and chin, and is fastened closely round the neck; and, during sweeping, the mouth and nose are covered with a cloth after the manner of the Belgian sweeps. The clothes are made in the house, and the suit which I have here was made for my messenger by Herr Fricke's people.

The same make and arrangement of clothes was used in the other towns which were visited, and the same material was employed; and in every house the same excellent arrangements for daily washing in large wooden tubs in a special room were observed. It appeared to be the custom for the journeymen to sleep in the house of the master sweep. In the house of Herr Puschmann, in Göttingen, my messenger was shown the bedroom of one of the journeymen, which opened out of the bathroom. The bed was made, and the sheets and pillow were quite white and clean.

The clothes are only washed from time to time, perhaps not more than once in many weeks. The nature of the material is not favourable to frequent washings. But it was found that the coarse shirt which was worn beneath the

jacket was washed every day by some of the men after they had washed themselves.

The dwelling rooms were exceedingly clean in all the houses which were entered, and the furniture was in some of them even handsome, while the master sweeps were a very superior class of men. Herr Puschmann's daughter had been governess in an Irish family for some time. There was not one of them who had ever heard tell of a case of cancer in a sweep. Herr Schikorrer, of Kiel, believed they were among the most healthy of the population because they washed so much more than men in other trades.

The protection afforded by means of clothing and washing was displayed in a manner and to an extent I had not conceived. In the first lecture I told how the supposed decline of chimney-sweeps' cancer has been attributed by some persons—I might almost say by many persons—to the fact that "climbing boys" have not been permitted in this country since the year 1840 or thereabout. It was not that the boys themselves were liable to cancer of the scrotum, but it was suggested, with some show of reason, that the exposure of the scrotum to the daily contact of soot from childhood upwards, beginning when the skin is soft and tender, rendered the sweeps much more liable to the disease than they would otherwise have been; and this belief received support from the fact that warts occurred on the scrotum of some of the boys who were employed in "climbing." To my surprise I discovered that climbing boys are largely employed on the Continent. In the north of Germany boys of 14 years, and sometimes younger, are employed, and in Belgium, perhaps more than in any country in Europe, the employment of climbing boys is of daily occurrence. In Brussels and Antwerp we saw several of these boys, black with soot and dressed like the men. At Mechlin a boy, 7 years old, was seen standing with his mother at the door of the sweep's house. The woman said he was employed in climbing chimneys but, as he was rather delicate, and had a cough, the doctor had advised her not to permit him to "climb," any longer. At one house we were told that the boys began at the age of 4 years to "climb." And the chimney-sweeps' signs in the Belgian towns usually present three figures of sweeps in their working clothes, carrying their implements. Foremost stands a man, next follows a boy of about 15 years of age, and last comes a tiny boy.

THE CROONIAN LECTURES ON THE CHEMISTRY AND THERAPEUTICS OF URIC ACID GRAVEL AND GOUT.

Delivered before the Royal College of Physicians of London.

By SIR WILLIAM ROBERTS, M.D., F.R.S.

LECTURE III.—CHEMISTRY OF URATIC PRECIPITATION IN GOUT.

THE chemistry of gout in its full extension embraces changes of the most diverse character in the blood and tissues. I do not propose to deal with the subject in this comprehensive sense, but to confine myself entirely to the relations of gout with uric acid. By far the most characteristic feature of gout is the formation of chalk-like deposits in certain parts and tissues of the body, especially in and about the joints. The essential component of these deposits is the biurate of sodium, and it is always present in the crystalline condition. The crystals are distributed through the implicated tissue in the form of delicate needles, aggregated into tufts, bundles, and stars. The arthritic incidents of gout may be said, not improperly, to be simply incidents pertaining to the precipitation of these crystals in the structures of the joints. Without the occurrence of this precipitation the gouty paroxysm could not take place, nor could the more chronic changes in the joints, with their train of attendant symptoms, follow after. Were it possible for us to keep the sodium biurate in a state of solution in the bodily fluids, the clinical portrait-ure of gout would be completely transfigured. Whatever other manifestations of the gouty constitution we might have