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Power, D'Arcy, 1855-1941.
Royal College of Surgeons of England

Publication/Creation

London : Practitioner, 1903.

Persistent URL

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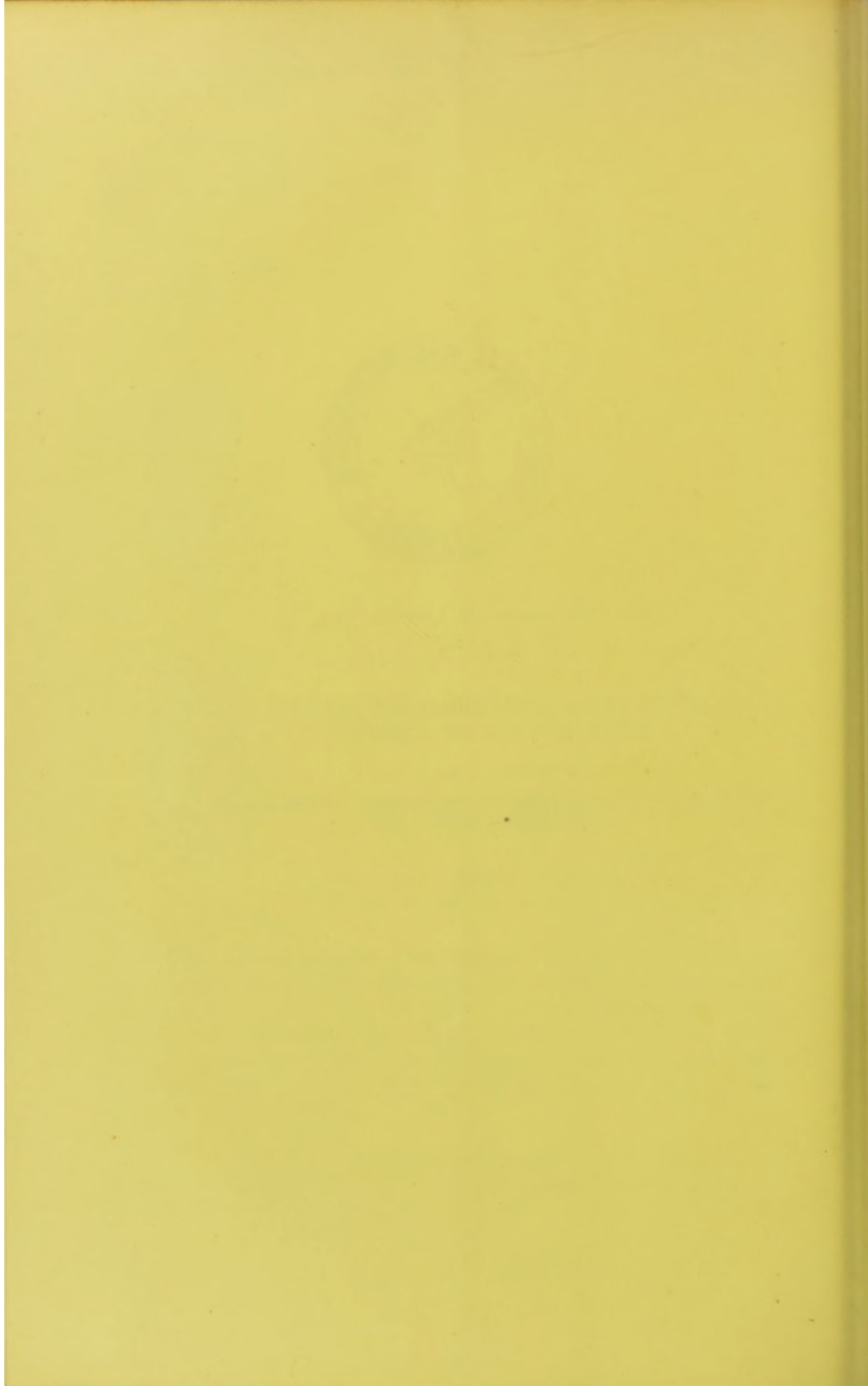


From "THE PRACTITIONER" for May, 1903.

A FURTHER CONTRIBUTION TO THE
DISTRIBUTION OF CANCER.

By D'ARCY POWER, F.R.C.S. (ENG.),

*Senior Surgeon to the Victoria Hospital for Children, Chelsea; Assistant Surgeon at
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"THE PRACTITIONER," LIMITED,
30, HOLBORN, LONDON, E.C.

L O N D O N :
PRINTED BY EYRE AND SPOTTISWOODE,
HIS MAJESTY'S PRINTERS,
EAST HARDING STREET, E.C.



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THE object of post-graduate study is best attained, I think, if each lecturer brings forward some account of the work in which he is especially interested, particularly if such work is of a pioneer character and deals with some of the more important scientific problems of the day. Benefit thus accrues to the lecturer as well as to his audience. The lecturer reviews his facts and theories, because he is obliged to marshal them; he may even be tempted to draw conclusions tentatively; but he is certain to be helped by the suggestions and questions of those who listen to him. The audience, on the other hand, gain some knowledge of what is being done by different workers each in his own field. They have the opportunity, too, of seeing each investigator, and of correcting what he says by the personal equation which is so valuable a factor in judging every piece of original work.

Acting upon this principle I am about to give you an account of some work on the local distribution of cancer which has recently occupied a part of my spare time. Like many other medical men I am interested in the increase of cancer which has undoubtedly taken place within the last fifty years, and I have made many attempts to discover the cause. I thought, at first, that the question might be solved in the laboratory, and I spent much time in examining the various appearances which were put forward so confidently as "cancer-parasites." My distrust of the "parasites" as a cause of cancer increased on more intimate acquaintance, and

¹ A post-graduate lecture delivered at the Medical Graduates' College and Polyclinic, April 7, 1903.

ended in complete disbelief, when I found that many of them could be produced by artificial means in normal epithelium which had been submitted to various forms of irritation.¹ But I have not yet quite lost faith in the infective or parasitic theory of cancer; and as the time at my disposal becomes yearly less, I have been obliged to turn from researches in the laboratory to an examination of other fields, which require a thorough exploration before it can be said that the cause of cancer is beyond our present powers of elucidation.

My attention of late years has been directed more especially to places where deaths from cancer have appeared to be unduly numerous, and the kindness of various friends has brought to my notice several such villages. I am going to give you details of two of these villages, because they appear comparable with each other, and show very well the fallacies, as well as the advantages, of this method of examination. In the one set of cases the increase in cancer is real; in the other set it seems to be only apparent. Yet I may say parenthetically that in neither district would I reside, on any account whatever, unless I knew that my ancestral tree was absolutely free from even a suspicion of cancer.

The details of the first village are shortly as follows² :—

The district is a flat country which lies from 60 to 150 feet above the sea-level and consists geologically of gravel overlying boulder-clay. It is well watered, for one small river rises within its confines, and it is traversed by another which rises a few miles away, while it is intersected by many small and unnamed streams. There are several fens in the neighbourhood, and much of the country shows the ordinary characters of marsh-land. The population is scanty, agricultural for the most part, the peasants living in cottages many of which are but moderately comfortable. The bulk of the population live in one or two small villages. There is no marked tendency for the same families to intermarry in different generations, and the younger men and women do not go far afield. Insanity

¹ "Some Effects of Chronic Irritation upon Living Tissues." *The British Medical Journal*, 1893, Vol. II., p. 830; *The Journal of Pathology and Bacteriology*, Vol. III., p. 24, and Vol. IV., p. 69.

² A fuller account was published in the "Cancer" number of *THE PRACTITIONER* (April, 1899, p. 418).

is common, and phthisis is fairly frequent; but cancer is the prevailing disease.

The population of the whole district is just over 12,000, and during the years 1872-1898 173 cases of cancer were under observation, 59 occurring in males and 113 in females; but 3 of these patients were suffering from cancer when they settled in the district. The age-distribution was as follows:—

Between 20-30	years -	-	-	4 cases.
" 30-40	" -	-	-	4 "
" 40-50	" -	-	-	7 "
" 50-60	" -	-	-	33 "
" 60-70	" -	-	-	32 "
" 70-80	" -	-	-	37 "
" 80-90	" -	-	-	7 "
" 90-100	" -	-	-	1 case.

The ages of the remaining patients are not known.

Forty-nine patients had cancer of the alimentary canal; 10 had epithelioma of the lip; 22 had cancer of the liver. The breast was affected in 37 cases and the uterus in 31. The ovary, testis, and bladder were the seat of cancerous disease in 1 case each; the kidney in 2 cases, the bone in 3, and the skin in 5. The exact seat of disease was not specified in 11 cases.

The actual numbers are not very imposing, but the interest centres in the manner in which the cases were distributed. The disease appears to cling to certain spots and groups of buildings, irrespective of their size, and, what is still more suggestive, of their age.

In this district malignant disease has attacked patients in the Hall and the Manor-house as well as in the cottage of the humblest labourer; it has occurred in new buildings of brick as well as in the old thatched homestead. In one village of 1,036 inhabitants, amongst whom 42 cases of malignant disease occurred between the years 1872-1898, I find that 4 houses had more than 1 case of cancer apiece. In 4 cases cancer occurred in adjoining cottages under the same roof, and in 2 cases in houses which adjoined each other, though they had not a common roof. In 7 instances malignant disease occurred

in neighbouring houses separated from each other by such short distances as the width of a street or the length of a field, there being in each case no intervening building. I was careful to enquire whether there was a common well, when two or three houses under the same roof had provided cases of cancer. A single surface-well supplied the cottages in most cases; in others each cottage had its own water-supply. In one case the occupants of a cottage had actually taken the trouble to send some distance for their drinking-water, although there was a well on their premises; yet they, like their neighbours, had suffered from cancer, whilst those who shared the water with them were unaffected.

All ages and both sexes were attacked, though, as is usual, the older people suffered in by far the larger proportion.

A careful examination of the individual cases showed some remarkable sequences. A man, aged 26, whose great-aunt had died of cancer of the breast, lived in a new house on land which had previously been pasture. He died of an epitheliomatous ulcer of the groin. His successor in the house died of cancer of the rectum, and the latter's successor, again, died at the age of 36 from malignant disease of the brain, secondary to a growth in the testis.

In another series of cases there were three cottages under one roof. A married daughter died in one of these cottages in 1892 of a pelvic sarcoma at the age of 22; her mother, who lived in the next cottage, died of cancer of the uterus in 1894 at the age of 52; and in 1898 a man, aged 74, died of cardiac dropsy in the third cottage, who had been operated on some years previously for an epithelioma of the lip.

A man and a woman lived in two new brick houses adjoining each other, each built by the owner and occupier; the woman died of cancer of the uterus at the age of 62, her mother having previously died of the same disease; whilst the man died at the age of 80 of epithelioma beginning in the lip. Both patients died in March, 1874. Two other neighbours, living next door to this man and woman, died within six months of each other—the one a man, aged 69, of an epithelioma of the lip; the other a woman of 80 of an epithelioma of the arm.

The sister-in-law of the clergyman of the parish died of

cancer of the breast. Her maid, who had lived long in the family, died eighteen months afterwards of cancer of the uterus, but she had moved to another part of the village after the death of her mistress. Thirteen years later her next-door neighbour died of a similar complaint.

A man, aged 69, died of cancer of the stomach in 1895; his widow is still alive, but one of her breasts has been amputated for scirrhus.

Some of the sequences of cases in these series are very weak, and in all probability are accidental, whilst others are sufficiently strong to make it worth while to keep under observation the houses where they have occurred.

The incidence of cancer in different generations is well seen in some of the cases, though they are few in number. Two brothers died of cancer of the rectum; the next generation consisted of two sisters, one of whom died of cancer of the breast and the other of the cancer of the tongue. A mother died of cancer of the breast; two of her daughters died of a similar disease, and the third of cancer of the uterus. A father died of cancer of the rectum and the mother of cancer of the uterus and breasts; the daughter has since died of cancer of the breast. In one or two cases the child has had malignant disease before the parent has shown any sign, though it has developed in the latter subsequently.

An unduly large proportion of the cases of cancer occurred near the streams which water the district. They are most numerous, of course, in the little villages through which the streams run, but cases of cancer are not absent from the scattered houses on their banks; whilst, as if to emphasise the connection between the waterways of the district and the distribution of the cases of cancer, one whole series of cases occurred in a hamlet traversed by a small brook arising a mile or two away in a mere. One of the rivers rises in a fen within the district, the other a few miles beyond the area under consideration, but in a similar manner. The fen in which one of the rivers takes its origin is only 86 feet above the sea-level, so that the course of the river is naturally sluggish. It flows, at first, amongst marshes, and afterwards through a well-wooded country. The second river is only

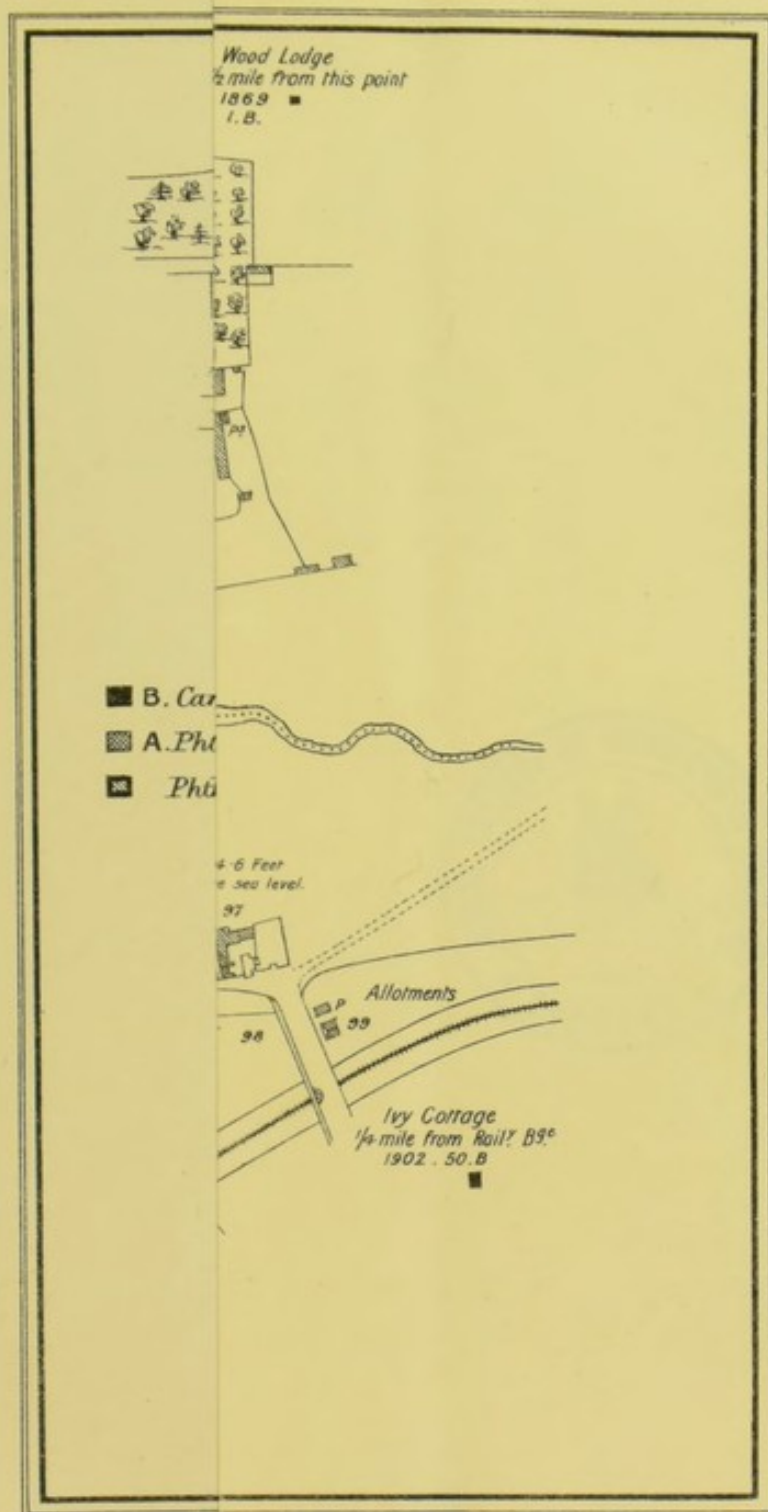
69 feet above the sea-level when it enters the district, and it, too, traverses a marshy and well-wooded country.

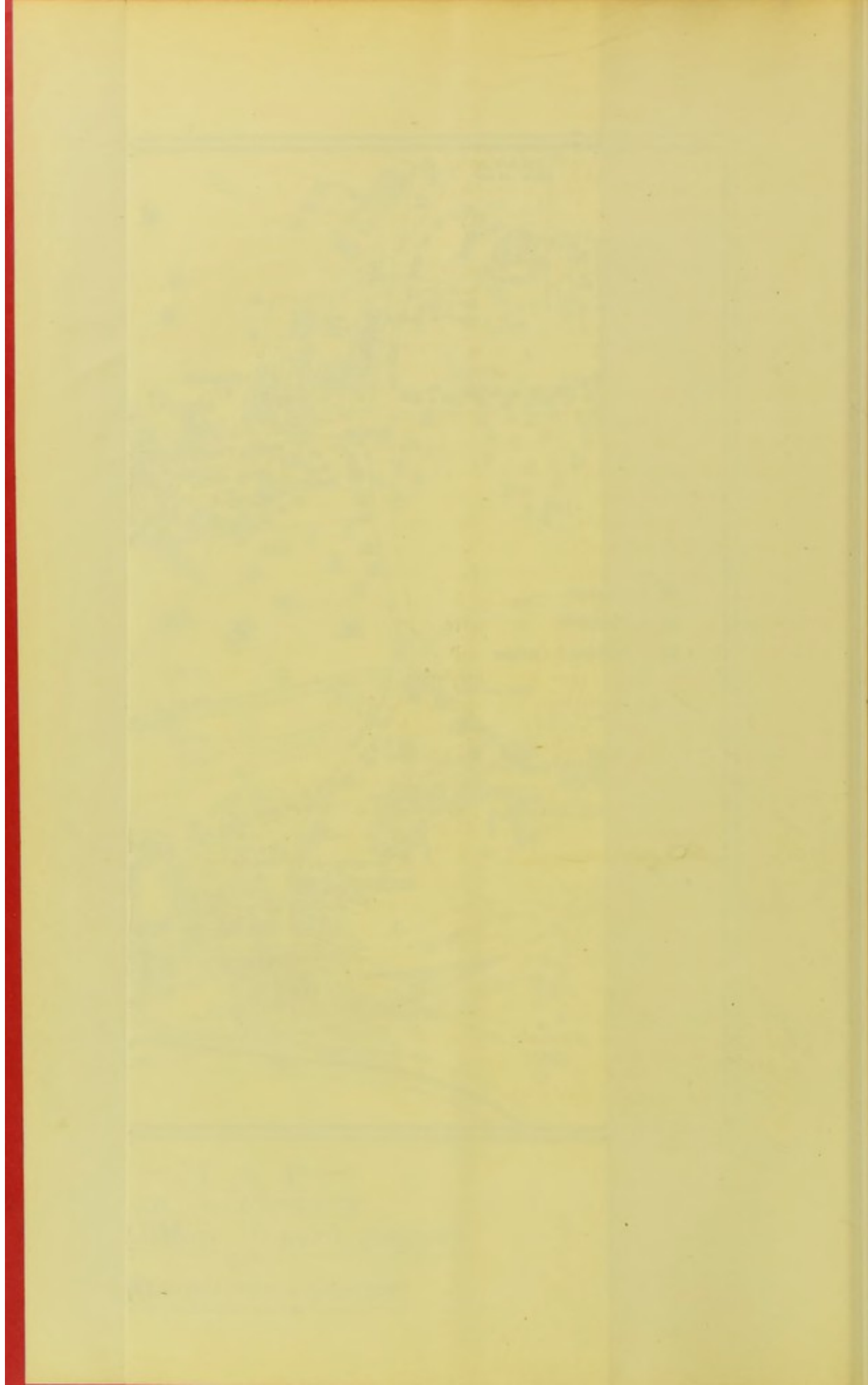
It is impossible, I think, to resist the conclusion that the marshy grounds from which the rivers arise in this district, as well as their wooded banks, have some causal connection with the numerous cases of cancer which have been observed in their immediate vicinity. This part of the country must at one time have been preëminently malarious, and thus the inhabitants must have been constantly in a debilitated condition. But improved drainage of the land and a higher standard of living and personal comfort have led to a disappearance of ague, partly by abolishing the particular species of gnat which carried the infecting protozoön, and partly by increasing the resisting-power of the natives. A greater number of people in this area thus reach the age when cancer is common, but they do not reach it in average health; for the conditions under which the agricultural labourer exists are not so favourable as those of the townsmen. He is more exposed to the inclemency of the weather; his hygienic surroundings are often bad, his wages are low, and his cookery is usually beneath contempt. It is well known that the tendency to cancer is increased by irritation of the tissues and by depressing influences of body and mind. It is not improbable therefore that the hypothetical cause of cancer might have increased facilities for its work and growth in such surroundings as those which have just been described.

In April, 1902, I received a letter from Sir William H. Broadbent containing enclosures which led me to take the train to a little village about eighty miles from London. The rector of the parishes received me very kindly, and I have been able with his help to gather the following facts:—

The village (*see* Map ¹) consists of two parishes with a united population, in 1901, of 456 persons. It is situated on the Northampton sands, which consist of ironstone and sandstone, the equivalent of the Stonesfield slate, says the *Geological Survey of England*, and just beyond the village is a bed of

¹ The numbers and dates on the map correspond with those in Table A.





upper lias clay. A stream divides the parishes, and in so doing separates the village into two parts, which are fairly equal in point of size and in number of inhabitants. The stream is marked on the Ordnance Survey map as being 203 feet above the sea-level, the houses on the right side being 260 feet, and those on the left side 230 feet, above the sea-level. The stream thus lies 30 to 60 feet below the banks upon which the houses are built, but none of them are situated very close to the water. The stream is little more than a sluggishly-flowing brook which opens into the River Nen about a mile and a half away. It was dammed up some time ago at the point where it passes through the village, and the village drains empty themselves into this portion. One drain became such a nuisance that it has been diverted quite recently to open a few yards below the dam. The water in the lake is opaque and stagnant (it has been stocked with fish two or three times, but they always die). The dammed-up piece of water is about half a mile in length, and it floods the surrounding meadows every two or three years.

The surrounding country is well wooded, and the whole village swarms with gnats, flies, and mosquitoes. Both parts of the village are in a highly insanitary condition. There is hardly any attempt at drainage, and the drains are so ill cared for that (when I saw the village) liquid sewage was oozing through the soil at one or two places and trickling over the road. Most of the villagers keep pigs, and the water-supply is obtained from surface-wells, the contents of which are greatly polluted, the water containing numerous animalcules. The children all look thin and anæmic, and the whole population is constantly ailing, diphtheritic sore-throats, recurrent bad colds, poisoned wounds, and boils being of frequent occurrence; whilst people who come fresh to the village (such as shop-assistants, domestic servants, and newly-married women) go through a most painful process of acclimatisation before they become immune to their unhealthy surroundings.

The following deaths from phthisis and cancer have taken place in this small population of 456 persons from 1869-1902 :—

TABLE A.

A.—PHTHISIS.				B.—CANCER.		
1	1869	None.	—	Female -	46	Breast.
2	—	—	—	—	—	—
3	1870	Male -	21	None.	—	—
4	—	Male -	20	—	—	—
5	1871	None.	—	None.	—	—
6	1872	None.	—	None.	—	—
7	1873	None.	—	None.	—	—
8	1874	Male -	70	None.	—	—
9	—	Male -	19	—	—	—
10	1875	None.	—	None.	—	—
11	1876	None.	—	None.	—	—
12	1877	Female -	23	Male -	78	Penis.
13	—	Male -	23	—	—	—
14	1878	None.	—	None.	—	—
15	1879	None.	—	None.	—	—
16	1880	Female -	16	Female -	58	Breast.
17	1881	Male -	25	None.	—	—
18	1882	None.	—	None.	—	—
19	1883	None.	—	Female -	36	Stomach.
20	1884	Male -	63	Female -	69	Uterus.
21	1885	Female -	25	Male -	38	Rectum.
22	—	Female -	48	Male -	62	Stomach.
23	—	Male -	28	—	—	—
24	—	Female -	20	—	—	—
25	1886	None.	—	Female -	60	Breast.
26	—	None.	—	Female -	46	Sarcoma of breast.
27	1887	None.	—	None.	—	—
28	1888	Female -	41	None.	—	—
29	1889	Male -	32	None.	—	—
30	—	Female -	25	—	—	—
31	1890	Male -	27	Male -	56	Stomach.
32	—	Male -	11	—	—	—
33	—	Male -	38	—	—	—
34	1891	Female -	19	None.	—	—
35	1892	None.	—	None.	—	—
36	1893	Male -	14	None.	—	—
37	—	Male -	40	—	—	—
38	1894	Male -	49	None.	—	—
39	1895	Female -	9	None.	—	—
40	—	Male -	39	—	—	—
41	1896	None.	—	Male -	25	Rectum and penis.
42	1897	Male -	37	Female -	?	?
43	1898	None.	—	None.	—	—
44	1899	None.	—	None.	—	—
45	1900	Male -	32	None.	—	—
46	1901	None.	—	None.	—	—
47	1902	None.	—	Female -	53	Breast.
48	—	—	—	Female -	40	Vulva.
49	—	—	—	Male -	47	Rectum.
50	—	—	—	Male -	52	Rectum.
51	—	—	—	Male -	78	Lip.

There remain in the village an unmarried woman with cancer of the breast, aged 42, and a married woman of 60 with cancer of the face.

45 A only lived in the parish two years; 50 B, a native of the parish, died just beyond the boundary.

The Tables A and B show that since 1869 there have been 264 deaths in the two parishes of which the village consists. Of these deaths 44 have been caused by cancer and phthisis, 17 being due to cancer and 27 to phthisis. Of these two diseases, therefore, phthisis was the preponderating cause of death until 1902, but in this year there were seven cases of cancer in this small population, and by the end of the year five of the seven patients had died. Of the total number of 17 cases of malignant disease, 9 occurred in women and 8 in men. These numbers show that the deaths from cancer have been more numerous than they should have been in this village. Dr. J. F. W. Tatham, the Superintendent of Statistics at the General Register Office, states¹ that the cancer-mortality per million persons living in the decennium 1891-1900 was 597 males and 903 females, and that it was rather less in the previous decade. The recently issued² special Report on Cancer in Ireland shows that during the year 1901 cancer was the cause of death in 6.5 cases per 10,000 of the estimated population, the proportion of males to females being 45 to 55 per cent. But if the cancer-rate in this village had been equalled in other parts of the kingdom, the mortality would have been nearly 20,000 for females and almost 18,000 for males; or, putting it conversely, if the ordinary cancer-rate throughout the kingdom had been applied to this village there should only have been one death in seventeen years.

An examination of the table shows that the men in the village have been as often affected with cancer as the women, which is quite unusual; for men should only be affected in the proportion of five or six men to nine women, owing to the frequency with which the breast and the organs of generation become cancerous in women.

The women in the village have died, as is usual, from cancer of the breast (seven cases), from cancer of the uterus (one case), cancer of the vulva (one case), and only one case from cancer of the stomach. The men, on the other hand, have died from cancer of the stomach (two cases), and from cancer

¹ *The Clinical Journal*, May 14, 1902, p. 58.

² *The Times*, April 6, 1903.

of the rectum (four cases). Only one man has died of cancer of the lip, and one from cancer of the penis. The tongue, œsophagus, and liver have escaped, though cancer in men is common in all these situations.

I have examined the relationships of the various patients who have died of cancer and phthisis with the following results :—

Cancer.

(i) A man, aged 78, died of cancer of the penis in 1877, his son having died of phthisis at the age of 20 in 1870.

(ii) A man of 62 died of cancer of the stomach in 1885, his daughter at the age of 42 is suffering from cancer of the breast in 1903.

(iii) A man died of phthisis at the age of 31 in 1870, one of his brothers died of phthisis at the age of 37 in 1897, and another brother died of cancer of the rectum at the age of 52 in 1902.

Phthisis.

(a) A man, aged 21, died of phthisis in 1870, one nephew died of consumption at the age of 37 in 1897, and another at the age of 52 from cancer of the rectum in 1902 (this is the family mentioned above as No. iii in the cancer list).

(b) A man died of phthisis in 1877 at the age of 23, his nephew died of consumption in 1890 at the age of 11 years.

(c) A son died of phthisis at the age of 25 in 1881, his father died of phthisis in 1884 at the age of 63, and another son of the same disease in 1893 at the age of 40.

(d) A woman died at the age of 48 in 1885, her son at the age of 14 in 1893, both of phthisis.

(e) A woman died of phthisis at the age of 41 in 1888, her sister at the age of 19 in the year 1891.

(f) A man died at the age of 49 in 1894, and his niece at the age of 9 in 1895.

It is clear, therefore, that the family history shows a stronger predisposition to the disease in phthisis than it does in cancer, and it is further clear that members of the same family may die of cancer and of phthisis.

An inspection of the accompanying map proves that I have

been at some pains to ascertain the local incidence of cancer and phthisis in different parts of the village, for the houses in which cases have occurred are marked and numbered in accordance with Table A., and in each case the date of the patient's death is noted. The map shows that eleven cases of cancer occurred on the left or lower side of the village, and seven in the right or upper part. Patients have died of cancer in many contiguous houses, but only after long intervals of time, and only in one case have two deaths from malignant disease occurred in the same house, and even these are doubtful.¹ There are consequently no houses with a local reputation for cancer such as I described in the previous case (page 6). Two deaths from cancer took place in comparatively outlying parts of the village, but, as might be expected, the majority occurred where the population was most dense.

I have already drawn attention to the fact that the whole village is infested with gnats and flies. I asked my friends to catch me different varieties, and to pickle them at once in Foa's solution (Müller's fluid saturated with corrosive sublimate). I then completed the hardening in alcohol, and had careful microscopical sections made through their heads and abdomens. These sections I afterwards submitted to rigorous microscopical examination under a one-twelfth oil-immersion lens, but in no case did I find any appearance with which pathologists are unfamiliar, or which could not be accounted for by the ordinary changes occurring in growing or decadent tissues, viz., vacuolation, colloid degeneration, and hyaline change. Some of these changes in the tissues of flies obtained from another part of the country are described at greater length, and are figured by me in *The Edinburgh Medical Journal* for July, 1902.

There is a local impression that the increase of cancer is due to the impurity of the water drunk in this village, and my friends' minds have been so greatly exercised upon the subject that they have taken especial notice of the water-supply in no less than 19 houses where cancer occurred. In 10 of these cases it was condemned, after analysis, as unfit

¹ These were a man who died from cancer of the penis in 1877, and a man who is said to have died at the age of 25 from cancer of the rectum and penis in 1896.

for drinking purposes ; it was reported as bad, after analysis, in three cases, and it was considered to be bad, but without analysis, in two cases. There was no evidence as to its condition in three cases, and in one case the patient had lived in too many parts of the village to ascertain what had been her usual supply of drinking-water.

The bad water-supply may act as a contributory factor toward the apparent increase of cancer in this village by lowering the vitality or resisting-power of the inhabitants, but it cannot, I think, be looked upon as the main cause. Indeed, many of the inhabitants are beer-drinkers : there are three public-houses to supply this little population of 456 persons, and there is a local brewery. The brewery, it is true, obtains its water from a shallow well, but the process of brewing undoubtedly sterilises the water before it reaches the consumer in the form of beer. The inhabitants, however, are sober, law-abiding, and moral, for the younger generation are in great request as grooms, gardeners, and domestic servants in various large establishments in different parts of the country.

There are many ways of investigating the cause of cancer, and as no one is better aware than myself of the fallacies attending the method here adopted, I have thought it right to bring these two villages under your notice. I believe that the increase of cancer in the first village is a real increase, but that in the second village the increase is only apparent, in spite of the large number of cases which have occurred in the small population. Chief amongst the fallacies in the second case is the smallness of the numbers dealt with, because it gives a wholly disproportionate value to a few additional cases which may occur, and in all probability have occurred, quite accidentally in the village under consideration. The deaths from cancer were comparatively few and far between until the year 1902, when five of the inhabitants, whose ages varied between 40 and 78, died of malignant disease. There appears to have been no undoubted death from cancer in the village between 1890 and 1902 (p. 10), though a man, aged 25, is said to have died of malignant disease in 1896—the return says “of cancer of the penis and rectum,” which may have been a sarcoma, or perhaps only a tubercular

ulceration extending from the prostate. A woman is also said to have died of cancer in 1897, but she died away from home, and no details are forthcoming about her.

The five deaths in 1902 suddenly brought up the average, and the rapid sequence naturally caused some alarm in a small community where everyone is known. It is probable, however, that when the two persons have died who are now affected with cancer, there will be no more deaths in this locality for many years to come. The mortality of the village, too, is not quite comparable with that of a town, nor even with that of the surrounding parts of the country. It is practically, as the following Table B (p. 16) shows, a mortality of children and old people with a few weaklings of youth and middle age, since the majority of the younger people, as I have said, go out to service far away from home, even in preference to seeking work in a large manufacturing town only four miles distant, where many thousands of hands are employed in a sedentary trade.

But if fallacies beset the method of investigation here adopted, there is no doubt that certain advantages attend it, because it affords information which is unattainable in any other way. The smallness of the numbers and the compactness of the area enable many facts to be gathered easily and accurately by a single observer, for the family history of the patients is well known, their habits are known—perhaps only too well for the individual's peace of mind in so small a community—and their surroundings are also well known. The people in this village have lived very much as they have always lived and as their fathers have lived before them. Their habits have undergone no violent alteration, and the average duration of their lives does not seem to be increasing. The additional purchasing-power of their wages has undoubtedly added to the comfort of the present generation by allowing them to be better shod, and to go more warmly clothed, as well as by giving them a greater variety of food. Their standard of cooking, on the other hand, has not been raised; and they probably eat less food than did their fathers, but it is of better quality.

Another advantage of an investigation in a small community is that it enables the family history of the patients attacked

TABLE B.

Deaths from all causes, and at the ages mentioned.

—	Parish A.	Parish B.	Total.
1869	82, 3, 7 weeks, 7, 70 - -	57, 46, 3, 72, 7 - -	10
1870	72, 72, 5, 7, 55 - -	17, 10, 59 - -	8
1871	63, 65, 20, 50, 8 months, 81, 11, 30, 2, 1 year.	49, 86, 66, 69 - -	14
1872	54, 65, 68, 13 days, 56, 14 months.	18 months, 74, 75 - -	9
1873	56, 66, 19, 74, 63, 47 mths., 5 mths.	76, 70 - -	9
1874	4, 19 months, 4, 30, 70, 19, 20 months.	26, 71, 79, 82 - -	11
1875	3 months, 65, 5 weeks, 59, 10 months, 63, 60, 3 months, 1 year.	72 - -	10
1876	59, 77, 2, 42, 42, 69 - -	— - -	6
1877	74, 70, 23, 74, 23 - -	78 - -	6
1878	40, 8 months - -	42 - -	3
1879	75, 50, 33, 4, 40, 35, 6 months, 7 months, 67.	74, 77, 69, 73 - -	13
1880	76, 60, 7, 16, 66, 8 months, 31 months.	52, 85 - -	9
1881	25, 74, 19 months, 10 months	81 - -	5
1882	11, 35, 5, 49, 67, 71 - -	81, 9 months, 79 - -	9
1883	36, 76, 58, 4, 75, 10, 17 - -	64, 16, 64 - -	10
1884	61, 74, 14 days, 2, 71, 11 months, 63, 9 months, 23 months, 60, 69, 77.	89, 69 - -	14
1885	25, 38, 48, 8 months, 3, 28, 74, 76, 20, 18 months, 88, 5 weeks, 2½.	62 - -	14
1886	24, 17 months, 79, 46 - -	18 days - -	5
1887	10 days, 4 months - -	84, 2 months - -	4
1888	24, 41, 77, 31, 31 months, 35 months, 59, 14 weeks.	37 - -	9
1889	23 months, 14 days - -	32, 82, 86, 25 - -	6
1890	10 months, 27, 11, 71, 69 - -	57, 38 - -	7
1891	19, 7 months - -	— - -	2
1892	12, 72, 56, 11 - -	27 - -	5
1893	21 months, 77, 14, 78, 40, 85, 79.	49, 49, 38 - -	10
1894	67 - -	79, 49 - -	3
1895	9, 10, 9 - -	75, 33, 39, 56 - -	7
1896	6 months, 80, 15 months, 59, 65, 64.	25, 74, 80, 3, 65 - -	11
1897	14 months, 64, 42 - -	80, 78, 62, 37, 84 - -	8
1898	1 month, 47 - -	9 months, 88 - -	4
1899	87, 79, 82, 90, 65, 44, 6 months	— - -	7
1900	61, 79, 35, 32, 28 days - -	65 - -	6
1901	73, 21 months - -	— - -	2
1902	81, 47, 53, 21, 78 - -	40, 45, 86 - -	8
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to be easily elucidated, and the heredity of cancer is still a matter of some dispute. There is widespread belief that

cancer is hereditary, but the term heredity is so elastic that people use it in very different senses. Cohnheim and the pathologists of his school affirm that the offspring of cancerous parents are born with such epiblastic peculiarities that a very slight stimulus is sufficient at the appropriate time to produce the diseased activity of the epithelium which is cancer. I believe that such a statement is far too absolute and is usually incorrect. It is more likely that a person is born with a predisposition to the disease, though there is every reason to suppose that such a predisposition may be acquired. The predisposition consists perhaps in some chemical change in the tissues, enabling them to support the life and growth of an organism, which in turn reacts upon the epithelial cells and makes them multiply out of all due proportion. If cancer is truly hereditary in Cohnheim's sense, the various members of a cancerous stock should suffer from the disease whether they remain at home or scatter themselves abroad. The time at which they are attacked should vary with the vitality of the individual tissues in each person, for cancer is essentially a disease of decadent epithelium. Every member of the family, however, should not suffer, because every child does not inherit the epiblastic peculiarity which, on Cohnheim's theory, is a necessary factor in the production of cancer.

Many observers and statisticians have devoted themselves to a consideration of the heredity of cancer, and their conclusions do not lend support to Cohnheim's view. Mr. Butlin teaches that heredity influences cancer, but that the relationship in the cases he has examined were almost invariably on one side, and there were scarcely any cases in which the history of cancer was divided between the families of both parents. Mr. Roger Williams¹ has analysed the records of the family history of more than 700 patients affected with innocent and malignant tumours, in order to ascertain the frequency with which there was a history of heredity. He found that there was a history of heredity in 28 out of 124 cases of uterine cancer, which is equal to a proportion of 19.7 per cent. In 136 cases of mammary cancer there was an hereditary history of cancer in 33 cases, which gives an average of 24.2 per cent. Of 92 other female

¹ *Twentieth Century Practice of Medicine*, Vol. XVII., p. 264.

cancer-cases there was a history of heredity in 22 or 23·9 per cent. Thus of the 370 females suffering from cancer there was a history of heredity in 83 or 22·4 per cent. Of 209 men suffering from cancer there was a history of heredity in only 23 or 11 per cent.—a difference which Mr. Roger Williams attributes to the fact that men know much less than women about the details of their family history. In 345 cases of malignant disease occurring in women there was a family history of innocent tumours in 13 or 3·7 per cent., whilst in 101 cases of non-malignant tumours in women there was a family history of cancer in 18 or 17·8 per cent., and in these same 101 women there was a family history of cancer in 15 per cent. The history of heredity, therefore, is not a very strong one in many cases, and appears to indicate little more than a predisposition to the disease.

A study of the predisposing causes of cancer seems at the present time to afford better prospects of elucidating the cancer-problem than the statistical examination of its hereditary incidence. The more I see of cancer cases, the more I am struck with the frequency with which a widow or widower dies of malignant disease, when the husband or wife has previously died of cancer. I think, at present, that these cases are more than mere coincidences, and that they may point to some common factor in the joint lives of the sufferers which has allowed their decadent epithelial cells or connective tissue to run riot. This factor may be predisposing, as is the more likely, in which case it might be of a chemical nature, associated with modern alterations in diet and habits; or it might be an exciting cause such as a parasite or other infective agent.

I have already said that I do not believe cancer to be hereditary in the sense that all, or even some of, the children of parents who have died of malignant disease are themselves predestined to die of cancer, but I feel sure that under appropriate conditions they are more likely to do so than those who have not inherited any such proclivity. I believe, in other words, that some tissues are more fitted than others to develop cancer under the influence of an exciting cause as yet unknown, just as syphilis, phthisis, typhus and scarlet fever run a much more malignant course in some people than in others. It

must be borne in mind, on the other hand, that a very remarkable series of cases of cancer may occur in families which have no hereditary history of cancer. Everyone who has worked much at cancer has met with such families, and here is a case in point. A lady, unmarried and aged 61, came to me lately on account of an inflammatory swelling in her knee, and in the course of conversation she mentioned that her breast had been amputated for cancer five years ago. On enquiry she said that her mother was alive and was over 90. Her father, a gentleman and a Londoner, had lived in his own house at Islington, where he had died just before she was born. The family consisted of seven children, the last being twins. The eldest brother died of cancer of the liver at the age of 58, and the eldest sister died in childbed at 40; Ellen, the next sister, died at 58 of cancer of the breast; Fanny at 30 of a tumour of the brain. This sister was married at 16, lived at Cheltenham, and had a healthy son, who is alive at the present time. She had no miscarriages, so far as is known, and the cerebral tumour is therefore more likely to have been tubercular or sarcomatous than a gumma. Clara, a twin sister, died at 52; her breast had been amputated for cancer, and five years later she had cancer of the liver. Her twin brother Edward died at 58½ from a recurrent tumour of his knee. All the brothers and sisters, with the exception of Fanny, had lived together in the old home, as it was only by uniting their incomes that they could afford to maintain it. No history of malignant disease could be traced in the ancestors or collaterals of this family, though the old mother must often have enquired anxiously as one after another of her children was taken away. It is obvious that both sarcoma and carcinoma were present in this family, or, in other words, that the connective tissues were as liable to disease as was the epithelium.

Such a family seems to show that the predisposition to cancer may be acquired, and the village about which I have told you bears out this assumption. It would be very interesting to ascertain whether the predisposition to cancer is being now developed, and if so, under what agencies, even if we remain in ignorance for a time of the actual cause of the disease. There is no marked heredity in the history of the little community under consideration; the evidence, indeed,

rather leads to the conclusion that the disease is not hereditary here, for only in one family have the two children (both females) suffered from cancer, and no cancer has appeared in the collateral lines even of this family. But the cancer in this community has only attracted attention within the last few years, and it will be a matter of extreme importance in the future, and yet of comparative ease for those who live on the spot, to watch the descendants of these men and women through one or two generations and note the diseases of which they successively die. This my friends have undertaken to do so far as lies in their power.

I have endeavoured in this lecture to describe the advantages, and point out some of the fallacies, which attend any investigation of cancer by watching the disease in small communities which are practically free from external influences. The method is necessarily a long one, and it is only by noting the facts as carefully as possible that any advance can be made. It may, indeed, take a generation or two to establish the facts, but with maps of sufficient scale, accurately marked and kept up to date, there should be no very great difficulty in carrying the enquiry to a successful issue. I have already said that I believe the increase in cancer is real in the first district; largely fictitious—in the sense that it is accidental—in the second village. But in both villages the inhabitants are hardly up to the average standard of health, and it will be very interesting to observe whether the increase in the number of cancer-cases continues so long as the inhabitants of the second village are condemned to drink bad water, and whether, when a good water-supply is provided for them, the cancer-mortality falls to the normal rate. Should this occur there will be some grounds for believing that a prolonged lowering of the bodily health may predispose the agricultural classes to malignant disease, just as we know that amongst the upper classes grief and worry act as predisposing causes of cancer.

