influence of the great nerves of the heart were vague and unsatisfactory. Bichat (1771-1802) emphasised the distinction between the sympathetic and cerebro-spinal systems. In 1792, Sömmering (1755-1830) asserted that the cardiac nerves were distributed only to the vessels of the heart; Scarpa (1747-1832) showed, however, that the nerves actually ended in the muscular structure. Humboldt (1769-1859) showed in 1797, for the first time, that galvanism excited cardiac contractions; but it was not until 1837 that Burdach first observed the contractions of the heart become stronger when he applied both wires of a voltaic pile to the cervical portion of the sympathetic. The lecturer alluded to the experiments of Legallois, Wilson Philip, Flourens, and Valentin, all of which, though often contradictory and misleading, helped towards the elucidation of this difficult question.

In 1838-9, appeared the celebrated researches of John Reid (1809-1849) as to the functions of the eighth pair of cranial nerves. After giving a short sketch of the life of Reid, the lecturer described him as one of the most learned, accurate, and cautious physiologists that ever lived. His work was not connected with a great generalisation, or even a great discovery, and hence it may be undervalued and forgotten; but it was work so true and thorough, so masterly in its conception and execution, as to entitle him to a place in the first rank of workers.

In 1845, the Webers discovered the inhibitory action of the vagi. Before this, in 1839, Remak had described the cardiac ganglia. The older anatomists had, fairly enough, supposed that the vagus was a motor nerve of the heart (Piccolomini, born 1556; Willis, 1622-1675; Lower, 1631-1691; Valsalva, 1666-1723). The Webers' discovery dispelled this idea, and laid the foundation of the doctrine of inhibitory nervous action. The lecturer then gave a short account of the information collected as to the innervation of the heart since 1845, which has led to the recognition of the action of the intracardiac ganglia, and of the inhibitory and accelerating fibres. Specially, he pointed out how the centres of the inhibitory and accelerating mechanism in the medulla oblongata and spinal cord may be influenced by peripheral impressions, a department of knowledge which owes much to Ludwig and his disciples.

Retracing his steps, the lecturer then detailed the beginning of experiment as to the innervation of the vessels. Pourfour du Petit, an oculist and surgeon (1664-1741), noticed between the years 1712 and 1727 that injuries to the sympathetic nerve in the neck caused contraction of the pupil, partial closure of the eyelids with protrusion of the third eyelid, and redness and apparent swelling of the eye. In 1755, Molinelli observed similar facts. In 1816, Dupuy, a veterinary surgeon at Alfort, under the eye of Dupuytren, observed the same phenomena, but he noticed, in addition, a rise of temperature on the affected side. These results were confirmed by Brachet in 1830; but they led to no theoretical views till Claude Bernard, in 1852, rediscovered them, and, in particular, noted the dilatation of the vessels and the rise of temperature. Bernard himself states that, between 1841 and 1852, he had often repeated Pourfour du Petit's experiment, but failed to recognise its significance. In the same year, 1852, Brown-Séquard, then in America, observed similar phenomena; and he found that irritation of the upper end of the sympathetic nerve caused the vessels to contract, and the pupil to dilate. Bernard also states that Biffi observed the effects of galvanisation.

These experiments showed that the blood-vessels are under the control of filaments in the sympathetic nerve; but it was not easy to trace the actual connections existing between the sympathetic and the cerebro-spinal system. A new method was wanted, and that was supplied by Augustus Waller, who, in 1849, discovered a process for investigating the nervous system, founded on disorganisation of the distal end of a divided nerve. By this method, along with Budge, he worked out the locality of the cilio-spinal region, for which they received the Monthyon Prize in 1852. At last, Bernard, in 1858, announced his great generalisation of vaso-motor nerves. The lecturer described the actions of these nerves, the necessity that arose for dividing them into vaso-constrictor and vaso-inhibitory, the discovery of the locality of the chief vaso-motor centre in the medulla, and the ways in which the activity of this centre may be elevated or depressed. He also gave an account of the physical phenomena of the circulation as influenced by nervous action.

It is evident that the nervous mechanisms of the heart and vessels must have a great influence on the pressure and velocity of the blood-current. Without arrangements for observing these physical phenomena accurately, such information could not have been ascertained. By means of the kymograph, in particular, physiologists have been able to work out the question—"To whom are

we mainly indebted for these results?" Mainly, in the lecturer's opinion, to the Webers, John Reid, Claude Bernard, and Ludwig. The Webers took the first step towards recognising the great principle of inhibitory action; John Reid taught physiologists how to investigate the functions of nerves by his work on the eighth pair; Claude Bernard developed the great conception of vaso-motor nerves; and Ludwig showed how this conception, whilst it certainly made the hydraulic problems of the circulation infinitely more complicated than they were even to the imagination of Thomas Young, accounted for some of the phenomena, and indicated, at all events, the solidarity of the arrangements in a living being. Further, Ludwig used the evidence supplied by some of the phenomena of the circulation to explain phenomena of the nervous system, and he developed the methods by which the physiological effect of active substances, used as remedies, ought to be investigated. Finally, the lecturer showed that, without a knowledge of these facts, all of which had been gathered by experiment, most of the phenomena of fever and of inflammation were inexplicable.

AN INQUIRY INTO THE CAUSES OF THE INCREASE OF CANCER.

By HUGH P. DUNN, F.R.C.S.

IN the preface to the forty-second Annual Report of the Registrar-General, the following observation is made in connection with the mortality from constitutional disease: "Cancer also maintained the increased rate to which it has been gradually mounting for many years." Let us proceed to inquire upon what data this opinion has been grounded, and test the accuracy of the statement by means of the figures which the report contains.

A cursory examination only is sufficient to divulge that the fell disease claims year by year a higher ratio of victims. Confining our remarks to the period of twenty years from 1860 to 1879 inclusive, and commencing with the first ten, we find that the total number of deaths from cancer during that time was 80,049, and the annual average increase was 248. During the years 1870-1879, the total number of deaths from cancer was 111,301, and the annual average increase was 320. Thus we have here, as far as numbers are capable of showing, conclusive evidence of the increment in the mortality from cancer. It is observable, also, that the rate of increase is much higher in the latter than in the first ten years. It is, moreover, the case, that the annual rate of increase is higher in the years 1860-1869, than in the preceding decennium—namely, in the years 1850-1859. In short, in the years 1850-1859, the increment was about 2,000; in 1860-1869, 2,480; in 1870-1879, 8,200. As the population increases at about the rate of one-tenth in every ten years, the influence of this upon the cancer-returns amounts to very little. We have, then, confessedly, to face the fact that cancer is increasing in our midst at a rate which bids fair to become more and more serious with the advance of time.

But, in dealing with the question of cancer, it is necessary to be mindful of its character as a disease, and of the manner in which its influence is exerted upon the community at large. Let us remember that the war which man has waged, and is waging, against innumerable morbid besiegers, has resulted in the extermination of some, and in the reduction to feeble resistance of many others. In carrying out these undertakings, the aid of science has been invoked with a success which has been good in the past, and is still progressive. By means of the enforcement of sanitary laws, the health of the community, as a whole, is immeasurably better than in the days of a civilisation which, though necessarily advancing, was yet in a primitive condition. But it may be said of civilisation now, that it has acquired a character of refinement—a delicacy, in fact, of organisation—so unequivocally marked, that it recoils upon itself, and brings into existence evils which, except under circumstances of this nature, would have remained unknown. Not only is man compelled to herald the approach of new morbid arrivals, but the circumstances of the case compel him to submit to an increment in the mortality from some diseases the pedigrees of which reveal an ancient ancestry. Of cancer, it is true that we possess no available resources for permanently diminishing its intensity and curtailing its extent. In accounting for this, it is only necessary to recollect the prevalent insufficiency of our knowledge of the origin of the disease. We can adduce no reason for its appearance in a person of robust health, nor as yet have we discovered any data which might tend to throw light upon the causes which influence the evolution of the various forms

of the malady. As to the question of its local or constitutional origin, there is as much to be said on one side as on the other. The acceptance of either one or the other can only be, in the present state of our knowledge, supported by statements which, at the best, are merely conjectural. Under these circumstances, then, it is not to be wondered at, that the annual increment of cancer continues without abatement. When obstructed by difficulties and problems of insoluble depth, we find our knowledge of the disease limited to an area which practically excludes us from interrupting its progress.

Turning now to the subject proper of this paper, our first inquiry has reference to the relative frequency of cancer in the male and female. We may ask, Is the increase general, or is it chiefly confined to one or the other sex? Let us turn to the tables in the report. We learn at once that the increase is chiefly noticeable in one sex, and that the female; for whereas, in the male, the numbers vary in a given series of years between increment and decrease, in the female, the former is always predominant. Having thus been shown the location of the increase, our next inquiry is, to what influences is it due? Are the social conditions different as respects women from those under which in former years they were placed. Possibly; but of this it is difficult to hazard a suggestion which might be even approximately true? Still, however, the principle of cause and effect must be at play in a matter such as this, about which no ambiguity can exist. If, indeed, cancer is increasing at the rate to which we have referred, it is conceivable that something is at work to lead to this result; and in reference to this point, we are reminded of the predilection which cancer exhibits for certain organs in the female, as the breast and uterus. Statistics collected by Birkett, West, Velpeau, and others, conclusively showed that the breast and uterus became cancerous chiefly in married women; and still more that their liability to the disease increased with their fecundity. Here then, is a point into which, in connection with this subject, it is necessary to inquire. It is essential for our purpose to assume that greater fecundity is now prevalent amongst women than was the case in former years. Where, however, is the evidence? Let us turn our attention to the record of the marriage-rate, by the side of which is inserted the birth-rate. We find that, in the year 1853, the proportional marriage-rate for 1,000 persons was 17.2, with a birth-rate of 33.2. In 1863 the marriage-rate was 16.3, and the birth-rate 34.1. In 1879 the lowest marriage-rate which has ever been recorded since the compilation of the returns was 14.2, with a birth-rate of 35.0. Thus it would appear from this, that whilst the marriage-rate has decreased, the number of births, as the result of sexual union, has increased. But if fecundity increased a woman's liability to cancer, perhaps we should find that the tables would exhibit a special increment of the disease at some particular period. This is the case. The most marked augmentation of the disease, and, be it observed, the most constant one, occurs between the thirty-fifth and forty-fifth years. Now, in women who have been prolific, the unequivocal manifestation of cancer is generally but little delayed after the cessation of childbearing; hence the figures of the table lend appreciable support to the suggestion at which we have hinted, that in the greater fecundity of women may possibly be found some explanation of the augmented mortality from cancer. The latest returns to which we have had access are those for the years 1878-79-80. In 1878, between the thirty-fifth and forty-fifth years, the number of cases in women was 1,222; in 1879, 1,286; in 1880, 1,298, or a net increase of 76 cases in three years during this period of life. For the sake of comparison, we append a table copied from the Registrar-General's Reports for the years in question, illustrating this point.

DEATHS FROM CANCER AT DIFFERENT AGES, 1878, 1879 and 1880.

Years.	All Ages	Total under 5 years	5	10	15	20	25	35	45	55	65	75	85
1878.													
Males	4207	32	14	20	27	28	122	351	803	1226			
Females	8457	37	14	9	26	36	307	1223	2057	2348			
1879.													
Males	4183	29	51	10	35	39	143	337	1249	1264			
Females	8616	32	52	12	22	37	383	1286	2162	2306			
1880.													
Males	4461	25	17	17	28	38	125	294	1294	1294			
Females	8817	25	13	19	30	38	346	1298	2149	2396			

It has been suggested as probable, that the increment of cancer is more apparent than real, upon the grounds of the greater certainty in diagnosis which at present prevails, and of the exercise of more

discrimination in relegating to the proper cause the deaths from the disease. This hypothesis, however, cannot be supported, for the tables set forth in the Registrar-General's reports plainly indicate that the chief increment occurs in women at a time of life during which the recognition of cancer would involve no difficulty. For instance, the diagnosis of carcinoma of the breast or uterus, the organs which, in the female, suffer most frequently from the disease, belongs to some of the most simple questions upon which surgeons are called to express an opinion—a simplicity, indeed, of which the earlier surgeons were fully aware. And, furthermore, we may add that the effect of improvement in diagnosis would rather tend in the direction of limiting than of adding to the mortality from cancer; inasmuch as a skilful diagnosis, by enabling the surgeon to apply, under favourable circumstances, speedy radical treatment, would afford the patient the best chance of preserving life. But, although the strong predisposition to cancer which fecundity creates in the female, may operate, as we have supposed, in augmenting the mortality in the present day, it is conceivable that other influences are at work, to which the same result may in part be attributable. There is, for instance, a close connection between certain nervous conditions and the production of the disease. The eminent author of the *Clinical Lectures and Essays*, states that he has frequently observed that the spontaneous appearance of cancer has been preceded by mental grief or some anxiety of mind. Women, apparently healthy, pass through a period of trouble and anxiety, and subsequently to this, the breast or uterus (it may be) becomes the seat of a cancerous growth. The question might, however, be raised: What is the real connection between what amounts to the influence of the mind upon the body, and the appearance of cancer? Does mental anxiety simply cause a cancerous predisposition to become manifest, and in this way to hurry into existence that which, in time, would have become unequivocally demonstrated; or is it likely that patients, in whom cancer has appeared after mental troubles, would, except for this, have continued in health, and unaffected with cancer? It is needless to pretend that we know more than a very little as to the rôle played by the mind in the production of changes in the body. As we can adduce no scientific data upon which to found a physiological or pathological belief, we are compelled to resign ourselves to the unphilosophy of conjecture. There is, however, abundant evidence to show that mental disturbance may be productive of nutritional changes in the body, which vary in intensity. The inhibitory influence, for instance, of mental trouble upon the processes of digestion, which, may be succeeded by exaggerated functional activity of the intestines, as evidenced by the occurrence of diarrhoea, is perhaps one of the simplest examples to which we could refer. So far this is comprehensible; but how are we to explain the outbreak of cancer in a breast, the appearance of which immediately followed a period of mental anxiety, through which the patient had lately passed? How is it that a local cell-growth should suddenly commence to pass beyond its natural limits, and merge into prominence exhibiting characters suggestive of the developmental vitality of the embryo, and this after some perversion of nerve-power which was mental in origin? There is always some degree of "shock" present in all cases of mental grief; and "shock" implies a reduction of nerve power, to an ebb which is co-ordinate with certain phenomenal results, the persistence of which varies with the intensity of the cause. Hence, it is probable, that the depression of power following mental trouble has the effect of depositing the inhibitory influence of a well balanced nervous system, by the action of which the occurrence of morbid phenomena of various degree becomes impossible. It is, moreover, conceivable, that the effect of mental impressions upon the body would, at least in part, be determined by the condition of the nervous system. The higher the development of the nervous system, the more susceptible does it become to impressions from without. In the present state of civilization in a crowded community, it is becoming more and more the case, that the occupations in which men and women are employed are of such a nature as to develop the nervous system pre-eminently in relation to the rest. In other words, the consumption of nerve-power in the daily routine of life, is not only of high rate, but coincidentally with this there is also, in the present day, less opportunity of promoting healthy nervous action. Dr. Handfield Jones writes as follows, in 1864: "It is difficult to form a decided opinion on the matter; but there seems, I think, reason to entertain the belief that failure of nerve-power is much more characteristic of disease of the present day, than of that which prevailed thirty years ago. For this there may be various causes: the greater confinement of large numbers of the population within doors, and often in unhealthy rooms and workshops; the greater struggle to be main-

tained in the battle of life; the greater amount of the *commoda vitæ*; may all tend to increase the susceptibility of the nervous system, and to impair its resisting power." If, now, we refer to the forty-second annual report, we find that the annual average increase in the mortality from nervous diseases for the decennium 1860-69 was 580, while that for the decennium 1870-79 was 790, or an increment of 36 per cent. in the last ten years. Against this, however, there is the statement in the preface of the forty-third annual report, that the mortality from nervous diseases per 1,000,000 persons in the year 1880 was the lowest on record. It may be for the present there is a lull in this particular mortality; but it is observable, that this record only applies to deaths which have directly resulted from diseases of the nervous system. It obviously takes no account of the deaths from other diseases, the origin and fatality of which have a direct bearing in connection with persons in whom nerve-power is deficient and depraved. And this, taken in conjunction with the fact that the transmission of a neurosial temperament from parent to offspring is apparently sufficiently common in the present day, attaches to the consideration of nervous diseases an importance of no small degree.

"Nervous" patients, so called, usually beget "nervous" children, and the inheritance of the latter usually accompanies them throughout life, unless, indeed, by some means or other, they gradually cease to be less susceptible to its effects. It is conceivable, then, that with a nervous system, the equilibrium of which is easily disturbed, there must be in persons of either sex a greater proneness to exhibit on certain occasions unequivocal results of nerve-disturbances; in other words, a sensitive nervous system augments the predisposition to the production of nerve-disorders, increases the liability to the origination of neurosial effects when any perversion of nerve-power arises, and confers upon disease, when it occurs, a character indicative of the prevailing temperament, by intensifying more especially the subjective symptoms. The late Charles Moore, whose invaluable researches into the subject of cancer threw a flood of light upon the disease, was attracted in 1865 by the rate of increase in the mortality of cancer as prevalent then. He believed that it was owing to the well-being of the nation, and ascribed it to corn laws, good living, to the discoveries of gold, and sanitary improvements. Now a disease such as cancer, which is characteristic of the healthy, may be expected to abound amid conditions of health. Probably, then, its prevalence is greater amongst the rich than amongst the poor. According to Marc d'Espine, this is the case, for whilst in the wealthy classes the proportion of cancer is about 106 in 1000, in the poor classes it is 72 in 1000; or at the rate in the former case of 10.6 per cent., and in the latter of 7.2 per cent.

It has been observed that cancer is more frequent amongst the carnivora than amongst the herbivora. But the means of obtaining data upon this point are so meagre and uncertain, that it has been found impossible to formulate a satisfactory statement. In answer to a letter which I addressed to Mr. Forbes, of the Zoological Gardens, he states that, according to his experience carcinoma is not a common disease in animals in the Gardens, of any class. It is, perhaps, nearer the truth, then, to believe that, whilst occasionally carcinoma may appear in the carnivora, the occurrence of the disease in the herbivora is so rare as to be practically unknown. Dr. Crisp, however, stated in the discussion upon cancer at the Pathological Society, that carcinoma is not at all an uncommon disease amongst the domesticated animals; whilst in wild animals and uncivilised man it is rare; and in 230 of the quadrupeds which he had examined, there were no traces of cancer. Mr. Haviland, in 1879, read a paper at the Society of Arts, on the "Distribution of Disease Popularly Considered," in which he stated that the mortality from cancer is highest in those districts which skirt the banks of the rivers of our country, which are seasonably flooded; that the Thames flows through a vast cancer-field; that there does not exist an important river, subject to seasonal flooding, that does not flow through high mortality districts; and he attributes the large mortality to the geographical, together with the climatic-surroundings of the rivers in question. It seems to us, however, that there is some fallacy in supposing this to be the case. It cannot be denied that the death-rate from cancer stands high in the propinquity of certain rivers, but this, we imagine, is for the most part due to the aggregation of towns along their course. If, however, the flooding of rivers were distinctly connected with a high cancer mortality, the record of the rain-fall for the year would probably indicate whether we might expect an increment or a diminution in the mortality from the disease. But a reference to this subject fails to yield any information in support of Mr. Haviland's hypothesis; for whereas, in the eight years between 1872 and 1879, inclusive, the annual rainfall varied between 20.0 in 1874, and 31.3 in 1879, the

mortality from cancer shows an actual increase of 2806, or an annual average increase of 350. The comparison, however, between the rainfall for the years we have mentioned, and the mortality from cancer, is so marked, that we append the records of both in the following table—

	Rainfall.	Deaths from Cancer.
1872	30.0	9.993
1873	23.4	10.455
1874	20.0	11.011
1875	28.2	11.414
1876	24.2	11.604
1877	26.9	12.122
1878	29.2	12.664
1879	31.3	12.999

As the seasonal flooding of a river could hardly occur without a due proportion of rain, and as, in spite of the variability of the rain-falls, the increase in the cancer returns, as the table indicates, is year by year maintained, it is conceivable that Mr. Haviland's suggestion, ingenious and interesting though it is, requires further confirmation. Again, analogy would lead us to expect a higher mortality from cancer in the centres of population than in the country. The inquiries, however, made into this subject by several observers, have for the most part shown that this is not the case, and that the disease is not more prevalent among those who reside in towns, than compared with the inhabitants of country districts. The Thames may, nevertheless, be an exception to the rule, considering the enormous population which lives along its course. At any rate, let us hope that, if not this, at least some other and more tangible reason may account for the high cancer-mortality with causing which the river is credited; and that, after all, the Thames itself does not possess a subtle malignity, which, although unproven as it is, nevertheless causes us to look askance with some misgiving when enjoying the apparent innocence of its surroundings between the locks on its course. It is not improbable that the natural mortality from cancer in large towns with hospitals, and notably London, is exaggerated by the immigration of many advanced and hopeless cases which originated elsewhere, as Moore has suggested; and it is necessary, therefore, to take this circumstance into consideration when assigning a special cancer-mortality to a particular district.

Now, the evidence contained in the Registrar-General's Reports, conclusive as we believe it to be of the real increase of cancer, enables us also to determine that this increase is chiefly confined to a period of life commencing at early middle age (thirty-five), and terminating at the seventh decade. We do not find, on referring to the tables showing the mortality from cancer at different ages, that the disease has increased during early life. Speaking generally, we may say that the death-rate from cancer, especially during the first quinquennium, has for many years been constant.

[To be continued.]

A SERIES OF ABDOMINAL SECTIONS, PERFORMED DURING 1882.*

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THE following remarks are based upon the work, and the experience obtained from it, which occurred in my practice during the year 1882.

The cases, classified into a table, are as follows:

Operations and Disease.	Cases.	Deaths.	Operations and Disease.	Cases.	Deaths.
Exploratory Incisions.....	3		For chronic ovaritis.....	14	2
Operations for cystoma, 33			" pelvic deformity	1	1
One ovary	15		Removal of myoma	1	1
Both ovaries	10	1	Hysterectomy (Porro's operation)	1	
Parovarian cyst	4		Fibro-cystic tumour.....	2	1
Hydrosalpinx	1		Hæmatocele	1	
Pyosalpinx	3	1	Peritonitis	5	
Removal of uterine appendages, 22			Disease of liver	1	1
For myoma.....	7		Tumour of kidney	1	1

Making a total of 70 abdominal sections, with 7 deaths. Of the patients, 49 were married, and 21 were single.

* Read before the Birmingham and Midland Counties Branch.