The Influence of the Seasons on the Incidence of Certain Diseases

by

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Cieft.

Ἰητρικὴν ὅστις βούλεται ὀρθῶς
ζητεῖν, τάδε χρὴ ποιεῖν· πρῶτον
μὲν ἐνθυμέεσθαι τὰς ὥρας τοῦ
ἔτεος. Ἱπποκράτης.

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The death-rates for the various diseases, based on the Registrar Generals returns, give us comparatively little information with regard to the seasonal incidence of these diseases. Many forms of disease, though fairly common, are seldom fatal, and so are not registered as the cause of death. In other cases, though the disease may ultimately prove fatal, the length of the illness varies so much that the date of death gives us little information as to the date of onset.

The influence of the Seasons on Mortality from different diseases was carefully studied and recorded by Dr. Buchan and Sir Arthur Mitchell in their well known paper published in 1875 (1) but their influence on the production of outbreaks of the various diseases is more difficult to demonstrate. We may perhaps hope that a system of

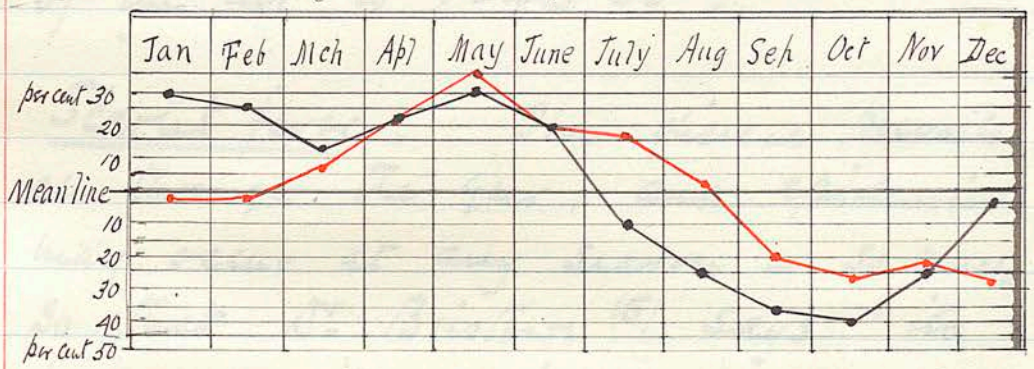
notification, not merely of infectious diseases as at present, but of all diseases may at some future time be introduced into this country, somewhat on the lines of the system which I understand is in force in Norway and Sweden; but at present it is hardly possible (especially for those of us who are engaged in country practice, and so cut off from ready access to libraries) to collect reliable information on this subject. I have therefore selected merely a few of those diseases on the incidence of which the seasons of the year seem to have a well marked effect; and I propose to compare the seasonal incidence of these diseases singly and in groups. We shall look first at some of the infective fevers.

Small pox. Outbreaks of this disease may occur at any time of the year, but summer is the time of least, and winter and spring the season of greatest pre-

= valency. (2)
The present system of notification has not been in force long enough to include a sufficient number of outbreaks to enable us to generalize, and we are therefor on safer ground if we take the deathrate as the basis of our calculations, for in this case the deathrate is a pretty fair guide to the incidence of the disease.
The Registrar General for England in his annual summary of Births and Deaths for 1890, gives a chart reproduced below (fig 1.), but from which, for the sake of clearness I have omitted the weekly oscillations, shewing the death rate from Smallpox for fifty years (1841 to 1890). In this chart, which almost exactly corresponds with that of Buchan and Mitchell (3) the year begins with a death rate slightly over twenty per cent above the average. At the end of January and beginning of

February, it is over thirty per cent above the average, and falls consickerably, but not to normal during March. In April and May it is again nearly thirty per cent above the average, but from this point it falls steadily till the end of September, when it reaches its minimum, and then rises again to the end of the year.

Fig 1.
(Small pox)



In the above table the red line represents the average number of cases of Smallpox notified to the Metropolitan Asylums Board in London during each month of the eleven years from 1890 to 1900.(4) This shews a maximum (35 per cent above the average) in May, and a minimum (26 per cent below

normal) in October.

Dr. Moore of Dublin (5) quotes statistics from Sweden for 1862 to 1869 showing the greatest prevalence in May, 13·7 per cent of the total cases in the year — and the least prevalence in September, when only 3·9 per cent of all the cases occur. He also quotes Dr. Ballard to shew that Smallpox is much more prevalent when the mean temperature of the air is below 50° F.

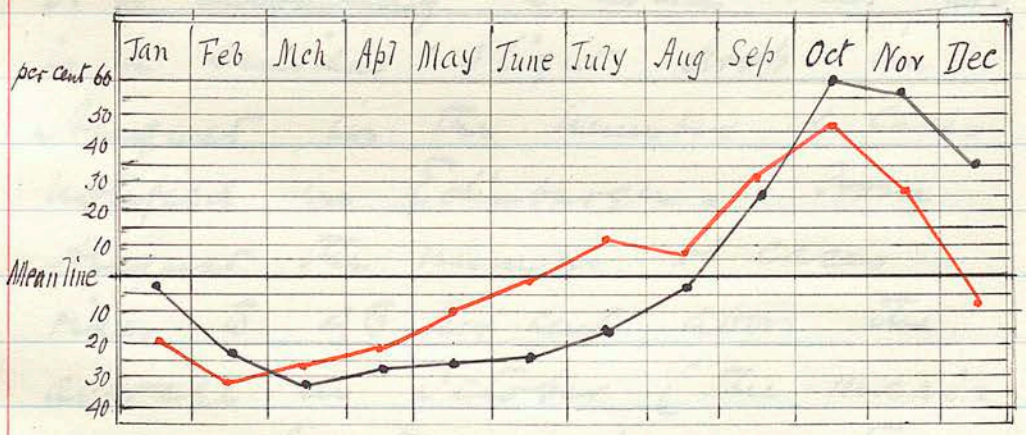
Scarlet fever. This disease prevails all through the year, and epidemics may occur at any season — so much so that Dr. Bristowe (6) says "its prevalence seems independent of season" — but the majority of writers hold strongly that the influence of the seasons is well marked.

On the following Chart (Fig. 2) the red line represents the number of cases notified, and the black line, the deaths registered.

The figures from which I have constructed these curves are taken, as

regards the cases notified, from the fifteenth report of the Statistical Com= =mittee of the Metropolitan Asylums Board (?) referring to over 225,000 cases occurring in the years 1890 to 1900; and as regards the deaths from the report for 1890 of the Registrar General for England, and it represents the average number of deaths from Scarlet fever registered in England in each month during the thirty years from 1861 to 1890.

Fig. 2
(Scarlet fever)



In this and the other charts each line represents five per cent above or below the monthly average through= =out the year. For the sake of clearness I have taken the monthly rather than the weekly averages,

as given in the above mentioned reports.

In examining the above curve we notice that in January the number of cases notified is 19 per cent below the average, and in February it falls to 32 per cent, which is the minimum for the year. From this point it rises steadily, reaching the average in June. In July it is 12 per cent above the average, and drops again in August to 7 per cent. It is interesting to notice that there is a similar slight drop in August in the number of cases notified in Edinburgh. From August the number of cases rises to 46 per cent above the average in October (the maximum for the year) and then steadily declines, crossing the mean line in December.

Thus we see that the incidence of Scarlet fever is below the average during the first half of the year, and above the

average in the second half, with an absolute minimum in February and an absolute maximum in October.

The death-rate follows a very similar course, but a little later than the notifications, which is of course what we should expect. The year begins with a death rate just below the mean line, and it reaches its minimum (32 per cent) in March and remains almost stationary till June, when it rises rapidly and steadily, without any drop in August as in the case of the notifications, till it reaches the maximum (60 per cent) at the end of October, and then falls again to the average at the end of the year. It is interesting to note that while the notifications reach the average in June, the deaths do not do so till August, and also that the death-rate reaches a higher point (60 per cent) in October than the notifications (46 per cent),

but remains much lower during May June & July, tending to shew that scarlet fever is a more fatal disease when it occurs in Autumn than in Early Summer.
The Curve of scarlet fever Mortality given by Dr. Buchan and Sir Arthur Mitchell (8) based on the figures for the thirty years from 1845 to 1874 is almost identical with the one I have given above.

Measles attains its maximum death rate at two periods of the year, June and December, of which the latter is the higher. The minima occur in February and September, the autumn fall being greater than in Spring. This is well shewn by the black line in fig. 3 which is taken from the annual Summary of the Registrar General for England for 1890, the weekly oscillations being omitted.
Dr. Whitelegge (9) says that the interval between Epidemics in

this country is usually about two years, but frequently six months longer or shorter time elapses between them. He points out also that there are epidemic waves of longer interval (about twenty years) with a high mortality: and that in Sweden and Norway six or seven years usually elapse between successive outbreaks.

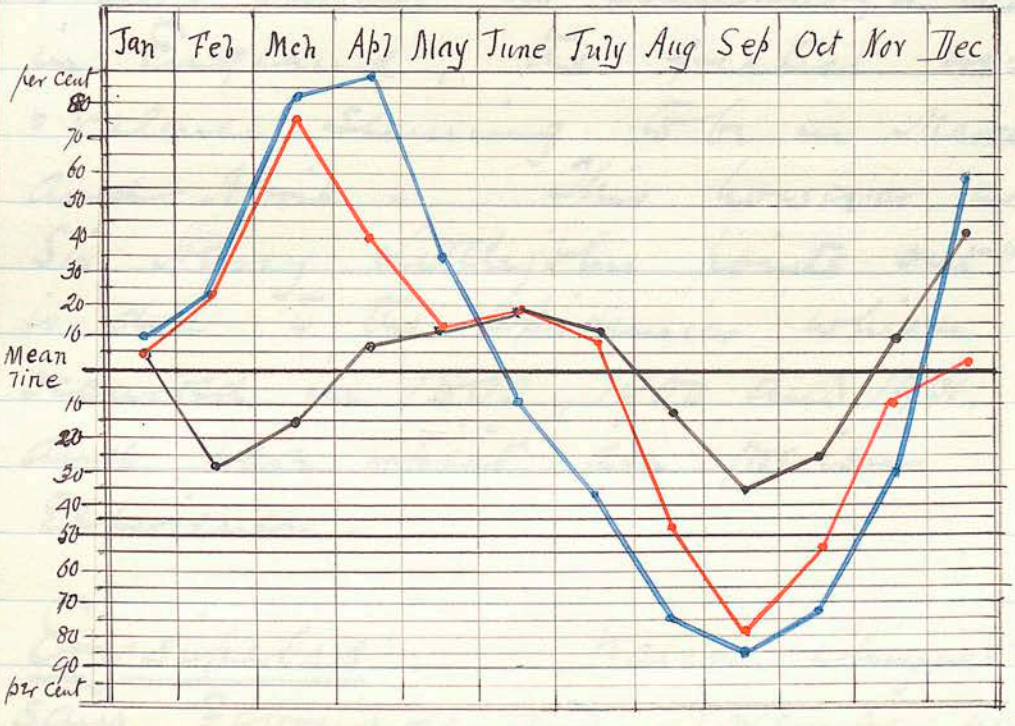
Dr. Harvey Littlejohn (10) says that the average interval between the six epidemics which occurred in Edinburgh between 1880 and 1890 was twenty months.

Dr. J.W. Moore (11) believes that a mean temperature above 58.6°F is not favourable to the spread of the disease, and that a mean temperature below 42°F is equally inimical to its prevalence.

Measles has been notified in Edinburgh since 1879, and in his annual report as Medical Officer of Health for the year

1900, Sir Henry Littlejohn gives an extremely interesting table shewing the number of cases notified in each quarter during twenty one years.
The monthly incidence in Edinburgh is shewn in the following chart (fig. 3) in which the red line shews the average number of cases notified in each month during the four years 1898 to 1901 - The figures are taken from Sir H. Littlejohn's annual reports.

Fig. 3
(Measles)



The blue line represents similar figures

for the ten years from 1880 to 1889 and is copied from Dr. Harvey Littlejohns table (12). I believe the monthly figures for the intervening years, 1890 to 1897, have not been published.

The black line shews the death rate and is taken from the Annual Summary of the Registrar General for 1890, and represents the figures for fifty years from 1841 to 1890.

From this table it would appear that the summer wave of Measles occurs earlier in Edinburgh than in England, the greatest prevalence seeming to be in March and April. This, however, as Sir Henry Littlejohn points out (13) is due to the Epidemics which occurred in 1899, 1900 and 1901, and has upset all previous Experience.

Erysipelas. Watson Cheyne (14) says February and November are the months when this disease is

most common. There are months associated with Con= =siderable changes of temperature and on the whole are cold and damp. The prevalence of the disease at these times may also be accounted for by overcrowding in ill ventilated rooms, and want of exercise which commonly occur at these seasons.

Professor Osler (15) says the disease is particularly prevalent in Spring and that the Ery= =sipelas wards in the Philadelphia Hospital are usually empty except in spring and autumn.

Buchan and Mitchell (16) say that the deaths from Erysipelas are above the average from the middle of September to the end of March, and below the average for the rest of the year. The maximum is at the end of November.

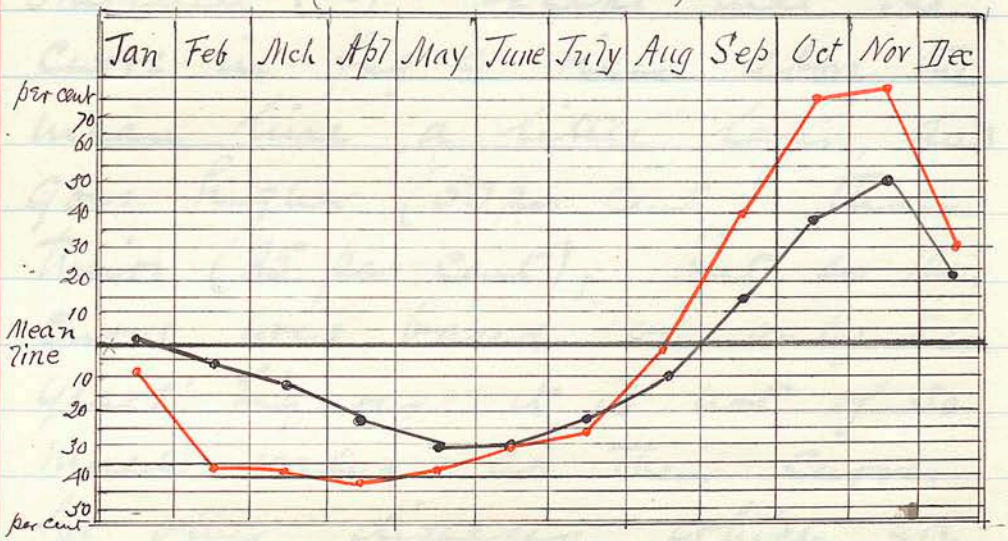
Enteric fever. It is generally admitted that although this disease occurs at all seasons of the year, it is much more common in Autumn and much more in Spring than at other times. Professor Osler (17) says that of 1381 cases treated during twelve years in Toronto General Hospital, 761 occurred in August September and October. D. J. W. Moore (15) says that in Dublin Enteric fever increases in prevalence towards the end of July, becomes epidemic in September, continues till the end of February, and then declines to its minimum at the beginning of May.

The following table (fig 4) is based on the number of cases (over 38000) notified in London in the eleven years from 1890 to 1900 (19). The curve is a very even one, shewing a rapid decrease from the normal rate at the beginning of the year

till February and then slower till April, when it reaches the minimum - 42 per cent below the average. From this point the rise is steady, though not very rapid till July, when it

Fig 4

(Enteric Fever)



increases very rapidly and without any break till October, and reaches the maximum (77 per cent) in November, falling again very rapidly to the end of the year. This curve may be taken as representing pretty accurately the incidence of Enteric fever in London, but Dr. Orschfield (20) states that the figures for the whole of England

bring out the maximum in October instead of November. The black line in fig 4 shews the deaths registered in twenty two years 1869 to 1890. (21) This agrees very closely with the curve given by Dr Buchan and Sir A. Mitchell (22) except that the curve in fig 4 rises above the mean line a little later, and goes higher (50 per cent) than theirs (35 per cent), but as their curve was based on only six years' figures it is not of so much value as their curves for other diseases which are based on thirty years' figures.

Diarrhoea of Children. The effect of the seasons on the incidence of this disease is perhaps more marked and more constant than of any other. As Dr Stowell (23) has shewn the essential factor in causing the extraordinary rise in the number of cases, and in the infant death rate which occurs

Every Summer seems to be the temperature of the air. He says that in Melbourne, New York, Berlin, and Dresden when the mean temperature rises to about 60°7 diarrhoea becomes epidemic; and that when near this point, a difference of 1° or 2° has a marked influence in increasing the number of cases. Dr. Ballard (24) states, and Dr. Eustace Smith (25) and Dr. Moore (26) agree with him, that the mortality begins to run up when the Subsoil temperature at four feet below the Surface rises permanently to 56°7. Other meteorological conditions, such as humidity, Subsoil water, winds etc. do not seem to have any constant effect on the prevalence of this disease.

Buchan and Mitchell's Curve (27) remains steady at about 70 per cent below the average monthly rate from the beginning of the year till June when it suddenly

begins to rise, and continues to do so till, at the beginning of August, it reaches 300 per cent above the average, and then falls again almost as quickly, reaching its former low level in November.

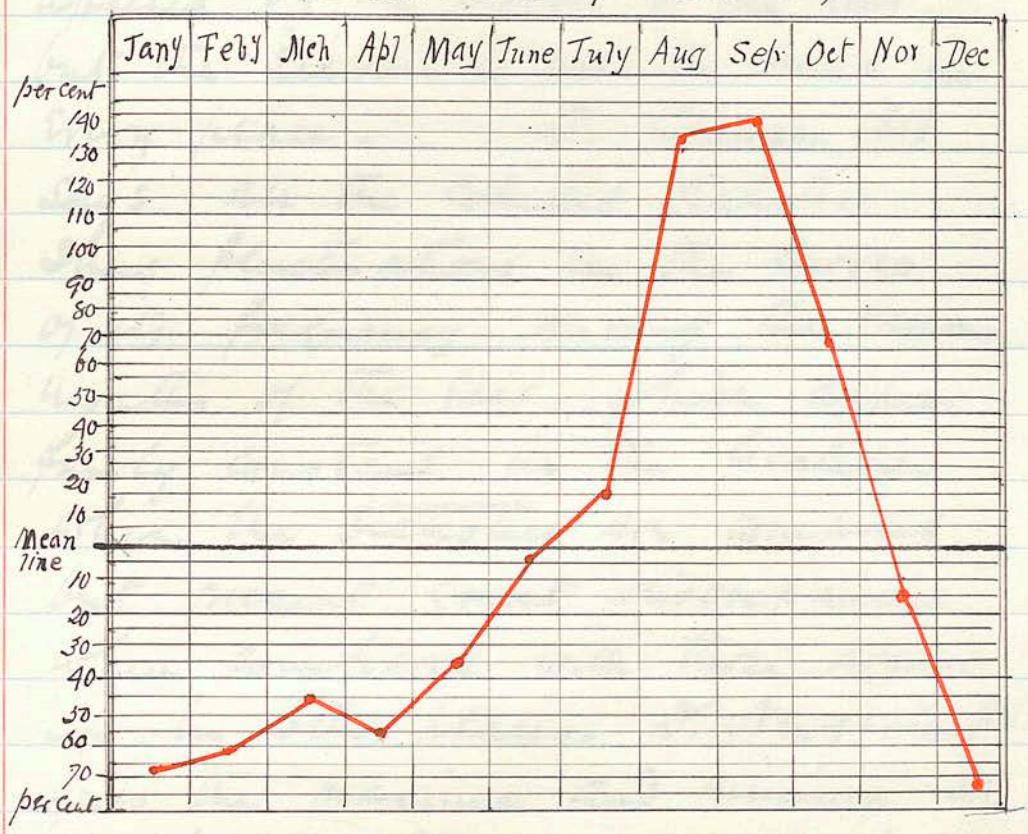
Dr. Moore (28) gives the figures for twenty years in Dublin, which do not shew anything like such a high rise (only 15 per cent above the normal) but it is quite as abrupt. It occurs nearly a month later than in London.

The following diagram (fig 5) based on 1719 cases brought to the outpatient department of the Sick Childrens Hospital in Edinburgh (29) in six years, 1893 to 1898 shews the same abrupt rise in August. This is well marked in each of the six years. In five of these years the numbers fall again in September, but in one year, 1898, they rise in September to the highest point (125 cases) reached in any one month in the whole series. This makes

the percentage for September much higher than it would otherwise be.

Fig. 5

(Diarrhœa of Children)



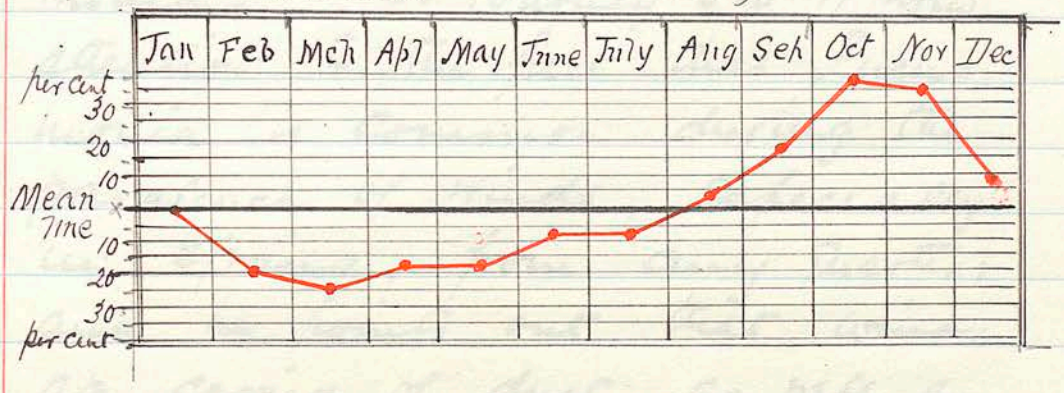
On the other side of the Atlantic it seems the Epidemic occurs earlier in the summer than in this Country. Professor Osler (30) says the rise begins in May, attains its maximum in July and gradually sinks through August and September.

Acute Rheumatism. There can be little doubt that the incidence of Acute Rheumatism is much affected by the season of the year, but the season is not the same in every place. Dr. Churen (31) says all the collected statistics shew fluctuations in the curve of its frequency during the various months of the year, which appear fairly constant in the localities when the statistics are compiled, but present great discrepancies when compared with those drawn up in other places. Dr. Newsholme (32) gives the maxima and minima at Christiania, Stockholm, Helsingfors, Berlin and Munich, but these do not coincide with what is observed in this country, nor with one another. Osler (33) says that in America and Canada the largest number of cases occurs in Spring. The incidence of this disease in London is shewn by the figures compiled by Dr. Gabbet referring to 2000

cases admitted to the London Hospital in the years 1873 to 1881, and by Dr. Phillips of 1998 cases in St. Bartholomew's Hospital in 1882 to 1893. These figures are quoted by Dr. Church (34) who puts them in a tabular form. The following table, calculated from the combined figures (3998 cases admitted during twenty years) shows that there is a

Fig. 6

(Acute Rheumatism)



steady fall from the normal in January to the minimum (25 per cent under the average) in March, from which point the curve rises pretty steadily till it reaches the normal in the beginning of August, and then more rapidly to the maximum (38 per cent above the average) in October, and falls again to the

end of the year.

Pneumonia. Dr. Eustace Smith (35) holds that in seasons when the temperature is changeable, and the weather damp, the disease is more common than at times when the temperature is uniformly high or low, but Dr. Pye Smith (36) considers that cold and dry winds have more effect in causing Pneumonia. Dr. Burney Yeo (37) drew attention to the fact that Pneumonia is common during the prevalence of winds, especially in spring, from any quarter; and he points out that winds are carriers of dust as well as abstractors of heat, the latter action predisposing the individual to the action of the bacteria in the dust. Dr. Hertingham (38) made careful investigation into the connection between meteorological conditions and the incidence of Pneumonia in London in 1893, and he concluded that

the three condition which seem to have most effect in causing this disease were first, sudden variations of temperature; second, low relative humidity; and third, the prevalence of east winds. These conditions were in operation from the end of March to the end of June, in which period nearly as many cases occurred as during all the rest of the year put together. Professor Osler (39) says that statistics every where shew that more persons are attacked from December to May than in summer and autumn, and quotes Seitz's statistics of 5905 cases in Munich which give 32 per cent in winter, 36.8 per cent in spring, 15.3 per cent in summer and 15.7 per cent in autumn. He also points out (40) that in Montreal the sudden changes characteristic of March April and May are more productive of Pneumonia than the steady cold of January.

Dr. Moore (41) quotes Hirsch's figures for a large number of places in Europe and America. His average for all the places mentioned, compared with Seitz's are as follows:-

	Hirsch	Seitz
Spring (March to May)	34·7	36·8
Summer (June to August)	18.	15·3
Autumn (Sept: to Nov:)	18·3	15·7
Winter (Dec: to Feby)	29.	32.

Dr. Maguire (42) noted in Manchester a tendency to an increase in the number of cases of Pneumonia in March and April and again in October. This he said corresponded to a great extent with what had been described in Munich, and there it had been shown that not only was cold a factor in producing Pneumonia, but that there was a distinct and inverse ratio between the amount of Pneumonia in the town, and the amount of moisture in the atmosphere; the more moisture the less Pneumonia and vice versa.

Dr. Moore and Dr. Grimshaw (43) distinguish very sharply between ordinary and Pythogenic Pneumonia, and say that whereas the ordinary form is specially prevalent during a Continuance of cold dry weather with high winds and extreme variations of temperature, Pythogenic Pneumonia reaches its maximum during tolerably warm weather accompanied with a dry air and deficient rainfall, hot sun and rapid evaporation. My own experience in this matter is somewhat exceptional. During the years I practised in the East of Fife, where for several months every year the conditions are typically those which produce Pneumonia, viz: high, cold and dry winds with great and frequent variation of temperature, I did not find that the disease was specially prevalent during the Continuance of these conditions. This may be due to the fact

that the East winds blow from the Sea, and consequently are not laden with bacteria to the extent they would be if they travelled over land.

The death rate from Pneumonia as shewn in Buchan and Mitchell Chart (44) gives a steady curve, varying little from year to year. It starts in January about 80 per cent above the average, falls slowly till the end of March, crosses the mean line in April, reaches the minimum in August, and rises rapidly during October and November.

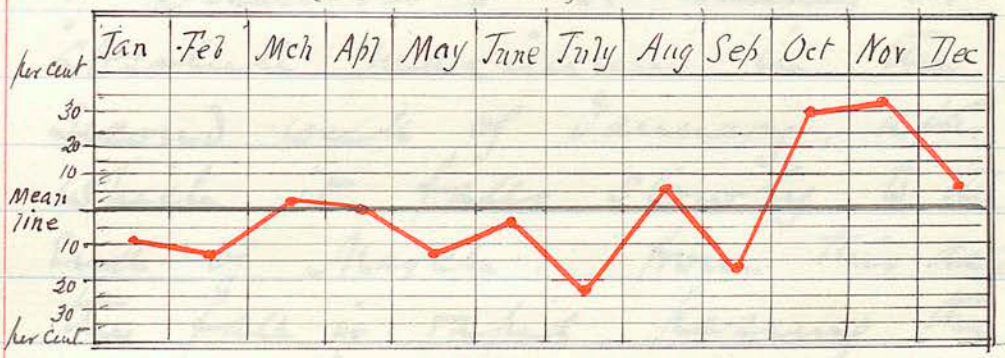
Bronchitis. Damp and cold combined, according to Dr. Eustace Smith (45), especially where great variation of temperature occur, are fruitful causes of Catarrhal disorders. Dr. Ewart (46) says although sudden changes to cold winds, especially north East winds are marked by a large increase of Bronchitis, it does not ap=

=/ear that mer bleakness or habitual exposure to strong winds, particularly from the north and East so largely tend to set up Bronchitis as might be supposed, and he gives some figures to prove this.

The seasonal incidence of Bronchitis in Edinburgh is illustrated by the following Curve based on 2068 cases brought to the outpatient De=

Fig. 7

(Bronchitis)



=partment of the Sick Children's Hospital in the years 1892 to 1898. (47) From this it will be seen that by far the greatest number of cases occur in October and November, and

that the numbers in January and February are actually below the average. It is curious that there should be such a marked rise in August. This occurs in each of the six years except one, 1894.

The death-rate in London, as shown by Buchan and Mitchell (48) has its minimum in summer (August). It begins to rise in September, and goes up very rapidly from the middle of October to the first week of December. It attains its absolute maximum in the second week of January, after which it falls slowly to the end of March: from this date the fall is rapid, passing the mean line at the end of April, till it reaches the minimum in summer.

Dr. Moore (49) gives curves of the death-rate from Bronchitis in Dublin and London for 1876 to 1885, and he points out

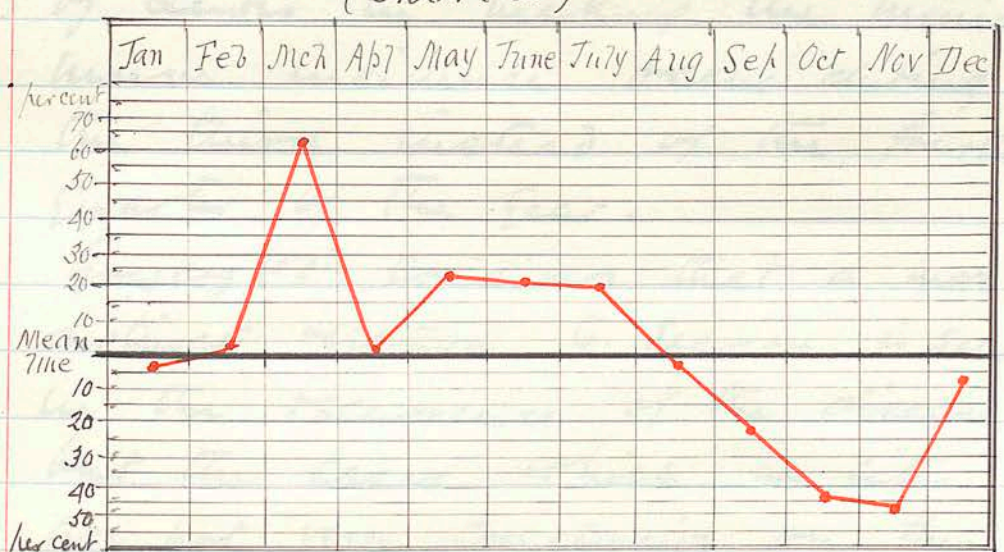
that in both cities there is a curious dip in the death curve from the Seventh to the tenth week of the year, for which he gives the following reasons:- first, the removal by death at the beginning of the year of those individuals who were most susceptible to Bronchitis. Secondly, the acclimatization of the surviving population to the continued cold of winter: and thirdly, the prevalence of South west winds and open weather towards the close of January and early in February. With the setting in of the searching east winds of early spring the death curve again rises at the beginning of March.

Chorea. There has been much discussion on the relation of Rheumatism to Chorea, and the point is not definitely settled. Most authorities maintain that Rheumatism is an important factor in the causation of the

disease. The seasonal incidence of Chorea is as different as possible from that of Rheumatism, but it does not follow that because the maximum incidence of one disease corresponds in season with the minimum of the other, that there is no connection between them.

Sir William Gowers (50) and Sir Risien Russell (67) quote Dr. Morris Lewis' figures with reference to the seasonal incidence of Chorea in Philadelphia, which may be represented by the following curve, from which it is seen

Fig. 8
(Chorea)



that the number of cases is above the average from February to August, the maximum being in March — and below the average during the rest of the year, with a minimum in November.

Sir W. Gowers (82) says Putnam failed to trace any influence exerted by season in Boston, but that, in this country, the incidence in each quarter of the year is — First quarter, 33 per cent, second quarter 25 per cent, third quarter 20 per cent and fourth quarter 27 per cent. These figures differ from those of Lewis in making the minimum incidence occur during the third instead of the fourth quarter of the year.

Gowers (83) considers that a more distinct relation to season is seen in the recurrence of the disease, but the cases which he cites are not very conclusive on this point.

Dr. Morris Lewis (57) made a careful investigation into the relation between meteorological conditions and the incidence of Cholera, but did not find that temperature, humidity or barometrical variations had any influence on the number of cases: but he did find some correspondence between the prevalence of the disease, and the number of cloudy and especially of stormy days. Dr. Weir Mitchell (58) also makes the same assertion.

Tetany. In some years many cases of this disease are met with, while in other years there are hardly any. In those years when it is present nearly all the cases occur between December and April.

In adults, Frankl-Hochwart (58) found that out of 52 cases connected with pregnancy, lactation and the puerperal

state, 39 occurred from January to April. In Vienna, among shoemakers and tailors, who seem to be peculiarly subject to this dis=ease, the epidemics occur chiefly in March and April. (57)

In children, the disease occurs more frequently than among adults in this country. In New York there was almost an epidemic of Icterus in young children in the first part of 1889. In the begin=ning of the following year there was a similar outbreak in Prague. Of 150 cases in children Frankl-Hochwart found that the majority occurred in February March and April.

Dr. John Pirie (59) gives details of 10 cases brought to the Sick Childrens Hospital, Edinburgh during the first four months of 1892. This was a most unusual number, only two or three cases a year had occurred previously. He points out (60) that during these months there were unusually persistent northerly and

Easterly winds of an anti=
=cyclonic character.

It is a little curious that so few writers on this subject seem to consider the season of the year as an etiological factor. For instance Sir W. R. Gowers (61) in treating of the causes of Tetany, makes no reference to the season. Professor Stewart of McGill University (62) gives four classes of causes, but season is not one of them. Dr. B. Bramwell (63) considers infantile Tetany merely a manifestation of Rickets, while in older patients he thinks it probably due to a deficiency of Thyroid secretion.

Poliomyelitis anterior acuta occurs almost exclusively during the hotter months of the year. At these times it takes almost an epidemic form. For instance Medin (64) reports 29 cases occurring in Stockholm between 9th August and 23rd September.

Caverley [65] records an Epidemic of 132 Cases in 1894. It began in the Early Summer, which was said locally to be unusually hot and dry. The outbreak reached its maximum about 1st August, and ended early in October. He also states that during this time some of the lower animals (horses, dogs and fowls) suffered in a similar manner.

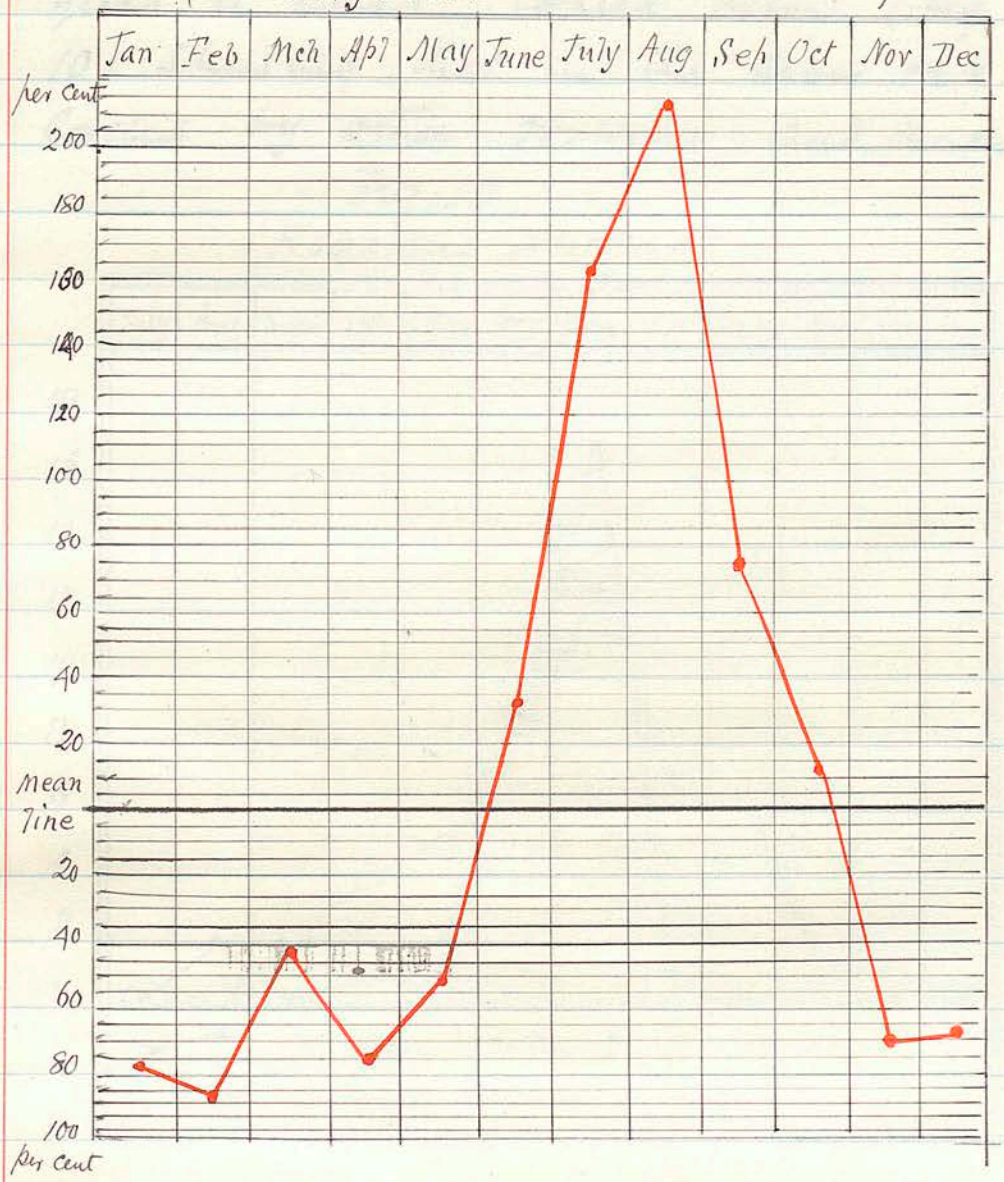
Gowers [66] quotes Sinkler to the effect that four fifths of the cases occur between May and September, and he cites his own cases which shew an enormous increase during June, July, August and September.

D. Starr [67] gives a table shewing the month of onset in 53 cases recorded by Barlow, 235 cases by Sinkler, 70 by Gowers and 94 by himself. The figures of these different observers agree in a marked way, and I have put the totals into the form of a curve (fig. 9) which shews

the very rapid rise from May to August and the equally abrupt fall from August to November.

Fig. 9

(Poliomyelitis Anterior Acuta)

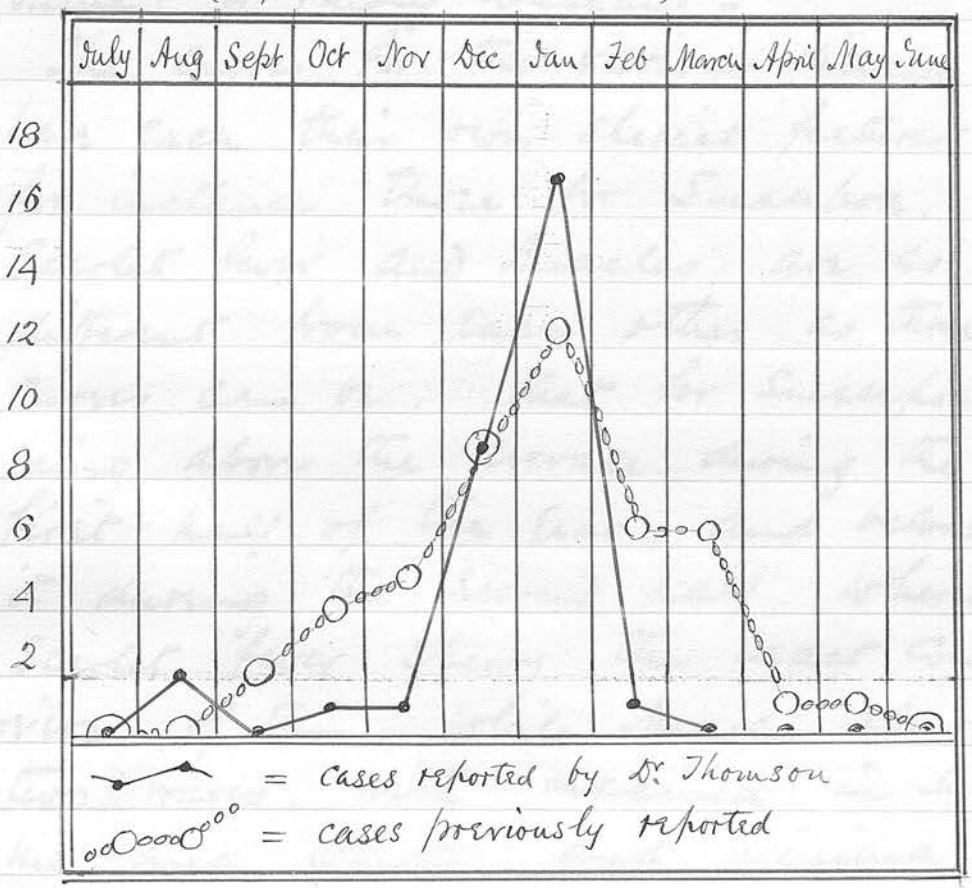


Spasmus Nutans. Dr. John Thomson (65) points out that this curious affection

is mainly if not entirely due to defective light in the house, and consequently occurs much most commonly in the darkest months of the year; and he gives a chart, copied below, (Fig. 10) shewing that in the cases recorded by other observers, and much

Fig. 10

(Spasmus Nutans)



more markedly in his own cases, by far the greatest number of cases occur in January, and that from

March to September hardly any cases are met with.

We thus see that each of these diseases is specially prevalent at certain seasons, and that the curve of incidence for each year, though of course not always the same, is fairly constant.

The curves for the various diseases have each their own special features; for instance those for Smallpox, Scarlet fever and Measles are as different from each other as three curves can be; that for Smallpox being above the average during the first half of the year, and below it during the second half, whereas Scarlet fever shews the exact converse of this, while Measles shews two waves, with maxima in Summer and Winter, and minima in Autumn and Spring.

Certain diseases which have apparently no connection with each other pathologically or

otherwise, shews a curious simi=
=larity in their seasonal incidence.
If we look for instance at the
curves for Scarlet fever, Enteric fever
and acute Rheumatism, we find
that the number of cases of each
of these diseases falls during the
first two or three months of the
year, remains low during the
early summer, rises rapidly
during the hot months, attaining
its maximum about October, and
falls again to the end of the year.
Again the curve for Poliomyelitis
anterior acuta shews a curious re=
=semblance to that for Diarhoea,
in suddenly running up to a
great height in August.
Buchan and Mitchell (69) shew
that the death rates in certain
groups of diseases have very
similar curves; for instance
in the case of nearly all dis=
=eases of the digestive system
there is a marked increase in
the deaths in summer, while
the curve is much below the

average during Winter: that the maximum number of deaths from diseases of the nervous System occurs in March and April: that the curves for diseases of the kidneys shew an alliance with that for Rheumatism; and that all diseases of the respiratory System have essentially the same curve, being much more fatal in winter than in Summer.

I have not been able to obtain definite statistical information as to the incidence of a sufficient number of diseases to enable me to generalize in the way Buchan and Mitchell were able to do from the death rates. I am therefore inclined to think that however useful and interesting it may be to know the commonest time of onset of individual diseases, the arrangement of them in groups based on their seasonal incidence in contra distinction to their death rates is not at present of much

practical value -

References

(1) Buchan and Mitchell. Journal of the Scottish Meteorological Society July 1875.
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