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 III.—TAR AND PARAFFIN CANCER.

IN the last lecture I endeavoured to show that the preparation of the skin of the scrotum for cancer is effected by means of the soot of hard or stone coal, and the various conditions necessary or favourable to the preparation were discussed. Then followed the important question of the reasons why the sweeps of foreign countries do not suffer from cancer of the scrotum. At first the evidence appeared to show that they owe their immunity from the disease to the innocuous qualities of the soot in those countries. But it was discovered that the sweeps of North Germany and Belgium, where hard coal is generally burned, enjoy a similar immunity, and this was traced to the care which they take to protect their bodies from the contact of the soot, and in North Germany to the practice of washing the body daily from head to foot. The protection afforded by these measures was found to be so efficient that, in spite of every other condition which may be regarded as favourable to the disease, including the employment of children as "climbing boys," it is really almost unknown in those countries.

When once I had become convinced that the absence of sweeps' cancer of the scrotum from those countries is accounted for by the precautions taken by the workmen, I began to wonder whether the immunity from the disease enjoyed by the chimney-sweeps of other countries might not be explained by the use of similar precautions rather than by differences in the quality of the soot. If these measures serve to protect the sweeps in countries where hard coal is habitually burnt, why should they not equally serve to protect them in the countries in which brown coal, wood, coke, etc., are burnt? I had become aware that similar clothing was worn by the sweeps over the whole of Germany and throughout Holland. And in Switzerland, as in the North of Germany, in addition to the clothing being very efficient, I found that what had been previously told me of the sweeps of Bern by Professor Kocher is generally true—namely, that it is the custom of the Swiss sweeps to take a hot bath every evening and to cleanse the body thoroughly in a special room provided for the purpose. At Bâle we were shown the room in the basement where the journeymen made their toilet. There were two stoves for heating water, plenty of hot and cold water in readiness, tubs, and a large zinc bath, in which each one of the men washed his whole body every night.

In the north of Italy and in France, however, the precautions against the contact of soot with the body and the means for removing it are not so perfect as they are in the countries which have been named. I shall say little of Italy, because the conditions relating to the chimney-sweeps are peculiar. The sweeps, both men and boys, who serve the large towns in the north, such as Milan and Turin, are not inhabitants of the towns for more than a few months in the year. They come down from the mountains in the neighbourhood of the great lakes, spend the winter or a large part of it in miserable lodgings in the towns, make a circuit of the surrounding country in the spring, and return to the mountains for the summer months. Consequently, very little is known of their lives, of their old age, or of the chronic diseases from which they suffer and die.

In France I shall say little of the large towns in the north which were visited—Amiens, Arras, Lille, Roubaix, Rouen, and Tourcoing—for I really have no information regarding the occurrence of sweeps' cancer of the scrotum in any of them. They are for the most part manufacturing towns, and a great deal of hard coal is burned in them. The dress of the sweeps varies somewhat in the different towns, but it is generally made of a washing material. The blouse is sometimes provided with a hood, but not invariably. The sweeps were said to be much like other people in the matter of cleanliness, and it appeared that they washed all over about once a week.

Paris, on the other hand, deserves attentive consideration. There is not the least doubt that sweeps' cancer of the scrotum is so rare there as to be almost unknown. The statements of Vidal and Nélaton, which have been already quoted; the works of distinguished surgeons and pathologists, such as Verneuil, Tillaux,[1] Péan,[2] Richelot,[3] Richerand,[4] all tell the same story; and Lebert, in his *Traité pratique des Maladies Cancéreuses*,[5] was not able to give an account of cancer of the scrotum from his own personal experience, for he had never seen a case in any patient. And he expresses the doubt whether cancer of the scrotum in England is really a disease peculiarly prevalent in chimney-sweeps. The works of these authors cover a period of about seventy years, from 1821 to 1890, and I have not met with a single statement which conflicts with them. Now in Paris, all the sweeping is in the hands of the *fumistes* (stove makers and menders, etc). The heading *Ramoneur* does not, I believe, occur in the Paris Directory. The establishment of M. Sgrena, *fumiste*, was visited, where an *employé*, aged about 30, was seen, who said that during boyhood he had been apprenticed for five years. He wore a blue blouse, shirt, and trousers, a cotton cap over his head (if he ascended a chimney) boots, kneecaps and backside piece of leather. His blouse was buttoned a little to one side of the middle line in front. Each day, after sweeping, he washed, but not in a bathhouse. At M. Portel's, in the Rue Ballu, the head clerk said that during the winter his establishment sometimes employed as many as 100 men. They dressed in a linen blouse or rather jacket, buttoned in front, trousers of the same material, coarse shirt, and boots. These clothes were put on in the workshop before the men started on their rounds. After work they were taken off in the workshop, the men washed, and, on their return home, they were said to wash again. The clothes are washed once a week. The suit of clothes which I have here was purchased at the shop in the Rue Pont Neuf, where many of the sweeps buy their clothes, and are of the exact pattern and quality supplied to the men or masters. The shirt is furnished with holes for studs, and fits pretty closely round the neck. The jacket does not fit closely at the neck; it buttons almost down the middle by a few large buttons. The trousers are supplied with a band and buckle at the back, and fasten with buttons down the middle in front. During sweeping the jacket is sometimes thrust inside the trousers, but not by any means invariably. Drawers are sometimes worn beneath the trousers, but the sweeping garments are not worn over the clothes as they often are in Holland and in Belgium. A cotton cap is drawn down over the face and neck if the sweep ascends a chimney (such as the chimney of a factory), but not if he sweeps an ordinary chimney from above or from below. The machine largely used for the cleansing of the chimneys in Paris is a *hérisson*, which is usually let down with a rope from above.

It is quite evident that the costume of the Paris sweep is not so efficient a protection against the access of soot to his body, especially to the lower part of the body, as the costume of the sweeps in the countries which have been discussed. The clothes appear, however, to be regularly washed, and the men are said to wash every day, but the washing does not take place in a chamber properly adapted for the purpose, as it is in the houses of the North German and Swiss master sweeps, and grave doubts may be felt, knowing the generally dirty habits of the lower classes, whether these men wash the lower part of the body every day or even every week. Although it is not possible to speak certainly upon the matter, I cannot but feel very strongly that the Paris soot has not the same nocuous properties as the soot of the towns in which hard coal is burnt. If it really possessed the same influence in preparing the scrotum for the occurrence of cancer, it seems incredible that the disease should be so rare in Paris that no one of the great surgeons attached to the Paris hospitals should

[1] *Traité de Chirurgie Clinique*, Paris, 1889.
[2] *Clinique Chirurgicale*, Paris, 1888.
[3] *Dict. Encyclop. des Sciences Méd.*, 1880, "Scrotum."
[4] *Nosographie et Thérapeutique Chirurgicale*, 5th edition, 1821.
[5] Paris, 1851, p. 672.

have ever seen a case. For, seeing that the dress worn by the Paris sweeps is only superior to that worn by our own sweeps in the matter of cleanliness, and does not protect the body from the contact of soot, the entire absence of the disease would augur a degree of personal cleanliness on the part of the men which is wholly inconceivable to any person who is acquainted with the general habits of the French lower classes in that respect.

The second kind of information which may assist in this inquiry is that regarding the immunity from cancer of the scrotum enjoyed by persons engaged in employments kindred to the sweeping of chimneys. Looking through the list of the occupations of persons who have been admitted into my own hospital with cancer of the scrotum in the last twenty years, I do not find a single collier, or coal porter, or engineer in a factory or ship, or dustman. And yet it might have been expected that the men engaged in some of these trades would be liable to cancer of the scrotum. Paget, in 1853, said, "for the disease is wholly unknown among colliers."[6] And Buck, in his *Hygiene and Public Health* (1879) said: "It is certain that charcoal powder will not produce it, and it is unknown among colliers." I do not know on what authority Buck's statement rests of the immunity of the men engaged in the dealing with charcoal powder; and the immunity of colliers might be very uncertain on account of the difficulty of obtaining reliable information regarding their diseases. But there are ample reasons for believing that they really do enjoy this immunity: first, because vast numbers of men are engaged in the coal mines, and cancer of the scrotum has never been mentioned as a disease which occurs even rarely among them; secondly, because the men engaged in carrying and carting coal in the cities, and particularly in London, so seldom come under our care with the disease that they may be regarded as exempt from it. Yet they get horribly dirty and covered with the grit and dust of coal.[7] Even the men engaged in stoking appear to be very rarely attacked by cancer of the scrotum, although I can furnish a couple of cases of the disease among them. One of the patients was under the care of Mr. Mitchell Banks, who operated for the primary and recurrent disease.[8] Mr. Banks says: "Although not really a chimney-sweep, his occupation was much of the same character, being that of a stoker in a gasworks, and he admitted that the wrinkles of his scrotum were generally full of gritty powder....." The other patient was a coke-hole man, who was admitted into the hospital on January 3rd, 1890, under the care of my colleague, Mr. Marsh. He was 51 years old, and had been employed on and off for about twenty-five years in coke raking. In order to ascertain the character of his work, I visited the place of his employment, the King's Cross Branch of the Gaslight and Coke Company's works, where Mr. Horton, the chief engineer, was so good as to show me the coke-hole men at work. They stand in the basement below the level of the retorts, which are on the ground and first floors. The burning coke, now fit for sale, falls continually down from above through wide fissures prepared for the purpose. The coke-hole men throw cold water upon it to extinguish the flames and cool the coke, then rake it back against the wall behind them, where it lies until it is carried away by the buyers. Once in every hour the men ascend to the retorts and rake into them a quantity of white and red hot coal out of the fires immediately above. I saw no soot or tar in connection with any of this work, nor was there even a smell of these substances. I could not ascertain that the men engaged in it were liable to cancer of the scrotum, and the patient himself had never seen or heard of a similar disease to his own in any of his fellow-workmen. He attributed his own trouble to irritation of the scrotum from heat, steam, and dust, which led him continually to scratch the part. The work is, of course, exceedingly hot, and the men are half naked, for they wear nothing but a shirt, a pair of trousers, and a pair of boots. Under these circumstances, the wonder is not that a case of cancer of the scrotum occurs among them once and again, but that the disease is as rare as it is. And this I take to be but another proof of the resistance to the occurrence of cancer offered by the integument of the scrotum under all ordinary, and under many extraordinary circumstances.

A certain liability to cancer of the scrotum has been attributed to the men engaged in two very different trades, namely, to tin and copper smelters and to shoemakers. Dr. Paris, speaking of the poisonous effects of arsenious acid on plants and animals,[9] said: "It deserves notice that the smelters are occasionally affected with a cancerous disease of the scrotum similar to that which infests chimney-sweepers."

This remark of Paris has been referred to or quoted by several authors, both English and foreign, but I have failed to find the smallest evidence on which it can rest. As Dr. Paris spoke especially of the smelting works and burning houses of Cornwall, I made careful inquiries of the doctors at Camborne and Hayle. In the neighbourhood of Camborne there are several tin-burning houses, the tall chimneys of which puff forth a white smoke. The surrounding fields are very poor in vegetation and there are but few cattle in them. The atmosphere is said to be unhealthy to animals and men, rather from sulphurous acid than from arsenic. I was told that not long since an action had been brought by a gentleman in the neighbourhood to restrain the tin-burners from continuing to burn tin there. The plaintiff declared that he had lost a horse owing to the unhealthy fumes, but he lost his action also. Mr. Pike, a gentleman largely engaged in the mines, told me that there is but little arsenic now compared with what there was a few years ago. Neither Dr. Hutchinson, who had been more than thirty years in practice in Camborne, nor my brother, who has been practising there for more than twenty years, nor Dr. Erskine, with ten years' experience of the diseases of the people, ever remembered to have met with a case of cancer of the scrotum in the whole course of their experience.

Hearing that tin smelting is carried on at Hayle, I drove there, and called on Dr. Mudge, who has been for very many years in practice, and, with his sons, attends a very large area around Hayle, and is familiar with the diseases of the work-people of all descriptions. He said that the smelting of tin is not now carried on to the same extent as formerly in that neighbourhood. Dr. Mudge remembered to have seen in past times eruptions and even rawness of the scrotum and insides of the thighs of the men exposed to the fumes of arsenic, but he had never seen a case of cancer of the scrotum, although he had seen several cases of cancer of the penis. Speaking of the effect of the arsenical fumes on animal life, he had never seen the loss of the hoofs of horses and cows described by Dr. Paris. On more than one occasion of late years the death of a cow had been attributed to the fumes of arsenic, and attempts had been made to obtain damages from the smelters. The viscera of some of these animals had been sent to Dr. Herepath, of Bristol, who had quite failed to discover arsenic in them. He further told me that the skin affections of the scrotum were healed by very simple measures when the men washed themselves, which they very often neglected to do when they were in good health.

In order to obtain information of the copper-smelting works, I wrote to Dr. Roger D. Williams, of Morriston, near Swansea, in the very heart of the smelting district. He replied: "In our practice, which is largely composed of smelting works, I do not think we have met with one case of cancer of the scrotum—that is a period of ten years."

Under these circumstances, I have come to the conclusion that there is no special liability of smelters to cancer of the scrotum. An occasional case may have occurred in men suffering from eczematous affections of the skin of the scrotum, just as it occasionally occurs in association with eczematous affections of the skin of other parts of the body; but that is a very different thing from the special liability of sweeps.

Lizars[10] says: "Chimney-sweeps, smelters of ores, and shoemakers are chiefly the subjects of this malady;" and he gives a sketch of an ulcerated tumour of the scrotum in a shoemaker; but I cannot but think this to have been an exceptional circumstance, for I find no mention of the liability

[6] *Loc. cit.*

[7] During the course of these lectures, Mr. Ballance has had the kindness to furnish me with some statistics which have lately come into his hands, which are intended to prove that coal miners are not only not subject to cancer of the scrotum, but that they suffer less frequently from cancer than men do generally. The statistics relate only to the miners of a particular locality.

[8] *Clinical Notes upon Two Years' Surgical Work in the Liverpool Infirmary*, page 67.

[9] *Pharmacologia*, 6th edition, ii, 96, 1825.

[10] *Practical Surgery*, Second Edition, 1847, p. 440.

of shoemakers in the works of any other author, and there is no confirmation of Lizars's statement in the statistics of the London or foreign hospitals.

The third source of information is that which tells of the liability to cancer of the scrotum incurred by persons engaged in wholly different employments to that of sweeping chimneys. I refer to the liability of the workers in tar and paraffin.

In the year 1875 Professor Volkmann, of Halle, in his well-known *Beiträge zur Chirurgie*, S. 370, published a paper "On Tar, Paraffin, and Soot Cancer (Chimney-Sweeps' Cancer)." He said: "Three cases of skin cancer of the scrotum, which I have had the opportunity of observing during the year, are of particular interest, because they developed in workmen who were employed in brown-coal-tar and paraffin manufactories, and because, even in the smallest details, both of their clinical course and anatomical structure, they agreed absolutely with the so called chimney-sweeps' cancer of the English."

In the following year (1876) the *Edinburgh Medical Journal* (page 135) contained a paper by Dr. Joseph Bell, F.R.S.E., on "Paraffin Epithelioma of the Scrotum." In this he said: "But, if chimney-sweeps' cancer is rare and becoming rarer every year, I believe we are to find a successor for it in a malady affecting the labourers exposed to the fumes of paraffin in shale works. Of this disease, epithelioma of the scrotum—ascribed by patients to paraffin fumes and contact with the oil—I have seen two cases within the last eighteen months, which I now briefly report." Dr. Bell does not seem to have been aware of Professor Volkmann's paper, for he concludes his own account by saying that he has not seen any notice yet of the form of scrotal epithelioma just described; so that it is probable that the two papers describing the same disease and attributing it to a similar cause—a cause which had not previously been known to be in any way associated with the occurrence of cancer—were the result of independent observation in two different and distant countries.

Of the resemblance of these cases of cancer of the scrotum to those occurring in chimney-sweeps, Professor Volkmann's description leaves really no doubt; and not only his description, but the excellent sketches of the general and microscopical appearances. In addition to the mere description of the cancerous affection in the three cases, he has given a very admirable account of the conditions which preceded the development of the cancer. This account is the more valuable because it agrees very closely with that given in 1871 by Professor Ogston,[11] "On the Local Effects of Crude Paraffin." Bell quotes Ogston's account, and confirms it, but does not add to it, with the important exception of two cases of epithelioma of the scrotum. Substantially, the effects of the liquid tar and paraffin on the skin of those engaged in the manufacture and whose bodies were actually exposed to them consisted in eruptions of an acute and chronic character. The acute forms sometimes passed off, and were so completely recovered from that they scarcely left any trace behind them, but they passed on in many of the people to become chronic. In the acute form the hair follicles and sebaceous glands were chiefly affected, often with the production of an eruption of bright red nodules closely approximate to each other, and usually largest and most numerous on the wrists or wherever the dress tightly embraced the skin, the dorsal aspects of the parts being most severely affected and the palms of the hands and the soles of the feet enjoying a complete immunity. The red nodules corresponded with the hair follicles. With the diminution and disappearance of the red eruption, the hair follicle remained enlarged, its mouth gaping and occupied by a little mass of epithelium and dirt, so that black points were visible over the surface of the affected skin. The only difference in the descriptions of Ogston and Volkmann is that the former speaks of the hair follicles, the latter of the sebaceous glands, as the structures affected and the seat of the black points. In the chronic condition the skin between the hair follicles or sebaceous glands was also altered; it became thickened, dry, and stiff, chiefly by increase in the thickness and alterations in the quality of the epidermis. Volkmann describes, in addition (probably because his observations extended over a longer period and were made on a larger number of individuals), little knots of epidermis, tiny horns, and flat dirty-brown scales and crusts. He found that the infiltrations of the skin were most frequent on the forearms and scrotum, where particularly they were prone to become moist and offensive. He says: "In one old workman I numbered fifteen of these larger hard warty bodies, with thick crusts, on the dark brown spotted, fissured forearms, and three on the scrotum." It is remarkable how closely this description of the chronic condition of the skin accords with that given by Paget of the skin of chimney-sweeps: "In many of them, even when they are thoroughly cleaned, the whole skin is dry, harsh, and dusky, and.....it is a common question whether one or more warts or scaly patches near the chief seat of the disease should be removed with it." And in another place in the description of the skin of a sweep, already quoted: "His skin was dusky and dry, and many hair follicles were enlarged by their accumulated contents." Horns on the scrotum of chimney-sweeps were described and figured as long ago as 1817 by Mr. Wadd. If we look upon these as precancerous conditions—a description they justly deserve—it is of the greatest interest to observe that the alterations in the hair follicles, sebaceous glands, and epidermis present precisely the same characters in the workers in hard coal soot, in paraffin, and in brown coal tar.

In the comparison of the effects of these substances, the question arises whether the scrotum is the part of the body which is especially liable to disease. On this point Professor Volkmann had no doubt. "The most remarkable circumstance," he says, "is that the disposition to become cancerous seems to be particularly special to the scrotum. Against three cases of carcinoma of the scrotum observed during this year I can only place one, not quite certain, case of cancer of the upper eyelid due to a tar wart." And his later experience, to which reference will presently be made, discovered four more cases of cancer of the scrotum against two cases of cancer of the upper extremity. In all, then, seven cases of cancer of the scrotum compared with three cases of cancer of other parts of the body. And Dr. Bell, while describing his two cases of cancer (epithelioma) of the scrotum, tells how one of the patients had an eczematous eruption, the other "paraffin acne" of the upper extremity, but no cancer there.

Of the kind and condition of the substances on which these affections of the integument depend, the following may be learned from Professor Ogston: "The *modus operandi* of the crude paraffin in producing these results seems to be as follows: the oily matters in the shale, called 'blae oil,' when separated, are both penetrating in their properties and irritating to the skin;" from Dr. Bell, who reports that the disease "was ascribed by the patients to paraffin fumes and contact with the oil." And from Volkmann, who gives a more detailed account, which is worthy of being reproduced. "It is," he says, "scarcely sufficiently known to what extent the fabrication of tar, photogen, and paraffin has increased in our district. The brown coal, which is found in the near and far surroundings of Halle in inexhaustible quantity, serves as material. A large and still increasing number of factories has arisen in the last ten or fifteen years, in which many thousands of workmen are employed.

According to the reports of those expert in such matters, about 600,000 cwt. of tar are produced, which yield some 100,000 cwt. of paraffin and 300,000 cwt. of oil. The first product is always the so-called brown coal tar, a black-green watery mass, which is procured by means of simple smouldering (Schwelung), and from this are procured by further distillations the lighter and heavier oils—benzine, photogen, solar oils as they are called—and paraffin. It is easily understood that in such factories there are all kinds of injuries and accidents, and thus I have had to do from time to time in the clinic with the workmen, and the description of their peculiar affections of the skin, which I shall now give, is based on the experience of the last seven years; for very soon it was apparent that these people, when they had worked in these branches for a certain period, exhibited, in those departments which obliged a continual contact with the still liquid or pappy products of the manufacture, almost without exception diseases of the skin, which were named by themselves "tar scratches" (Theer-kratze). This somewhat curious name is well understood, when I add that certain forms and stages of

[11] *Edin. Med. Journ.*, xvii, 544.

these affections of the skin are associated with violent itching (a circumstance which Ogston also refers to), on account of which the sufferers are forced to scratch themselves." In a footnote is added: "In a visit to one of our largest factories, I found the pure tar distillers or smoulderers (Theer-schweler) quite free from the affection. They simply extract the tar, and in doing so at the most soil their hands, but not their clothes or the rest of their bodies. Yet there might have occurred certain cases of disease among them. But even among those who handle exclusively the firm prepared paraffin, I found no affections of the skin. This might surprise us, because the paraffin bandages which we thought to have used in the place of plaster bandages, were given up because pustular and eczematous eruptions formed beneath them, which were characterised by great obstinacy. Yet it is easily explained when we remember that the workman only brings the prepared dry paraffin and the paraffin candles, which are also made in this factory, in contact with the palmar surface of the hands and fingers, where it is protected by thick epidermis; and these parts of the body I found always free from disease, even in the most active and severe cases. On the other hand, almost all the workmen who had to manipulate the fluid or pappy products, and continually moisten themselves with them, exhibited affections of the skin; so also the workmen at the presses, in the cellars, where the raw and still very dirty and oily paraffin is taken from the first forms and triturated, etc. All these people put on peculiar clothes in the factory for the work, which are quite soaked by the products of manufacture, and which become quite stiff. They help themselves occasionally so far, that they wash out (although they are forbidden to do so) these pieces of apparel with the brown coal oils (photogen, solar oils, etc.)."

Towards the conclusion of his article Professor Volkmann compared the action of these substances with that of soot in the following terms: "The products of the dry distillation of brown coal, which is worked in our paraffin factories, apparently cause much more irritation than the chimney soot. There is no account in the English authors of such an active irritation of the skin as is exhibited in the bright red, painful, sometimes even confluent, papules and lumps which have been described. This need not surprise us when the fluid or pappy nature of the products of the fabrication is taken into account. On this account the occurrence of cancer has followed much earlier in our cases than has been common in the chimney-sweeps. In England the sweeps commence their vocation in the seventh year of their age, and, after forty or fifty years of continual work in the soot, cancer at length develops in the warts, which commenced only a short time previously. Our whole industry is not much more than ten years old, and most of the workmen have been employed in it only a few years." The only objection I would make to these statements of Volkmann is that, in the days when boys were engaged in sweeping, horns were observed on the scrotum even before the age of puberty, and that occasional examples of cancer occurred at a comparatively early age.

Tillmanns of Leipzig, following up the researches of Volkmann in an excellent paper, "Ueber Theer-, Russ-, und Tabak-krebs,"[12] first describes a case of cancer of the scrotum in a paraffin worker, then his visit to the paraffin manufactory at Rehmsdorf near Zeitz, where he found conditions among the workmen precisely resembling those observed by Volkmann. He proceeds to say: "The occurrence of tar cancer on the scrotum and on other parts of the body is, I believe, very rare. In order to arrive at more certain knowledge in this direction, one of my friends, the owner of a paraffin factory, had the kindness to place himself in communication with a large number of chemical manufactories, tar manufactories, stone-coal-tar distilleries, wood distilleries, pine-soot (Kienruss (?) lampblack) factories, and the like in the province of Saxony, and, further, in Cologne, Amsterdam, Doos near Nuremberg, Höchst-a-M., Berlin, Frankfort-a-M., List near Hanover, and Prague. In none of these places had similar cases to those of Volkmann and myself been observed. From all our correspondents who were applied to in this direction we learned in short the following. In pine soot—(?) lampblack—factories and in stone-coal-tar factories cancer of the skin and severe dermatitis do not appear to have been hitherto observed as in the workers in the brown-coal-tar and paraffin industries."

[12] *Deutsche Zeitschrift für Chirurgie*, xiii, 519, 1880.

In the first lecture, in speaking of the employments of the patients in the wards of St. Bartholomew's Hospital, I said that twenty-nine of the thirty-nine patients who were admitted with cancer of the scrotum were chimney-sweeps. The analysis of the employments of the remaining ten men is also very interesting. It is as follows:

Salesman	1	Tarworker	1
Nightwatchman	1	Pitch and asphaltemaker ...	1
Police instructor	1	Barge and boatbuilder	3
Gasfitter	1		—
Sailor	1		10

Of these ten men, five at least were engaged in work which did or might bring them in contact with tar or similar substances. It is possible that the sailor had been also engaged in a similar manner to the boat builders, but there is nothing in the notes to tell whether this was so or not, and the man died of the results of a trivial operation, so that there are now no means of gathering any further information regarding his precise work. On the subject of the general liability of sailors to cancer of the scrotum, I have none but negative information. The general reports of the cases under treatment at the Seamen's Hospital, Greenwich, during the years 1875, 1876, 1877, 1878, 1879, 1882, 1883 and 1884 contain not one case of cancer of the scrotum. The men admitted there are taken from all nations, and are suffering from all kinds of disease and accident. But they are for the most part, of course, young men, under forty years of age at least. Nor have I any information as to whether the men engaged in the first four employments, salesman, night watchman, etc., had been previously so employed that they might have been long exposed to the contact of soot, pitch, or the like.

Nor could I obtain information of the exact nature of the employment of all the last five men. The pitch and asphaltemaker was admitted into the hospital in 1873. The number of the house in which he lived in a small street off Bow Common had disappeared, and no news could be obtained of the man himself when I searched for him in 1889. All I knew was that he had been at his employment for some eighteen years, and that he had suffered from a diffused tuberculated growth of the scrotum, which had commenced in the form of a wart. One of the boatbuilders came up from Hastings in 1878 for the removal of a small epithelioma of the scrotum which had begun as a sore. He returned after the operation to the seaside, and has been so thoroughly lost sight of that I could obtain no word of information regarding him or his employment. A bargebuilder whom I visited last year in Rotherhithe had been twice in the hospital, the first time for cancer of the prepuce, for which the penis was amputated by my colleague, Mr. Smith; the second time for a cancer of the scrotum, which commenced as a small wart or pimple, and was associated with an enlarged gland in the left groin. The cancer and the affected gland were removed by Mr. Langton. When I saw him two years and a-half after the second operation, he was in good health and free from recurrence. He told me that his work was chiefly in wood, like a carpenter, but that he frequently coated boats with a mixture of gas-tar and hair. The mixture did not get about his body, so far as he was aware, and he did not connect the occurrence of his cancers with it. He was in his working clothes, which did not smell of tar or show any sign of having been saturated with tar. And he had no warts on his hands or forearms, such as I have seen in some of the workers in liquid pitch or tar.

I learned from my colleague, Mr. Walsham, that the tarworker had been engaged at a tar factory at Barking Creek, and that some years ago Mr. Walsham had visited the factory and had learned that the man was employed with the "anthracene." A few months ago I called at Mr. Davy's tar factory at Barking Creek, and saw Mr. William Davy, jun., who very kindly gave me what information I required. He said that the men who were particularly subject to warts and skin eruptions were those who were employed with the liquid anthracene, the last product of the distillation of gas-coal tar. These men wore a canvas apron over their moleskin trousers. The apron, and in time the trousers, were soaked through with anthracene. When this happened the skin beneath became affected with warts, often very badly.

For some years past this particular branch of the tar industry had been transferred to Beckton. Benzine, creasote,

and anthracene are still obtained by distillation at Mr. Davy's works, and the men engaged about the retorts are prone to suffer in a slight degree from warts, which Mr. Davy attributes to the action of the vapours which issue from the retorts. But the working up of the liquid anthracene no longer takes place at Barking.

I have only once seen the skin eruptions produced by the crude paraffin. The patient from whom this sketch was made was a man 53 years old who had an epithelioma removed from his forearm by my colleague, Mr. Baker, in the year 1886. He had been engaged in the paraffin works at East Greenwich. In December of last year I searched him out at his own home and found him quite well and without any recurrence of the cancer, but still suffering from eruptions on the hands and forearms, although not so badly as when he had been in the hospital, for he did not happen at that particular period of the year to be performing the same duties as usual. He told me that he worked in the crude moist paraffin, which was to be made up into wax for candles, and that his arms were bare. He wore an apron over his ordinary clothes, and the apron got soaked with the paraffin, but the liquid never reached his body. All the men who worked like he did in the moist paraffin were liable to eruptions, but his was the only case of cancer he had known of. The men who were employed in moulding the wax into candles were not subject to eruptions. He told me that he and his mates were obliged to "keep their flesh very clean" to avoid the occurrence of warts and sores.

The papers of Volkmann, Bell, and Ogston were written so many years ago that it seemed very desirable to obtain some later information on the occurrence of skin disease and cancer in the brown-coal-tar and paraffin workers. In the course of the year 1889 I wrote to Professor Volkmann, and received from him, only a few weeks before his death, a very kind letter, together with papers by his pupils on skin cancer and other subjects in which I am interested. The latter, after confirming what his original paper had stated of the ill-effects of the fluid and pappy materials on the workpeople, concludes thus: "The manufacturers most willingly responded to my wishes (with regard to baths, etc.), and since that time the paraffin cancer has become much more rare in these particular factories, so that I only see an occasional case of the disease in the clinic." One of the papers enclosed was an interesting production by Dr. Schuchardt.[13] The date of its publication is exactly ten years after the publication of Volkmann's original paper, and it contains an account of all the cases of paraffin cancer which had been met with in the clinic during those ten years. They were six in number, and the dates of their occurrence were 1877, 1878, 1881, 1882, 1884, and 1885, so that they were very evenly spread over the whole period.

During the year 1890 I wrote to Dr. Ogston and Dr. Joseph Bell, and received most courteous replies. Dr. Ogston's was: "I have never seen a case of paraffin cancer in Aberdeen. I expect this is due to the very small number of workmen who are employed in this industry." Dr. Bell said: "As to the paraffin disease in the scrotum of shale workers, I have seen two or three other cases since the ones I published, but I believe that early treatment on the part of the local doctor and greater care in cleanliness on the part of the workmen have so far limited the number of cases and diminished their serious character."

From all that has preceded, I think we may now draw the following conclusions:—

1. That it is possible to prepare the skin for the occurrence of cancer by the constant or repeated application to it of certain substances during a long period of years.

2. That the nocuous substances in this relation, of which we have the most information, are hard or stone coal soot, brown coal tar, and crude paraffin.

3. That there is evidence to cast grave suspicion on certain other substances, such as stone coal tar, but that these are far less to be feared.

I am myself prepared to go farther, and think that the soot of brown coal, wood, charcoal, and peat is innocuous in this respect, but further proofs may perhaps be asked for before this is admitted.

I take it that no pathological question is ever so thoroughly settled or so deeply buried but that it contains the germs of new questions in pathology, often more complex and more difficult to answer than the original question. Sooner or later these present themselves, not always in a welcome fashion, and not always to the original inquirer, but with a repeated intrusion which at length compels attention; so, from the conclusions which have been set down, arise various considerations which may be expressed in the form of queries, some of which may be answered now or may be thought to have been already sufficiently answered, while the remainder await an answer at the hands of someone better fitted to cope with the problems they contain than I am. Are these substances (soot, tar, and paraffin) equally potent on the integument of all parts of the body, or are certain areas of the integument especially liable to be influenced by them?

What are the essentials in these substances which prepare the integument for the occurrence of cancer? Is the preparation due to the action of one or of several elements in each substance, and are the same essential elements present and active in all the different substances? Is cancer of the mouth and tongue in smokers and chewers of tobacco due to the same or a similar active element in the tobacco smoke and juice? How far are the floating particles of soot in the air responsible for the occurrence of cancer of other parts of the body, particularly of the respiratory and alimentary tracts, and how far does the smoke nuisance of large towns tend to the increase of cancer?

To the first of these questions I would reply that the evidence points very strongly to a specific action of the substances (soot, tar, and paraffin) on the tissues of the scrotum. It has been shown in the course of these lectures how little liable the scrotum is, under all ordinary circumstances, to the occurrence of cancer. Yet it is the seat of election of the cancer which is induced by the action of these substances. This special liability of the scrotum has been again and again attributed to the peculiar character of the integument, especially to the deep depressions between the rugæ, from which it is difficult to dislodge the nocuous substances. The same reasons should make the scrotum the seat of election of cancer in many dirty occupations, in which scrotal cancer is practically unknown. Again, other parts of the surface of the body which are quite as much exposed to the action of these nocuous substances (soot, tar, and paraffin)—for instance, the pubes and insides of the thighs—are very rarely attacked. And, as I think, a more powerful argument, the areas of the integument which are particularly prone to cancer generally, of the upper part of the face and of the lower lip, are not more often attacked by cancer in soot, tar, and paraffin workers than in other men. Yet these parts, in the sweeps, are covered every day with a coating of soot, and are exposed to the fumes and probably also to the actual liquids in the workers in tar and paraffin. A certain immunity from cancer may certainly be claimed for them on the ground of the daily washing which every sweep, however dirty he may naturally be, performs. But when it is remembered how very prone these parts are to cancer, and how very imperfectly the wrinkled skin of the face, especially about the orbits, is cleansed in English sweeps, how the lips are often cracked and sore during the cold weather, and the soot must be rubbed and driven into the sore places, it is difficult to believe that its action can be so powerful on these parts as it is upon the integument of the scrotum. Nor is there any serious difficulty in assuming that a nocuous substance may exercise a different effect according to the part of the body to which it is applied. It is quite conceivable that the effect may depend on, or be modified by, special qualities in the part affected. Instead of attributing immense influence to the anatomy of the easily-affected areas, we may assume that they possess physiological and chemical properties in which they differ from other areas of the integument as decidedly as they do in their coarse appearance. What is there in the lower lip which renders it so liable to a cancerous disease which is almost unknown on the corresponding margin of the upper lip? And what is there in the lower part of the face which protects it from the cancer to which the upper part is so singularly prone? The explana-

[13] Beiträge zur Entstehung der Carcinome aus chronisch entzündlichen Zuständen der Schleimhäute und Hautdecken, *Volkmann's Sammlung*, No. 257, 1885.

tion must be looked for in the chemical and physiological properties rather than in the anatomy of these areas of the integument.

To the second question I can give no satisfactory reply. Some persons have thought that the sulphurous acid in the soot is to blame, others that the evil influence is due to ammonia or combinations of ammonia, but at present there is no kind of evidence on which a sound opinion can be formed. I am not even acquainted with a good analysis of stone-coal soot, so that material for further investigation from a chemical point of view is still wanting. I would, however, suggest that the nocuous element is probably to be found in greatest quantity in crude paraffin, in brown coal-tar, and in stone-coal soot. in much less quantity in stone-coal tar, and that perhaps it is absent or only present in very minute quantity in the soots derived from brown coal, from wood, and from peat.

Esmarch and Langenbeck, in the discussion on tar cancer to which reference has been made, suggested that the relation of tobacco smoke and juice to cancer of the mouth is probably similar to that of soot, tar, and paraffin to cancer of the scrotum. In Tillmanns's paper, which has been quoted, this suggestion is much more fully discussed, and the author is of opinion that the same nocuous elements, powerful in predisposing the integument to the occurrence of cancer, are present in tobacco smoke and juice, stone-coal soot, brown coal tar, and paraffin. The paper is well worthy of study, but the evidence on which the theories rest is not sufficient to establish them.

The question of the influence of floating particles of soot is one of the greatest interest, and perhaps of equal importance. The intention of these lectures has been to prove, among other things, that soot exercises little or no influence in inducing the occurrence of cancer of any part of the skin, with the exception of the skin of the scrotum; but that its influence on the scrotum is indeed remarkable. But it must not on this account be assumed that soot is incapable of inducing the occurrence of cancer of any other part of the body than the scrotum. It is quite possible that there are areas of mucous membrane—of the respiratory and alimentary tracts, for instance—on which soot is capable of exercising as pernicious an influence as it does upon the skin of the scrotum. We who live in large cities swallow and inhale soot every day in greater or less quantity. We accept the position, grumblingly no doubt, still we accept it; we know that our great smoke fogs make many people ill, and that they kill a certain number with acute disease. But it is possible that we owe far more than this to the influence of floating soot, and that a part of the increase in the occurrence of that awful disease, cancer, of which the national statistics tell so striking a tale, is due to the daily contact of soot with areas of the lining mucous membrane, or to the entrance of soot into some one or other of the internal organs in which the conditions are favourable to its action. The national statistics tell little more than these two things: that the deaths from cancer are steadily increasing, and that the increase is greater among men than among women. We want to know far more than this. We want to know whether there is an equal or tolerably equal increase in the occurrence of cancer of all parts of the body, or whether the increase is limited to the cancers of certain parts. And I do not see how this information can be obtained by any private individual or combination of individuals. The Government alone has the power to obtain it.

My task would be but imperfectly fulfilled if I were content merely to tell the story of a dangerous malady, to discuss its curious phases, to show that the men of one country are subject to it, while the men of another country under conditions almost precisely similar escape it. The information which has been obtained in the course of this inquiry has very plainly indicated the reasons of the exemption from cancer of the scrotum of the sweeps of those countries in which the disease ought certainly to prevail. From the moment the belief in these reasons attains the strength of a conviction, we are bound in the name of humanity to use what means we can to abate the evil which lies close beside our door. It is nothing to the purpose to say that the total number of sweeps who die annually of cancer of the scrotum in this country is very small. The Registrar-General has deduced from his statistics that chimney-sweeps are eight times more liable to die of cancer than men are generally. On this computation, out of forty-nine men who died of cancer in the course of three years, there were forty-two deaths too many. Perhaps all this surplus of deaths cannot be attributed to the influence of soot, but at least thirty of them must be set down to soot, and it is more than probable that some, if not most, of the cases of cancer of the internal organs, such as the stomach and liver, owned the same cause. But if the deaths were only half as numerous, the obligation would remain as great to point out and insist upon the measures which may serve to diminish or to remove the evil.

They may be summed up under two headings: those which are directed to the protection of the individual against the contact of the nocuous material, and those which are intended to remove it thoroughly every day.

Examples of efficient protection may be found in the clothing of the Dutch, the Belgian, and the German sweeps, who not only so cover the body as to protect it against the contact of soot, but who are also careful to cover the nose and mouth during sweeping, so as not to inhale or swallow soot. From conversations with the sweeps of these countries I have not been able to discover that these precautions are taken from any other motive than cleanliness, for they have never attributed any special maladies to the action of soot. At the same time, the trouble they take to protect the mouth and nose from the access of soot suggests that they fear, as well as dislike, to breathe and swallow it; and I do believe there is a lurking distrust of stone-coal soot in the minds of many of them, for a young sweep in Bâle, when I pointed out that the legs of his trousers were not tied at the ankles, told me that he should tie them round with a cord if he swept a chimney where stone coal was burned. He could, however, give no other reason for doing so than that it was the custom of the trade.

The daily baths of the North German and the Swiss sweeps, taken in full-length metal baths, or in large wooden tubs in a small bath room plentifully provided with hot and cold water, with soap and soda, are examples of measures of the second kind. I daresay either of these means would prove perfectly successful in preventing the occurrence of soot cancer in this country, but I believe the best result would be attained by the adoption of such clothing as is used by the Belgian or the North German sweeps, and of the daily washings from head to foot of the North German and the Swiss sweeps. There should be but little difficulty in obtaining the adoption of such simple measures as these. They entail a very small expense, and the trade of a chimney-sweep is lucrative, while the increased comfort to the individual and his surroundings ought to prove a sufficient incentive in itself; but I can foresee difficulty in the prejudice and ignorance of the men themselves, and in their dislike to any innovation, especially if it owns a foreign origin; also in the lesser master sweeps, who form a numerous class, and many of whom are really only independent journeymen; and last, in persuading the masters and the men to take immediate and daily precautions during a long period of years against the occurrence of a disease which, though terrible enough to those who suffer from it, is certain never to attack the large majority of those on whom the measures of protection are enforced.

FUNERAL REFORM.—The Funeral Reform Association has recently held a series of meetings in London. A conference was held at the Church House under the presidency of Earl Fortescue, at which Dr. W. T. Greene read a paper on the insanitary state of St. Giles's Cemetery, Camberwell, and it was resolved to present a memorial to the Local Government Board on the subject. A drawing room meeting was held at Lady Frederick Cavendish's, and was addressed by, among others, Archdeacon Donne, Dr. Needham, Professor Flower, Dr. Norman Kerr, and General Lowry. A tent was exhibited suitable for the protection of mourners at the grave side. The annual meeting was held at the Church House, under the presidency of the Bishop of Wakefield. Resolutions were adopted in favour of a simple earth-to-earth burial with the use of antiseptics, and recommending cemetery authorities to take special precautions for the preservation of the health of mourners in inclement weather.