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(Read before the N. O. Medical and Surgical Association, May 5th, 1877.)

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Physician in Charge of the Mountain Sanitarium for Pulmonary Diseases, Asheville, N. C.; Corresponding Member of the New Orleans Medical and Surgical Association, etc.

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The object of this paper is not to enumerate all the remedies used in the treatment of Phthisis, only those which my own experience and that of others have shown to be of value to phthisical patients.

When we consider the vast number of invalids who leave their homes for health, we naturally ask: What conditions should determine them in their choice of a health resort? It may be comparatively easy to advise in a single case, yet even then we may doubt if the patient might not improve more rapidly under different medical, hygienic, or climatic treatment; but when we must decide where to send a number of invalids, the question becomes complicated. We need not go to the old world, to Davos (Switzerland), buried in the snow five months of the year, to the Riviera, to Cairo, in order to see invalids wintering under the most extreme climatic conditions—we find them scattered in our own country through almost every degree of latitude and longitude, in California, Colorado, and the western territories, Florida, and the Southern States, Minnesota, and the Adirondack Mountains. Each region claims peculiar advantages, and the busy practitioner, who has not the time or does not care to seek the truth through the abundant phraseology of the publications

of different health resorts, is often amiss when called upon to make a proper selection. A climatic association, as proposed by Dr. Chas. Dennison,* would to a great extent overcome this difficulty, but at present we are not so far advanced as to say positively that a certain climate is suited to a special class of consumptives. There are other essentials to the improvement of invalids besides climate, and these are frequently lost sight of. To draw attention to some of these, and to the relative value of certain climatic factors, is the object of the present sketch.

That consumption, at least certain forms of it, can be cured, is to-day scarcely doubted by any advanced physician. We even see cures in the most heterogenous climates, and sometimes under the most anti-hygienic conditions. Though we may see a consumptive improve in spite of improper treatment, of deficient, bad nourishment, of unhealthy accommodations, we would nevertheless hesitate to recommend a patient to live under the same circumstances. Dr. Brehmer, in his book on Chronic Consumption, cites a very instructive case. A large landowner called on Dr. Stokes, of London. Having examined him, Dr. S. consulted with his family physician, and they decided that nothing could be done for him, and advised him to go home. A year and a half afterwards a healthy-looking man, weighing at least 12 stones, entered the doctor's office with a very sarcastic expression, and asked him if he recognized him. The doctor said that he did not. Then the gentleman told him that he was the same man pronounced incurable 18 months before. The most minute examination failed to reveal any symptoms of the disease. Questioning him, the doctor found that his patient, thinking that he must die, had lived as when in perfect health, eating and drinking of everything on the table, and taking his milk-punch regularly, generally seven glasses a day. He occupied himself duck shooting whenever he felt strong enough. When the doctor said, You must have wet your feet very frequently, he replied: I did not take much care of my feet, for I often waded through the water up to my hips four or five hours, following up the birds on a fine winter's day.

It is therefore of the greatest importance to learn, not where or how some patients may have been cured, but where and how

* The Best Welfare of Invalids, by Charles Dennison, M.D., Denver, Col. 1875.

they are most likely to be cured. The requirements of places wh ch offer patients a chance for improvement or recovery must be manifold, and are not of so simple a character as might be expected from the great number of places which advertise themselves as health resorts. In enumerating climatic conditions, we find as the main factors of climate: temperature, barometric pressure, humidity of the atmosphere, and mostly dependent from these three a number of others, as for instance, ozone, electricity, insolation, wind, rain, purity of the atmosphere, etc.

Great stress is laid on equability of temperature. Although we must acknowledge that places with high, and especially sudden daily ranges are not suitable localities for consumptives, there is nevertheless a certain degree of range desirable and wholesome. A daily range of 20 to 25 degrees often takes place, and no physician would advise patients to stay in the house because the morning or evening temperature is 25° lower than the temperature at noon. A light overcoat fully equalizes the difference, and patient and physician are satisfied and not afraid of the ominous "taking cold." Why do we not think and act in the same way when the difference, instead of falling upon one day, takes place on two succeeding days? We are not afraid of a daily range of, for instance, 25°, but when the following day is cooler, patients are apt to stay in the house on account of the "great change." Can a difference of temperature which is considered harmless if occurring within 12 or 14 hours, be injurious when the interval is 24 hours? Does not a light coat prevent the possible ill effect here just as well as in the first instance? If we exercise care in dressing ourselves, ranges like the above cannot injure us.

A similar misconception exists in regard to the influence of cold air and night air on consumptives. Iceland and the country round Orenburg enjoy immunity from phthisis, and both have very cold climates. The mean annual temperature of the first is 40°, of the second 37.7°; the mean of the coldest month is 28.4° and 7.5° respectively. Every year patients winter in very cold regions with benefit; and in Europe it is quite popular to send them in winter no less than in summer to health resorts in elevated regions, the temperature of which is colder than that of the lowlands in the same latitude or of the Southern resorts. The conviction is general in Europe, that a consumptive needs something more than relief of symptoms and prevention of fresh

injury. His treatment must be active; his functions must be properly stimulated, he must acquire power of resistance, which warm air, because enervating, cannot give, but which is gained in the cool air of elevated regions—points which are more fully discussed in another essay of mine.* Very few people consider that in Southern resorts east of the Mississippi the thermometer frequently falls below the freezing point, that there are occasional snow storms, that these climatic changes are keenly felt by invalids, enervated by the prevalent warmth ot these sections. But where the air is constantly cooler, and the skin is less inclined to perspire, changes are borne more easily and with less discomfort, because the system is more vigorous, the skin is more active in its functions, and the patient therefore is less inclined to take cold.

Night air is dreaded very much by many patients, and when we ask them, why? we are often answered, "it is too damp to be out." But we see the same patients unhesitatingly sit in the open air on a sheltered verandah during day time when the hygrometer shows great humidity, or even when rain is falling. Day and night air are perfectly homogenous, and differ only in temperature—sometimes in condensation of vapor of the atmosphere, caused by decrease of temperature. Statistics have not so far shown that occupations, which compel their followers to work during the night (in the open air), are more injurious than the same when followed during the day. Accepting this view, we ought not to object, indeed rather advise patients, to leave a window either wholly or partly open during still nights, especially when we consider how essential pure air is for invalids, and how quickly the air becomes contaminated in a close room. Absolutely pure air is composed of oxygen 20.96 parts, nitrogen 79 00 parts, and carbonic acid 0.04 parts. An analysis of Pettenkofer (Munich) states that the quantity of carbonic acid in a dwelling in the morning is 0.054; the same increases gradually to 0.061, and so on up to 0.087. In a sleeping room during the night, with windows closed, it is 0.23, with windows partly open 0.082. A grown person excretes by way of respiration and perspiration, within 24 hours, about 20 cubic feet of carbonic acid and 2½ lbs. of water. We ought therefore to bring in at

* Altitude and Climate in the Treatment of Pulmonary Phthisis. Baltimore, 1875.

least 600 cubic feet fresh air every hour for each person, if we do not want to accumulate more than the maximum of carbonic acid compatible with health. Headache, want of appetite, fatigue in the morning, are often attributed to dyspepsia or liver complaints, when they ought to be considered symptoms of intoxication from carbonic acid by sleeping in closed rooms. Already in 1855, McCormack (England) recommended consumptives to sleep with open windows; and lately, Rohden (Germany) urged the same. Of course this measure has to be applied "cum grano salis," and we would do very wrong to let consumptives indiscriminately, and without regard to the weather and their condition, have their windows open every night. Here, as well as in every instance in the treatment of consumptives, it is necessary to individualize.

The beneficial influence of elevated regions with low barometric pressure is now acknowledged by the majority of physicians, and even the opponents of this theory cannot help appreciating the favorable results obtained by this treatment. The number of resorts which are situated at elevations from 1500 to 4000 feet, is increasing in Europe every year. We are justified in assuming that the good effect of altitude is lost, or at least is not perceptible to the patient, if the elevation is less than 2000 feet. The claim that phthisis decreases in high elevation, has gained strong corroboration by two recent publications. At the meeting of the Society of Natural Scientists of Switzerland, in 1863, a committee was appointed to investigate the occurrence of phthisis throughout the country, in its different relations to age, sex, occupation, elevation of places, etc. After several deliberations, it was agreed to extend the time of observations over 5 years, from 1865 to 1869, and now the result appeared in a report made by the Actuary, Dr. Emil Müller.* The part of the resumé at the end of the report, which relates to the influence of elevation on phthisis, presents the following points:

Decrease of Phthisis in Switzerland beyond doubt follows increase of elevation.

Phthisis occurs even in the most elevated places, although it is very rare.

Low regions average to have twice as much phthisis as the

* Die Verbreitung der Lungen schwindsucht in der Schweiz von Emil Muller, Winterthur, 1876.

highest; after deducting cases acquired abroad, considerably more.

The decrease of phthisis is not in strict proportion to the increase of elevation, and these variations taking place are mainly due to social conditions of the people, i. e., whether they follow farming, manufacturing, or both.

The second work is by Jourdanet,* who practiced four years and a half in Mexico, and observed only six cases of consumption amongst 30,000 visits to patients. The conclusions he arrived at are as follows:

1. Consumption in Mexico is extremely rare at an elevation over 2000 metres (about 6560 feet).

2. There is an almost absolute immunity among the better classes.

3. Disposition to consumption, acquired by young people somewhere else, generally disappears as soon as they remove to the mountainous regions.

4. Complete cure was frequently observed in patients who contracted their disease at other places (France).

The humidity of the air can be determined by different instruments. Saussure's Hygrometer indicates the absolute quantity of vapor contained in the air; Mühry's Micro-atmometer measures directly the quantity of water evaporated, whilst Leslie's and August's Psythrometer or Vaporimeter indicates the humidity by the difference between two thermometers, the bulb of one of which is exposed (dry bulb) the bulb of the other is surrounded by a wick immersed in water (wet bulb). The latter instrument, which is most used, enables the observer to calculate most of the different factors which show the humidity of the air, viz:

Relative humidity, i. e., the ratio of the quantity of vapor actually contained in the air to the quantity it could contain if fully saturated.

Absolute humidity, i. e., the weight of aqueous vapor in a given quantity of air; in this country the weight of vapor in grains in one cubic foot of air, in Europe generally in grammes in one cubic meter of air.

Dew-point, i. e., the point of condensation of vapor, or the temperature at which the air begins to part with the moisture, which it cannot hold at a lower temperature.

* Influence de la pression de l' air sur la vie de l' homme Climats d' altitude et climats de montagne. Par D. Jourdanet. Paris, 1875.

Elastic force of vapor, i. e., the pressure of the whole vapor in the atmosphere over the place of observation. It is expressed in inches of mercury of the barometric column, and is equal to the observed barometric pressure, diminished by the pressure of dry air.

It is not necessary to know all the four factors enumerated in order to determine the humidity of the climate of a certain place, but I cannot approve of the way which is generally adopted of comparing localities by means of relative humidity alone. It makes a great deal of difference, if the lungs inhale an atmosphere containing 2.59 grammes of an aqueous vapor in one cubic meter (the means of amount of vapor January, 1870, at Davos, Switzerland), or one containing 7.34 grammes in a cubic meter (the means of January at Cannes, France), the relative humidity being the same for both places, viz., 86 per cent.* The merit of drawing attention to the importance of the absolute humidity is due to Dr. Henry B. Baker, the eminent statistician of Michigan. I quote from the fourth annual report of the Secretary of the State for the year 1870, page 294, the following:

"The temperature of the air passing out of the air passages of human beings is believed to be fixed, or nearly so, the temperature shown by a thermometer under the tongue being about 98° Fahr., it is probable that the temperature of the expired air does not vary greatly from this, and as those passages are naturally supplied with moisture, the quantity of vapor in a given quantity of air exhaled from the lungs must be nearly uniform throughout all temperatures. The capacity of air for moisture being different when cold from its capacity when warm, the quantity of vapor entering the air passages must be different at different temperatures, supposing the air to contain all it can in every case; consequently the relative humidity is not sufficient for our purposes of comparison, as it only expresses the percentage of saturation at the temperatures existing when the observations were made. As indicated in the last report, we want to know for each month the relative quantity of moisture abstracted from the human air passages in excess of that inhaled; we should therefore ascertain the relative quantity of vapor in each cubic foot of air inhaled in each month."

* Klimatologische Notizen neber den Winter un Hochgebirge, by Arthur Wm. Waters, F.G.S. London, 1871.

When we give to the absolute humidity the importance it deserves, we can then without difficulty understand, why places with high relative but low absolute humidity show all the properties of a very dry climate, as do, for instance, the lofty alpine health resorts in Switzerland. Biermann, a well-known writer about Climatology in Europe, states as the three main factors constituting climate, "temperature, barometric pressure, and absolute humidity," and subordinates the relative humidity as a secondary factor to the latter. The following table, which for want of data could only be extended over nine months, will show that a place with a higher relative humidity can have lower absolute humidity. The data of relative humidity referring to Aiken are taken from a recent publication of Dr. W. H. Geddings, in the *Charleston Medical and Surgical Journal*, entitled, "Aiken as a Health Station." The calculation of absolute humidity is based on Table XII, by James Glaisher, page 103, B, Meteorological and Physical Table, by Arnold Guyot, Washington, 1859, with omission of the decimals in the temperature.

TABLE.

Time of Observation.	Asheville, N. C.			Aiken, S. C.		
	Temperature.*	Relative Humidity.	Absolute Humidity.	Temperature.†	Relative Humidity.	Absolute Humidity.
August, 1875	70.9	81 7	6.53	77.4	79.5	7.85
September, "	63.9	79.8	5.15	72.5	69.5	5.90
October, "	53.1	64	3.01	62	63 2	3.95
November, "	43.3	72 3	2.46	52.2	71.2	3.24
December, "	37.3	74.5	2.07	45.6	68.9	2.50
January, 1876	37 3	61.6	1.72	47	61.8	2.39
February. "	38.9	62	1.79	48 2	64.3	2.57
March, "	44.8	56	1.97	53.2	51.8	2.44
April, "	54.1	58.1	2.82	62 1	55.8	3.48
Means	49.2	67.7	3.05	57.8	65.1	3.81

We see that Asheville, with an average relative humidity of 67.7 per cent., shows 3.05 absolute humidity, whilst Aiken, with a somewhat lower relative humidity of 65.1 per cent., shows 3.81 absolute humidity.

Rain originates from increased condensation of aqueous

* Not knowing the means of temperature at Aiken, we have taken the monthly means of a series of years—of 8 years for Asheville, of 11 for Aiken.

† In Dr. Geddings' above publication, by mistake the relative humidity of Asheville was taken for the three months, May, June, July, 1876, instead of 1875, which gives Asheville a higher percentage, as the year 1876 was more moist than 1875, and which accounts for the difference of the figures obtained by Dr. Geddings and myself.

vapor, the vesicles of which flow together and fall as drops of water. These drops increase in size as they fall, because the aqueous vapor of the air, through which they pass, condenses and unites with them. Therefore a rain-gauge located high above ground indicates less rain than one stuck in the ground. Rain is generally a very unwelcome guest to invalids, and rainy days are not only the most dreary for them, but many, nay, the majority, are afraid of direct injury from the rain. They do not consider that it is the rain which washes the air out and frees it from the carbonate of ammonia, which accumulates in larger quantity in the air when it does not rain for a long time. The rain absorbs this gas and conducts it to the soil, for which it serves as manure. The air contains after a rain more oxygen and less carbonic acid, which latter is absorbed by the rain. The rain plays a very important part in nature by conducting to the ground all the substances, which when inhaled, are injurious to health and plant the germs of diseases of the respiratory organs. It would be desirable if the rain would fall always at night, in order not to interfere with the daily exercise of invalids. But it does not hurt them to be outdoors during a rain on a sheltered verandah, or even to walk out with an umbrella if they wear good boots. The fear of being out in the open air during a rain is greatly less in Europe, where very conscientious patients can be seen taking their exercise with umbrellas.

Ozone is oxygen in active form, and oxygenizes organic and inorganic substances with much greater energy than common oxygen. It is therefore of the greatest importance as a powerful disinfectant of the obnoxious gases originating from the decomposition and putrefaction of animals and plants. It can artificially be produced by exposing bitter almond oil to the rays of the sun, or by bringing phosphorus into a bottle with water at 86° F. and shaking it. In nature lightning is a generator of ozone, but its main originator is the chlorophyll of the plants, which, under the influence of the rays of the sun, parts with the carbonic acid formed during the night and exhales the ozone.

After contemplation of some of the main factors of climate and their relative value to the invalid, a few words may suffice to enumerate some points, outside of climate and drugs, which have to be considered in the treatment of consumptives.

The entire change of habits a patient undergoes when living

in a health resort, has undoubtedly a great deal to do with his improvement. But the influence of this change has been greatly overrated by some writers, who attributed to it more importance than to the climatic influence. The improvement derived from a mere change without resorting to a proper climatic station, is either only slight or at least only temporary; and we even see physicians, who adopt the above theory, send the greater number of their patients to health resorts of reputation. The value of certain climatic factors in treating invalids cannot well be denied, and the results obtained sustain their importance.

The unlimited use of fresh air is by far the chief desideratum for a consumptive. This is a point the value of which is greatly underrated by physicians, and which has to be repeated continually to consumptives. If we could make a patient in the city breathe pure country air several hours every day; if besides, we could put him under proper hygienic conditions, free him from mental cares—we could sometimes save valuable lives, or at least retard the progress of the disease. In speaking about night air, the contamination of the air by accumulation of carbonic acid in closed rooms is already mentioned. But an equally deadly enemy of the consumptive is the dust in its finest forms, which is always in a room, even if kept scrupulously clean with all the windows open. To convince ourselves of the great quantity of this finest dust, it is not sufficient to look at a ray of the sun shining into a room, but it is necessary to darken the room completely except a very small opening, and I doubt if many can be found who would approach the ray of light with their mouth open without disgust. The same experiment can be made with strong electric light. The time a patient is spending in a room is lost, and worse than lost. I mentioned here only dust as contaminating the air in a room, but there are a good many other injurious elements in our dwellings helping to deteriorate the air, as for instance, the decrease of oxygen, the excrements of respiration (carbonic acid and aqueous vapor), the excrements of perspiration, the products of illumination, the formation of carbonic oxide (results of gaslight, stoves), accidental vapors (tobacco smoke, kitchen vapor, etc.), the warming into motion of the whole conglomerate—each enough to drive a consumptive out of doors, who is in earnest to do the best he can for his health.

Exercise is another essential for phthisical patients, especially as it assists to overcome the deficient expansion of the chest, and to bring air into parts of the lungs which were more or less inactive. To achieve this end, ordinary walking is not sufficient, but the patient must take deep inspirations, stop when his breath shortens, fully recover it, then go on until the breath shortens again, never allowing himself to become even partially "blown." In this connection, it may be permitted me to say a few words about the manner of breathing, which I extract from Niemeyer's Atmiatry, and to which too little attention is paid as yet. We pay much and often painful attention to our food-diet, but how many are there who observe a respiratory-diet, which is equally if not more important than the first. One of the reasons of this neglect is the secrecy with which respiration takes place. Many acts are necessary for nourishment, the procuring of food, its preparation, mastiscation, digestion; the excrements are disagreeable to our senses—nothing of all this with the respiration. We breathe unconsciously, and if the air becomes bad in consequence of accumulation of respiratory excrements, it does not become perceptible to our senses. We distinguish three modes of breathing: shoulder respiration, the most important; costal respiration, depending upon the elasticity of the ribs; abdominal respiration, the most extensive, as the descent of the diaphragm sets about three-fourths of the lung into activity. The apices are the least ventilated parts of the lungs, as the shoulder respiration requires a certain position of the body and a certain amount of labor—unlike abdominal respiration, which is possible in all positions. Besides a proper position, some few more points interfere with full shoulder respiration: the scapula with its appendices, the extremities, rests like a roof on the top of the lung, and has to be raised by will in order to comply with the object in view. The apices have not those supplementary spaces at the side and the base of the lung suited to receive the inflated parts. Further, the bronchus of the upper lobe does not directly descend as in the lower lobe, but runs upward in a curved direction and divides very early into a multitude of bronchial tubes, so that the inspiratory stream of air has to run around many curves and corners, till it reaches its destination—the alveoli. The apices of the lung are therefore best adapted to serve as a reservoir of residual air, which stagnates and is seldom and imperfectly renewed—a fact which plays an important part in the

etiology of the primary seat of the disease, which, as well known, is in the majority of cases the apices. Full breathing is as essential to the lungs as eating to the stomach, and we delight to see the new-born child exert it to the fullest extent during the act of crying. All nomadic tribes are naturally full breathers, whilst we are accustomed to a sitting life and only occasionally, when bent over too long in one position, erect ourselves and take involuntarily a deep, full breath. Artificial positions assist in setting certain parts of the lung into activity, and ought to be recommended after careful selection to the patient. For the sake of illustration, examples of two positions may be mentioned: if we desire a patient to breathe more with one side, for instance the left, lower the right shoulder, let the right arm hang down, and raise the left arm and breathe deep. To promote shoulder respiration, let an attendant compress the false ribs of the patient, and have him cross his hands over his head and breathe deep.

The use of cold water in its different applications ought not to be neglected in the treatment of invalids, as their skin is inactive and prone to perspiration. Cultivation of the skin counteracts the disposition to catching cold, and cold water applications act very favorably against an accompanying fever.

The relief of unpleasant or dangerous symptoms, especially careful observation of the functions of digestion and assimilation, are of course to be kept constantly in view.

It would unduly extend this article if all the climatic factors and all the hygienic measures were discussed. We saw that a difference in certain elements of climate does not materially affect the value of health resorts, but that others are essential and must not be lost sight of, if we would place a patient under the most favorable conditions for improvement. In the class of hygienic measures belong further, good accommodations, nutritious, well-cooked food, diversion of mind, pleasant social relations, and a rational physician, well experienced in the treatment of consumptives. This quotation from the late F. Niemeyer will always be in point: "The consumptive must live under the constant supervision of a strict, conscientious physician, if favorable results are to be obtained." It is not a single remedy which is a panacea against phthisis, but it is the cautious and continuous application of a great number of remedies, properly selected for the individual case, which promises results. Patients generally know very little of what does them good or

what hurts them. They have to be taught, and this is often a most difficult task. It requires a careful study of and an untiring attention to all the surroundings of a patient, if we would have him to use all the proper hygienic and other remedies in the right way. The physician in daily practice cannot exert the necessary supervision upon which alone depends the welfare of a consumptive. A supervision of this kind, if used with discretion and adapted to the individual case, is never objected to by patients; on the contrary, as soon as they gain confidence in the physician, they like it and depend upon it. The experience of nearly two years has taught me the truth of this statement sufficiently, and the benefit received from it has been for a long time acknowledged in Europe. The objection to the aggregation of invalids, often heard against an institution, which, right or wrong, can be raised against any hotel or boarding-house, where consumptives congregate, does not hold good in practice, and invariably I have seen patients who hesitated to visit my Sanitarium on this account become converted to exactly the opposite view: they heartily appreciate the value of being in the institution. No patient considers his case the worst, and each enjoys to see others improve, and derives from that hope for himself. Besides, there are always a large proportion of well persons in such an institution, relatives and friends of the patient. One of the strongest points in favor of a medical institution and its preference to any other residence for consumptives, rests on the fact that the interests of the proprietor and physician are the same. The physician, whose first and main interest is to help the patient, will not hesitate to contradict and forbid, without fear, many things which a landlord will allow or even favor for the sake of pleasing or amusing his guests. A physician will give his patients all that he possibly can, as his reputation is based on the improved condition in which his patients return; a landlord will only do what will sustain the reputation of his house. The advantages of a medical institution are best illustrated by the actions of the stockholders of the Curehouse at Davos, who always boasted that their patients enjoyed more liberty, and could follow their own inclinations and notions more than those in a medical establishment. According to a letter I received recently, preparations are being made to change the Curehouse into a medical institution. I hope to be able before long to convince the profession by my results, of the advantages of a medical institution for consumptives.