

On cancer of the scrotum in chimney-sweeps and others : three lectures delivered at the Royal College of Surgeons of England / by Henry T. Butlin.

Contributors

Butlin, Henry T. 1845-1912.

Publication/Creation

London : Printed at the Office of the British Medical Association, 1892.


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ON
CANCER OF THE SCROTUM
IN
CHIMNEY SWEEPS & OTHERS

BUTLIN

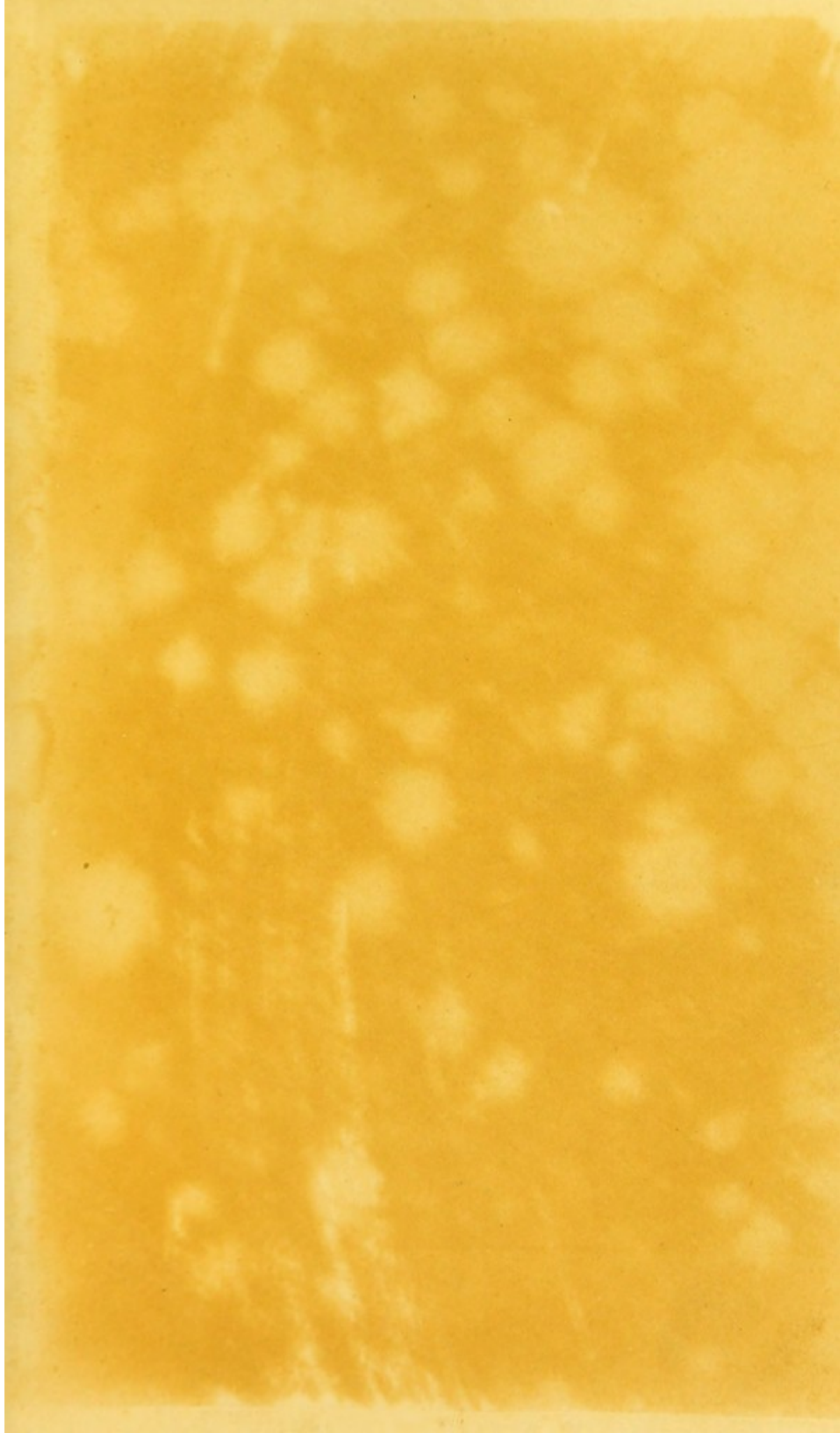


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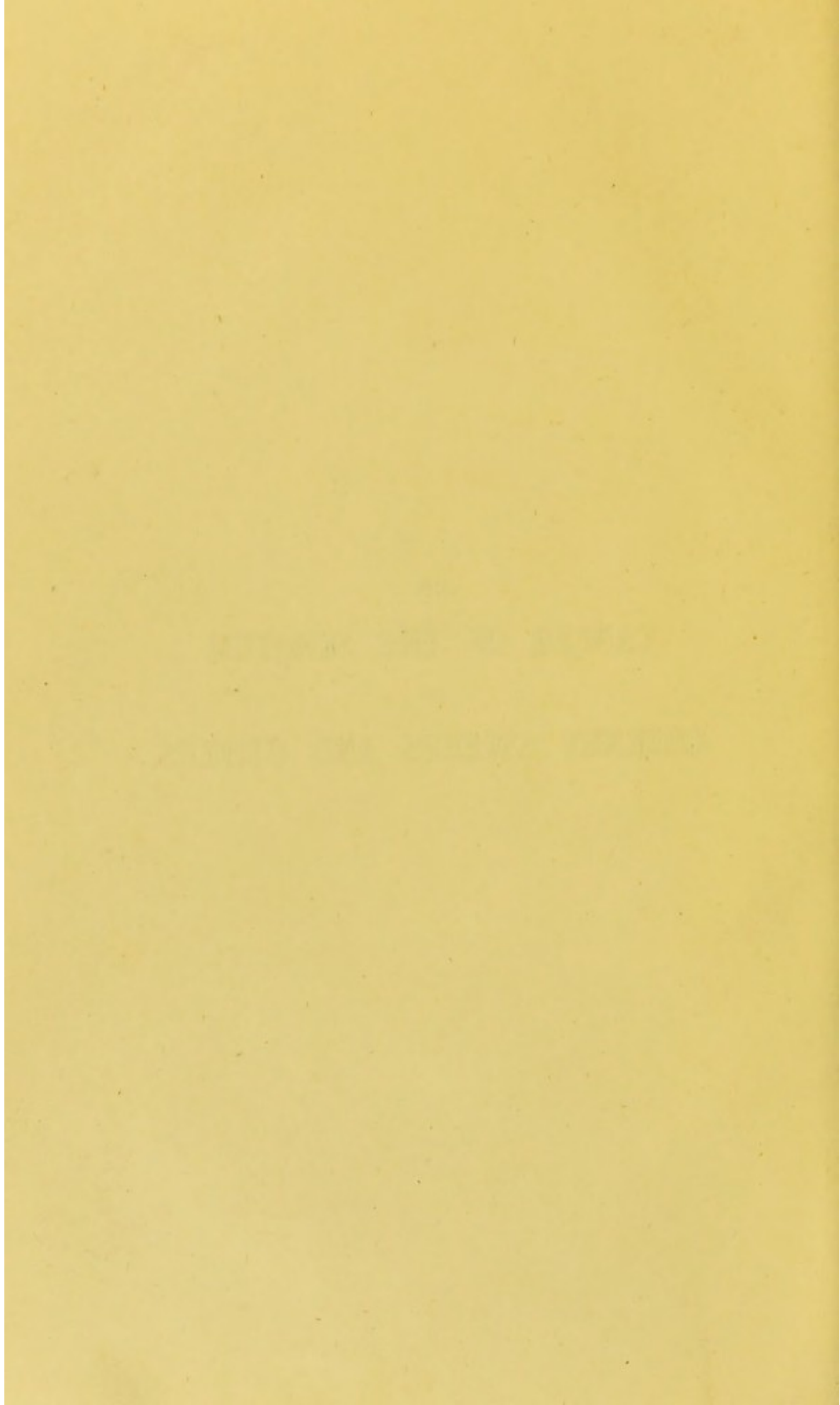




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ON
CANCER OF THE SCROTUM
IN
CHIMNEY-SWEEPS AND OTHERS.

THREE LECTURES

Delivered at the Royal College of Surgeons of England.

BY

HENRY T. BUTLIN, F.R.C.S.,

Professor of Pathology and Surgery at the College; and Surgeon to
St. Bartholomew's Hospital.

Reprinted for the Author from the BRITISH MEDICAL JOURNAL, June 25th,
July 2nd and 9th, 1892.

PRINTED AT THE OFFICE OF
THE BRITISH MEDICAL ASSOCIATION, 429, STRAND, W.C.
1892.

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CANCER OF THE SCROTUM IN CHIMNEY-SWEEPS AND OTHERS.

LECTURE I.

SECONDARY CANCER WITHOUT PRIMARY CANCER.

MR. PRESIDENT AND GENTLEMEN,—Several years ago, in the course of a correspondence on the subject of the cancer statistics of the United Kingdom, Dr. William Ogle asked me on what authority I had somewhere made the statement that chimney-sweeps' cancer had become less frequent in this country. I replied that a general impression prevailed among us that such was the case, and quoted in favour of this impression several of the leading textbooks of surgery. Dr. Ogle gave me to understand that the statistics of the Registrar-General did not support this view, and, in the Supplement to the Forty-Fifth Annual Report (1885, p. 56) he drew special attention to "one cause of death.....as being notoriously common among chimney-sweeps.....namely, cancer."

A year or two later, in working up the material for a book on *The Operative Surgery of Malignant Disease*,¹ I discovered that although a general impression prevailed that sweeps' cancer is not so malignant as epithelioma of many other parts of the body there was really no trustworthy material at hand from which the later results of operations for the radical treatment of the disease could be ascertained. And I discovered further that very little new information on this singular disease had been furnished by surgeons or pathologists in this or any other country during the last 50 years or more.

These circumstances first led me to take more than a passing interest in cancer of the scrotum. And, if more had been wanting to stimulate my interest, it might perhaps have been found in the fact that the first account of chimney-sweeps' cancer was written by Mr. Pott, to whose memory every surgeon of the hospital with which I have the honour to be connected looks with reverence and respect; and the second account was written also by a surgeon to St. Bartholomew's Hospital, Mr. Henry Earle.

At the first I intended merely to collect as much information on the results of operative treatment of cancer of the scrotum as the hospital records would afford; but in looking up these records curious facts became apparent, some of which seemed to have an important bearing on the general pathology of cancerous disease, and I soon determined to discover all that lay within my reach upon the subject so far as my powers and the time at my disposal would permit.

The literature relating to chimney-sweeps' cancer pre-

¹ J. and A. Churchill, 1887.

sents three important statements which deserve the gravest attention. The first is to the effect that the disease is seldom seen in any other part of the civilised world except Great Britain; the second that it is becoming more and more rare in Great Britain; the third that it is a comparatively mild malignant disease. One of these statements had received so rude a shock from the national statistics that it seemed desirable to test the truth of each one of the three and to see on what foundation each had been built. For there were none but the barest assertions in most of the works which were before me, often appearing to rest on a mere report of a conversation between the author and some more or less distinguished foreign surgeon.

The statement of the rarity of the disease in other countries is only suggested in the early English works on cancer of the scrotum. It is distinctly made in the works of foreign authors, and is mentioned in later English literature as if there could be no doubt of its truth. In the quotations which I make, it will be convenient to put all the statements into English for the sake of uniformity, but the references will be given so that the accuracy of the translations may be in every instance verified. Mr. Earle² in 1832 is reported to have said: "However, it was well known to be peculiar to those countries where coals were used as fuel." Sir James Paget in 1853³ speaks of "its comparative frequency in England, especially in the large towns, while in other countries where soot is abundant it is hardly seen." Vidal (de Cassis) speaks of chimney-sweeps' cancer as "this affection, which is met with far more frequently in England than in any other countries of Europe."⁴ Nélaton, in an account of a case of cancer of the scrotum (not in a sweep) says: "This malady, relatively pretty common in England, is so rare in other countries in general, and in France in particular, that very many surgeons have never had the opportunity of observing a case."⁵ Albert says: "Carcinoma of the scrotum is known under the name of chimney-sweeps' cancer. It occurs frequently in English chimney-sweeps."⁶ Billroth and Winiwarter in 1883 say: "In England epithelial cancer occurs tolerably frequently in the scrotum of chimney-sweeps."⁷ Agnew in 1881 speaks of the affection having been prevalent in Great Britain at one time, but that he had never seen a case in the United States.⁸ And Satterthwaite, in the *Reference Handbook of the Medical Sciences*,⁹ speaking of cancer of the scrotum, says that it rarely occurs in this country (that is, the United States), but "in England, where it appears to have been common among chimney-sweeps, it has been called chimney-sweeps' cancer."

That this statement of the rarity of the disease in other countries is correct, I think there can be no doubt. For several countries, it rests on no better authority than the bare statement of the surgeons attached to large hospitals in the principal towns, an authority which would not serve if the statements were modified, for they would amount then

² *London Med. and Surg. Journal*, i, 6.

³ *Surg. Path.*, ii., 464.

⁴ *Traité de Pathol. externe*, 5th edition, v, 222, 1861.

⁵ *Mon. des Hôpit.*, 1855, iii, 185.

⁶ *Lehrbuch der Chirurgie*, iii, 547, 1882.

Chirurgische Path. and Ther., 12th edition, Berlin.

⁸ *Surgery*, ii, 525.

⁹ *New York*, 1885, , 774.

merely to a kind of idea that the disease is less common or more common in one country than in another. But the statements are absolute and positive to the effect that the writers had either never seen a case of cancer in a chimney-sweep, or that a single case had been observed in the course of many years, that this case had been shown to other surgeons, and was the only case which any of them had observed. It would no doubt be more satisfactory were it possible to prove these statements by the aid of statistics of the hospitals on the Continent and in the United States, but this can only be done to a limited extent. Statistics such as are published by many of the general hospitals in London are not to be found in most Continental countries, and I am not aware that the American towns are in the habit of presenting them year by year. There are, however, excellent detailed statistics for some of the large hospitals abroad, and their figures on this matter are convincing. In the K.K. Allg. Krknhs. at Vienna, during the eleven years between 1874 and 1884 inclusive, there was only one case of cancer of the scrotum, but not in a chimney-sweep. In the Rudolf-Stiftung in the same town in the fourteen years, 1873 to 1886, there was not a single case. In the K.K. Allg. Krkhs. at Prague, in the course of the nine years between 1877 and 1885 inclusive, there only occurred one case of cancer of the scrotum, whether in a chimney-sweep or not I do not know. In the annals of the great Charité Krkhs. at Berlin during the eight years from 1878 to 1885, there was not registered a single case.

In the statistics of the hospitals of Paris for the year 1861 no case of cancer of the scrotum is recorded.

In the Reports of the City Hospital of Boston, U.S., during the five years (1881-2, 1882-3, 1883-4, 1886, 1887) there occurred but one case of cancer of the scrotum, but I do not know whether the patient was a sweep.

For comparison with these statistics, the statistics of some of the London hospitals may be taken. In four hospitals—Westminster, St. Thomas's, Middlesex, and St. Bartholomew's—in the year 1884, five cases of cancer of the scrotum occurred in chimney-sweeps. In the year 1881 the statistics of University, St. Bartholomew's, Middlesex, Westminster, and St. Thomas's give a total of four cases. And the number of patients in these hospitals, as I shall have occasion to show by-and-by, cannot be compared with the numbers in some of the hospitals abroad whose statistics have been quoted. It may further be remarked that the hospitals given above have not been specially selected, and that the years are taken at random, and are not picked years in any sense of the word.

I do not know who is responsible in the first instance for the statement that chimney-sweeps' cancer has become much less frequent in Great Britain; but the earliest notice of it which I have found is in the first edition of Holmes's *System of Surgery* (1864), where Professor Humphry says: "It is much more common in this country than in others; but it appears to be on the decrease here, perhaps owing to the more general use of machines." It occurs, as might almost naturally be expected, in Holmes's smaller *Surgery*. In the first edition of Bryant's *Surgery* (1872) the author says: "Cancer of the scrotum is a rare affection compared with what it was some years ago when sweeps ascended flues." In the ninth edition of Erichsen's *Surgery* (1888) it is said: "This disease is much less common now than it was formerly, when 'climbing

boys' were employed instead of machinery for the sweeping of chimneys ;" but this remark does not occur in the eighth edition, which appeared four years previously. The decline of the disease is thus made a part of the teaching of medical students, for these are works which are very generally read for examinations.

So strongly has this impression gained ground that I asked one or two of my colleagues at the hospital whether they thought there were fewer cases of chimney-sweeps' cancer now than fifteen or twenty years ago, and the reply was, "Certainly; they were quite frequent when I was a student, but one scarcely ever sees a case at the present time." In order to ascertain how far this was true, I consulted our hospital statistics, and found that since the foundation of the statistical tables and the registrar's notes—a period of twenty years—there have been thirty-nine different cases of cancer of the scrotum under treatment in the wards, and that twenty-nine of the thirty-nine patients were chimney-sweeps; that scarcely a year had passed without a case of chimney-sweeps' cancer; and that the number of cases during the last ten years was quite as large as the number during the preceding ten years. Further, it was interesting to remark that there was scarcely a single member of the surgical staff, surgeons or assistant surgeons, who had not had at least one case under his own personal care. The statistical tables of other London hospitals to which I had access told a similar tale—that there has never been a time during the last eighteen or twenty years in which cases of chimney-sweeps' cancer have not been observed, and that the frequency of the disease, so far as tables tell, is much the same as it was at the time when these tables were first made.

I have already referred to the correspondence with Dr. William Ogle and to the Supplement to the Forty-Fifth Annual Report of the Registrar-General. At page 56, under the heading "Chimney-sweeps," attention is drawn to the generally high mortality among this class of workers. Two hundred and forty-two deaths had occurred among them during the three years 1880, 1881, 1882, and of these no fewer than forty-nine were attributed to cancer. Dr. Ogle calculated from the figures which came before him that "the liability of chimney-sweeps to malignant disease is about eight times as great as the average liability of all males." And he proceeds to say: "These figures scarcely support the belief expressed by some authorities that improvements in the art of sweeping and habits of sweeps have caused this disease to be comparatively infrequent among them." Of course the scrotum was not the part affected by cancer in all these cases; only twenty-three of the forty-nine deaths were attributed certainly to cancer of the scrotum, penis, testis, and groin. Thirteen of the patients died of cancer of the lip, face, orbit, palate, neck, stomach, and liver. But, in the remaining thirteen cases the organ affected is not stated, so that we may be sure that a large proportion of these patients suffered from cancer of the scrotum.

I know of no other definite sources from which the relative frequency of chimney-sweeps' cancer in this country can be ascertained. These numbers lend no colour to the theory of the decline of the disease; they tell only that it has occurred with a certain regularity during a long period of years. And if anyone will take the trouble to converse with the

sweeps themselves, especially with the lesser master sweeps, he will find that most of them can tell of some sweep, a friend or member of their family, who has died of cancer of the scrotum within the last few years, or who is even now suffering from the disease.

There has seldom been seen a more curious illustration of the steady growth and progress of a false impression than this in relation to the decline of chimney-sweeps' cancer. One is irresistibly reminded by it of the growth of a slander or of that entertaining winter evening game in which the players sit in a long row, and the first tells in a whisper to the second some short tale or anecdote. The second repeats it to the third, still in a whisper, and the third to the fourth, and so on through the row, until the last player tells it aloud, to the infinite amusement of the whole, who can scarcely recognise in the garbled version the story as it left them each in turn.

It is very probable that the whole story of the decline of chimney-sweeps' cancer originated in the mere expression of a belief uttered by Professor Humphry in the *System of Surgery*, who only said, "it appears to be on the decrease here." This has been taken up and repeated by one person to another, from book to book, until it has become a definite statement, of the truth of which no one expressed a doubt until the force of figures impelled Dr. Ogle to inquire on what authority it rested. It is quoted in the works of foreign authors. Busch, of Bonn,¹⁰ speaks of the disease as having become very rare even in England. Kocher, of Bern,¹¹ says it has greatly diminished in frequency in England; and von Langenbeck,¹² in the discussion of a paper on tar cancer by Volkmann, goes so far as to say it has completely disappeared from England. More curious still are the various theories which have been advanced from time to time to account for the decline of the disease. By some it is attributed to the law which has prohibited the use of "climbing boys." Others consider that the use of machinery for the cleaning of the chimneys has produced the change. Some attribute it to the cleaner habits of sweeps. One surgeon, Mr. Lawson, in an article in the *Lancet*, "On the Probable Cause of the Diminution of Chimney-sweeps' Cancer," has traced the improvement to "the depreciation in the value of soot," which is so great that the men are no longer employed as formerly in sifting it through a sieve, owing to which there was constant friction between the soot-covered clothes and the scrotum. But, perhaps, the most curious reason of all which I have found is that given by Agnew, of Philadelphia, who says that the disease has almost entirely disappeared "since the introduction of coal for the purpose of heating dwellings." (1)

The only ground on which the belief in the decline of the disease could reasonably rest would be the proof that it has been at some period within the last hundred years (during which it has been observed) a frequent malady. So far from this having been the case, the very contrary would appear from the writings of the first authors who treated of the disease. Earle, in 1823,¹³ said: "Fortunately, it is one of comparatively rare occurrence, when it is considered how many are ex-

¹⁰ *Lehrbuch der Chirurgie*, ii, 242, 1869.

¹¹ *Deutsch. chirurg. Lief.*, 50b, 1887.

¹² *Verh. deut. Gesellsch. f. Chir.*, iii.

¹³ *Med.-Chir. Trans.*, vol. xii.

posed to the application of the poison, if I may be allowed to use so strong an expression." Sir Astley Cooper, in 1830,¹⁴ thought there must be some circumstances which predispose to the occurrence of the disease. For there are many sweeps, and comparatively few are attacked by the cancer. Dixon, in 1850,¹⁵ said: "It is sometimes supposed that chimney-sweeps' cancer is a common affection, but it would appear that this is not the fact, if the number of cases admitted in certain hospitals in a given time is taken as a criterion. At St. Thomas's, for instance—an institution so placed as to be the likely refuge of a great many chimney-sweeps thus affected (he is speaking of the old hospital)—the number of applications has been particularly small." These statements are the more important because they represent the experience of three surgeons attached to large London hospitals in which cases of chimney-sweeps' cancer have occurred with as great frequency as in any other hospitals in London.

I have devoted time to this question of the supposed decline of the disease because I regard it as essential to a thorough appreciation of the various problems connected with cancer of the scrotum that the ground should be cleared of the various impressions, true or false, which prevail regarding chimney-sweeps' cancer. The impression of its decline rests on no evidence whatever. The evidence which can be adduced all shows that it never was of frequent occurrence, and that it occurs with as great frequency now as ever in the institutions in which records have been preserved, and during the period over which those records extend. Of its relative frequency in proportion to the increase in the number of chimneys and the probable increase in the number of persons employed in sweeping chimneys, nothing can be said. But the foundation of new hospitals, general and special, and the improvement in the character of the Poor-law infirmaries, where many operations are now performed, afford space for such a relative increase without rendering it necessary for the older hospitals to show a larger number of cases of the disease than formerly.

The third question of the comparatively mild nature of the disease may be answered by referring to a paper which I published in vol. xxv of the *St. Bartholomew's Hospital Reports*, 1889, p. 193, on the further history of cases of cancer of the scrotum which had been under treatment in the hospital during a long period of years. The measure of success which had attended these operations led me to believe "that the prospect afforded by removal of uncomplicated cancer of the scrotum is very hopeful," that "cancerous affection of the glands need not deter the operator from removing the primary disease and the glands with it if they are within reach of even a severe operation," and that "operations for recurrent disease may be undertaken with a far better prospect of success than is usually offered by such operations."

Notwithstanding its comparatively mild nature, there is not the least doubt that the disease is cancer. Its life-history is that of commencement in the form of a wart or warts on the scrotum, which are so common and so constant a precursor of the cancer that the "soot wart" is as well known

¹⁴ *Observations on the Structure and Diseases of the Testis.*

¹⁵ *Lancet*, vol. i, p. 337.

as the "soot cancer." The warts may exist for years, and some sweeps are covered as to the scrotum with soot warts, not one of which need become cancerous. But in the course of time, probably owing to some especial irritation, one of the warts grows slowly larger, becomes more prominent and at the same time more deeply fixed, and its centre ulcerates. At this period it is probably decidedly cancerous, although it is difficult to be sure of the moment at which the actual change from the innocent papilloma to the malignant carcinoma takes place. Commencing on the surface of the scrotum, the cancer may remain during a long period scrotal, and may spread slowly along the skin. On the other hand, it frequently penetrates more deeply until it reaches the tunica vaginalis and even the testicle, which may be laid bare and in time destroyed. The primary disease seldom, in these days of early operations for cancer, exhibits the same terrible aspect as it appears to have done before the days of chloroform, when it sometimes destroyed everything between the anus and the pubes, and resulted in a horribly foul and offensive sore, against which no treatment availed.

Secondary affection of the groin glands is frequently observed, but is often long delayed. In some cases the first enlargement of the glands is simply due to irritation, not to the formation of cancer in them; for their subsidence has been so frequently noted after the removal of the primary disease that it has been almost an axiom of the operative surgery of the disease that enlargement of the groin glands should not contraindicate a radical operation, and that the glands should not be removed if their enlargement has been of short duration. On the other hand, their malignancy in many cases is proved by the steady progress of the glandular disease, the deep ulcers which form in them in the course of time, the character of these ulcers, and the fact that death has occurred in several, if not in many, cases from the advance of the ulcer into the femoral or iliac artery. Death may be long delayed, even in cases in which the progress of the disease has not been stemmed by operation. But in the course of time the patient's strength is slowly wasted by pain and profuse discharge from ulcers in the scrotum and groins, and he dies worn out by the disease. Of the occurrence of secondary deposits other than those in the glands little is known. Few of the patients die in the general hospitals, and in these few cases either no examination has been permitted after death, or it has so happened that no secondary cancer has been found. I take it that, as in the case with similar cancers of some other parts of the body—notably the lower lip and tongue—secondary disease, with the exception of secondary affection of the glands, is not common. That it may take place, however, I cannot doubt, for I have found an observation by Mr. Travers of the examination of the body of a sweep who had died of recurrent cancer of the scrotum and what I believe to have been numerous cancerous nodules scattered on the surface of the peritoneum,¹⁶ for Mr. Travers concludes his account of the case thus: "It was remarkable that the testicles, though exposed and shrunken, were not affected by ulceration; on inspection, the entire peritoneal surface was found studded with the small white tubercle of scrofula."

¹⁶ *Med.-Chir. Trans.*, vol. xvii, p. 346, 1832.

The continuous invasion of contiguous tissues, the steady progress of the disease from bad to worse in spite of every treatment save removal, the secondary affection of the lymphatic glands, the similarity of the ulceration of the glands to that of the primary disease, all tell plainly the cancerous nature of the disease, even if there were not the further proof afforded by the microscope. From that we learn not only that it is cancer, but that the structure is that of the great family of skin cancers, squamous-celled carcinoma or epithelioma.

It is needful to be thus precise in furnishing the proofs of the cancerous nature of the disease on account of certain peculiarities which it exhibits. Two of them are of especial interest: the affection of lymphatic glands years after the successful removal of the primary disease, and the affection of the groin glands without primary disease of the scrotum or neighbouring parts. The first peculiarity is very interesting. I have met with records of two or three such cases in surgical literature, but it will be better to describe one which happened in the hospital.

C. C., aged 48, a chimney-sweep, was admitted into St. Bartholomew's Hospital in 1878. At the age of 28 years, a soot wart had been removed from his scrotum. At the age of about 35 years, a second wart or cancer had been successfully removed. In 1873, when he was 43 or 44 years old, my colleague, Mr. Baker, removed an epithelioma the size of a walnut from the left side of the scrotum. The disease penetrated so deeply that a portion of the tunica vaginalis was of necessity removed, and the testis was exposed. There was no enlargement of the lymphatic glands at that time. When he was admitted into the hospital in January, 1878, he was suffering from a large mass of adherent glands in the left groin, from which offensive liquid discharged through several openings. He was quite sure that the enlargement in his groin was of not more than two months' duration; he certainly had not noticed it till then. The scrotum and adjacent parts were examined with the greatest care, but the closest scrutiny failed to detect any wart or ulcer or any unnatural induration of the healthy scars. The case was not considered suitable for operation, so the patient was discharged.

Similar examples of late or deferred affection of the lymphatic glands may occasionally be met with in connection with primary malignant disease of various parts of the body, for example, the mamma. But they appear to occur with unusual frequency in association with primary cancer of the scrotum, when the number of recorded cases is compared with the general frequency of cancer of the scrotum. They are difficult to understand on the generally accepted theories of secondary affection of the lymphatic glands. When glands which could not be felt, even on the most careful examination, at the time of the removal of a primary cancer become cancerous, as they frequently do within a few months of the operation, and without any recurrence of the primary disease, the explanation which occurs to most of us is that they were already impregnated with cancer before the operation was performed, but that they were not obviously enlarged. Even if the enlargement of the glands does not become apparent for many months, it is still comprehensible that the cancerous disease had been slowly advancing during the whole period, but that its course had been very slow, like the

course of many cases of primary cancer. But when the glandular enlargement is deferred for several years, and there has been no recurrence of the primary disease or renewed affection in or about the seat of the primary disease during the whole of this long period, it is much more difficult to accept this simple view. It is, of course, possible that cancerous disease, or a something which is capable of inducing cancerous disease, may lie latent during a long period of time, and I believe many facts might be adduced in favour of this view. But I am more inclined to account for these and similar cases by means of a theory which I shall advance in connection with the second peculiarity to which reference has been made—of the affection of the groin glands without primary disease of the scrotum or neighbouring parts.

I have met with the records of three cases of this rare condition, and, by a rare good fortune, they are described by competent observers. The first is recorded by Sir James Paget in the *Medical Times* of 1852 (new series, vol. 414), but much more fully in the first edition of his *Surgical Pathology* (ii, 447), and the description is so excellent that it must be quoted at length.

"I have seen one example of primary epithelial cancer in lymphatic glands which I will relate, both for its own interest and because it illustrated many of the foregoing statements. The patient, who was in St. Bartholomew's Hospital last summer, was a sweep, aged 48. His skin was dusky and dry, and many hair follicles were enlarged by their accumulated contents; but he had no appearance of cancer or wart of any kind on the scrotum or penis, yet his inguinal glands were diseased, just as they commonly are in the later stages of scrotal soot cancer. On the right side, over the saphenous opening, a cluster of glands formed a round tuberos mass, more than an inch in diameter. It felt very firm, heavy, ill-defined, and as if deep set. Over its most prominent part the skin was adherent and ulcerated, and a soft dark growth protruded through it. Above this mass were three glands, enlarged but not hardened. On the left side, below the crural arch, one gland was enlarged to a diameter of half an inch and hard, and four others felt similarly but less diseased. All these were movable under the skin.

"The disease had been observed in progress for fifteen weeks, having begun in the right groin as a hard lump under the skin, like those which were now in the left groin, and which had commenced to enlarge somewhat later. The ulceration in the right groin had existed for a week. I removed all the glands that seemed diseased. The chief mass, from the right side appeared, on section, lobed, soft, greyish, mottled with pink and livid tints. The same changes, but with increased firmness, were seen in the largest gland from the left side, and the material pressed from both these (a turbid, grumous, and not creamy, substance) contained abundant epithelial cancer cells. The other glands were not evidently cancerous, but, during the healing of the operation on the right side, a gland, which I had thought it unnecessary to remove, enlarged and became hard; it was destroyed with chloride of zinc, and then the wounds healed soundly."

The other two cases were under the care of Mr. George Lawson, who thus speaks of them in the *Lancet* of 1878, ii, 576:

"Chimney-sweeps' cancer, as a rule, originates in the skin,

but to this there are occasional exceptions. In two cases which I have had under my care in the Handel Ward, Middlesex Hospital, the disease started in the glands in the groin, the skin became adherent to the infiltrated glands, and then ulcerated. The ulceration extended, and each patient died from hæmorrhage caused by the ulceration involving the main vessel, in the one case the femoral, and in the other the external iliac artery." This statement is confirmed by the more detailed relation of one of the cases, and an account of the healthy condition of the scrotum.

It is quite curious, considering the great importance of these cases, and the light which a study of them may throw on certain difficult questions in the pathology of cancer, how little attention they have attracted. Thiersch alone, of the various authors I have examined, mentions their occurrence, and assumes that the glandular enlargement was secondary to an actual epithelioma of the scrotum, which had not ulcerated, and which lay beneath the surface of the integument—in fact, to an overlooked primary disease.¹⁷ He refers, of course, only to the case described by Paget, for the other cases had not then been published. In some circumstances this explanation might be accepted as reasonable, but, to us here, it would appear really impossible. The importance of the first case as an example of primary epithelioma of the glands was fully appreciated by Sir James Paget. The patient was a chimney-sweep, so that a primary affection of the scrotum was suspected and sought for with the greatest care, but there was not even a wart on the external organs of generation to which the suspicion of primary epithelioma might have been attached; and the cases of Mr. Lawson afford the strongest confirmation of the possibility of the occurrence.

Excluding the possibility of such malignant disease of the external generative organs as is apparent to sight and touch, even when directed with the greatest care by the most skilful eyes and hands, it must be admitted that the affection of the glands in these cases may have been secondary to a primary disease in some other part of the body. The lower extremity and the rectum present themselves as possibilities. The lower extremity is, however, really not tenable; primary malignant disease in such a situation could not have been overlooked, and the disease of the glands in both groins is not consistent with the supposition. The rectum is almost as improbable. The groin glands are seldom affected in such case, and certainly not until the disease is so far advanced that the bowel disease forms the most prominent trouble so far as the patient is concerned.

Again, there is the question of a simultaneous or almost simultaneous affection of glands, such as occurs in some cases of sarcoma, but there is really nothing in these cases in common with cases of general sarcomatosis.

In the absence of an evident primary source from which the lymphatic glands could have been affected, the possibility of primary cancerous affection of the glands must be taken into account. Such cases are not of very unusual occurrence under the terms lymphadenoma (Hodgkin's disease), lymphosarcoma, and primary sarcoma of lymphatic glands. We are familiar with such primary malignant affections of the glands of the neck, the mediastinum, and the axilla; therefore the

¹⁷ *Der Epithelialkrebs*, S. 66, Leipzig, 1865.

possibility of their occurrence in the groin must not be overlooked. But the conditions of those and of the disease in question are so different that it is well-nigh impossible to conceive that they have anything in common. Their course is usually slow, they are prone to affect many glands in different regions of the body, they seldom break down and ulcerate, and rarely if ever cause death by opening a large blood vessel. And, above all, they are lymphatic or sarcomatous diseases, while this disease of the groin glands was carcinomatous.

But now the question naturally presents itself—Why should not these have been cases of primary epithelioma of the lymphatic glands? It is true that we know little or nothing of such an affection. I have found no instance of it in the *Transactions* of the Pathological Society. Works on pathology and tumour diseases are for the most part silent on it. But that is not a reason why the disease should not exist. Last year, at the Royal Medical and Chirurgical Society, Mr. Walter Spencer, in a most interesting communication, showed how the soot particles may be found in the interior of the cells, and suggested that their presence there might afford a possible explanation of the pathology of the very class of cases we are considering. I examined Mr. Spencer's sections with great care, and was convinced of the correctness of his observations. But when I came to consider how they could be applied to these cases of epithelioma of the lymphatic glands I was forced to admit that the reasons against the adoption of this theory are stronger than those in favour of it. I shall presently give reasons for believing that soot, if it is in any way the cause of the occurrence of cancer, acts only as a predisposing cause, merely as a mechanical or chemical irritant. It is quite conceivable that such an irritant should induce the occurrence of malignant disease in internal organs, and in organs of very different structures, provided it can reach them. But it is wholly inconceivable that it should induce in these different organs the occurrence of a variety of malignant disease which does not naturally occur there—of squamous-celled carcinoma, for instance, in the interior of a lymphatic gland. The thing is so inconsistent that I was forced to reject the theory as untenable. Every circumstance concurs to the belief that the affection of the groin glands in these cases was secondary not primary.

Here, then, we are brought face to face with a cancerous affection which is not primary, inasmuch as it fulfils none of the essential conditions of primary cancer; which presents all the characters of a secondary affection, but for which no primary source can be discovered. More than this, it presents the characters of an affection which is not only secondary, but is secondary to a particular variety of cancer occurring in a definite situation in the near neighbourhood. So decidedly, indeed, were the characters of the glandular disease similar to those which are observed in cases of secondary affection of the groin glands in connection with sweeps' cancer of the scrotum, that the resemblance at once struck Sir James Paget, and a close examination of all the conditions of the case confirmed the first impression.

I scarcely venture to suggest it—and yet I believe it is the case—that we have here to do with a cancerous affection of the glands which is secondary to a primary cancer which has never had any existence. The mere statement appears to imply an

absurdity. But the facts of the cases which have been recorded are so clear, and the contingencies which depend on the acceptance of this explanation are so weighty, that I am fain to attempt to make good the theory.

Before doing so, it will be well to draw attention to one or two points in relation to the pathology of cancer. Cancer (the term is employed here in its widest sense, and is applied to every kind of malignant tumour) is sometimes regarded as a mere disorderly reproduction of elementary tissues. But this offers a very incomplete conception of the disease. It is disorderly only in the continual tendency to produce new tissues, and in the many varieties of form which the new elements, especially the cells, present when compared with the natural elements of the part in which it occurs. On the other hand, it is so orderly in the arrangement and grouping of the elements that each variety of cancer is as distinguishable as are the various normal tissues. These characters are reproduced in the secondary tumours, often so faithfully that it is difficult to distinguish sections of the primary and secondary growths. And, more than this, what may be regarded as accidental characters of the primary growths, such as organisation, degeneration, hæmorrhage, may occur with equal frequency and to an equal degree in the secondary growths.

It is evident, then, that the elements of the cancer, or of the part in which the cancer originates, have become endowed with other and more potent properties than a mere tendency to active reproduction—the power, namely, to arrange themselves in certain definite groupings, and the power to reproduce similar groupings of elements in any near or distant organ to which they chance to be conveyed, and in which the conditions are sufficiently favourable to their maintenance and development. So strong are these acquired powers that the transferred elements of the primary disease are not only enabled to reproduce faithfully the groupings of the primary disease, but they are wholly incapable of producing any other than these groupings, with trivial modifications.

With regard to the manner in which the transference of the primary disease to the lymphatic glands is effected, two theories seem reasonable—first, that portions of the primary tumour are conveyed through the lymphatics to the glands; secondly, that some foreign organic element, which has perhaps been instrumental in inducing the occurrence of the primary disease, has travelled through the lymphatics into the tissues of the glands.

Of the possibility of the first method of transference there can be little doubt. What may be described as a coarse conveyance of cancer through the lymphatics may be observed from time to time. In such cases the growth of the disease in the lymphatic glands is practically continuous with the primary disease; but, in the majority of cases, the conveyance through the lymphatics must be assumed. The closest investigation, even by the most accomplished observers, fails to discover even an occasional cancer cell or recognisable part of a cancer cell in the lymphatics between the primary disease and the secondary affection of the glands. Nevertheless, the absence of ocular demonstration is no real obstacle to the acceptance of the theory. It is only needful to assume that minute portions of the primary disease pass from time to time, or have passed with the lymph, into the glands, and that they are capable of full development and of

reproduction, and that they carry with them the new powers which have been acquired by the elements of the primary disease.

At the first sight the second theory seems more attractive than the first, for it renders the comprehension of the primary disease more easy, but there are certain difficulties in accepting it. An organic element, such as the organisms on which various diseases are believed now to depend, enters the body from without under favourable circumstance, excites the tissues of the part in which it settles to the development of the variety of malignant disease to which they are liable, and in doing so itself undergoes such modification that when it is conveyed to other parts of the body where it is capable of inducing the occurrence of cancer, it is only able to induce the occurrence of the particular variety of cancer which was excited in the part of the body primarily affected. I have in my mind Dr. Hunter's bodies, Gussenbauer's molecules, and the newly-discovered objects in cancer—psorosperms. The difficulty in accepting such a theory is, to my mind, the admission that such an organic element, even endowed with very great powers, should have the power, not merely of exciting the tissue elements to active reproduction, but of forcing the tissue elements of one series to assume the characters and grouping proper to the tumours derived from another and wholly different series, for instance, of forcing the elements of connective tissues to assume the characters and groupings of epithelial tissues or of tumours derived from epithelial tissues.

The same argument applies to the view that the transference is accomplished by the agency of a liquid—a cancer juice wholly devoid of even microscopic solid particles.

Whether we accept the first or the second of these theories is of little consequence, provided it is understood that the particles of the primary cancer possess the powers of development, of reproduction and grouping in the midst of tissues of various kinds and origins; and that the supposed organic element, in its passage through the tissues first affected, has been modified in such a manner as has been suggested.

Now I would venture to go one step further and to suggest that the tissues of a part like the scrotum may be affected in such a manner, either by long-continued irritation of a particular kind or by the admission to them of an organic element, that cancer ought to have been induced. But, owing to certain causes, among which probably great resistance of the tissues attacked plays an important part, the cancer, so to speak, aborts. In spite of this, it is quite conceivable that the elements of the affected tissue may have acquired powers which they are not able to exert *in loco*, and may exert them as soon as they have been transferred to a more favourable soil. Or that the exciting organic element, passing through the tissues where it might have excited cancer, but where the cancer has aborted, has been so modified that, when it reaches the tissues of the neighbouring lymphatic glands, it is capable of inducing there the occurrence of cancer, but only of the particular variety of cancer which would have occurred in the tissues primarily attacked. The cancer of the glands in such case is secondary, inasmuch as its variety and its very occurrence depend on the character and influence of the tissues in which the primary cancer has aborted; it is primary only in the circumstance that it is the

first visible manifestation of cancer in the individual attacked.

If we accept this explanation of the occurrence of cancer in the groin glands of chimney-sweeps who have never suffered from obvious cancer of the genital organs, we may employ the same theory to explain the occurrence of many curious growths whose existence has hitherto been a puzzle. Some years ago an innominate bone, containing in its interior a cylindrical-celled carcinoma, was exhibited at the Pathological Society, and in 1886 a "cylindrical-celled cancer of the humerus" was exhibited by Mr. Jonathan Hutchinson, jun.¹⁸ In both cases the occurrence of the tumour was explained on the supposition that it was secondary to an undiscovered malignant disease of some part of the body; I would suggest rather that these tumours were secondary to a primary disease, which, for some reason, had aborted; and, in the same way, may be accounted for some of these cancerous affections of the glands of the neck which have all the characters, general and microscopical, of secondary tumours, but for which a close investigation fails to discover any primary source.

Returning to the cases of long-deferred affection of the lymphatic glands, some of them may be explained on the same theory, and it may be assumed that the glandular affection has no direct relation to the previous cancerous disease of the scrotum, but is secondary to a fresh attack which has failed as a primary disease. On the other hand, it may be assumed, if the occurrence of cancer depends on the presence of a foreign organic element, that this has lain dormant until its action has been excited by some fresh cause, or the resisting power of the part is lessened.

It will be noticed that the title of these lectures is "Cancer of the Scrotum in Chimney-sweeps and Others." To limit the study to cancer of the scrotum in chimney-sweeps alone would be to study a very small part of a very large question. In this larger field, the first point which strikes the student is how rarely the scrotum is the seat of cancer, except in persons who are engaged in sweeping chimneys, or in some kindred employment. In proof of this let the statistics of the hospitals of Berlin and Vienna be examined. In the Rudolf Stiftung at Vienna, in the fourteen years 1873 to 1886, there were 363 males with malignant disease but there was not one case of cancer of the scrotum. In the annals of the Charité Hospital at Berlin in the eight years from 1878 to 1885 inclusive, there did not occur a single case of cancer of the scrotum, yet the number of males under treatment for cancer in those eight years was 466. In the Allgemeine Krankenhaus at Vienna, in the eleven years from 1874 to 1884 inclusive, there occurred only 1 case of cancer of the scrotum, namely, in the year 1883. And this is the more remarkable when the enormous number of cases of malignant disease of all parts of the body admitted yearly into this hospital is taken into account. It amounted to from 460 to 750 cases in each year, a total in the eleven years of 6,759 cases of malignant disease, of which about 2,400 occurred in males. Take, further, the statistics of the Allgemeine Krankenhaus at Prague, during the nine years between 1877 and 1885 inclusive, where about 40 men with malignant disease are admitted every year. In the year 1879 there occurred 1 case of carcinoma of the scro-

¹⁸ *Path. Trans.*, xxxvii, 379.

tum, which may be compared with about 360 cases of malignant disease in male subjects. In the City Hospital of Boston, in five odd years of the decennium 1880 to 1890, there occurred 1 case of cancer of the scrotum. I do not know the number of cases of malignant disease admitted during these five years, but the total number of males under surgical treatment in the hospital was within 15 of 10,000. Well may van Buren say, "Cancer of the scrotum in this country is a rare disease."¹⁹ Of the occurrence of cancer of the scrotum in the Paris hospitals I can only give the statistics of the year 1861, in which there was not a single case.

In the English hospitals, on the other hand, the disease has been comparatively common. Thus my own hospital alone (St. Bartholomew's) has, in the course of twenty years, treated within its wards thirty-nine different patients with cancer of the scrotum. I cannot give the exact number of cases of malignant disease treated during the same period, for in the earlier volumes of the statistics they are scattered through the tables, but the number treated in the surgical wards was about 3,200, of which about 1,500 occurred in males; so that it may be taken that about one case of cancer of the scrotum occurs in every forty cases of malignant disease in males treated in the surgical wards of the hospital. In the Middlesex Hospital, in the course of the sixteen years from 1867 to 1882 inclusive, the statistical tables show that there were twenty cases of cancer of the scrotum under treatment in the wards, and that the total number of cases of malignant disease in the surgical wards during the same period was 2,147. Probably at least two-fifths of these patients were males, so that the proportion observed in the wards of this hospital agrees closely with that observed at St. Bartholomew's Hospital. At St. George's Hospital, again, nine cases of cancer of the scrotum were treated in the wards in the ten years from 1869 to 1878, and there appear to be from thirty-five to sixty cases of malignant disease in the surgical wards in the course of each year.

Cancer of the scrotum is, however, not so much more common in England than in other countries, if the cases of the disease occurring in chimney-sweeps be separated from the rest. The mere statistics do not tell the trade of the individual sufferers from disease, but the notes attached to the tables often furnish information on this point. Of the 39 patients treated in St. Bartholomew's Hospital, I found that 29 were actually engaged in chimney-sweeping, 5 or perhaps 6 in another employment which appears to predispose to the occurrence of cancer of the scrotum, and that only 4 or 5 other persons outside these employments had been admitted with cancer of the scrotum into the hospital in the course of twenty years; 5 of the 9 patients in St. George's Hospital were certainly chimney-sweeps, and some or all of the other 4 may also have been sweeps for all there is to tell to the contrary; and a large majority of the 20 patients in the Middlesex Hospital were also certainly sweeps, but I have not the exact numbers before me.

From these various figures it may safely be averred that the tissues of the scrotum are not in the least disposed to the occurrence of cancer. Nay, I would go so far as to say that they offer a very considerable resistance under all ordinary

¹⁹ *Dis. of the Genito-urinary Organs*, 1874.

circumstances to the occurrence of cancer. For the skin of the scrotum, by reason of its position, its frequent change in tensity, its exposure to injury and various evil influences, its tendency to collect and hold every kind of dirt between its folds, and the caking of dirt and sweat in every part, might naturally be regarded as a part of the surface of the body which ought to be peculiarly liable to the occurrence of cancer.

Seeing, then, the comparative frequency with which cancer attacks the scrotum in chimney-sweeps, the inference is strong that there is something in the trade of a sweep which modifies the skin of the scrotum to such an extent as to render it liable to the occurrence of cancer. Nay, more, the modification is so decided and of such a kind that the integument of the scrotum is not merely predisposed to the occurrence of cancer, but is more predisposed to it than the integument of any other part of the body. The statistics of cancer furnished by English and foreign authors on the relative liability of persons engaged in various employments to cancer of different parts of the body do not show that sweeps are more liable than other persons to cancer of the face, the lip, and the general surface of the body. And the statistics of the Registrar-General, which afford the most reliable information in this respect, because they deal with all the deaths of chimney-sweeps during a period of three years, show that of 36 deaths from cancer, in which the part of the body affected is noted, only 1 patient died of cancer of the lip and 2 of cancer of the face, while 23 died of cancer of the "scrotum, penis, testis, groin." (The remainder died of cancer of the stomach and the liver (7) and the palate (1). And if these 23 cases had been accurately analysed, it would almost certainly have been found that the primary disease was of the scrotum in at least 18 or 20 of them. This enormous preponderance of cancer of the skin of the scrotum is the more striking when it is compared with the single case of cancer of the lower lip, a part of the surface of the body which is above all others, in man, predisposed to cancer.

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,

¹ *Dublin Journ. Med. Scien.*, xxi, 137, 1847.

² *Surgical Pathology*, ii, 464, 1853.

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 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 œsophagus, 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 *Bâle*, 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. *Chauffe-pieds* 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



German sweep's costume.

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."

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



Belgian sweep's costume.

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 province 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 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-sweep's 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 *briquettes* 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 Tour-

³ *Arch. de Méd. Belge*, vi, 255, 1844.

nai, 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. Thiriart, 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 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.

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

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

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 woollen 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 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-blanche. 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.

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

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.

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 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, ex-

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.

ceedingly 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

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

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 Morrision, 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.

Lizars¹⁰ 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 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—asccribed 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

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

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

¹¹ *Edin. Med. Journ.*, xvii, 544.

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 is 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 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."

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

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

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 tar-worker 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 par-

ticular 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.

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

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 noxious 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 noxious 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 noxious 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 explanation 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 noxious 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 noxious 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.

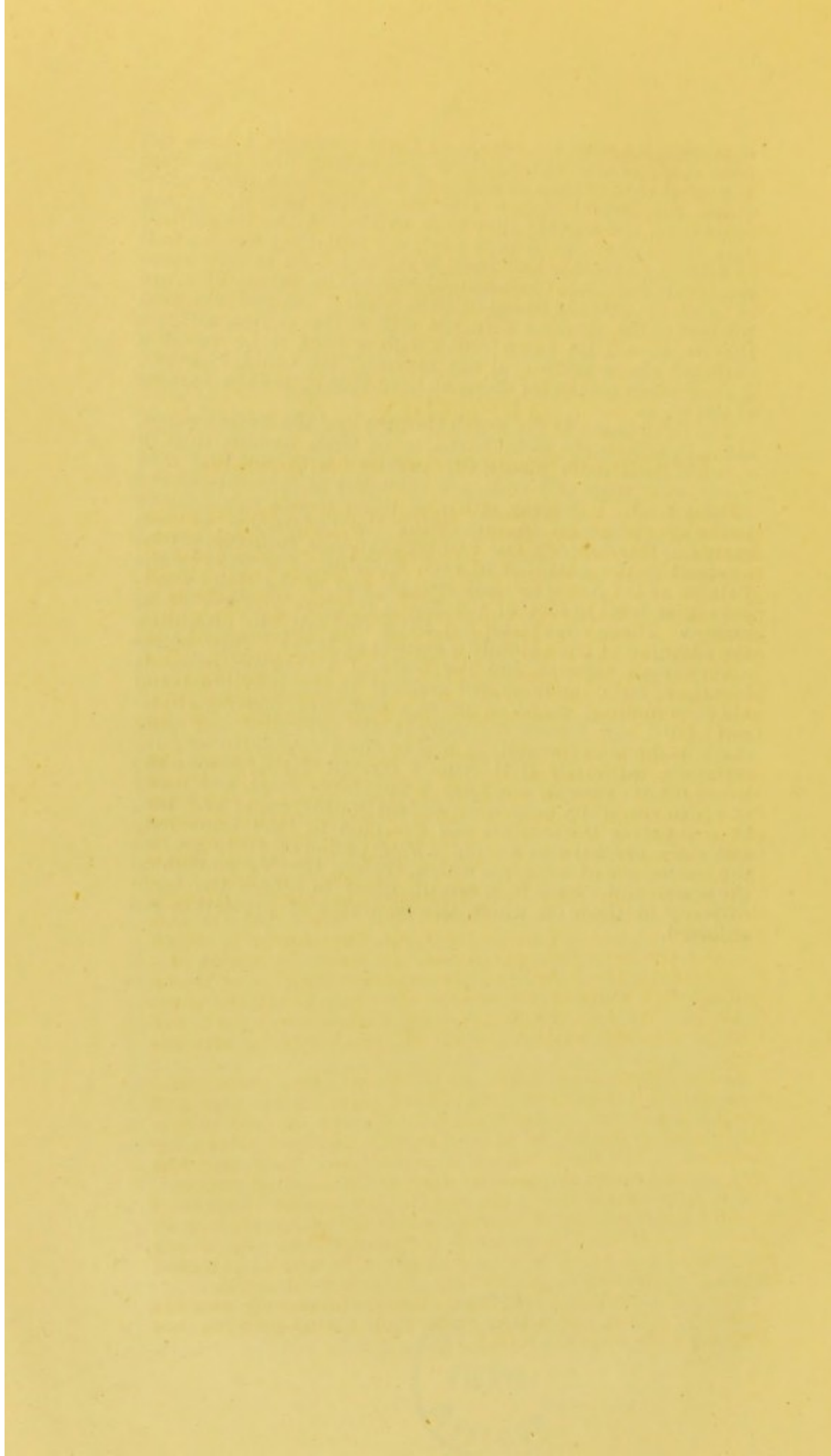
They may be summed up under two headings: those which are directed to the protection of the individual against the contact of the noxious material, and those which are intended to remove it thoroughly every day.

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.





APPENDIX.

THE CHIMNEY-SWEEPS OF SOME OTHER COUNTRIES.

Holland.—In the course of September, 1889, I sent an assistant to several of the Dutch towns. Utrecht, Amsterdam, Zaandam, Haarlem, Gouda, The Hague, Leyden, and some of the smaller towns, were visited. Peat is largely burned in all of them, and in almost every town of large size there is a peat market (Turfmarkt) and sometimes a wood market (Houtmarkt), for wood is largely burned. In addition coke is used, and in the larger cities hard coal (Steenkohle). The Dutch are generally economical with their fuel, burning it in stoves, and, on a small scale, in iron and earthenware pots, using perforated footwarmers in their churches (as in Utrecht).

In Utrecht a sweep was seen at a house in the Lange Jan Straat, a well-looking young man, age about 20. His clothes were made of coarse brown holland. They consisted of a loose kind of Garibaldi blouse, which was tucked inside his trousers at the waist; a hood fastened at the neck behind and tied in front; trousers with leggings, and spats tied on just below the knee, and leather boots. The house was very clean.

In Amsterdam Herr Ravelli's house was visited. His wife was very obliging. She showed the blouse and trousers fastened with buttons down the front, the manner in which the trousers were fastened round the waist by means of a running tape, the hood, and the separate leggings of brown holland with wings at the bottom to cover part of the shoes or boots. She said the clothes were washed every week, and that her husband washed himself all over every day after his work.

At the Hague, Herr Togni, in the Veen Laan, came home from his work in his sweeping clothes, carrying his rope and weight, his broom, and soot shovel. He was dressed in precisely similar clothes to those his wife had just shown my assistant. The hood formed a part of the blouse, and was tied closely round the neck by means of a tape in a runner.

The only exception to the rule in the matter of make of clothes and character of material was found on an old man in Hoorn (one of the dead cities of the Zuyder Zee). He wore a cloth waistcoat, brown woollen blouse and trousers, and looked much more like an English sweep, for he wore no hood.

The brown holland sweeping clothes are often worn over the ordinary clothes, and afford them such a good covering that they are little, if at all, soiled.

My assistant was surprised to find that the names of many of the sweeps, in fact, of the majority of them in the large towns, were not Dutch names—for instance, Ravelli, Togni, Rusconi. Mrs. Ravelli said her husband's family came from Italy because the Italians could climb better than the Dutchmen. The waiter in the hotel at Amsterdam mentioned other Italian names of sweeps—Andreoli and Macconi—and said that for at least 200 years the sweeps of Amsterdam have been almost always Italians.

North Germany.—In addition to the information furnished in the text of the lectures, the following matters are worthy of notice. It was found that most of the towns were under municipal control in regard to the sweeping of chimneys, and for that purpose were divided into zones or districts. Every kitchen chimney must be swept at least six times a year, and the chimney of every ordinary room at least four times a year. Hamburg, as a free city, has refused to accept this control up to the present time, although its suburb, Altona, is divided into zones like the other towns.

The age at which the boys begin to learn their business is almost always 14 or 15 years, after they have been "confirmed." They are apprenticed for four years, and before they can become master sweeps must pass two examinations, one practical, the other theoretical. The practical examination includes the actual climbing of a chimney, sweeping it from above—the usual method in North Germany—etc., before properly appointed examiners. The theoretical examination deals with the qualities of the soots of wood, coal, and peat, of their relative liability to catch fire, etc., with the measures necessary for the rapid extinguishing of chimney fires, and the like. The fees for these examinations amount to about 25 marks (25s.), and the successful candidate receives a certificate.

The business of chimney-sweep appears to be carried on by many families for generation, and the general opinion of all the sweeps and of their wives is that the business is a very healthy one. With the exception of an occasional accident on the slippery roofs, no accident or disease was directly attributed to the conduct of the trade. One woman, the widow of a sweep who had died some years previously of consumption, was quite incredulous of the business being unhealthy. She had, or had had, uncles, brothers, and a husband all employed in the trade. One of the uncles was 72 years old, and neither he nor any of the other members of her family had ever suffered from any disease which could be attributed to the soot.

North of France.—In the lectures no account has been given of the conditions of sweeping in Rouen and some of the large towns in the north of France, because there are no reliable materials from which the occurrence of sweeps' cancer can be ascertained.

Rouen, with its 107,000 inhabitants, was visited in September, 1890. Early in the morning my assistant met two little sweeps, fearfully dirty from the soot of the chimneys they had been climbing. One of them stopped and talked for a few minutes. He said he came from Savoy, and had been ten months only in Rouen, that he was $12\frac{1}{2}$ years old, and began to "climb" when he was 11 years old. His master employed three boys and one grown sweep. His sweeping dress consisted of a shirt of coarse linen, which, being open

in front, exposed his skin, so covered with soot that the dirt might have been scraped off; loose trousers of a coarse canvas material over a pair of drawers; a loose jacket of the same material, and a cotton night-cap. He was generally very dirty, but said he washed every day—which was difficult to believe.

The proprietor of the hotel said that nothing but hard coal is burned, that the chimneys of the ordinary rooms are swept about once a year, that of the kitchen about four times. The boys all come from Savoy, and appear to be always dirty. Large numbers of them usually arrive in the month of October. Fifteen years ago a boy had been killed in the kitchen chimney of the hotel, owing to some mistake in managing the weight, which fell upon his head.

M. Porraz, a master sweep, was seen in the Rue des Bons Enfants. He employed 6 boys and 4 men. The boys lived in his house and had clean linen every week. They were all Savoyards. They did the dirty work, the men being only employed in the cleaning and mending of stoves, stove-pipes, etc. The master and the men were quite clean and were dressed in ordinary workmen's clothes with a blue linen blouse. The boys were dressed like those who were seen in the morning, but wore also leather knee-caps to protect their knees during climbing, and the same kind of leather plate over the backside as is worn by the Paris sweeps.

Madame Tardivet, in the Rue du Pauneret, said she employed 4 boys and 6 men, more of the latter because she swept many of the chimneys in the factories, and the men could do this better than the boys. The boys were Savoyards and lived in her house. Their sweeping clothes were washed from time to time and carefully patched. The boys appeared to wash themselves thoroughly for Sunday, but only to wash the face and hands during the week.

Madame Crey, in the Rue Dulong, said her husband had been a sweep from his first communion (which he took at 10 years of age) until now, and that he was 68 years old. She and her husband only employed one journeyman, who lived in another quarter of the town. She would not have any apprentices because, she said "Il n'y a pas moyen de les faire se laver." They had been so dirty that they would sometimes sit down to meals with unwashed hands, and they often went to bed dirty and not even undressed.

At Amiens (80,288 inhabitants) coal was chiefly burnt, but the chimneys were not always swept once a year, from which it was inferred that the people are very sparing in the use of fuel, especially in the use of coal. The chimneys are for the most part still swept by "les petits Savoyards," whose dress and habits are the same as in Rouen.

The proprietor of the hotel at Arras (27,000 inhabitants) said that there were only two sweeps in the town, and that he had not had his kitchen chimney swept since he succeeded his father in the hotel, twenty years ago. The chimneys were so wide that the soot fell down, and they did not require much sweeping. Coal is generally burned. It came from the immediate neighbourhood, and some of it was very good (*gras*), but the people were careful in the quantity they burned, because it is dear.

Lille has nearly 200,000 inhabitants, and is a very dirty, smoky town. The names of seven master sweeps were found in the directory. M. Arpin, in the Rue St. Anne, employed

two men and two boys, and, in addition, often himself swept when it was a busy time. He began to work at the age of 7½ years. He had always been healthy, and never knew a sweep to be seriously ill. If necessary, the sweeps climbed the chimneys; if not, they swept them with brushes and the "herisson." Their dress was made of "toile," called "fort en diable," consisted of shirt, trousers, and a blouse, made at the neck exactly after the manner of the blouse of the Dutch sweeps, and furnished with a hood. These clothes are washed once a week; and when M. Arpin learned that the English sweeps wear the same dirty clothes day after day, he wondered that they did not catch fire through being so full of soot. Madame Fremery, in the Rue du Molfonds, whose husband employed nine sweeps, two or three of whom were boys, said they were not allowed to employ a boy before he had taken his "first communion" (10 years of age). The *employés* lived in the house. They washed, but not as often as they should do, and in the summer they generally bathed in the river. In an adjoining room my messenger found M. Fremery making up the day's accounts with the journeymen. The room was clean and comfortable, warmed by means of a stove, and furnished with two long deal tables and benches, on which were sitting nine sweeps, as black as negroes, with white teeth grinning between their black lips, some of them smoking. They showed their clothes, which consisted of trousers, shirt, blouse and hood of the same grey "toile." Their clothes were regularly washed.

Roubaix (100,000 inhabitants) and Tourcoing (58,000) were also visited, large manufacturing towns, where coal is almost exclusively consumed. The same conditions of sweeping were found; and the same make of dress, the same material, and the same weekly washing of the clothes.

The general conclusions arrived at were that the sweeps of Rouen are not in the least careful to protect themselves against the contact of soot with their bodies. The men, however, do very little dirty sweeping, and are much more cleanly and careful of themselves than the boys are of themselves. The latter are foreigners, most if not all of whom return to their native country. Their future is practically unknown, and there are no means of discovering whether they suffer from scrotal cancer or not. In the large manufacturing towns of the North of France, the clothing of the men appears to afford much more efficient protection against the contact of soot; it closely resembles the clothing of the Belgian sweeps, and the clothes are regularly washed once a week. The sweeps themselves are of opinion that the coal is not so rich (*gras*) as the coal of England and Belgium, so that, perhaps, it is less dangerous. Of the occurrence of scrotal cancer in these towns, I have not thus far been able to obtain any kind of information.

Italy.—In passing through Placentia we inquired at the hotel how the chimney-sweeping was performed. The waiter told us by strangers who came down from the mountains and remained during the winter months. We were taken to the Via Lampoginani where the hotel sweep was living. There we saw a man and a boy, about 10 to 11 years of age, but we could learn but little from them, as they only talked a difficult *patois*. They were clad in sateen or jean jackets and trousers. The boy's body beneath his shirt was covered with soot, but the soot was reddish brown, not black. He showed us

a kind of holland cowl, which is drawn down over the head and face as far down as the shoulders during "climbing," and we saw some holland trousers hanging up to dry.

At Perugia the old waiter at the hotel said that Tyrolese sweeps came sometimes into the town, but he did not think there were any there now. Madame Brufani told us that the flues of her stoves were cleaned by the men who put the stoves in, and that very little mess was made.

In Rome I gathered much valuable information from Dr. and Mrs. Young, who have lived there for some years and who formerly lived in Florence. Wood, coke, and charcoal are principally burned. Mrs. Young said that there are really no regular chimney-sweeps in Rome, and that the flues and chimneys are cleaned from time to time by the "grate-men" or stove-men.

In Milan there is a regular Association of Chimney-sweeps (Patronato degli Spazzacammini), presided over by a president, vice-president, treasurer, etc. Its object appears to be to regulate the sweeping of chimneys at regular intervals. I saw the President, who gave me all the information he could. He said the sweeps were a migratory race, who came from the mountains, chiefly in the vicinity of the Lago Maggiore, lived in Milan during the winter and returned to the mountains for the summer. They were for the most part very poor and lived in a very poor way. Unfortunately, we could not see any of them, for they were on "circuit" in the surrounding country before returning to the mountains. They were said to wear a flannel suit over their ordinary clothes, but no hood. The flannels are washed once a week. Of their personal habits in regard to washing I could learn nothing. Wood-coal and wood are chiefly burned in Milan. The city is divided into twenty-four districts for sweeping. The President said he had known these sweeps for more than twenty years, and regarded them as a very healthy set of men, and that he had never seen or heard of a case of cancer of any part of the body among them. Dr. F. Cozzi, whom I saw at the Ospedale Maggiore, told me that, in the course of many years' civil and hospital practice in Milan, he had never heard of a case of chimney-sweeps' cancer.

Switzerland.—In the spring of 1890 I visited Basle. Wood-coke, coke, turf, and wood are burned there, and very little hard coal. The directory contained the names of ten master sweeps. At the house of a master in the Elizabethanstrasse none of the journeymen were at home, but the master told us that the sweeping of Basle was very properly and regularly performed; the kitchen chimneys were swept four times and the ordinary chimneys twice a year by order of the authorities. The house was very clean. At a second house we were shown into the parlour, which was beautifully clean and well furnished. The master told us he employed six men, and took us down into a chamber on the basement, or rather a series of chambers, to which there was a separate entrance from the street. The sweeping implements were kept in these, and one of them was fitted up as a bath room, with large tubs, a full-sized bath, plenty of hot and cold water in readiness, and two stoves for heating water. We were told that every one of the men washed his whole body from head to foot every day after work. Here we saw a young man who had just returned from work. He had a jacket of rough cloth, fastened rather at one side with brass buttons, and buttoned

closely at the neck. About a quarter of a yard above the bottom of the jacket was a leather belt around the waist. His trousers were of the same material, buttoned down the front. Large patches of leather covered the knees, the elbows, the fastening of the trousers, and the back, to protect the clothes. He had a hood separate from the jacket, and carried a piece of cloth with which to cover the mouth during sweeping. The clothes were not made of washable material. His jacket was tied around at the wrists to prevent the soot from running up his sleeves, and he told us that when he swept a chimney where stone-coal had been burnt, he always tied his trousers close round the ankle as well. In the street he wore a tall hat like the German sweeps (Cylinderhut). His implements were also like those of the Germans—a short ladder, a flue brush, rope and weight, a little broom, a brush of yew on a handle about 3 yards long, and a piece of curved iron for scraping the flues. This lay upon his shoulder, where the jacket was protected by a stout piece of leather.

At Berne I learned from Professor Kocher that it is the regular custom for the sweeps to take a hot bath from head to foot every day after work. Very little coal is burned in Berne.

With regard to the occurrence of scrotal cancer in these towns, Dr. Karl Hagenbach, assistant-surgeon to the surgical klinik at Basle, told me that no case of the disease had occurred there during the years he had been attached to the klinik, and the master sweeps of that town had never heard of such a disease. Professor Kocher, the well-known author of the article on Diseases of the Male Sexual Organs in the *Deutsche Chirurgie*, lief 50 b, 1887, speaks of the disease as being much more common in England than on the Continent, and his account of it appears to be derived from the works of English writers on the subject. Desiring to obtain further information regarding the liability of the Swiss sweeps to cancer of the scrotum, I wrote to Dr. Kocher, who took a great deal of trouble on my account, for which I take once more the opportunity of thanking him. In a letter dated January 17th, 1890, he says: "The disease of chimney-sweeps' cancer is really unknown here in Berne." In February of the same year I received a second note from him, enclosing two postcards from his colleagues, Drs. Bourgeois and Demme, in answer to an inquiry he had made. Each spoke of a case which he had seen, but it was many years previously, and when I came to compare the accounts the cases were one and the same. Dr. Demme gave the clearer account of it, for the patient had been under the care of his late father. Two members of the same family of chimney-sweeps, the father between 60 and 70 years of age, and the son between 35 and 40 years, had suffered, the former from a true cancer of the scrotum, the latter from soot warts. Both had been entirely cured by operation. These were the only examples of the disease or anything approaching to it which the principal surgeons of Berne could recall in the course of many years.

Denmark.—During a visit to Copenhagen in the autumn of 1891 some inquiries were made on the subject of chimney-sweeping, but they were made with difficulty owing to ignorance of the language, and are therefore not so complete as they otherwise might have been. The Directory of the town contained the names of sixteen master sweeps, and the town is divided into a certain number of districts for sweeping, after the manner of Hanover. One of the journeymen was

examined. He was bare-footed. His trousers were made of stout linen, tolerably new, but not clean; they were loose about the legs. He wore a jacket, which buttoned down the front, and the bottom of which was tucked inside the trousers when he was at work. On his head was a round cap. During sweeping the neck was closely covered. The knees were protected by leather patches, and the men wore a backside piece of leather, like the Paris sweeps. Boys are employed in Copenhagen to climb the chimneys, and a photograph which I have shows not only the make and manner of wearing the clothes, but a boy-sweep just emerging from a chimney with his little broom upon his shoulder. The houses are heated by means of wood, peat, coke, and stone coal, all of which are burnt in stoves; open grates apparently are very rare.

ACTS OF PARLIAMENT RELATING TO THE EMPLOYMENT OF
BOYS IN THE SWEEPING OF CHIMNEYS IN ENGLAND.

George III, 28, ch. 48. 1788.—To compel the masters to provide proper clothes for the climbing boys, and to cause the boys to be washed and cleaned from soot and dirt at least once a week. Also that the boys should attend public worship on the Lord's Day, on which day they were not to wear their sweeping clothes. The masters were not permitted to take more than six apprentices at one time, and no apprentice of less than 8 years of age.

William IV, 4 and 5, ch. 34 and 35. 1834.—The age of the apprentices was to be not less than 10 years.

Victoria, 3 and 4, ch. 85. 1840.—To provide that from and after July 1st, 1842, no sweep under the age of 21 years should climb a chimney. And that no apprentice of less than 16 years should be taken.

ON THE OCCURRENCE OF CANCER OF THE SCROTUM IN MEN
WHO HAVE LONG CEASED TO BE EXPOSED TO THE
CONTACT OF SOOT.

So far as I have been able to ascertain, this impression rests chiefly on the authority of Mr. Earle and Mr. Curling.

Mr. Earle relates the case of a man named Bennett, aged 28, who was under his care in Baldwin's ward, St. Bartholomew's Hospital, for "an affection of the inguinal glands, which was no doubt produced by soot, and was analogous to chimney-sweepers' cancer.....The patient at first denied having ever had anything to do with the business of a chimney-sweeper; but, on being pressed upon the subject, he admitted that about fifteen years before he had been employed in carting soot, and at times had warty excrescences on the scrotum and groin. At last the inguinal glands became affected."¹

Mr. Curling's statement is as follows: "It is well known that persons who have been sweeps when young but have abandoned the occupation have afterwards been attacked with chimney-sweepers' cancer, although they have long been removed from all contact with soot.....A sailor between 40 and 50 years of age was admitted into the London Hospital with

¹ *London Medical and Surgical Journal*, 1832, i, 6.

an ulcerated sore on the scrotum, presenting all the characters of genuine chimney-sweeps' cancer. The inguinal glands were indurated and enlarged and subsequently ulcerated. He had been brought up as a sweep, but for the last twenty-two years, during which period he had served at sea, he had not been employed amongst soot in any way whatever. The disease first appeared in the scrotum about three years before. In this instance, therefore, the influence of soot, if this were really the exciting cause of the disease, must have been exerted nineteen years before its appearance, during which period the part was entirely exempt from the action of the substance. It has sometimes happened after the morbid parts had been completely extirpated and the wound healed, the patient having avoided further contact with soot, that the disease has reappeared, as it were, afresh a second and even a third time, not, however, in the cicatrix of the wound, but on a different part of the scrotum. These and similar facts lead to the conclusion that, though abandonment of his occupation may render the adult chimney-sweep less liable to cancer, it by no means forms a satisfactory security against its occurrence."²

Although it is possible that the cancer in both these cases was due to the influence of soot, yet a just objection may be taken to both of them. Affection of the groin glands without cancerous disease of the scrotum or any of the neighbouring parts is so rare that a much closer account of all the conditions of Mr. Earle's case would be required before most surgeons and pathologists would be inclined to accept it as a case of cancer due to the influence of soot or even as a case of cancer.

And Mr. Curling's patient, after relinquishing the business of chimney-sweep for that of a sailor, might have been brought in frequent contact with tar in the course of his work. Even if the contact with stone-coal tar rare suffices to induce the occurrence of cancer of the scrotum, it is quite conceivable that it might exercise a much more decided influence in a man who had been previously exposed for some years to the contact of soot.

While I am not disposed to admit so far-reaching an influence of soot as is claimed for it on the authority of these two cases, I do not, on the other hand, for a moment doubt the truth of the statement of Mr. Curling of the reappearance of soot cancer in men who have suffered from it and have relinquished their occupation in consequence. Many of the patients who suffer from soot cancer suffer at the same time from warts on the scrotum, and, in almost all of them, the integument of the scrotum is more or less modified by the action of the soot. To relinquish their occupation may render them a little less liable to the occurrence of cancer of the scrotum, inasmuch as it removes them from further contact with fresh soot, but it is not reasonable to expect that the preparation which the tissues of the scrotum have already so successfully undergone should be at once and for ever removed by no longer continuing the work of preparation for the occurrence of cancer. The damage has been done.

² *Diseases of the Testis*, 2nd ed., 1856, 507.

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