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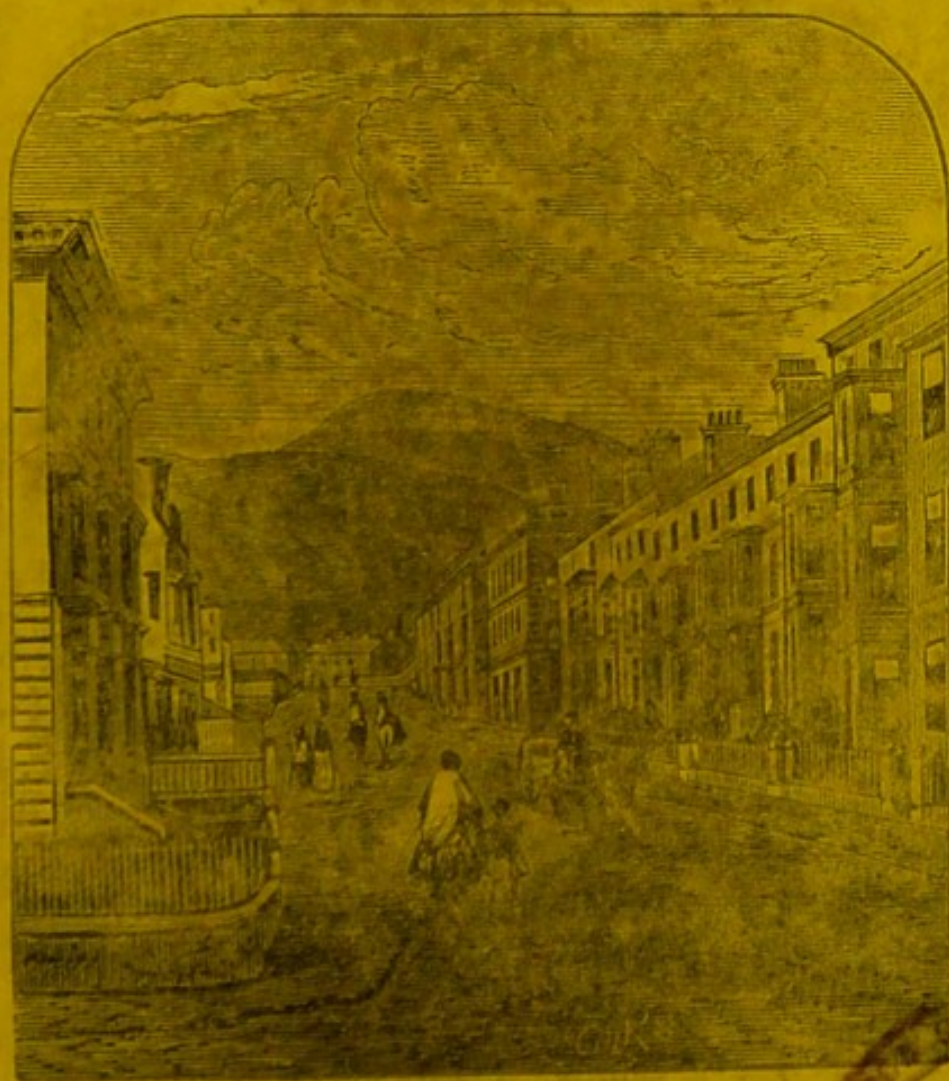


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THE
CLIMATE OF LLANDUDNO.



CHURCH WALKS.

BY JAMES NICOL, M.D.



THOMAS WILLIAMS,
Dispensing and Family Chemist,
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THE CLIMATE OF LLANDUDNO,

Contributed by Dr. NICOL to the "History and Natural History of Llandudno," is, by permission of the Author, presented to the public in this convenient form of a pamphlet, with the view of diffusing more widely a correct knowledge of the climate of this growing and important watering-place.

THOMAS WILLIAMS,

CHEMIST, CHURCH WALKS,

PUBLISHER.

LLANDUDNO,

July 28, 1864.

THE CLIMATE OF KENTUCKY

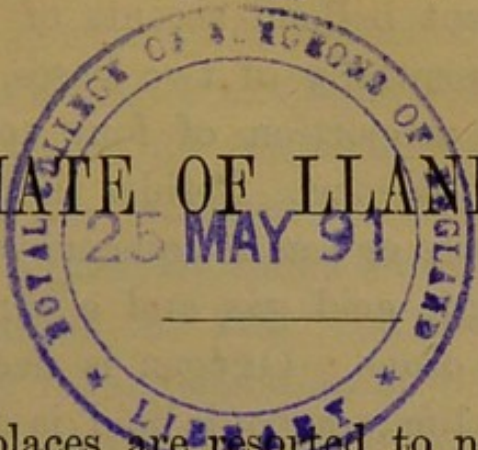
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THOMAS WILLIAMS

Author of "The Climate of Kentucky"

1880

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CLIMATE OF LLANDUDNO.

As watering-places are resorted to not merely by the healthy for the sake of pleasure and relaxation, but also by the invalid in search of health, we intend in this little pamphlet to give a succinct account of the Climate of Llandudno; though we are well aware that the space allotted to us is altogether insufficient to do justice to a subject of such comprehensiveness and importance.

Llandudno has long enjoyed *popularly* the reputation of salubrity, and the result of meteorological observations taken during several years, has now, as we hope to be able to show in the sequel, put the matter beyond doubt. Before entering, however, upon the consideration of our own particular climate, we deem it advisable to take a brief review of the constitution of the atmosphere as a whole, and of those laws which govern climate generally, with the view of making clearer and more easy of comprehension what is to follow.

The atmosphere which envelopes the earth is an elastic fluid, that presses on every square inch of surface, at the level of the sea, with a force or weight equal to 15 lbs. It is supposed to extend about forty-five miles from the earth's surface, gradually decreasing in temperature and density, but not uniformly, as

shown by the recent balloon ascents of Mr. Glaisher. It is composed essentially of two gases, Oxygen and Nitrogen, in the proportion of four volumes of the latter to one of the former. Besides these elements, it always contains more or less of aqueous vapour, a small quantity of carbonic acid gas, and a variable amount of electricity and ozone. Oxygen is necessary to the support of animal life ; carbonic acid is destructive to it, but nourishes vegetables. As for nitrogen, its qualities are negative, and apparently it has no other function in the atmosphere than that of a mere diluent.

The union of these gases is not chemical but mechanical, and the particles of aqueous vapour are likewise commingled mechanically with those of the oxygen and nitrogen. According to a general law, all bodies are expanded or increased in bulk by heat, and the atmosphere is no exception to this law. When two or more substances of different degrees of heat (such as air, water, and earth,) are placed in contact with or near each other, the warmer body imparts heat to the colder, until equality of temperature is attained. Bodies absorb heat at different rates as well as in different quantities ; and, generally speaking, those which absorb heat quickly, part with it quickly, and *vice versa*. Water especially belongs to the second class. It not only absorbs heat slowly, and gives it out slowly, but its capacity in respect to quantity is unusually great ; and it is owing to this property that it exerts so much influence in modifying climates. Heat may exist in two very different conditions, as *sensible* and *latent*. In the one case it can be felt and measured ; in the other, it cannot be appreciated either by the senses or the thermometer ; yet in the latter,

as in the former state, it plays a most important part in numerous operations of nature connected with the weather. As a simple example :—If heat be applied to a piece of ice at 32° till it is *merely* melted, it will be found that the temperature of the water thus obtained is not higher, by indication of the thermometer, than was that of the ice. All the heat imparted to the ice during its liquefaction, now therefore exists in the water in a *latent* or insensible form. The same takes place during the conversion of fluid water into aqueous vapour ; and of course, during the converse of these processes, this latent heat is evolved, and again becomes sensible. The chief source of heat in the atmosphere, and at the surface of the earth, is the sun ; and as the strength and intensity of his rays are greatest at the equator, and smallest at the poles (decreasing by about one degree of mean temperature for every degree of latitude), we might naturally expect that the temperature would decrease at a uniform rate from the one point to the other, and that all places occupying the same latitude would have the same temperature ; but this is not so ; for, besides that of latitude, there are many other circumstances that influence the distribution of heat and the laws of climate ; such, for example, as the relative position and extent of land and water, elevation above the sea, geological character of soil, and aspect or exposure. Of all these the influence of water is the greatest ; and it is owing to this that, in the same latitude, islands are warmer and milder than continents, and seaside places than inland situations. The action of the sea in this respect is much increased by its relatively high temperature, by its tendency towards equality of temperature in all latitudes, and by

its great extent compared with that of land. Water being one of the most mobile of fluids, its particles freely intermingle with each other, when, through the operation of heat or otherwise, its density or level is changed. Thus we have the ebbing and flowing of the tides ; thus the constant currents of warm water from the equator to the poles, and of cold from the poles to the equator. Thus, also, we have the mighty Gulf-stream, which, from its high temperature (86°) at starting, the great extent of its waters,* and the direction of its course, at first towards the north, then eastward across the Atlantic to our very shores, must, and undoubtedly does, exercise a vast influence upon the climate of these islands, especially along the west coast. This is one reason why the westerly winds, laden not only with moisture, but with warmth, are so soft and balmy, and so unlike our easterly winds, which, blowing as they do over a great extent of land, are characterized by the opposite qualities of dryness and harshness. Thus, therefore, currents of wind, as well as currents of water, have a great influence upon climates ; both elements being similarly acted upon by heat, the air, like the water, is constantly struggling towards an equilibrium of temperature, and flitting about from place to place. Were the surface of the earth perfectly level, and geologically homogeneous, there would be a regular and unvarying set of warm currents from the equator to the poles, and of cold currents in opposite directions ; but, as with the aqueous currents, so with aërial, there is, in every country and every climate, a vast variety of local causes which tend to disturb the

* The breadth of the Gulf-stream off Cape Hatteras, is 75 miles ; its depth 200 fathoms.

regularity and uniformity of their course. In reference to the motion of air or wind, we need hardly explain that it is caused principally by heat. When a body of air is acted on by heat, either coming directly from the sun, or by radiation and reflection from the earth, it increases in volume, as we have already explained, and, becoming specifically lighter than it was before, rises in the atmosphere. Thus a partial vacuum is formed, and the cooler and heavier air in the neighbourhood rushes in to fill up the vacuity. This principle is well illustrated at the seaside (especially on the Continental coasts) during the hot weather of summer. In the day-time the air over the land, being more heated than that over the water, becomes rarefied and ascends from the surface; and the comparatively cold air from the sea, then flowing in to supply its place, constitutes what is called the sea-breeze. During the night this process is reversed; for the land, giving out heat more rapidly than the water, soon becomes so much reduced in temperature as to be colder than the adjacent sea, and hence the land-breeze prevails. Thus, by lowering the day temperature and raising the night temperature, the diurnal range of the thermometer at the seaside is lessened, and not only so in reference to the daily range, but in reference to the annual range as well.

Having now premised what we deem sufficient, in explanation of the principles and laws of climates in general, we proceed, with the aid of these principles, to apply ourselves to the climate of Llandudno in particular. As the promontory on which Llandudno is situated is more than three-fourths surrounded by water, it necessarily possesses a climate of an almost insular character; and it is to this circumstance, in a

great degree, that its temperature is so much higher than we would expect from its latitude, and the mean daily range so small. In order to make this more obvious, the reader is referred to two meteorological tables at the end of this article.

No. I. relates entirely to Llandudno, and exhibits a summary of observations for one year, ending 31st March, 1860. Table No. II. refers to nine other stations in England, and has been drawn up, by the aid of Glaisher's Quarterly Reports, for the sake of comparison with our own. It may be argued by some, that a single year's observations are not sufficient to establish the true character of any climate, and that the results deduced from such limited data are undeserving of implicit reliance. No doubt these objections are so far valid ; but, in order to obviate them as much as lies in our power, we have, as will be observed, made the comparison as fair as possible, by drawing up both tables in the same manner, and for the same period of time. On looking over table No. I. it will be noted that the mean yearly temperature of Llandudno is $50\cdot3^{\circ}$; its mean diurnal range $8\cdot1^{\circ}$; its mean monthly range $26\cdot9^{\circ}$; and its extreme range for the whole year $58\cdot2^{\circ}$. In reference to the mean yearly temperature of Llandudno, it will be observed that it is higher than that of any of the stations mentioned in table No. II., Ventnor alone excepted, the difference in favour of the latter being only $1\cdot8^{\circ}$. It is, however, the *range* of temperature more than the *mean* that affords a true test of quality in climates ; as, where this is moderate, the air is not only equable but invariably soft and unirritating. Now, in this respect, we think Llandudno will bear comparison with many of the

most fashionable watering-places both at home and abroad, and it is not merely in its small differences of temperature between night and day, but also in its moderate fluctuations from one day to another, and throughout the year as well, that Llandudno lays claim to steadiness and equability of climate. On comparing the two tables, it will be seen that the mean daily range of this place is smaller than that of any of the other stations even at the seaside; and that it is less by more than one half when compared with Manchester and the Royal Observatory, whose mean daily ranges are 16.4° and 16.5° respectively. This small range of temperature depends chiefly, as already explained, on the influence of the sea, though in part also, we have no doubt, on the character of our soil, which, from its dry and porous structure, absorbs heat freely during the day, and gives it out as freely during the night; thus contributing, in no inconsiderable degree, to keep up the night temperature of our atmosphere. The sea, in reference to its action on temperature, operates like the fly-wheel of a steam engine; as the wheel steadies the motion of the machine and lessens its tendency to eccentricity, so the sea acts on the land in its vicinity, not only by raising the mean temperature and modifying its range, but also by rendering its fluctuations gentle and less abrupt.

The influence of the sea, then, on the climate of Llandudno, is to raise the mean temperature, *especially during winter and autumn*; to lower it during the day in the hot summer months, and at all times to lessen its range. Throughout the entire year, however, it raises the night temperature; for in summer, as in winter, the minimum temperature of the sea is several

degrees above the minimum temperature of the land, and, in the latter case, not unfrequently above the maximum of the day. If we take Aldershot, the Royal Observatory, Oxford, and Manchester, as types of true inland stations, and compare their *yearly* range of temperature with our own, it will be found that there the temperature rises $8\cdot0^{\circ}$ to $10\cdot3^{\circ}$ higher in summer than at Llandudno, and falls to about the same extent below it in winter. Results, strikingly in favour of Llandudno, are also obtained by comparing its monthly range of temperature with that of these and other stations. In this manner we have gone over a great number of Glaisher's reports, besides those referred to in table No. II. ; and though the invasion of such a jungle of figures did not, at first sight, seem very inviting, we are now free to confess that we derived from the investigation a degree both of pleasure and profit far beyond our expectations. The more we study these tables, the more strongly does the conviction impress itself upon our mind, that Llandudno, *as a whole*, enjoys a climate of no common order of excellence ; and such as perhaps is nowhere else to be found by the seaside, in the British isles. We will not attempt to deny that, both at home and abroad, climates exist which excel ours in one or more particulars ; but if general excellence of character be the test, if the largest combination of those rare qualities which enter into the constitution of a really salubrious climate be the test, we venture to affirm that Llandudno need not fear the strictest scrutiny of any impartial inquirer. It is a great mistake to suppose that *extreme* mildness and equability in a climate are the first and chief qualities to be looked to ; for, according to the best medical

authorities, (among whom we may mention Sir James Clarke and Dr. Andrew Combe,) a *very* equable climate is not conducive either to health or longevity, and the lengthened residence of the invalid in such a situation is productive of injury instead of benefit. Thus, the Registrar-General of Scotland, commenting upon the great increase of mortality in the last quarter of 1863, says, in reference to this point, that though the mean temperature was 2.2° above the average, "there was not nearly the usual amount of change, variation, or daily and monthly range. In fact, there was not a sufficient range of temperature to strengthen the animal constitution against the tendency to debility caused by the unusual mildness and dampness of the atmosphere: sudden changes of temperature, as all are aware, are hurtful, but the experience of this and former seasons fully demonstrates, that a certain amount of variation of temperature is essential to health."

We cannot with impunity contravene Nature's laws. She, having destined us to live in a world of change and variety, has wisely adapted us to bear with impunity those frequent atmospheric fluctuations to which we are "ever and anon" exposed, and even to derive strength and vigour from them, if they are not immoderate or too sudden. The action of these changes is essentially tonic and invigorating, as we may learn from analogy, by observing that trees which grow in very warm and sheltered places, have not the same strength and toughness of fibre as those growing in colder and more exposed situations.

Before dismissing finally this part of our subject, we beg to refer to the fine southern aspect of Llandudno, and the admirable shelter afforded it by the Great

Orme's Head, from the north and north-west winds, as subordinate causes which exert no inconsiderable amount of influence on the temperature of its climate. Some, indeed, complain that we have too much sun, and regret the absence of trees and shade. We do not share in these regrets. However much trees may tend to beautify the landscape to the natural eye, our opinion of them is, "that distance lends enchantment to the view," when they are looked upon with an eye to health ; for they not only interrupt free motion of the air, they attract also and retain dampness, generate noxious miasmata, and thus breed disease. Though the physiological action of the solar rays in conducing to health is not exactly known, the fact itself is unquestioned and unquestionable. Look at the miner who spends his days underground, how pale his cheek, how feeble his frame, how premature his death ! Look at the plant which grows under the shade of a great tree, how sickly and delicate its aspect, how faint the hue of its petals, and the complexion of its leaves ! Ask further the physician, and he will tell you that his patients on the south side of an hospital make better recoveries than those on the north ; and that, by living in a house with a good southern exposure, a man is supposed to add to his chance of life a period of eight or ten years. But the amount of sunlight enjoyed by Llandudno, is not owing merely to its fine exposure, &c. We are convinced, for reasons which will be stated when we come to treat of its humidity, that this is more particularly owing to the unusual clearness of our sky, and to a consequent and correspondent increase of *direct* solar radiation. In proof of this, we would direct attention to the flowers of Llandudno, both wild and cultivated,

how beautiful their hues, how brilliant their colours ! We think we have never seen such flowers any where else.

As different portions of the town of Llandudno occupy different elevations above the level of the sea, we naturally expect (in accordance with the general law of temperature, decreasing 1° for every 250 feet of perpendicular ascent) that a variety of climates should obtain in this place. Now, to a certain extent, such is the case, though not exactly in a ratio corresponding to the elevation. Whatever, therefore, the thermometer may indicate to the contrary, the feelings unmistakably pronounce that the upper portion of the town, skirting along the base, and extending up the slope of the mountain, is warmer even in summer, but more especially in winter, than that part of the town which occupies the *flat*. This apparent anomaly is easily explained on philosophical grounds. The same temperature which, in a *calm*, feels sensationally warm, may, in a gale, feel sensationally cold, though the thermometer indicates the same degree of heat in both instances ; for, where air is in free motion, the natural evaporation from the surface of the body goes on at a more rapid rate than usual, and, as evaporation is a heat-absorbing and therefore cooling process, the temperature of the body is actually lowered. The thermometer however, having neither sensations nor feelings, takes no note of these nice distinctions. In the *flat* or low part of the town, the intensity of the sun's rays is moderated by the continual play of currents between the two bays ; and on the *slope* the natural decrease of temperature to be expected from elevation, is counteracted by reflected heat and diminished motion

of the air. In neither case, however, is the atmosphere ever complained of as oppressive, for this is effectually obviated by increased motion of the air *below* ; and by its increased rarity and lightness in the higher situations. But, should there be any desire for a more bracing air, this may readily be obtained by going up to the Head ; where the temperature is always several degrees lower than it is below, and where there are no obstacles of any kind to mar the free motions of the winds. We look upon this Head as a great boon and an immense attraction to Llandudno, not merely for the protection it affords from the north, but as enabling the invalid, when the weather is suitable, to enjoy without much fatigue that exhilarating luxury, a mountain climate. A ramble along this commanding platform is equal to a voyage by water, and may be obtained not only at a less expense of purse or strength, but without the drawback of sea-sickness.

The quality next in importance to temperature, in forming an estimate of climate, is humidity ; and, in entering on this subject, we beg to direct attention to columns 7 and 8, in Table No. I. The second of these columns shows the amount of rain-fall at Llandudno for each month, and for the year ; the first shows the mean amount of humidity or moisture existing in the atmosphere in the invisible form of aqueous vapour. If, in viewing these results of actual observation, we keep in mind that, as a general rule, more rain falls at the seaside than inland ; more on the west coast than on the east ; and that, in respect of aqueous vapour, seaside climates are usually more humid than those of the interior ; we must at first sight be struck with the smallness of these figures, and naturally be led to in-

quire as to the cause. The cause, we think, exists in the geographical situation of Llandudno, and in the geological features of the district in the neighbourhood. Unquestionably that extensive range of mountains, beginning at Penmaenmawr, and extending far to the south and south-west, has much to do with this peculiar characteristic of our climate. In these directions it is often seen to rain, and apparently to thunder, when we are not only free from storm here, but in the enjoyment of abundant sunshine and fair weather.

Our opinion then is, that these mountains intercept a great portion of the moisture which the south winds bring from the equator, thus rendering the air comparatively dry before reaching this latitude. To understand this fully, we must explain that, though air is capable of containing an amount of aqueous vapour proportional to its temperature, there is a point with every temperature at which saturation is attained (reckoned by meteorologists at 100); and if air of any temperature, so saturated, comes into contact with a body colder than itself, its temperature is reduced, and its capacity for vapour diminished. A portion of that vapour, therefore, forthwith assumes a visible existence, and is deposited in the form of rain, fog, mist, &c. Remember, also, that during this process of condensation the heat previously existing in the vapour, in a latent condition, is now evolved as sensible heat, thus becoming equally appreciable to the feelings and thermometer. Remember further, that the south and south-west are the moistest winds that prevail; also that a very large portion of rain in general comes from that quarter, and we think the reader cannot resist the conclusion arrived at; viz., that the mountain

ranges in question attract and condense the superabundant moisture of the winds blowing over them in this direction, rendering those winds much drier when they reach Llandudno, than they would have been had they blown over the sea or level land ; and yet, though these mountains are high enough, and cold enough, therefore, to condense a considerable amount of aqueous vapour in the air, they are not sufficiently so to cause any material reduction of its temperature ; for the loss of this, in one way, must be pretty nearly compensated in another, by the evolution of a certain amount of latent heat during the process of condensation. We conclude, then, and, we think, on legitimate grounds, that the air of Llandudno, being less humid than that of many seaside climates, and even less so than many inland stations, yet containing a fair average quantity of moisture, is not, on the one hand, so dry as to prove irritating, or, on the other, so humid as to prove relaxing ; but contains that normal amount of moisture which experience has proved to be best adapted for the preservation and recovery of health. Our limits will not permit us to explain, physiologically, the reasons why a redundancy or deficiency of moisture in the air acts injuriously on the system, further than to state, in general terms, that they both operate by interfering, though in different ways, with the functions of the skin and lungs, preventing the elimination of certain effete and noxious materials, which nature intended these organs to throw out of the body. If, under such circumstances, these poisonous materials are not got rid of, and that soon, through some other channel, they must ere long so clog the animal mechanism, and so strain its various

functions, as to cause its breakdown somewhere, generally at the weakest point. In considering the influence of humidity, a distinction should be made between marine and land humidity. The latter, generally speaking, is the more noxious of the two, but not so much from its quantity as from its quality; inasmuch as it is usually more or less contaminated by the presence of malaria, resulting from the decomposition (a process much favoured by moisture) of decaying animal and vegetable matter. The humidity of Llandudno, being chiefly derived from the sea, contains, of course, none of those objectionable ingredients; and, if our air is happily circumstanced in regard to its invisible moisture, it is not less so in regard to its visible; for not only is fog or mist a phenomenon of the rarest occurrence amongst us, and rain moderate in amount, but, in reference to the latter, a very large proportion relatively of the whole quantity deposited, falls during the night. This remarkable and happy peculiarity has been long observed, and often remarked upon by visitors as well as residents. Owing, moreover, to the dry and porous character of our soil, rain very speedily disappears by percolation, and therefore causes but little discomfort, neither producing much increase of humidity in the air, nor much reduction of temperature by its evaporation. It is remarkable how soon, even after a heavy rain, the roads become dry and fit for exercise, or how seldom it rains a whole day continuously.

THUNDERSTORMS are also unusual phenomena at Llandudno, and this we attribute to the same cause that exempts us from excess of rain; viz., the extensive range of mountains to the southward attracting elec-

tricity as well as moisture. This circumstance, trifling as it may appear, is a matter of no little importance, especially to the invalid, whose nerves are so sensitively alive to atmospheric changes, that he can appreciate variations too minute to be felt by the strong and healthy, or even indicated by the most accurate instruments. And, if this be true in regard to electric tension, it is no less true in regard to barometric fluctuations, of which a rise or fall of half an inch produces an increase or diminution of pressure on the human body of no less than five hundred pounds. A glance at table No. I. will show that the fluctuations of the barometer are moderate at Llandudno, more so indeed than usually obtains at the seaside, and certainly much more so than at inland stations, judging from Glaisher's accurate and valuable reports.

CARBONIC ACID GAS, though a normal ingredient in common air, is found but in very minute quantity where the atmosphere exists in its natural purity. It is generated abundantly during the process of combustion, the respiration of animals, putrefaction, fermentation, &c. It is, therefore, more abundant in towns than in country situations, not only because it is more abundantly formed there, but also because, from its great density, and the comparatively stagnant condition of the air of towns, it mixes but slowly with the surrounding atmosphere. In respect to this noxious gas, the air of Llandudno is unexceptionable ; for in the absence of close and confined buildings (and consequent overcrowding of population), of manufactories, and of public works, and with a free circulation of air in every part of the town, we have neither the conditions concerned in the generation of carbonic acid (or other

equally noxious gases), nor those which interfere with its speedy diffusion. Carbonic acid, by itself being incapable of supporting life, is more or less injurious to health when mixed, even in comparatively small quantities, with the air we breathe. According to Dr. Richardson, one per cent. in the atmosphere is sufficient to prevent recovery from consumption (even under circumstances otherwise favourable), and to generate the disease in those predisposed to it, though only occasionally breathed. Purity of air, then, is as essential to health as wholesome food, and indeed more so, for, if its presence be withdrawn but for a few minutes, life and all its functions come to an end. When the quantity is stinted, or partially replaced by carbonic acid, all these functions languish, especially the power of generating heat; for be it remembered that the heat generated within the body is mainly due to the chemical action of the oxygen inhaled through the lungs and skin. Pure air, then, by quickening and stimulating the various functions of the living organism, begins its action by increasing the waste of the system; and hence some invalids, on first arriving at Llandudno, complain that the air is keen, especially if they have just escaped from close and heated rooms, and the pent up atmosphere of crowded towns. Generally speaking, however, after a few days' acclimatizing, these unpleasant sensations not only disappear, but are replaced by a more genial warmth of skin, greater buoyancy of spirits, sounder sleep at night, and a marked increase of appetite and strength. Indeed, the appetite often becomes so keen, that, unless restrained, it is apt to lead to bilious and intestinal derangement. The necessity of pure air within as well as out of doors, especially to the invalid

suffering from diseased lungs, cannot be too strongly inculcated; yet we fear this matter is often not duly attended to, especially as regards crowded rooms, late hours, and the inordinate use of artificial light therewith associated. Were people generally sufficiently impressed with these facts, that one pair of human lungs consumes, and therefore contaminates, a gallon of air per minute, that the combustion of one cubic foot of coal or oil gas generates an equal quantity of carbonic acid gas, they would less willingly consent to be "cribbed, cabined, and confined" in warm and stifling rooms; they would be less likely to waste their health, strength, and beauty over the midnight lamp, to the neglect of the free and glorious light of the sun at the best period of the day.

OZONE is one of those constituents of the atmosphere which is not to be found at all times and in all situations. It is more abundant in stormy than in calm weather, in the free and open country than in the stagnant atmosphere of the densely crowded town, at the seaside than in the interior. According to some observers it is *always* present over the sea, and in the air of seaside places; but whether this be so or no, there can be no dispute as to the fact, that it exists in much greater abundance there than any where else. Here, therefore, as might be expected from our peculiar hydrographic relations, more or less of it is always to be found. The chemical constitution of ozone is still a matter of doubt; some maintaining that it is closely analogous to, if not identical with chlorine (which is known to be a powerful deodoriser); others assert that it is oxygen in a new form, with new and more powerful affinities. Be its nature, however, what it may,

it possesses, by universal consent, such remarkable qualities as to render it a subject of great interest and importance to all who devote themselves to the study of climate, and the improvement of public health. This substance has been designated nature's great disinfectant, and not inappropriately; for its affinity for noxious gases and deleterious effluvia *of all kinds* is so intense, that it at once combines with and destroys them. With the exception of COMMON SALT and IODINE, it is unnecessary here to notice any of the other accidental or occasional ingredients in the atmosphere. Iodine and salt are, as a rule, only found in sea air, and, no doubt, add considerably to its tonic and stimulating qualities. The iodine is supposed to exert a beneficial influence in scrofula and its allied affections.

Another very important element to be considered in estimating the salubrity of a climate, consists in its water; and here, we are glad to say, our supply is both abundant in quantity, and excellent in quality. According to the analysis of William Herapath, Esq., F.C.S., its hardness is only 15 degrees, and it contains of organic matter next to none. Its inorganic or mineral ingredients consist chiefly of carbonate of lime and common salt, of the former two-thirds are deposited by boiling, and the hardness thereby reduced to 5 degrees. Lime and common salt, being both tonic and stimulating in their action on the system, are generally beneficial, therapeutically as well as dietetically, to health; especially in the case of children and growing youths, to whom lime is often administered artificially as a tonic, and with the view of supplying one of the necessary elements of bone.

In regard to the class of diseases, and conditions of

the system, to which the climate of Llandudno is adapted, their name is legion. It is beneficial in almost all cases of debility, whether general or local, constitutional and inherited, or the result of acute and chronic disease. It is beneficial in all affections accompanied by a relaxed habit of body, or characterised by excessive secretions or discharges ; it is beneficial in chronic bronchial affections, in relaxed sore throats, in certain varieties of asthma, hay fever, neuralgia, chronic rheumatism, &c. &c. Its power of imparting vigour to the old, and health and strength to the young, is quite remarkable, especially if there be any taint of scrofula in the latter. In the treatment of scrofula, sea air, especially if dry, undoubtedly possesses great power ; it often, indeed, entirely supersedes all medicinal remedies, and always materially aids them in their action when necessary.

In using the term scrofula, we do not limit it to that enlarged and inflamed condition of the cervical and other glands to which popular opinion restricts it. With us the term scrofula has a much wider signification, for scrofula may attack any structure of the body, internal as well as external. Hence it often shows itself in relaxation of the bowels, diseases of the skin, especially that of the head and eyes ; chronic discharges from the nostrils or ears, affections of the bones, throat, &c. &c. Often, indeed, mere general debility, unaccompanied by any specific disease, is caused by the presence of a scrofulous taint in the blood ; and this, though latent and inactive for the time being, is sure to be developed at some future period, if not now eradicated. For all the numerous and varied forms of this common malady, this climate is a valuable and efficacious remedy.

It is, indeed, astonishing how soon, under the influence of our pure and bracing air, the pallid cheek and pasty complexion, so characteristic of this complaint, are replaced by the hue and glow of health. But a complete cure of scrofula must not be expected from a short and occasional residence of a few weeks or even months. In order to attain this desirable object, the visits must be frequent and long continued. In truth, the sea-side should be the principal abode of all who suffer from this dire affection ; and for this purpose, children ought to be sent there to school, so that while the body is being strengthened, the mind may not be neglected.

In this way, and, we verily believe, in this way only, is it possible to extinguish the seeds, and check the propagation of this dire malady ; and, until this course is generally adopted, scrofula will continue to rank as one of our severest scourges, and will, we fear, be likely to increase more and more, both in extent and virulence, by hereditary transmission. In no other stage of life are the powers of growth and nutrition so active and vigorous as in youth ; at that period, therefore, a delicate constitution may be more easily and effectually consolidated than at any other stage of existence ; and, if so consolidated *then*, it will unquestionably save from much sorrow and suffering in after life, suffering which, alas ! too often leads to consumption and premature death.

Is consumption then, it may be asked, but another of the numerous and varied forms of scrofula ? and, if so, is the climate of Llandudno adapted for its alleviation and cure ?

To these important queries we reply, that the diseases in question are essentially the same in their origin and

cause; for consumption is now regarded as nothing else than scrofula attacking an internal and vital organ, the lungs; while scrofula proper usually manifests itself in the external and less vital parts of the body. This being so, we conclude on grounds not more natural than logical, that that particular climate which is beneficial in the one case, is beneficial in the other also; and further, that those climates which experience has shown to be the healthiest *generally*, are the most suitable likewise for this complaint, especially in the earlier stages, when the chances of arresting its progress and development are greatest. To this conclusion, we believe, the opinion of medical men is rapidly tending, and a similar revolution is now also beginning to take place in the mind of the public generally. It is, therefore, not now the practice among us, to any considerable extent, to send patients abroad, believing, as we do, that almost, if not all, the benefits and advantages to be obtained by a change of climate may be found in our own islands, *minus* many of the drawbacks and discomforts necessarily attending a lengthened residence in foreign countries, far from home, and all those comforts and endearments which that sweet word implies. Neither are the *very mild* and more relaxing climates at home, in so much repute as they were wont to be. Though no doubt suited to a large number of cases, (such as those in which relief from suffering more than cure is hoped for, and also those complicated with great bronchial irritation and a *very* sensitive mucous membrane,) this species of climate does certainly not possess the same sanative and healing power which belongs to the drier and more bracing climates. It must not be supposed from this, however, that climate pos-

sesses any *specific* property or quality in itself, by virtue of which it directly cures disease ; for its therapeutic agency is entirely owing to its action on the system generally, through its numerous and complicated functions, and its efficacy in this respect is governed by the rapidity and degree of completeness with which it restores tone to the enfeebled organism. Its primary action is upon the stomach and accessory organs, enabling them to digest and assimilate good and wholesome food, and to elaborate good and wholesome blood. This consummation attained, health eventually follows, as a necessary consequence.

Still less is it the practice (except where acute inflammatory disease complicates the case) to confine consumptive patients to close and warm rooms with unvarying temperatures, where the atmosphere, being always more or less contaminated by their own exhalations, and the frequent use of artificial light, can never, even in the most favourable circumstances, be so pure as out of doors. ' Consumptive patients are now, therefore, recommended to court the open air, if not on foot at least on horseback, and to expose themselves boldly, though not recklessly, to the sea and mountain breezes, and this for the sake of exercise as well as fresh air. Assuredly there is no more certain method of confirming the disease, and strengthening its hold upon the system, than an indoor life and constant confinement to the couch or sofa. Exposure even to inclement weather is less to be dreaded than this. According to our view of the matter, then, those climates are the best for consumption that permit the greatest amount of outdoor exercise. To this character we think Llandudno possesses a good and valid claim ; in its moderate fall

and speedy absorption of rain ; in its dry atmosphere and soil ; in its small range of temperature, diurnal, monthly, and annual ; in its abundant sunshine, &c., &c. Neither must we forget its bold and beautiful scenery ; for undoubtedly health is often benefited or injured, through its action on the mind, by gay or gloomy scenes. "We believe," says a writer in *Good Words*, "that fine scenery, wide and varied views, huge mountains, great seas, by expanding the mind expand also the chest, and give to the body, as to the soul, a larger life." They are, in truth, a "healing medicine from the hand of nature thrilling through our whole system ;" swelling the mind with grand conceptions and noble emotions ; thus drawing it away from self or selfish objects, and from moody or morbid reflections. To this class of scenery belong the views of Llandudno, which moreover are ever varying, ever new, from the constant play of light and shade on the mountain and sea, and the great variety of tint and colour thereby occasioned. The landscape thus often appears like a grand diorama, or a magnificent dissolving view passing before the eyes of the spectator ; and, therefore, never palls upon the sight, or wearies by its uniformity and sameness. Every where around us, also, there is a rich and varied field for the study of natural history, in zoology, geology, and botany ; a field abounding in numerous and excellent themes for the recreation and amusement of the amateur, or the profound reflection of the scientific inquirer. These studies, while they promote the bodily health by the open air exercise required in their pursuit, "bring into healthy play some of the finest faculties of the mind, and furnish abundant stores of useful, as well as interesting information."

Though great intellects are necessary for their thorough investigation, "they nevertheless present the peculiarity of being facile of study to a limited yet beneficial extent, by the most ordinary of minds and unlettered observers."* To all, therefore, it is advantageous to be placed amid such scenes and such objects; but especially to youth, when the mind is more easily impressed than at any other period of existence, and when the tastes and habits of after life are being moulded and developed. "Whatever be the proposed pursuit of the youth, or the present occupation of the man, the mind, adolescent or adult, will expand through this noble study."

Llandudno having now become a favourite resort for invalids in summer, we hope the time is not far distant when it will acquire an equally great reputation as a winter residence. That it has not done so ere this is only owing, we believe, to ignorance and misconception

* Dr. Edward Forbes, in a lecture on natural history, says, "The tastes of most men can be traced back to the habits of their youth; and these habits are, in a great measure, moulded by the circumstances, physical as well as intellectual, amid which that youth has been passed. Grand scenery suggests grand thoughts, and every ennobling thought elevates, not merely momentarily, but permanently, the mind in which it glows. . . . The youth whose hours of relaxation are spent in the presence of those magnificent prospects, so rife and many around us, carries with him in after life the memory of their beauty and their grandeur. The man who has gazed upon and felt the worthy delineation of a glorious landscape, a grand Turner or a luxuriant Claude, never forgets the genial, wholesome glow of admiration that pervaded his spirit at the time. How much more, then, must he feel this ennobling sensation when he gazes on the reality of a majestic landscape! And if, with all this precious accumulation of the vast and the beautiful, there is combined that which is admirable in the minute—if nature in her smallest elements be prolific in objects of study and reflection, the effect and the benefit are enhanced."

of its climate at this season of the year. Now, however, that its excellent character has been established by facts and figures (not of speech but of arithmetic) which cannot be questioned or gainsaid, we do not entertain a single doubt that, in process of time, it will meet with that public attention and favour which, as a winter resort, it deservedly merits. As we have now spent several winters in Llandudno, and have given considerable attention to the study of its climate, we have no hesitation in stating that, however much we like the place in summer, we, in many respects, like it still more in winter; for at no other period of the year is the climate so steady, and the range of temperature so small, and at no other season is its superiority to inland climates so striking and marked. Any one must see this at a glance who will take the trouble to look over our tables, and compare them with the still more detailed reports of Glaisher. Take Manchester as an example, and compare it with Llandudno, from November to February, inclusive. The mean temperature of Manchester for these respective months is $39\cdot6^{\circ}$, $34\cdot1^{\circ}$, $37\cdot7^{\circ}$, and $34\cdot5^{\circ}$; while that of Llandudno, for the same period, is $46\cdot3^{\circ}$, $40\cdot5^{\circ}$, $43\cdot8^{\circ}$, and $39\cdot4^{\circ}$. Again, the mean daily range of temperature for the same months is, Manchester $13\cdot1^{\circ}$, $11\cdot0^{\circ}$, $10\cdot8^{\circ}$, and $13\cdot4^{\circ}$; Llandudno, $7\cdot3^{\circ}$, $7\cdot2^{\circ}$, $5\cdot1^{\circ}$, and $7\cdot8^{\circ}$. The season of the year in which the mean temperature of Llandudno, and of seaside places generally, approximates nearest to inland climates, is in spring. By that time the sea has lost a great portion of the heat absorbed by it during summer, and its influence, therefore, in raising the temperature is at its minimum; but even at this season of the year, though the mean temperatures approximate, there is a

marked difference in the range. Take Manchester again as an example; for the months of March, April, and May, the mean daily range is respectively $14\cdot0^{\circ}$, $18\cdot1$, $23\cdot9^{\circ}$; for Llandudno, $7\cdot9^{\circ}$, $8\cdot7^{\circ}$, and $10\cdot6^{\circ}$. During this season, especially in April and May, a great deal of sunshine invariably prevails in Llandudno, and this wonderfully ameliorates the keenness of those easterly winds which are, more or less, to be expected every where at this time of the year. The usual dryness and harshness of the east wind is also somewhat softened here, by that considerable portion of the sea which stretches towards the east and the north-east, in the direction of the mainland of England.* Altogether, therefore, this is a most enjoyable season at Llandudno; and, so far as our observation goes, one of the healthiest throughout the year.

A word, in conclusion, on the mortality of Llandudno in further evidence of its salubrity. According to the last census (1861), the *permanent* or *resident* population is 2316; and, according to an extract obtained from the registrar of the district, the number of deaths for the year ending 16th March, 1861, is 30, making the rate of mortality $12\cdot9$ per 1000 of the population for that year. This rate, though only for one year, must, we think, be a very near approximation to the average.† Be this as it may, however, we find it im-

* A reviewer did not understand how this portion of the sea affected the east wind. He was probably unaware of the fact, that on the west coast, owing to the influence of the Gulf Stream, the sea is warmer than on the east. The east wind, before reaching Llandudno, must pass over this portion of sea, and be rendered warmer and moister in consequence.

† The mean death-rate for the years 1862 and 3, is $13\cdot1$ per 1000; the mean for the years 1861, 2, and 3, is therefore $13\cdot0$ per 1000.

possible to obtain results so reliable by any other method of procedure ; for we have no means of estimating the population of the last few years, the rate of increase having been so much more rapid towards the end than in the beginning or middle of the last decennial period. Accepting the above, then, as at least not under the average, we must come to the conclusion that the climate of Llandudno is extremely salubrious. This is more strikingly brought out by comparison with other districts. The rate of mortality for the whole of England and Wales is 22·2 per 1000, for London 25, for Brighton 21, for Tunbridge 20, for Hastings 18, for Isle of Wight 17, for Bath 24, for Cheltenham 20, for Scarborough 21. The Registrar-General considers 17 per 1000 as a "healthy death-rate." The death-rate of Llandudno being more than 4 per 1000 less, speaks volumes for its salubrity.

We cannot forbear also to notice the extreme rarity of zymotic or infectious diseases in Llandudno ; indeed, so far as our experience goes, epidemics are unknown in this place ; and, when an isolated case of any infectious case does occur, it exhibits no disposition to malignancy, and but little tendency to spread. This, therefore, is another proof, not merely of the salubrity of our climate, but of the excellent sanitary condition of our town.

The drainage of the town is indeed most efficient. The plans were prepared by T. Macdougall Smith, Esq., C.E., and the works, constituting the main basis of operations, carried out by contract under his direction and superintendence; additions having been made from time to time by the Improvement Commissioners, as the progress of the town rendered such extension neces-

sary. The main sewer, which is four feet six inches in diameter, inside measure, extends from the Parade on the Llandudno side, the whole length of Gloddaeth Street to Conway Bay, where it discharges itself into the sea about 500 feet within high-water mark, a framed wooden trunk being constructed for that distance across the beach. A penstock is provided, at a short distance above high-water mark, to prevent the influx of sea-water into the sewer when the tide is up; the main sewer being constructed of the large size above stated, to act as a kind of retaining sewer during those stages of the tide when the penstock is closed.

The lateral drains vary, according to requirements, from one foot to two feet six inches diameter, and are of brick or glazed stoneware pipes, as required. In Mr. Macdougall Smith's original plan, provision was made for flushing the main sewer, and the sewer running along Mostyn Street, by means of tanks near the Llandudno Parade, which were to fill with sea-water at high-water of spring-tides; but this not seeming altogether sufficient or satisfactory, and the rapid increase of the number of buildings requiring that the drains should be flushed oftener than that provision admitted of, the Commissioners have made arrangements with the Directors of the Llandudno Water and Gas Company, whereby a supply of water for flushing, not only the main sewer, but also the whole of the drainage of the town, is granted at all reasonable times—a boon which cannot be too highly appreciated. In addition to the arrangements already referred to, ventilating shafts are placed over all the principal drains, by which the impure and obnoxious gases, which are invariably generated in drains, are carried off before reaching the

houses ; and when the Commissioners shall have laid the kerb and channel stones along the various streets of the town, they will not only be adding thereby to the present imposing appearance of the streets ; but, by conducting the surface-water to the gulleys already existing, they will thus effect an additional means of flushing the sewers, and avoid the unsightly appearance of pools of rain-water, collected here and there along the streets, after heavy showers.

ANALYSIS OF LLANDUDNO WATER.

BY W. HERAPATH, ESQ., F.C.S.

	Grains.
Chloride of Calcium - - - - -	0·163
Sulphate of Magnesia - - - - -	1·433
Common Salt - - - - -	5·643
Organic Matters - - - - -	0·326
Nitrates - - - - -	Traces
Carbonate of Lime - - - - -	9·963
Sulphate of Lime - - - - -	0·433
Oxide of Iron - - - - -	0·003
Silica - - - - -	0·463
	18·427

No. I.—METEOROLOGICAL TABLE.

LLANDUDNO SUMMARY, FOR YEAR ENDING MARCH 31ST. 1860.

	Mean monthly temperature.	Mean daily range of temperature.	Highest day temperature.	Lowest night temperature.	Monthly range of temperature.	Monthly range of barometer.	Mean humidity of the month.	Amount of rain in the month.	Number of days on which rain fell.	Number of days on which there was sunshining.	Yearly range of temperature.
	deg.	deg.	deg.	deg.	deg.	in.	deg.	in.			deg.
1859—April	45.6	8.7	67.6	32.0	35.6	0.63	77.3	2.7	15	21	58.2
May	52.6	10.6	68.0	37.3	30.7	0.42	72.3	0.2	4	28	...
June	58.5	10.4	75.0	49.3	25.7	0.36	77.3	1.2	12	27	...
July	63.0	9.5	80.8	55.0	25.8	0.66	76.0	0.8	11	28	...
August	61.9	8.6	72.3	54.0	18.3	0.71	75.0	1.9	12	27	...
September	57.3	6.3	77.0	49.6	27.4	0.70	76.2	2.3	15	22	...
October	52.2	8.5	70.2	32.0	38.2	0.79	79.9	4.2	14	26	...
November	46.3	7.3	57.0	33.3	23.7	1.43	77.8	2.3	14	25	...
December	40.5	7.2	54.8	22.6	32.2	1.44	78.4	3.4	18	23	...
1860—January	43.8	5.1	57.0	35.0	22.0	1.44	84.3	2.1	17	19	...
February	39.4	7.8	48.3	24.2	20.1	0.72	78.4	0.5	11	21	...
March	42.5	7.9	52.7	29.0	23.7	1.32	78.9	1.6	20	29	...
Means for the Year	50.3	8.1	64.2	38.1	26.9	0.87	77.6	1.9	13.5	24.6	
Totals for the Year								23.2	163	296	58.2
	1	2	3	4	5	6	7	8	9	10	11

No. II.—METEOROLOGICAL TABLE.
MEAN RESULTS FOR THE FOLLOWING STATIONS,
Extracted from Glaisher's Quarterly Reports,
 For the year ending March 31, 1860, as in Table No. I.

	Mean yearly temperature.	Mean daily range of temperature.	Mean of highest day temperature.	Mean of lowest night temperature.	Mean of monthly range of temperature.	Highest temperature in July.	Lowest temperature in December.	Extreme range of temperature in the year.	Mean monthly range of barometer for the year.	Mean degree of humidity for the year.	Amount of rain for the year.	Mean monthly fall of rain.	Number of days on which rain fell.
	deg.	deg.	deg.	deg.	deg.	deg.	deg.	deg.	in.	deg.	in.	in.	
Aldershot	48.9	15.5	67.8	31.4	37.3	93.0	15.5	77.5	1.228	83.0	35.6	3.0	172
Clifton.....	48.8	14.1	67.4	31.3	36.2	86.5	10.2	76.3	1.290	82.0	36.4	3.0	190
Ventnor	52.1	9.5	64.5	37.0	27.6	79.0	23.0	76.0	1.161	82.6	35.4	3.0	146
Royal Observatory	49.6	16.5	72.0	31.4	44.6	93.0	14.0	79.0	1.253	80.0	...	...	...
Worthing	50.4	10.6	63.7	35.3	28.2	79.0	20.9	58.1	1.224	85.0	39.2	3.2	167
Scarborough	46.9	8.2	62.4	34.4	28.0	77.4	14.5	62.9	1.214	90.0	...	...	...
Oxford.....	48.4	14.4	67.4	30.2	37.2	86.0	11.4	74.6	1.296	80.0	29.5	2.4	146
Liverpool	49.1	10.0	64.9	37.1	27.8	82.0	16.9	65.1	1.189	81.0	26.0	2.1	163
Manchester	47.7	16.4	68.5	29.3	38.3	85.0	11.2	73.8	1.344	81.0	34.0	2.8	187
Llandudno	50.3	8.1	64.2	38.1	26.9	80.8	22.6	58.2	0.940	77.6	23.2	1.9	163
	1	2	3	4	5	6	7	8	9	10	11	12	13

NOTE.—In the above tables, the word *day*, used in reference to the fall of rain, implies 24 hours; and the smallest amount deposited, whether in the night or day time, is invariably noted.

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