A few remarks on climate : and on the rational treatment of affections of the throat and lungs by means of atmospheres of soothing properties : with an explanation of the action and use of respirators / by Julius Jeffreys.

A FEW

REMARKS ON CLIMATE,

AND ON

THE RATIONAL TREATMENT

OF

AFFECTIONS OF THE THROAT AND LUNGS

BY MEANS OF

ATMOSPHERES OF SOOTHING PROPERTIES.

WITH AN EXPLANATION OF THE

ACTION AND USE OF RESPIRATORS.

BY

JULIUS JEFFREYS, F.R.S., F.G.S., &c.;

FELLOW OF THE ROYAL MEDICAL AND CHIRURGICAL SOCIETY, LATE OF THE INDIA MEDICAL STAFF.

LONDON:

LONGMAN, BROWN, GREEN, AND LONGMANS,

PATERNOSTER ROW.

1849.

London: Printed by William Clowes and Sons, Stamford Street.

PRELIMINARY REMARKS.

"CLIMATE," when taken in its fullest sense, offers to the natural philosopher a field of inquiry of high interest and importance; but at the same time one of no ordinary difficulty to explore, since every one of the physical sciences falls within its compass. They have each to contribute not a little to its inquiries, and must therefore all be mastered by its successful cultivator. Meteorology and electricity are immediately connected with it, and have themselves but recently assumed the position of sciences. Physical geography also has an important share in the phenomena of climate, and astronomy enters largely into it. The earth's position in the solar system, and the influence down upon her from the great luminary, not only of heat and light, which produce the more obvious phenomena of climate, but of attractive and magnetic impulses also, have all to be studied. The gigantic circulation of the whole ocean-mass produced by the tropical solar rays, and conveying their warmth and electricity to colder regions, have a magnitude of action* at present but imperfectly

* Though extending these preliminary remarks, I cannot refrain from noticing here a very remarkable climatic provision in the geographical configuration of the earth's surface, on which, though it has been regretted by statesmen, navigators, and merchants, I believe it may be shown human existence depends in Britain, Scandinavia, and the Baltic countries of Europe. To the vast and heated ocean-current flowing up the American coast, and known as the Gulf Stream, which sets eastward and northward past the Azores, and sends large and warm offsets to

known. Neither can the influence of the moon be neglected. Even tides play a wider part in climate than is by many supposed. The effect of barometric pressure in the meteorology of climate also requires further investi-

renew constantly the waters of the German Ocean, and even of the Polar Sea—to this gigantic hot-water warming apparatus I believe every inquirer into the causes of climate admits the comparative mildness of our regions to be due. Now this set northward of the water of the tropical Atlantic would never take place were there, as has been so many a time wished for navigation, a broad sea-way between North and South America. The primary course of that equatorial water is westward, since it is constantly being displaced before it can acquire the velocity of the equator eastward. It sets into the Caribbean Sea, against the neck of land stretched providentially between the two continents. It is this barrier which alone prevents a body of water, even much greater than the Gulf Stream, from rushing through and mixing itself with the similar great westward current of the Pacific. It is here that its course is arrested and changed. It is forced with great velocity round the coast of Florida, and then takes its northerly direction towards us, to render genial our southern breezes wafted over it, and even to temper our northern by its poleward offsets. Thus the waters of the North Atlantic, from the pole to the equator, are kept mainly within its own great basin, performing in the arctic and temperate regions, no doubt, two curiously opposite circulations (which it were too long a departure from the main subject to trace out here). But did the Isthmus of Panama not exist, the Atlantic current would flow through into the Pacific, and if Behring's Straits between Asia and America were proportionally wide, the circulations of the northern portion of these oceans would, beyond a doubt, be united into one great circuit, from which a branch would, as a statical certainty, rush through Behring's Straits eastward to Europe, to balance the equatorial current westward into the Pacific between the Americas. Instead of the vast current charged with warmth from the south, there would descend to us from the north its equivalent through those straits—a frigid stream, freighted with iceburgs. Snow-clad Kerguelin, in the same latitude in the southern hemisphere, chilled no doubt by a polar current, would have to yield to England the distinctive epithet of "Isle of Desolation," since the frigorific causes affecting the latter would be incomparably the more powerful of the two. Our islands might soon become surrounded by perpetual ice, and buried under everlasting snows. Hence we may deduce a climatic apophthegm, at first sight paradoxical—Britain and Scandinavia uninhabitable but for the Isthmus of Panama.

gation. We have learnt something of the climate of mountain-heights, but their curious phenomena are only partially explored; and those which we are acquainted with are by no means fully explained.

But even so far as modern science does light us on the way, I am not aware of any comprehensive effort to reduce all that is known to a philosophical system, in the form of a TREATISE ON CLIMATE, in its enlarged sense. The great Humboldt has led the way by supplying many valuable materials and setting an example of highly philosophical inquiry in this interesting field; and if he could have cast his mantle upon a genius like his own, in the vigour of life, who would pursue the subject with similar ardour, aided by the great discoveries in magnetic and terrestrial electricity of Faraday, Oersted, and others, and by the observations now pursued in all parts of the world under the auspices of the British Association for the Promotion of Science, we might, before long, possess a work of the highest interest and value.

In this wide field of inquiry, there is one section which, though a small part of the whole, is, from its nature, of the greatest importance, viz., the influence of climate upon human health; and in the following unpretending pages I shall attempt to exhibit to the reader views upon one point only of this particular subject. I shall only invite his attention, and very briefly, to the manner in which the atmosphere acts, in obedience to physical law, upon those surfaces of the human body to which it has access at all times; requesting him particularly to note the difference in the ability of such surfaces to endure its action when they are in a healthy state, and when they are delicate or irritable; so that he may understand the need they have, when in the latter state,

of being treated with a different climate from such as is suitable to them in the former. He will then, I am persuaded, enter into my desire to supply the sufferer who has irritation in the air-passages and lungs, with a *local* artificial climate suitably different from the general atmosphere around his bodily surface, which is not irritable. Moreover, in addition to the *direct* action upon the irritable parts of local climates suitably adapted to them, he will have to attend to a variety of important objects to be attained through their *indirect* action. He will then perceive that all these objects are based in sound *medical* philosophy, and therefore that they would be well worthy of a serious consideration though *natural* philosophy had not yet presented to our view any means by which we might attempt to realize them more or less completely. When, therefore, the physical and physiological principles of Respirators are conjointly set before him, he will perceive these instruments to be, in a humble way, but soundly, the theoretical representative of all the above views and objects; and when he is made acquainted with their practical effects in the cure or relief of many thousand sufferers, even through an ill-understood and imperfect employment of them as yet, he will, I trust, also consider them to have proved as effective an embodiment of their principles as can in reason be expected, when the magnitude and variety of the objects sought are contrasted with the smallness of the instrumental agents. He will then perceive how unreasonable is any complaint against their bulk, into which so much duty has to be compressed, and also how unwise are they who, having learnt the utility of them out of doors, yet never avail themselves of their curative principle within doors, even when the air of a house is manifestly aggravating cough, &c.

I must first, however, explain to my reader the reason why questions of this character and importance are condensed into so small a space, and presented to him in the form of a short pamphlet.

Beyond a limited edition of a few pages, entitled "Observations on the Construction and Use of the Respirator," and published when these instruments were first introduced, no account, either of what was *promised* by their principles *in theory*, or of what has since been *realized* by them *in practice*, has been addressed *by myself* to the public. Many of them having remained unacquainted even with the profession of the inventor of Respirators; the extent to which these instruments have made their way, every year advancing in reputation, is a gratifying proof of their value to the numerous class for whose relief they were invented. At the same time inquiries have been repeatedly made after some Essay upon the principles and use of Respirators, and the diseases to which they are applicable; and the want of such a work has long been manifest to myself, various prejudices and mistaken views of the scientific principles having from time to time arisen, and been propagated, respecting these instruments.

I have however been hitherto deterred from appearing before the public myself as the advocate of my own invention. The course I adopted was to lay before the profession,* who were in a better position to form a judgment of them than the public, the views upon climate, and the atmospheric treatment of the lungs, which led to the invention of Respirators.

In the various communications I have been favoured with, the truth of those views has been fully recognised,

* In papers in the London Medical Gazette.

and they are confirmed by what Respirators have already effected for the invalid public, even through an imperfect employment of them, and chiefly in one form only.

The many instances which have come to my knowledge of parties suffering consequences of a serious character, from allowing their complaints to run on to an advanced stage before they had recourse to Respirators, urge me to adopt the present course, though imperfect—namely, of offering, in the condensed form of a few unpretending pages, an outline of the curative objects for which Respirators were invented, and of the manner in which it was intended they should have been employed.

I am well aware that the very same matter is liable to be viewed by many readers in a very different light, according to the form in which it is offered to them; and that some minds, not qualified for an independent judgment, may afford little attention to that which wears an humble form. But this cannot longer be permitted to prevent my performing a duty repeatedly pressed upon me.

The physical causes of climate, and its action upon the human frame, have been with me a favourite subject of study and inquiry from an early period of my professional life. Opportunities of a peculiar character were afforded me during a tour of six months in the Himalaya range for observations of much interest upon the climate of mountains, at various elevations, up to a height of sixteen thousand feet.* During a subsequent residence in the

* The medical properties of that climate formed the subject of an Essay published in 1824; in which I was led to commend to the attention of the authorities in India, its peculiar barometric, as well as thermometric, character. Not only the great equality of the latter at all elevated situations, but especially the diminished atmospheric pressure, promised to invite a freer action in the liver and the skin, the organs commonly exhausted in constitutions tried by the general climate of In-

different climates of the continent of India, and an intercourse of many years, both professional and private, with its various races, I was enabled to cultivate with advantage similar inquiries into climate, and its influence upon the animal system.*

Upon my return to Europe the first point of observation which presented itself was the prevalence of pulmonary irritation. By keeping in view both the local and the constitutional causes operating to produce and to keep up pulmonary affections, it became obvious that sufferers from irritation in the throat or lungs stood in need of both a *local* and a *general* treatment, of a character altogether distinct from the usual routine of introducing medicines into the stomach, and applying counter-irritants to the surface of the body, proper as these measures are at particular times and under particular circumstances. The demand of a *local* treatment of the air-passages sounded in the ears in every cough, which too plainly declared their need of protection from that chilling and drying influence which the air exercises over every irritated surface exposed to it. In short, the *uninterrupted* exhibition to the air-passages of the lungs, of a warm and moist climate, was the

dia. Among other communications from medical and civil authorities, I was favoured with one from the Inspector-General of Her Majesty's Hospitals in Bengal, stating that the arguments contained in that Essay had induced him to recommend to the Government the formation of sanatory stations at the elevations I had suggested, and that the question was seriously entertained. Shortly after, the stations of Simla, Missourie, and Landour were formed, and soon became a favourite resort of invalids, and also of the heads of the government.

* The reader who may desire to pursue this interesting subject, will find a work, published by the Author, in 1842, entitled "Views on the Statics of the Human Chest, Animal Heat, and Determination of Blood to the Head," to contain an exposition of many of these observations upon subjects of high interest, in connexion with animal chemistry, life, and health.

local treatment evidently called for; a treatment in which the surface of the body ought not to be involved, as will be explained in the sequel. The *general* treatment especially needed in these diseases was plainly the employment of those surest of restoratives, could they be commanded in conjunction with the local, namely, exercise, fresh air, and the elevation of the spirits resulting from them. Now by confinement within doors, invalids were being everywhere deprived of these natural and most important restoratives.

The thing then to be desired was a soothing climate acting locally, and employed duly within doors, and accompanying the party while in exercise out of doors. The pursuits in what might be termed Pneumatic Physiology, already alluded to, suggested to me certain philosophical principles which promised to yield the climate desired, if they could be brought down to act through the medium of matter, in the form of some very portable instrument.

Meeting neither with any person disposed to incur the risk of the considerable expense requisite, nor with any one prepared to do justice to the principles in all the nice points demanding attention, without which their virtue might be lost, I determined upon attempting the task myself, and had to contrive different machines and processes for the purpose; and to devise the various forms, fittings, and adjustments of the different kinds of Respirators.

ON THE MEDICAL PRINCIPLES OF RESPIRATORS.

THERE are certain membranes, or surfaces of the body, which, from their position and for the performance of their duties, are necessarily subjected to the continual action of the air. These membranes are the skin, the surface of the eye, and of the nostrils, throat, windpipe, and other air-tubes of the lungs; these being the surfaces to which the air has more or less access at all times. The property of the air is to dry and to cool (and in winter to chill) any warm and moist surface exposed to it, whether that surface be inanimate, as a towel dipped in warm water, and hung in the air, which soon becomes both cold and dry, or animate, as the living membranes in question. Such membranes, therefore, that they may bear this action of the air without becoming chilled and dried, are, in health, well provided with the means of supplying themselves with warmth and moisture as fast as these are carried off by the air.* Moderate exposure, then, is healthy and invigorating to all these membranes in their proper state. But directly they are delicate and irritable, they (especially the membranes of the eye and of the lungs) cannot endure this action of the air without suffering; and the more they are exposed when in this state, the more irritable and delicate they become. On the other hand, the more their natural warmth and moisture can be preserved, the sooner does their irritability subside, and their tone and vigour return. In the case of the eye, we can see its state so plainly, and guard it so easily from the air, and apply

* The skin must guard itself from being so dried as to be chapped; but the other membranes have to keep themselves even humid.

warmth* and moisture so readily to it by fomentations, that no one is so ignorant of what is suitable for that organ, when irritated, as to imagine that protection from the air and proper local treatment would increase its delicacy. On the contrary, every one knows that neglect and exposure tend, in such a state, to make it weaker and more irritable, and, if persevered in, may cause destruction of the organ.

Now, the case of the membrane lining the air-tubes of the lungs is precisely similar. It also is a moist and warm membrane, qualified, when quite in health, to bear the action of a very trying atmosphere; but when delicate and irritable, it is rendered all the more so by exposure. Hitherto no means beyond that of warmed apartments were at command for affording any *uninterrupted* treatment to the membrane of the lungs. But the air of a warmed room has a tendency still to dry the irritable surfaces of the lungs; and just as a warm fomentation or poultice, though well suited to an inflamed spot, would be intolerable if it were extended over the whole body, so would the air of a room be, were it heated up to the warmth, and given the humidity, which in many cases would be very comfortable if presented to the lungs alone. Moreover, the air of a common room, such as it is, involves with it confinement, and, in the case of a bedroom, is liable to a great fluctuation of the temperature by the fire going out.

It has to be borne in mind that whatever may be the ailment or disease of the lungs, it sooner or later induces irritability in the membrane lining the windpipe, air-tubes, &c.; and renders it, in by far the greater number

* Even when the application is cold, it must always be moist; that is, a lotion.

of cases, unable to endure the action of untempered air. Hence the symptoms that this membrane is being irritated by the air inhaled, namely, pain on air entering, or difficulty of breathing untempered air, soreness or tickling about the throat, hoarseness or cough, are, one or other of them, present in nearly all affections—asthma, consumption, or simple bronchitis, &c.

Since warmth and moisture cannot be applied to the inside of the windpipe, air-tubes, &c., in the liquid form, as in fomentations, but whatever enters these organs must be in the form of air or vapour, it was obviously a desideratum, much to be sought, that we should have at command means for fomenting the inside of the lungs, *continually*, by a *climate* of just such warmth and moisture as might, in each case, be found most suitable to the feelings. If possible, this fomenting climate should not surround the whole body, but should act only on the lungs, as keeping a person day and night in a warm bath would be an error where only a continued *local* fomentation was wanted. Hence, for many pulmonary invalids, no natural climates are exactly suitable. Those which suit the lungs by their warmth and moisture, after a time too often prove debilitating to the whole frame, by their relaxing action on the skin. Such is the tendency even of the climate of parts of the south of England, and of Pau and other places on the Continent, in the summer; while in the winter, none of them are warm enough for the lungs of the delicate. I have met with invalids from the different stations most suited to the lungs, who, after a time, had been compelled to leave them from their debilitating tendency.* Yet the invalid does well in visit-

* Although none even of these are in winter warm enough, without the Respirator, for the lungs of many of the invalids whose systems are debilitated by them.

ing, if he can, such mild natural climates so long as they suit him, since they operate uninterruptedly, without attention and inconvenience. It is a curious fact, however, and flattering to Respirators, that some pulmonary invalids, having them to protect their lungs, have sought with benefit the bracing action of even a colder climate than that of England. Although, in general, the soothing of the lungs must be attended to, even should it be at some expense to the general strength, as when invalids are sent to Madeira, Pau, &c., some cases occur in which more is gained by a bracing and dry climate, giving tone to the frame, though trying to the lungs, than by a warm and moist climate, soothing the latter at the expense of the former. These very facts, and the differences of opinion they have led to (some physicians recommending a cold climate for pulmonary invalids), confirm in a remarkable manner the leading principle upon which Respirators were founded—that of presenting to the air-passages and lungs a climate distinct from that in which the body is placed; and to this principle in Respirators is, beyond question, due no small part of their curative power in many cases; for they both soothe the irritable parts until they have recovered their tone, and at the same time allow the rest of the body to be invigorated by a bracing atmosphere. Let not, therefore, the invalid, who, in the bracing climate of North America, is thriving under the employment of Respirators, forget, as some appear to have done, that the improvement is due as well to the artificial climate afforded by the latter acting locally, as to the natural climate of the former acting generally. And when the wearer at last becomes independent of the instruments, it behoves him to bear in mind that his independence is the best proof of their curative action, they having induced such a subsidence of irritability as enables

him to breathe the bracing atmosphere without uneasiness, and ultimately with benefit. There are a few cases in which invalids can go to such a climate with benefit, and recover their health even without Respirators; but they do not in the smallest degree militate against the above general truth. In these, the exceptions, debility of the whole frame is the main cause of the pulmonary irritability, which latter disappears with its cause, even though the general remedy, the bracing climate, may be for the time trying to the irritable part.

Again, the local climate for the lungs ought, if practicable, to assume a portable form; not only accompanying a person about a house, but even attending him out of doors, and enabling him to enjoy air and exercise under its protection. Of such a climate we might anticipate, from the parallel of all other cases, that the sooner the lungs were placed under its protection, the earlier would the irritability subside, their tone be restored, and the artificial fomenting climate no longer be needed.

To afford such a climate Respirators were invented. The outgoing breath, in each act of breathing, carries away a large quantity of warmth and moisture from the lungs, thereby, when they are delicate, chilling, and drying them injuriously. Respirators are a philosophical apparatus which recovers as much of this warmth and moisture from each breath as is wanted, without detaining, at all, the air itself of the impure breath, which is freely voided. This warmth and moisture are given to the fresh entering breath, which then becomes as warm and moist as may be desired, and is thus converted into a fomenting climate for the lungs. The parts of the instruments are so arranged, such materials are employed, and the workmanship is of such a nature, that full effect

is given to the principles in the smallest bulk, and with the smallest weight. This renders them perfectly portable, and therefore the climate they afford is portable.

ON THE USE OF RESPIRATORS.

The reader of the preceding remarks cannot fail to perceive that the object of such an invention as Respirators is but partially fulfilled when one is employed only for taking exercise out of doors. So long as there is irritability in the chest or throat, and a fomenting atmosphere, upon due trial, does actually prove of comfort, and does moderate the tendency to cough, &c., so long assuredly ought it to be administered, without any reference whatever to the time of year, or to whether the person is within doors or without. The earlier the irritated part can be soothed into a natural state, the sooner does it become independent of the protection. As before remarked, every one knows this to be true of the eye when irritated, and it is equally so with the windpipe and lungs. Hence, in every case, the benefit derivable from Respirators is proportional to the earliness of the employment of them; and for the same reason, the earlier they are employed, while the ailment is only trifling, the sooner does the wearer become independent of them. This might be maintained with confidence upon the soundest principles in medical science alone, but it is confirmed by the experience of many thousands. A person may, no doubt, render any part, *which is in perfect health*, more or less delicate, whether it be the surface of the body, the eye, or the chest, by that over-protection at all times, vulgarly

called "coddling;" but when any part is already irritable, every degree of exposure only tends to increase its irritability, and, as has already been shown, the climate which the lungs often desire in such a state, is one more warm and moist than would suit the whole body. Hence even the air of a room ordinarily warmed may by no means be that which is best for the chest. A person therefore who does not allow the appearance of Respirators to deter him from wearing one at all times, *so long as uneasiness and cough return without it*, will, in not a few cases, realize an amount of benefit much surpassing his expectations. The Nasal Respirator is the most convenient form for use at night, for all persons who in sleep breathe through their nostrils chiefly.

Respirators are not proposed for superseding the employment of all proper medical treatment; on the contrary, they are designed to aid it; though their effect then proves such as to lessen materially the quantity of drugs requisite. The smaller the quantity of drugs introduced into the stomach, and the less the nervous system is acted upon by opiates, the sooner, as a matter of course, will whatever medicines are necessary have the important effect of restoring health.

All persons are familiar with the fact that a cold commonly commences in the nostrils, and often has its seat entirely in them. The reason plainly is, that they are the part exposed first to the cold air inhaled, which, at a moment of undue exposure, or of temporary delicacy, irritates the part by its chilling or drying action. Thus even a hot air, if very dry, will often bring on all the symptoms of a cold.* The effect of all irritation, whether

* A fact notably warning us against any instrument which should warm a cold air to be inhaled without at the same time moistening it.

by chilling or drying, is to produce an increased discharge from the membrane, and a temporary thickening of it, which causes a closing or stuffing of the nostrils. In such a state, a person who will put on a Nasal Respirator, and wear it *unremittingly, night and day*, will find it shorten the duration of his cold to a degree which cannot fail to surprise him. It should be observed that the first effect of the moist warmth of the Respirator may be an increased flow from the nostrils, but it is then thinner, the stuffing of them first subsides, and then the discharge. In this way a common cold may often be cut short at once; and in all cases its continuance will be materially lessened. In cases of influenza, and hooping-cough, and measles, the importance of this use of the *Nasal* or Ori-nasal Respirator, in conjunction with all proper medical treatment requisite, cannot be too strongly insisted upon, the one acting as a friendly adjuvant to the other.

The above is a brief account of the direct action of Respirators. Its indirect use is scarcely less important, and is indeed that which has been looked to by the public too much, to the exclusion of its direct action.

It is the out-door use of the Oral or Ori-nasal Respirator which, from its valuable effect, has led too commonly to the neglect of the in-door use above described. The importance of fresh air, exercise, and a relief of the spirits, is so very great, that no cause tends more to retard recovery, and often even to aggravate disease in the chest, than the confinement within doors, which the action of the atmosphere upon the lungs or throat compels so many persons to subject themselves to. In not a few cases it has proved better to submit to the mischief arising from inhaling a trying atmosphere, rather than suffer the greater mischief of undermining the constitu-

tion by confinement. In the majority of cases, however, exposure was the worse evil of the two; and persons delicate in the chest had to confine themselves, throughout the winter, if they remained in England.

Now, however, by the employment of a Respirator of a power suited to their feelings, there are no invalids, strong enough to bear exercise, who may not with perfect safety go out all through the winter, and in almost any weather. Indeed the only care requisite in the use of the Oral Respirator is to practise breathing in and out through the mouth only; and, upon returning home, not to remove the Respirator unless the room is quite warm. If, on the removal of the Respirator, the air of the room is felt to be cold to the lungs, it should be replaced until a larger fire has been made; or, what is better, during a temporary attack, Respirators should be worn in-doors as well as out.

Again. Not only do the Oral, Ori-nasal, and hand Respirators enable invalids to enjoy fresh air without-doors, but with an Ori-nasal or Nasal Respirator especially, the invalid in bed may every day have the doors and windows of his room thrown open for ten minutes, and a pure and even frosty atmosphere may be freely admitted, the bed-curtains being kept well open; and this may be repeated two or three times a day. All the care requisite is to have extra bed-clothes put on, *to set the instrument at its highest power, if the weather is very cold*, (care being taken that it fits the face well,) to place a warm cap on the head, and merely to avoid gusts of wind from blowing so violently against the face as to disturb the action of the Respirator. The invalid must of course be careful to breathe both inwards and outwards through the instrument. For this reason the Ori-nasal or Nasal Respirator is to be

preferred; especially the latter, which is sure to fit well to the face around the nose, the mouth being then kept shut. The effect of such thorough ventilation in allaying low fever, and invigorating a patient, is highly important.*

There are other indirect, but highly important effects of Respirators, in order to appreciate which we have to keep in view a three-fold manner in which air, ungenial to irritated lungs, is injurious. In the first place, such air, by aggravating the irritation, increases, in no small degree, the tendency to that depositing of lymph throughout the interstices of the lungs, which causes an adhering together and condensation of their spongy texture. In the next place, even where the former does not occur, the lungs are never properly inflated, so long as the air inhaled is irritating to them: for such air is unwillingly admitted by them. They learn to do with as small a volume of it as will support life. During all this time, the chest may be seen, even from without, to contract more and more, through the habitually confined respiration. The manifest consequence of these two causes is the gradual destruction of many of the smaller air-tubes and cells—in fact, a condensing of their spongy texture into a structure like that of the liver. Again, the same scanty stock of air in the chest which fails to inflate the lungs to a natural degree, also fails to oxidate the blood properly. This important fluid does not undergo a healthy change and removal of its superfluous elements.

* This particular use of Respirators is not confined to affections of the chest and throat. It is applicable in all cases in which a frequent and copious ventilation of the air of a sick-room is desirable. Next to taking a patient out, bringing a fresh atmosphere into his chamber copiously is a most powerful mean for invigorating him, allaying fever, and inducing an appetite.

Its tendency to deposit some of these in the form of tubercles, in the lungs, increases as the natural breathing diminishes. Now, next to whatever active treatment may in the first instance be proper, no measure, pointed out either by sound theory or abundant experience, offers a more efficient corrective of these evils than does an atmosphere of a character so soothing as to be drawn into the chest freely, copiously, and comfortably. By allaying irritation, it tends to prevent the deposition of lymph in the interstices of the lungs. By keeping the cells and tubes properly inflated, it checks the tendency to condensation of their structure, and by encouraging the free indraught of oxygen, it favours the purification of the blood, adding those elements to the fuel of animal warmth which would otherwise form the material of tubercles. Just in proportion, then, as Respirators are found by any sufferer to afford such a soothing atmosphere, do they tend to effect these desirable results.

Added to these there is another effect of Respirators, too important to be left unnoticed. By saving to the animal system so much of its warmth, a Respirator prevents that chilling of the extremities to which a delicate state of the lungs renders many persons liable. This chilling arises from the inability of the lungs, when delicate, to part with the large quantity of heat carried off by the breath, without lessening the stock of warmth in the blood to such an extent that this fluid when it circulates to the extremities of the body cannot warm them. Their chilly state, and the unequal circulation of the blood resulting from it, are very injurious in disorders of the lungs. Every wearer of Respirators can hardly fail to notice the extent to which this evil also is remedied by them. Persons who suffered so greatly from chilliness of the

extremities, especially of the feet in bed, as to be able by no other means to keep them permanently warm, have found a Respirator, while on, to restore their warmth completely. And in every case the warming effect is considerable.

There is yet another point connected with the atmosphere of cities, in which the *mechanical* action of the Respirators is of value. They filter the air from particles of dust, soot, and even smoke, when the metal-work is moistened by the breath.* These impurities, when they are entangled in a fog, and densely concentrated, are trying to healthy persons; to weak lungs they are highly injurious. When a London fog penetrates into houses, invalids would do well to put on their Respirators. To the invalid poor who are compelled to go out, the protection afforded by Respirators is doubly enhanced in a London fog.

When the soundness of the medical principles upon which the Respirators are founded, and the extent to which they have actually realized their promise in the case of many thousands, are borne in mind, although the most important, the *indoor* use of them, is often neglected, it is beyond measure surprising that so many cases should be allowed to run on without the employment of these instruments, through all the early stages when the disease is curable; recourse being often had to them only when medicine can do no more, and when Respirators can only act as a palliative.

Though space is not afforded here for replying to the various ill-founded objections which have been raised to Respirators, sometimes in quarters where they were least to

* A military officer of rank, at Windsor, communicated to the inventor the fact, that with his Respirator on he was enabled to breathe without distress in smoke from buildings on fire, which, from its acrimony, compelled healthy soldiers, engaged in putting out the fire, to recede from his side.

be expected, there are one or two it may be well to notice. It is imagined by some persons that when a Respirator is worn, the impure breath is retained by it, so that a person breathes again his own breath. It would indeed have been erring against all physiological principle to have constructed an instrument so defective and injurious in its action. The mistake of thinking that so compact an instrument could detain the breath, could of course only be made by persons unacquainted with pneumatics; and these even will at once perceive their mistake, if they will bear in mind that the air of the breath, although invisible, has a determined bulk like water, and that, though elastic, it would require a great force to compress it, even in a small degree. If we breathe into an air-cushion, we may sit upon that our breath without materially compressing it. Now, since each outgoing breath has the volume of about three-quarters of a pint, and since all the waste space in a Respirator would not hold a cubic inch of it, it must be obvious to any understanding that all the breath, since it is not compressible, passes through the Respirator; and it is obvious to the sight in cold weather, when the breath, being rendered visible by the condensed vapour in it, may be seen to issue out copiously. The other objection is, that the use of Respirators must increase a person's delicacy and dependence upon them, so that he may even never be able to leave them off. The reader of these pages will perceive this objection to be not only directly opposed to all experience, but, from what has been already said, so entirely refutable by sound medical reasoning, that any person acquainted with medical science could only raise it from a want of reflection. The cases in which Respirators can never be left off, are those in which the parties had been still less able

to bear the air without them, many of them cases where the employment of them had been put off to the last. Even in these, where the disease itself is not making an irresistible progress, but has become stationary, the due employment of Respirators almost invariably diminishes delicacy in some degree, though, no doubt, they cannot be left off in cases which all the resources of medicine have failed to cure. Any case in which a dependence upon Respirators is permanent, is of this character only. The affection, whether serious or trifling, not being curable, requires a continued use of the instrument. But, on the other hand, the cases are numerous, where delicacy, the most extreme, has been so completely removed by a full employment of these instruments in the different forms required by the case, that, whereas the parties could not, when they commenced them, leave a warmed room for a minute without suffering, and dared not for many seasons place their foot beyond the threshold for nearly half the year, they have been at once released from confinement, and in a few seasons have grown wholly independent of them, even in severe weather.

The invalid will be at no difficulty in judging whether Respirators are likely to benefit him, if he will reflect upon a fact already referred to, that affections of the pulmonary organs, of whatever kind, sooner or later bring the membrane lining the windpipe and air-tubes into a delicate and irritable state. Directly this is the case, the chilling and drying action of the air becomes the grand cause, keeping up and tending to aggravate the irritation. Any person may tell whether this is his case or not, by his own experience, whether it does or not produce any, or all, of these symptoms on breathing it—soreness or tickling in the throat—cough—pain or difficulty in in-

haling it—hoarseness—and a constant desire to expectorate. If any of these symptoms are present, the air is, more or less, concerned in producing them, and Respirators may be expected to diminish or remove them; and they ought, if health be more an object than any question of convenience or appearance, to be worn, whatever may be the month of the year, and whether the person, at the time the air is thus trying to him, is within the walls of a house or without them, provided he does actually find, by putting on a Respirator of the right kind for some hours, any measure of comfort, little or great, to arise from its action. Let him bear in mind that *nothing increases delicacy so much as irritation and cough*, and *nothing restores tone and vigour so much as giving rest and comfort to a delicate and irritable part.* Hence in every single case in which Respirators would prove soothing at all, the sooner they are had recourse to, and the more constantly they are employed, the sooner may the wearer expect to be independent of them and able to lay them aside. They should always be *adjusted to that degree of power which suffices;* the power being reduced as the improvement takes place.

In fine, although every person, upon his attention being called to them, must perceive the following facts to be both obviously true, and most important to invalids, yet, from the novelty of the question, they are being constantly overlooked by them, in many instances to their serious injury. The following is absolute and obvious truth: no opinion, however learned, can either increase or diminish it. Whensoever a person shall find that in the winter his throat or chest is more uneasy, and his breathing or cough worse, than it is in the summer—or in the outer air, than in a warm room—or if he finds

a merely warm but *dry* air still trying to him, while one that is *moist* as well as warm proves comforting,—it is manifest that the difference between the suffering and comfort in each of these cases, whatever it amounts to, is due to certain qualities of the atmosphere he is inhaling at the time. The truth of this is as certain, and must upon reflection be as obvious, as that, to the presence, or absence, of a thorn in the flesh, would be due pain, or ease, in the part. Moreover, just as a certain native practitioner in India failed in curing his patient, by introducing medicines into his stomach, and putting opiate plasters on the part, while he overlooked a thorn of two inches in length buried in the foot; or (to take, not only a parallel but a similar case) just as any person suffering from irritation or inflammation of the skin, as from a blain, or a burn, would have no reason for surprise at his cure being tedious or never taking place (however skilful the general treatment might be), *so long as the air was allowed to dry, and at times to chill, the sore part,*—just as in either of these cases the cure, if it took place at all, must be effected at the expense of much time and suffering, so is it precisely with the sufferer in the throat or chest. Let his treatment in other respects be how skilful soever it will, he will have no reason for surprise (much as he may have for regret) should his complaint baffle all efforts to cure it, if the atmosphere shall continue to act directly upon the part, and indirectly upon his constitution, by enforcing confinement.

Hence, in his case, to put off the employment of Respirators to the last from some imaginary fear of a permanant dependence upon them, manifests as infatuated prejudice in him or in his medical adviser, let him be who he may, as would be that of the scalded sufferer, or of his

surgeon, who, from a preposterous fear of rendering the part delicate by over-protection, should put off a continuous guarding of it from the chilling and drying action of the air, until the limb or life was nearly sacrificed.

But some one may say, "There are numerous cases of throat and chest affections in which Respirators can effect no cure, and some that they cannot even palliate at all." We admit and lament the fact, and would rejoice at the discovery of an universal cure for them. But we beg any such objector to bear in mind that, in like manner, the cases of *external* affections are numerous, which no protective or other means can cure, and not a few which are scarcely palliated by them. We would, however, at the same time invite him to reflect that the instances are numerous, as well of affections of the air-passages as of those of the surface of the body, in which due management (by Respirators in the one case, and local treatment in the other) has a large share in the complete cure which is effected, or, where a cure is not effected, in palliating the suffering. He, therefore, would be an unwise sufferer whom the above objection should deter from availing himself, *at the outset*, of such protective means, pointed out as they are by reason as well as by experience, especially as they cannot in any case do harm. And let me here remark, that in nearly every case which has come before my notice in which Respirators were supposed not to suit, the fault has lain in the manner of employing them; either the wrong degree of power was employed, or the lips were placed directly in contact with the metal-work, or, in using the *Oral* Respirator, the wearer neglected to breathe only inwards and outwards through the mouth; or the case was one of the many in which the in-door use of a Respirator, especially

in form of the *Nasal* at night, was chiefly wanted; or, from an unwise parsimony, he had used the same Respirator for a length of time until its fine apertures were clogged with dust and soot it had filtered from each breath before it entered his lungs; or he had tied some other covering in front of it. To some one or other of these avoidable causes, any disappointment in the action of Respirators has been traceable. At the same time, although I have scarcely met with the case in which, *when properly employed*, they would prove of no benefit at all, I am quite prepared to suppose such cases do exist; but that there are any in which the trial of them could do the smallest injury, it is altogether an error to imagine. The sufferer, therefore, who values his health or life at more than the cost of these instruments, insignificant as it is compared with their objects, will not neglect the trial of them.

ON THE PHYSICAL PRINCIPLES AND MECHANICAL CONSTRUCTION OF THE RESPIRATORS.

A FEW words only can be afforded upon these, in a pamphlet like the present. Some outline of the physical action has been already given while we were describing the *medical principle* of Respirators. It was there stated that these instruments were designed for the purpose of recovering from each outgoing breath such a portion of the warmth and moisture brought away by it from the lungs and throat as would suffice, if stored up, and given to each fresh entering breath, to warm and moisten the latter enough for preventing it from chilling and drying the membranes it has to traverse, when they are in a delicate and irritable state. This may be considered the physiological portion of the physical principles, or that connected with the functions and properties of the living body. In considering the part of these principles dependent upon the properties of inanimate matter, namely, those of the materials of which the instruments themselves should be formed, we find that a large volume of air, the outgoing breath, though a very bad conductor of heat itself, and therefore slow to part with it, has to be stripped of its borrowed warmth in a period of time proverbially fleeting--literally, "in a breath." The matter which has to abstract the heat from it must therefore be possessed of the highest conducting power. It must be metallic; and amongst metals, the best conducting. Also it must act upon all parts or interstices of the breath at once. It must divide the breath into a multitude of minute layers, that it may get at the heat amongst all its particles. To

do this, the conducting metal, then, must itself be minutely subdivided, with small intervening spaces. But one conducting impulse would not suffice. One layer of metal would do little. There must be many; and each of these must be kept distinct from, and have no metallic connexion with, its neighbour, that each may have its own grade of temperature; each layer passed by the outgoing breath, being always some degrees cooler than the one behind it, and able therefore to draw warmth from the breath, after it would give no more to that warmer layer just traversed. So that, as in the case of the Respirators of highest power, while the innermost of the twenty layers shall be at a tropical summer heat, the outermost shall be so cool as to draw warmth still from breath, just as it is leaving the instrument, which by the nineteen previous impulses has been reduced to within a few degrees of the outer air. Such an arrangement of metallic layers, kept distinct from each other, is also the one most suitable for imparting warmth, step by step, to the entering fresh breath as it rises in temperature. Thus, when the entering breath, having traversed the outer layers, passes the innermost layer, it receives from it warmth still, although the breath is now twenty or thirty degrees warmer than the outermost layer which gave to it its first impression of warmth.

By the same arrangement which recovers warmth from the outgoing breath, and transfers it to the fresh in-coming breath, moisture is likewise distilled from the former and given to the latter. In order to command this necessary moisture, as well as the warmth, it is manifest the outgoing breath and the in-coming air must pass over the same metallic surfaces. If the breath be conveyed out through different channels from those by which the fresh

air is made to enter, though warmth would be transmitted through the substance of the metal, it is plain moisture could not. On this account, apart from other serious objections to it, I purposely rejected such a construction from the first, since it would render the entering breath hot and *arid*, a state tending to increase, instead of allaying a febrile or irritable condition of the parts. This very construction, however, has been recently projected as an improvement on Respirators! Unsupported by any scientific reputation in the constructor of it, it is not probable this faulty copy of some of the principles on which Respirators were founded, will mislead many persons. In the absence of any acquaintance with medical science, an attentive perusal of the present pamphlet it is to be presumed would have rendered evident to the projector the necessity of providing moisture as well as warmth. But an apparatus of the kind attempted is necessarily defective in construction as well as principle, being oppressive, and not admitting of being cleaned, a point well provided for in the Respirators.

The reader will here also perceive, at once, the error of any who represent the action of Respirators to be similar to that of the bulky woollen wrapper commonly tied before the face. Were it so, instruments which have proved of such effect, and been needed by sufferers in all past time, could not fail to have been long since provided. But the nature of the one is so far from being similar to, and suggestive of, the other, that no two things could differ more widely from each other. The object for which wool is created, that of keeping in the warmth of the animal it clothes, requires that it should be as perfect a *non*-conductor of heat as possible; and it is created by Him who is infinite in wisdom and in resources, to make it such.

When a mass of it, then, is tied over the mouth, and breathed through, it cannot conduct off heat from the breath. The breath which goes out carries its warmth away with it; but a certain quantity of the heated breath itself is entangled in the bulky folds of the wrapper, and re-enters the chest in the next indraught of air, which it thus warms in a small degree. A wrapper of wool over the mouth can warm the breath in no other way; and therefore in proportion as it has any effect worthy of notice, must the quantity of impure air which re-enters the lungs be considerable. The Respirators, on the other hand, are formed of material which is the best conductor of heat in nature. They therefore, as already observed, quickly separate the pure warmth from the impure breath, which passes out comparatively cold.

It will hence be plain that the employment of woollen wrappers, or a handkerchief, so far from suggesting Respirators, tended not a little to keep the right material out of sight, by diverting the attention to materials acting upon totally different principles. The fact however is, that the views respecting climate, and the wants of irritable lungs, already described, led me to seek in animal pneumatics for some principles upon which to base an artificial climate, and, upon their discovery, to found upon them instruments formed of materials possessed of the physical properties requisite for giving those principles effect. These instruments I named "Respirators."

Now, while the mind apprehends these operations as fast as they are explained, as being easy enough in theory, they become by no means so easy in practice, when the subject of them is the living, sensitive, and often fanciful being, man; especially human beings in their infirmities. Thus, it would not be possible to reduce the instruments

to as small a bulk,* and to render them as light, as some persons desire, without sacrificing the principle, or creating too great an obstruction to the passage of the breath.

In the case of the nose, desirable as an instrument is for that passage alone in some cases, the unavoidable appearance which a *Nasal* Respirator assumes, of sufficient size for due effect, precludes the possibility of wearing it *in public* in England. Again, in compliance with the wishes of the public, it has been necessary to substitute for the perforated and stained silver plate in front of the Oral Respirator, a shawl fabric, that the whole may assume the appearance of a handkerchief. Although this fabric is made for the purpose, with much care, it cannot be given both sufficient closeness of texture for screening the instrument from view, and at the same time freedom enough of texture not to offer some small resistance to the passage of the breath. Under these circumstances, the course taken has been to consult appearances as far as could be done without compromising principle to any serious extent. Hence, there are few persons who feel any oppression in breathing through this Respirator. But with the

* From a desire to deprive their Respirators of all appearance of thickness, some wearers, in opposition to a rule to which attention is particularly directed, neglect to keep the lip-rests of the Oral Respirator well drawn up from the surface of the metal-work, so that the latter may be kept clear of the mouth. On the contrary, they let these leather rests or tucks loose, and apply the mouth at once to the metal-work. The consequence is, they have to breathe through a portion of the instrument equal only to the opening of the mouth, the lips shutting out all the rest. Their instrument is thus practically reduced to a size less than that made for young children. As a necessary consequence they must find a difficulty in breathing through it. Also, the breath being hurried through it in proportion, the warming effect is diminished; and, lastly, a slight galvanic action is excited, which causes a metallic taste; but this is of smaller moment.

view of removing all obstruction from this cause, and of screening the oral instrument from side winds, which often blow the warmth out of it, I have recently directed the adoption of a front guard-plate with a fissure at the lower edge of it for the exit and entrance of breath—a form which I have throughout preferred—but have hitherto been deterred from introducing, from a desire to avoid adding in any degree to the projection of the instrument. The space required, however, has been gained from its thickness elsewhere. It would be satisfactory not to be under the necessity of thus descending into questions of appearance.

ON THE EFFECTS REALIZED BY RESPIRATORS.

The sufferer from pulmonary delicacy, who desires to maintain a correct view of the treatment his case requires, so far as climate is concerned, should bear well in mind, that although Respirators had never been invented, or had proved the trifling and insufficient articles they are represented to be by some, yet the medical views upon which they were sought, and the objects they were designed to serve, would have remained equally well founded and desirable. They would have remained unimpeachable, although neither the properties of matter nor the resources of art had offered to us any means by which to give them effect. But small and insignificant as these instruments may appear when viewed in relation to their bulk, or merely as a fine combination of wirework, the physical principles upon which they rest are so sure, and have

been so fully realized, as to have produced effects disarming the prejudice of every candid inquirer into them.

On suggesting, when first the oral instrument appeared, that it might possibly in some instances supersede the necessity of a residence abroad, I was held to entertain too sanguine an expectation.—I have since received every year communications from parties altogether strangers to me, grateful for the ability it gave them to remain, and even follow their avocations, in England the whole year through. Some of these have since informed me, that, under the use of Respirators, they had improved so much as to have been enabled to lay them entirely aside. What is still more remarkable, is the fact that there does not appear to be any natural* climate which can, with advantage, be entirely substituted for the soothing one afforded by Respirators; warm ones, like the West Indies, being very debilitating. Hence the oral instrument is to be seen upon the faces of invalids abroad, at Pau, Nice, &c.; and in England, at Hastings, Ventnor, and Torquay; and I have actually received more than one letter from India expressing the value of it to the pulmonary sufferer there, at certain seasons.

I ventured, as a part of the principle of their construction, to promise a marked benefit from the humidity reserved in the instruments and given to the entering breath. Numerous proofs of the value of this property are continually coming before my notice.

Again, it was evident, before the instruments were even tried, that the warmth they saved to the system should be manifested in the rest of the body. It was not long

* Unless it is that of the Middle Island of New Zealand, which appears to combine in an extraordinary manner an equability and mildness unknown in Europe, with a bracing and exhilarating influence.

before I met with persons who named the Oral Respirator "a great coat," from the extent to which it warmed their whole bodies: and others, elderly persons, who found it the only successful means of keeping their feet warm in bed.

I have met with asthmatics who had been bent down with oppressed breathing and cough, and emaciated from suffering and want of rest; who, being of that class of asthmatics who suffer chiefly through the trying qualities of the air inhaled, found in the Respirators a remedy passing all their hopes. Their figures have become considerably more erect, and they have actually gained flesh in a manner surprising to their friends.

In cases of ordinary sore or ulcerated throat, also in measles and hooping-cough, I have seen the employment of Respirators mitigate the symptoms to an extent a person unacquainted with the effect of the air on the irritable surfaces could not have anticipated. In several cases of measles, by allaying the irritation of the air-passages, and determining to the surface, the use of Respirators has promoted a return of the eruption, which had receded, to the great relief of the patient. I have heard of a Respirator acting as a specific in a case of spasmodic croup; and I cannot doubt that the action would prove a powerful adjuvant to the treatment of inflammatory croup, and that it might lessen the tendency of the irritable surface of the windpipe to throw out the artificial membrane, which so materially aggravates the suffocation in that disease,

Young persons, with all the symptoms of commencing consumption, have, by an early use of them, in a manner approaching to that for which they were designed, never lost the ability to take exercise, nor suffered a very long endurance of cough; and, as a consequence, have entirely recovered without leaving England at all. These have

been cases in which no such result could have been hoped for without these instruments.

In that class of affections called bronchitic, the effect has perhaps been the most remarkable of any. Instances have occurred of persons, confined altogether to bed, and there compelled to have a lamp burning within the curtains, who, upon employing a Respirator instead, were soon enabled to go out of doors under the protection of an oral one. In cases so numerous as to amount to many thousands, especially cases of chronic bronchitis, this instrument has immediately released from confinement persons who had been compelled to remain within doors, throughout every winter, for many years; and in almost every instance which has come within my knowledge, in proportion as Respirators were unremittingly used while the air was at all trying, and no attempt made to brave the outer air without the Oral prematurely, the wearer has perceived an improvement in the tone of the organs, and the dependence upon them has been more or less diminished. In not a few cases, persons very delicate when they commenced using them have become, by degrees, independent of them in any weather. In one case a lady, who in an attack in the month of September could find no comfort without one even within doors, had, by an unremitted employment of them, the tone of the air-passages so well restored, that in the middle of the following *winter* she could ride out without one;—one of the many cases proving the error of neglecting an early and free use of Respirators in the fear of becoming dependent upon them. In another instance, last year, a lady on the Continent was reduced to a critical state of debility by an incessant cough, and by the remedies employed, to which at last it refused, even temporarily, to yield. In her case, I have

no doubt the drying action of the air was the chief irritant. A person sent over to London on purpose for an Oral Respirator, on his return to England a second time, described her relief to be complete.

I have reason to think Respirators have saved some invalids from an excessive irritation and closing of the larynx, which would have rendered necessary, for the purpose of breathing, an opening of the throat by a surgical operation: and more than one case has come before me, in which I believe this trying operation, so dangerous in its consequences, might have been avoided by an early use of them.

In one very remarkable case I was invited to see a gentleman whose respiration was entirely maintained through an artificial opening in the throat, which had been rendered necessary by a closure of the natural passage of the larynx through repeated attacks of cold in that part, occasioned by the action of the atmosphere while he was under the influence of mercury. From the history of his case I can have little doubt that, by an early and steady employment of an Oral Respirator when out of doors, and of a suitable one during sleep, these attacks, so obviously caused by the atmosphere, might have been entirely avoided. Considerable difficulty attended the contriving of a *Throat* Respirator for this case, on account of the sharpness of the current of the breath propelled through the small artificial aperture. By giving the instrument a wedge-shaped form and a double surface, the difficulty was entirely overcome; and I had the gratifying intelligence that he had travelled with comfort under its protection. Nine months, however, after this, I received from him a pressing request that I would see him. Upon inquiry, he admitted that, contrary to my

earnest recommendation at the time I had contrived the Respirator for him, he had never used it within doors, having been dissuaded from doing so. He was now suffering from advanced disease in the chest; yet, as the inhaled air was evidently drying the mucus in the air-passages, converting what ought to be a soft lubricating fluid into an irritating crust, hard pieces of which he occasionally coughed out, and as the air of the room, though quite warm enough for the rest of the system, was of far too low a temperature to be admitted through a passage so near to the lungs, even if they had not been diseased, I urged him to let me fix on his neglected Respirator, and called the next day to hear the result. In the presence of a physician of well known ability and eminence, who had, I understand, recommended him to apply to me, he stated that the Respirator had removed "ninety per cent." of his cough, and had given him sleep at night of six hours' duration: rest he had long been a stranger to. Disease, however, had run to a fatal length, and soon terminated his existence. I have felt it a duty to detail this case as a warning to those whose attacks in the throat have any tendency to obstruct the natural passage to the lungs. By a right, and early, employment of Respirators within doors as well as without, with of course all other treatment proper, it is my belief that the necessity of an operation would rarely, if ever, occur *as the result of cold;* and when a sufferer is in this unfortunate position, he would do well to take warning from the case detailed, and to avail himself of whatever a *Throat* Respirator might do for him.

The *Nasal* Respirator, an instrument for the nose only, not being yet known and appreciated as its importance requires, it is right that I should make the reader ac-

quainted with what it is capable of effecting. An invalid who had been reduced to great debility by complicated disease in the liver and other organs, was barely convalescing under the judicious management of his physician, when he was seized with the prevalent influenza of the season, in the aggravated form in which it was fatal to so many. His incessant cough was imperfectly checked by the most skilfully prescribed medicines, every form of which distressed his stomach, or aggravated a low fever from irritation, under which he was sinking. At this critical moment, when his case had been pronounced hopeless, the *Nasal* Respirator was applied, and worn uninterruptedly, being often not removed even when he was swallowing food. Under its action his symptoms gradually subsided, the purulent expectoration ceased in a short time, and, so long as the instrument was on, there was scarcely any cough; but for some days it could not be removed, even for a few minutes, without a return of irritation. Yet within two months he was able to lay it aside, and, as the spring advanced, to disuse, gradually, even the Oral Respirator out of doors. The rapid decline of the symptoms in this case, especially of the low fever, was due not only to the direct soothing action of the Nasal Respirator, but to its indirect use. Once or twice every day, additional plates having been previously placed in his Respirator, the doors and windows of his apartment, while he was yet confined to his bed, were thrown open for ten or fifteen minutes, even when the weather was frosty, until a thorough ventilation of his room had taken place. The invigorating effect of this, each time, was manifest to his friends and attendants. It may be well to observe that the bed-curtains were kept at all times quite open.

Many parties in advanced pulmonary disease, with cavities in the chest, and therefore incurable, and who were led to expect their decease long ago, are now going on from year to year, some even actively engaged, under the protection of Respirators, their diseases having been brought to a stationary condition at the least.

In stating some of the remarkable effects of Respirators which have come under my observation, the wearer will not imagine me to hold out the expectation of such results in all cases. In too many the constitutional tendency to disease is so great that it will make progress against all efforts. In others it will be found to have advanced to a stage in which the best efforts can prove but feeble palliatives; and, *during the highly febrile state* of acute attacks, in all stages of disease, the patient may not be able to bear a Respirator, especially as the breath may be very dry; but in all cases one of low power ought at least to be tried, since the trial cannot possibly do injury, and since Respirators have, even in a very acute stage, proved a valuable adjuvant to the active treatment required. As soon as the acuteness of the attack is over, the Respirator is almost sure to be more or less beneficial; and I must again caution the reader against imagining that it is intended for out-door use alone. Within doors, if cough or other irritation in breathing is present, and upon an hour or two's trial any relief at all is experienced from a Respirator, this fact should be looked for as an important notice, and one should be worn *uninterruptedly*, as the surest local means for aiding proper medical treatment in quieting irritability and effecting a cure. As a caution to those who would neglect a proper employment of Respirators, it may be well to remind them of the fact, that the mind is naturally too

willing to forget, upon an exemption for some time, a previous tendency to illness. Hence wearers of Respirators are to be met with, who use them on account of the immediate comfort they afford, but overlook the extent to which they have warded off many an attack without their knowledge at the time, but which formerly, under similar exposure, had always supervened. And on the other hand, I have often known persons suffer severe attacks from exposure, without at all reflecting on the probability, in some cases the certainty, of their escape, had they but been protected by a Respirator.

OF THE VARIOUS KINDS OF RESPIRATOR.

The few remarks I shall offer under this head will not include any detail of the construction of the different kinds of Respirator, but be confined to their uses.

The Oral Respirator is, and will always be, the form chiefly employed, the mouth being the feature to which may be adapted, with the least projection, an instrument, the acting part of which has surface enough for full effect. Here I must remind the reader that, in the same weather, different invalids require very different climates, according to their degree of delicacy. Also that the same invalid ought not by any means to employ in all weather a Respirator set at the same degree of power. One that in severe weather would yield a climate equal to that of a pleasant summer air, would in milder winter or spring weather give to the atmosphere a tropical degree of warmth, which is much more than is in general needed or desirable. The opportunity, by employing the

different powers, of commanding in all weather one equable climate, is an advantage afforded by the Respirator, of no small value, *equability* of temperature being a point of much importance in all pulmonary complaints. By employing a low degree of power in milder weather, and a higher as the weather is colder, the lungs may be given a climate of greater equality than is to be found in any natural one. Hence this Respirator has, from the first, been made of different degrees of power; but as many persons neglected to avail themselves of this, I have recently had each single instrument, of all the better kinds, so constructed that the acting part shall be in two packets detachable from the mouth-frame; one of these packets yielding a low, and the other a medium power; and the two together, as high a degree of power * as most persons are likely to need in any weather.

The Oral Respirator is the one chiefly to be recommended out of doors; and, as already remarked, care must be taken, when wearing this instrument, to breathe in and out through the mouth alone. It is of no moment if some of the breath passes by way of the nostrils; but to whatever extent this occurs, the effect is lessened. By a few days' habit every person may learn to respire by way of the mouth when a Respirator is on.

For persons desirous of an instrument for both the mouth and the nostrils, the Ori-Nasal Respirator has been provided. It is an effective instrument, and well suited for use within doors and in sleep, but the appearance is against the employment of it out of doors, and it does not sit quite so comfortably on the face as the Oral.

* In some Respirators these packets are made of wirework of different degrees of fineness, the one being twice as open as the other, that it may suit the most feeble breather, in case the finer one is oppressive.

The NASAL RESPIRATOR is intended for use within doors only. As its name implies, this is an instrument for the nose alone.* Being constructed of perforated silver plates, it is not quite equal in effect to the Oral, but it has abundant power for in-door use. It is of especial value at night. Throughout the whole of a severe winter, a person delicate in the chest was able to occupy a bedroom so cold that water frequently froze in it. Though the fire was never lighted, he passed the winter through without a single attack of cold. The Nasal Respirator was put on before undressing, sometimes before leaving the warm room, and was not removed

* It is proper that the reader should be prepared against objections which have been hastily made, even by eminent men, and which are, curiously enough, contradictory to each other. Some have objected to any *Oral* Respirator, upon the ground that the nostrils are the usual channel of respiration, and have recommended me to invent, instead, a *Nasal* Respirator. On the other hand, no less eminent men have written to me, discountenancing any *Nasal* instrument, upon the ground that the nose is a kind of natural Respirator, which warms the breath by the extent of warm membrane it has to pass over; so that any instrument for this passage is, they say, superfluous. At the same time they have admitted the value of the *Oral* Respirator. Thus I have been favoured with high opinions exactly opposed to each other! The reason is, each party has committed an oversight. The former have forgotten that respiration through the nostrils is chiefly a matter of habit (persons from childhood in Europe being taught to keep their mouths shut), and they have also overlooked the fact that breathing by the mouth is soon acquired when comfort is felt through a Respirator over that passage,—a fact proved by many thousand cases annually. The latter, on the other hand, have forgotten that the nose is but a very imperfect respirator, otherwise any invalid would only have to keep his mouth shut, and might then go out in the cold, trusting to his nose. Every delicate person instinctively tries this, and catches cold in the nose in consequence, if not also in the chest: hence the invalid must *not* breathe through the nose while under the protection of the *Oral* Respirator. But when in-doors, if he desires to have his mouth uncovered, and to breathe through the nose, or if he does this involuntarily, as in sleep, he requires, and will find much comfort from, a *Nasal* Respirator. This truth is also abundantly borne out by experience.

until after rising in the morning. Also in the remarkable case related in page 39, the cure was effected by a *nasal* respirator. The power of this Respirator is variable in any degree by varying the number of the plates singly.

The last form I have to notice is the HAND RESPIRATOR. I contrived this instrument for persons not so delicate as to require a fixed Respirator. Having ascertained by many trials, that in the case of those who are not very delicate, a transient removal of the Respirator out of doors is not any more injurious than a transient passage from one room to another, and very far less so than continued exposure without any Respirator, I have ventured on the introduction of a Hand Respirator for such purposes. Though I would always prefer that the Oral should be worn by the very delicate, it is right to mention that the Hand Respirator has carried persons, much too delicate to use none, throughout successive winters in health, though they were daily out of doors.

In conclusion, I may be permitted to request each wearer of Respirators to bear in mind that it is by the accumulation of facts medical science is advanced. In a field so comparatively new as the present, facts are especially valuable as the basis for general conclusions. I have to express my obligations to all who have favoured me with those statements of their cases, and of the effects of Respirators upon them, which have formed the foundation of the *experience* detailed in the preceding pages. Any such communications are of course held to be strictly private. The value of them is in proportion to the fulness with which the nature and history of the complaints are detailed. It is hoped that few, who have leisure, will neglect a request the object of which is information by which the efficiency of the means for their

relief may, if possible, be increased. It is requested, therefore, that if any disappointment or difficulty should be experienced in the employment of any of the different Respirators, it may also be freely stated.

I shall be most happy to receive, and to give full attention to, any suggestions for their improvement; although out of the many proposals tendered to me there have been none which would not have introduced defects instead of improvements.* As to suggestions for the improvement of the appearance at the expense of the action, they are not to be entertained for a moment. All that it is possible to effect towards that end, without a compromise of the principles, has been done. Moreover, it is not the *actual*, but the *unaccustomed* appearance of Respirators which has been the real cause of trouble to the modish. Of this, familiarity is the best corrective; and, as Respirators are daily increasing in use, it is proving so. Hence the objections to the appearance seem to be little felt now. The question of dress and fashion, however, is foreign to our subject. Respirators were not invented for sufferers whose minds are absorbed by questions of appearance; but for those who are ready to avail themselves of any means providentially suggested for aiding the restoration of their health.

* For two fancied improvements patents have actually been taken out by different parties. One of these has been referred to in p. 31.

London: Printed by William Clowes and Sons, Stamford Street.