—there is now a divergent squint produced. If now you were to attempt to correct this divergent squint by a tenotomy of the rectus externus, the movement of both eyes would become irregular in every direction; and the final result of such untimely surgical interference you would find to be this: irregularity of the movement and restriction of mobility; too strong prominence and difference in the size; and, lastly, amblyopia of the eye operated upon. If we compare with this the perfect correction of this position, the conservation of the sight, and its power of endurance, which are obtained by a timely and constant use of the right spectacles, we must come to the conclusion that, wherever the convergent squint is purely periodical, no operation should be performed.

It is quite otherwise with that category of squint which is represented by the second case introduced to your notice. Here we find a permanent deviation of the axis of the eye, but in a different degree, according to the effort of accommodation. During the fixation the degree of the convergency increases, and in such cases the necessity of an operation is indicated; but care must be taken not to produce so strong an effect, that, even during the fixation, there will be no deviation at all; for, by so doing, we should cause divergency during the vague look which we mentioned before. The operation is only intended to correct the constant deviation. That deviation which shows itself during the fixation can only be rectified by the spectacles which correct hypermetropia.

The third case shows a constant and very high state of convergency, which must be corrected as far as possible by operation. How can this be best performed?

If the internal rectus muscle be divided in the ordinary way, it is possible to correct a squint of from two to two and a half lines in adults, and from two and a half to three lines in children. But, if the deviation exceed this extent, it will be necessary to perform two, three, or even more, successive operations.

Whilst the division of the effect between the two operations, one on each eye, offers certain advantages with regard to the symmetry and uniformity of the movements of the eyes, the performance of a third or fourth operation—*i.e.*, its repetition upon a muscle which has been already divided—is attended with great disadvantages. In fact, by such a repetition of the tenotomy, anything like an approximative calculation of the result is rendered impossible. In some cases the effect will be *nil*, in others excessive.

This is probably owing to the cicatricial adhesions which are formed after the first operation, as they prevent the performance of the usual simple tenotomy. For, if we are not careful to divide these adhesions completely, it may easily occur, that a small band, which has escaped our notice, will mar the effect; or if, in order to ensure their complete division, we have been obliged to incise the parts freely, a divergent squint (in division of the internal rectus) not unfrequently results, with considerable loss of mobility inwards, sinking of the caruncle, exophthalmus, etc.; in short, all the disadvantages of the old and now abandoned operation. About nine years ago, I felt anxious to remedy, if possible, these defects by an alteration in the mode of operating; and I then determined to investigate with greater accuracy; (1) the anatomical relations of the muscles, with regard to the capsule of Tenon, the sclerotic, conjunctiva, caruncle, etc.; and (2) the mechanical effect of the operation for strabismus.

[To be continued.]

THE ETIOLOGY OF DIPHTHERIA.

I HAVE just read in this week's JOURNAL an article by Dr. Thursfield on the etiology of diphtheria, in which, while inclining to the opinion that there is a definite connection between it and local unsanitary conditions, he seems to consider that sufficient evidence has not been adduced by any writer on diphtheria to prove this conclusively. I beg to refer him to a paper by me in the *Edinburgh Medical Journal* for February 1860, in which the causation of the disease is clearly traced to defective sanitary arrangements. In one house mentioned, typhoid fever attacked one of the inmates and proved fatal. Immediately afterwards, three children suffered from diphtheria, and were scarcely convalescent, when the mother and a servant girl were seized with typhoid fever. An abstract of the paper will be found in the *Year Book* of the New Sydenham Society for 1860. Subsequent experience has amply confirmed the conclusions at which I then arrived. Very recently the subject has again been brought under my notice by Mr. Sleman, Medical Officer of Health for Tavistock. He has clearly traced the origin of an epidemic of the disease in Morwelham, an outlying hamlet in his district, to very defective sanitary arrangements.

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INFLUENCE OF MEAN TEMPERATURE ON THE PREVALENCE OF SMALL-POX.

By J. W. MOORE, M.D. Dubl.,

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PROBABLY it would have been more correct to have headed this paper with the title, "Influence of Season on the Prevalence of Small-pox," but it will be conceded that temperature is the most important factor in the complex series of phenomena we denominate "season," and I wish to restrict myself on the present occasion to a consideration of its apparent influence on small-pox.

The subject is not a new one, for just one thousand years ago the Arabian physician, Rhazes, wrote to the following effect: "I am now to mention the seasons of the year in which the small-pox is most prevalent; which are, *the latter end of the autumn, and the beginning of the spring*; and when in the summer there are great and frequent rains with continued south winds, and when the winter is warm, and the winds southerly." (*A Treatise on the Small-pox and the Measles*. By Rhazes. Translated from the original Arabic by William Alexander Greenhill, M.D., London: printed for the Sydenham Society, 1848. P. 33.) Avicenna also states that small-pox prevails most at the "turn of the year" (*apud alterationem temporis*), and especially in spring, the cases becoming numerous during a continuance of southerly winds (*variolic multiplicatur in successione austrinorum, quando multiplicatur eorum perflatio*. Liber iv, tractatus 4, caput vi, *De Variolis*.)

Passing on to modern times, we find that of late years the relations between meteorology and disease have attracted the attention of many thoughtful writers upon medical and sanitary science. Among other writings on the subject, Dr. Ballard's able analysis of the Islington "Records of Sickness" (*Eleventh Report of the Medical Officer of the Privy Council*, 1868. No. 3), will always hold a foremost place. In that work he clearly traces the dependence of the prevalence of small-pox upon season. The latest contribution to our knowledge of this dependence of the disease on climatic influence is found in a paper (On the Seasonal Prevalence of some Eruptive Fevers in India) by Dr. John Macpherson, late Inspector-General of Hospitals, which appeared in the *Medical Times and Gazette*, for July 12th, 1873. The author quotes various passages from recent Sanitary Reports, to show that in India small-pox increases during the earlier months of the year, and reaches a maximum in May, simultaneously with the setting in of hot and dry weather towards the end of the N.E. monsoon. It then rapidly declines with the advent of the rains attending the S.W. monsoon. Dr. Macpherson's remarks would go to prove that moist cool weather in India (that is, weather with a mean temperature of about 70 degs.) checks the spread and prevalence of small-pox. In fact, weather which closely resembles our northern and Atlantic summer, except that it is even hotter, is inimical to any great epidemic diffusion of the disease. Dr. Ballard, speaking of the result of twelve years observation in Islington, says (*loc. cit.*, p. 73): "The rule has been for small-pox to prevail least in the summer, to increase through the autumn and winter, and to prevail most in the spring of the year. The smallest number of cases on the whole was observed in the months of September and October; the wave rose gradually through the succeeding months (with a slight check in February), to attain its highest point in the month of May. From this point it sank rapidly through July and August to attain its lowest point again in September. Small-pox is, therefore, clearly a disease the extension of which is promoted by cold weather and checked by hot weather."

These remarks would, at first sight, seem to be contradictory of Dr. Macpherson's statements as to the seasonal prevalence of small-pox in India. But, as I have already observed, the cool weather of India corresponds closely with our summer weather; and, as regards climatic influences, the absence or deficiency of moisture in the air, rather than the presence of very intense heat, would appear to be the chief determining cause of the greater prevalence of small-pox towards the close of the north-east monsoon. Again, we may well imagine that defective vaccination among the millions of Hindoos and other natives, has told with terrible effect on the death-rate from small-pox; a death-rate which, there is every reason to believe, would be reduced to a minimum, owing to the warmth of the climate, were vaccination more generally carried out.

Dr. Ballard, in his paper, writes as follows: "The mean temperature of about 52 degs. is that which marks off the conditions, favourable or unfavourable, to the extension of small-pox. A temperature below this

promotes its spread, and a temperature above it tends to check its spread. It is clear, however, that this observation can apply only to the country in which it has been made, or to one presenting similar climatic conditions." Another remark of the same author is well worthy of being quoted, especially in relation to Dr. Macpherson's observations, namely, that "in all seasons of the year comparative atmospheric dryness is more conducive to the spread of small-pox than comparative humidity of the atmosphere."

Dr. Arthur Ransome has kindly furnished me with a copy of curves of the weekly number of deaths from various diseases in Manchester, during ten years ending December 1870, which he has projected with infinite pains and accuracy. From the small-pox curves in his diagrams, we learn that the seasonal prevalence of the disease indicated by Dr. Ballard, holds good in the case of Manchester also; that is to say, it holds good as a general rule, and making due allowance for the influence of an increasing or decreasing epidemic tendency from time to time.

In a paper on "Excessive Infant Mortality," read before the National Association for the promotion of Social Science, at York, in 1864, Dr. W. S. Trench, analysing the statistics of the mortality of Liverpool, in the decade ending December 31st, 1863, writes to the following effect: "Small-pox was least prevalent in the third or September quarters, when the range of the thermometer is highest. It was most prevalent in the first and second quarters of 1858, and almost absent during the second and third quarters of 1861. The mean heat during the former period was 48.5 degs.; during the latter 57.4 degs.; the range of the barometer and dew point difference being almost identical, and the only other difference being amount and duration of rain, which was greatest in 1861. As we know from experience that a high degree of atmospheric heat soon exhausts the power of the vaccine-pox, it may be a reasonable question to ask whether the virulence of the contagion of small-pox in the clothes of patients is not weakened by summer heat, and one mode of its propagation thereby lessened."

The suggestion here thrown out by Dr. Trench, as to the disinfectant power of warmth, appears to be well worthy of consideration; but I believe that a far more powerful agent in the diminution of small-pox during summer is to be found in the freer ventilation of the dwellings of the poor, and in the consequently lessened dangers of overcrowding and ocliosis, at that season of the year.

In Sweden, as shown by Dr. Wistrand, in his annual reports on the mortality and morbidity in that country (published in *Hygiea*) the greatest prevalence of small-pox is, on an average of several years, observed in May, the cases in that month being 13.7 per cent. of the total cases occurring in the year; while the least prevalence is observed in September, when only 3.9 per cent. of all the cases in the year occur. The mean temperature of April and May, at Stockholm, on an average of seven years (1862-68 inclusive), was 42.9 degs., and about the end of May the mean temperature reaches and passes 50 degs. From May, a rapid decline in the number of cases of small-pox takes place, while through the winter, from November to May, the number is high.

TABLE I.—Showing the Prevalence of Small-pox in Sweden by Months in the Years 1862-69 inclusive.

Year.	Jan.	Feb.	Mar.	April	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1862..	28	55	43	40	56	53	66	67	46	42	25	52	573
1863..	35	60	64	56	99	124	152	91	54	85	122	108	1050
1864..	163	148	157	222	267	314	187	130	160	163	244	317	2477
1865..	323	417	504	662	806	662	441	219	187	248	399	422	5290
1866	647	484	498	636	619	530	315	184	89	101	254	159	4516
1867..	260	289	396	468	551	427	401	321	227	281	321	456	4398
1868..	595	544	619	813	770	567	471	228	211	186	373	608	5985
1869..	635	464	641	835	1005	678	609	309	199	141	252	277	6073
Totals	2686	2461	2930	3752	4173	3355	2642	1549	1173	1252	1990	2399	30,362

Small-pox is, indeed, essentially a disease of winter and spring; and my object in writing this paper is to show how true are Dr. Ballard's observations, as tested by the course followed by the recent epidemic of the disease in London, Liverpool, and Dublin.

In an accompanying table I have entered the weekly number of deaths, during the epidemic period, in each of these cities, with the mean temperature of three weeks before set down opposite each entry. It will be seen that, in attempting to trace and to estimate the influence of temperature on the prevalence of the disease, I allow an interval of three weeks for 1, the period of incubation of the disease; 2, the length of the illness; and 3, the delay in the registration of the deaths. In doing this, I am justified by precedent, as all writers on the subject have followed this course. I wish, here, to express my indebtedness to the columns of the *Medical Times and Gazette*, for the vital statistics

and meteorology of the epidemic period in London, and for the weekly mean temperature at Liverpool; to Dr. W. S. Trench, the distinguished Medical Officer of Health of Liverpool, for the statistics of the disease as observed in that city; and to the Registrar-General for Ireland, and Dr. W. M. Burke, for the Weekly Returns of Births and Deaths in Dublin, which have supplied me with the requisite information about that city.

[To be continued.]

CASE OF RUPTURE OF THE AORTIC VALVES BY ACCIDENT.*

By BALTHAZAR FOSTER, M.D., F.R.C.P.,

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ACCIDENTAL rupture of the heart-valves is a lesion which has been long known to pathologists, who have divided the cases into two classes, in accordance with the previous condition of the valves. The tear of a valve previously diseased is not very rare, but the laceration of a valve previously healthy is a much less common accident. It usually occurs from some severe muscular effort, and is produced by the extra tension of the aorta under such conditions, associated probably with some jar to the main arterial trunk. The following case is a very good illustration of this form of heart-mischief, and I therefore bring it before the Section. It is the third case of rupture of previously healthy valves which I have met with in eight years.

Henry Horton, aged 33, was admitted to the General Hospital on November 7th, 1873, suffering from great dyspnoea and palpitation, with oedema of the legs. On auscultation, a double aortic murmur was detected.

Previous History.—He had originally been a jeweller, but, fourteen years ago, he enlisted in the Royal Marines, and served his time (twelve years), part of which he spent in Abyssinia. On the expiration of his twelve years of service, he was discharged at his own request, having enjoyed good health during the whole period. He returned to Birmingham, and for a time worked at Soho; but, in February, 1872, he left home for America, and, on his arrival in that country, finding no occupation, he joined the American navy as a marine. Before admission to the service, he was examined medically, and passed as sound. His ship was ordered to Valparaiso, and, during the voyage, he volunteered to act as cook, which he did up to the time when he met with the accident which disabled him. This occurred as follows. One day, during some very heavy weather, when coming up on deck, he was thrown violently forward by a lurch of the ship; he endeavoured to save himself by clutching the side of the hatchway, and partly succeeded. He was struck, however, sharply on the left side of the chest, and felt inwardly hurt and faint. He was ill for two days, and then felt well again, and resumed his work, but found the cooking too much for him. He gave it up; soon afterwards, when on watch one night, and all being quiet, he lay down on deck, he found that the horizontal posture made his breath very bad. The next day, he was examined by the surgeon, and, when at Valparaiso, was invalided and sent back to the States. On his arrival there, he was discharged and sent home to England. On the homeward voyage, he was very ill, and, on his landing at Liverpool, he was sent to hospital. He recovered there sufficiently to get to Birmingham in August last, but had ever since been ailing with shortness of breath, palpitation on exertion, cough, and some oedema of the feet. He never had rheumatic fever or any serious illness. He drank freely while in the service, but never felt any ill effects.

On admission, his difficulty of breathing amounted to orthopnoea; his cough was frequent and dry, and harassed him so, that he had not slept for days. Pulse jerky, 112; respirations 48. His expression was anxious; his face pale. The carotid pulsations were visible. On examination, the chest percussion-note was natural over the lungs anteriorly, and the breathing free from morbid sounds. Posteriorly, both bases were dull, especially the left, on which side the dullness extended to the inferior angle of the scapula, and laterally into the axilla, so as to merge into the area of cardiac dullness. Over the whole dull region behind, the breath-sounds were diminished; and, on the left side, the vocal vibration was lessened. The heart's area of dullness was increased, reaching close up to the second rib, and downwards to a little below the seventh; laterally, it extended, as far as we could make out from the lung-dullness, from the nipple-line to an inch beyond the

* Read before the Pathological and Clinical Section of the Birmingham and Midland Counties Branch.