An essay on the nature and treatment of the Indian pestilence, commonly called cholera / by Henry Penneck.

AN ESSAY

ON

THE NATURE AND TREATMENT

OF

THE INDIAN PESTILENCE,

COMMONLY CALLED

CHOLERA.

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London:

Printed by Compton and Ritchie, Middle Street, Cloth Fair;

AND PUBLISHED BY S. HIGHLEY, 32, FLEET STREET.

1831.

TO DR. CLUTTERBUCK.

MY DEAR FRIEND,

THE following pages contain, with additions, the substance of an Essay which I communicated to you some months since, and which was at that time submitted to the Russian government. Many of the opinions I have embraced are founded on the study of your work on Fever; to which class of diseases, and not to Cholera, I firmly believe this Indian pestilence to belong. Permit me, then, to introduce it to the Public under the sanction of your name, in proof of the high respect I have always entertained for you, and of the friendship which has so long subsisted between us.

I am your's, very sincerely,

HENRY PENNECK.

Penzance, Nov. 24, 1831.

AN ESSAY, &c.

THE great interest which the disease called Cholera has excited in the public mind, has induced me to examine very many of the papers which have been written on the subject, describing its symptoms, and the appearances on dissection. I have compared the descriptions contained in the Bengal and Bombay reports, and other Indian documents, on the one hand, with the accounts of the Russian Cholera given in the reports of Sir William Crichton, Drs. Keir, Russell, Barry, and others, on the other hand; and I have found the strongest reason to acquiesce in the conclusion which is most generally drawn, that the disease is identically the same in both countries, subject only to such variations as different climates may be well supposed to produce, and only modified by the fevers most prevalent in them. I am also convinced this disease is very distinct from the disease usually called Cholera in this country; and further, I hope to make it appear, that it is clearly and essentially a specific form of fever.

That I may not too much increase the bulk of this paper, I beg to refer at once, for the full detail of the symptoms and dissections, to the valuable documents already published by the Board of Health, quoting only such passages from them and others, as I may find it necessary to remark on. I observe the vomiting, purging, cramps, and suppression of all the secretions, coldness, and blueness of the skin, are made

to occupy the first place, whilst it is "observed*, that all the functions employed in carrying on life are suspended, or alarmingly weakened, except that of the brain, which appears in these extreme cases to suffer little, the intellectual powers usually remaining perfect to the last moment." When it is said that the functions of the brain "suffer little," I presume the intellectual powers only are intended, since the writer has just acknowledged, that "all the functions employed in carrying on life were suspended or weakened;" for what are these functions, if they are not either functions of the brain (considering it with its continuation, the spinal chord, as a whole), or functions in immediate subordination to it. It appears to me, that the loss of heat and circulation on the surface, and the vomiting, purging, cramps, and suppression of the secretions†, and "the loss of bodily power, as if the patient were suddenly struck down, or placed under the immediate effects of some poison," are the most striking evidences of the deranged action of the brain.

The Bengal report states, that, "the powers of voluntary motion were in every instance impaired, and the mind obscured: the patient staggered like a drunken man, or fell down like a helpless child. Headache, over one or both eyes, sometimes, but rarely, occurred. The pulse, when to be felt, was regular and extremely feeble, sometimes soft, not very quick; usually ranging from 80 to 100: in a few instances it rose to 140 or 150 shortly before death. Then it was distinct, small, feeble, and irregular. Sometimes very rapid, then slow for one or two beats. The mouth was hot and dry; the tongue parched, and

* Board of Health, 1st Pamphlet, p. 4. † Ibid. p. 2.

deeply furred, white, yellow, red, or brown." If the patient survived the cold stage, "the fever, which invariably attended the second stage of the disease," "partook much of the nature of the common bilious attacks prevalent in these latitudes. There was the hot, dry skin; foul, deeply-furred, dry tongue; parched mouth, sick stomach, depraved secretions, and quick variable pulse: sometimes with stupor, delirium, and other *marked* affections of the brain."

Mr. Orton, in his Essay, observes, that "in a large proportion there is no appearance of spasm in any part of the system. In many there is no purging; in some, no vomiting; and in others, neither of these symptoms." "These last were by far the most dangerous cases, and the patients died under them, often in an hour or two; the nervous power appearing to be exhausted almost instantaneously, like the electric fluid from a Leyden-jar."

"Several instances were heard of at Hoobly, and other places, of natives being struck with the disease whilst walking in the open air; and who, having fallen down, retched a little, complained of *vertigo, deafness, and blindness;* and expired in a few minutes. Mr. Gordon mentions many cases of this kind. At Bellary, a tailor was attacked with what was supposed to be Cholera, and *instantly* expired, with his work in his hands, and in the very attitude in which he was sitting." Mr. Orton observes, that the bile appeared in excess only in the milder cases; and the cases which appeared after this were all of a different nature, and much less severe.

Drs. Russell and Barry remark, that when the disease comes on rapidly, "*violent vertigo**, sick stomach,

* Board of Health, 1st Pamphlet, p. 29.

nervous agitation, intermittent, slow, or small pulse; cramps beginning at the tips of the fingers and toes, and rapidly approaching the trunk, give the first warning; then there is scarcely an interval." In the cold stage, they observe, "the features become sharp and contracted, the eye sinks, the look is expressive of terror, wildness, and, as it were, consciousness on the part of the sufferer that the hand of death is upon him:" "sometimes there are tetanic spasms of the legs, thighs, and loins*;" "the secretion of urine is always totally suspended, nor have we observed tears shed under these circumstances†: vomiting and purging, which are far from being the most important or dangerous symptoms, and which, in a very great number of cases of the present epidemic, have not been profuse, generally cease, or are arrested by medicine early in the attack." "Frictions remove the blue colour for a time from the part rubbed; but in other parts, particularly the face, the livor becomes every moment more intense and more general. The lips and cheeks sometimes puff out and flap, in expiration, with a white froth between them, *as in apoplexy*. If blood be obtained in this state, it is black, flows by drops, is thick, and feels to the finger colder than natural."

They go on to remark on the fever or hot stage‡, that, "after the blue cold period has lasted from twelve to twenty-four, seldom to forty-eight hours, or upwards, the pulse and external heat begin gradually to return; *headache* is complained of, with *noise* in the ears; the tongue becomes more loaded, redder at the tip and edges, and also drier. High-coloured

* Board of Health, 1st Pamphlet, p. 30. † Ibid. p. 31.

‡ Ibid. p. 32, 33.

urine is passed with pain, and in small quantities: the *pupil is often dilated.*" "*Ice to the head* gives great relief. In short, the patient is now labouring under a continued fever, not to be distinguished from ordinary fever. A profuse critical perspiration may come on, from the second or third day, and leave the sufferer convalescent; but, much more frequently, the quickness of pulse and heat of the skin continue; the tongue becomes brown, and parched; the eyes suffused and drowsy; there is a dull flush with stupor and heaviness about the countenance, much resembling *typhus;* dark sordes collect about the lips and teeth; sometimes the patient is pale, squalid, and low, with pulse and heat below natural: but with the typhous stupor, delirium supervenes; and death takes place from the fourth to the eighth day, or even later." "To give a notion of the importance and danger of Cholera fever, a most intelligent physician, Dr. Reimer, of the merchant hospital, informs us, that of twenty cases treated under his own eye, who fell victims to the disease, seven died in the cold stage, and thirteen in the consecutive fever*."

"This singular malady is only cognizable with certainty during its blue or cold period. After reaction has been established, it cannot be distinguished from an ordinary continued fever, except by the shortness and fatality of its course. The greenish, dark, and highly bilious discharges, produced in the hot stage by calomel, are not sufficiently diagnostic†; and it is curious, that the persons employed about these typhoid

* I must object to the term "consecutive fever," which tends to mislead; as if, instead of part of the same disease, it was a new and distinct complaint.

† Board of Health, 1st Pamphlet, p. 34.

cases, when they are attacked, are *never* seized with ordinary fever, *but* with a genuine cold, blue Cholera."

In one set of cases Dr. Keir says, "the patient looked as if he had been brought to the ground by a violent blow, or a stroke of lightning, so great was the oppression of the vital powers. In such cases it was evident, that the action of the vital organs, and particularly of the heart, had been paralyzed at a very early period of the attack. Here, all human aid was vain: the patient frequently died before there was time to try any remedy." In what he calls one form of the second period of the disease, there was "a congestive sub-inflammatory state of the brain and spinal chord: this last, as was natural to expect from the nature and seat of the affection, proved by far the most dangerous and most frequently fatal form of the second period." "The patient complained of pain in the back, between the shoulder-blades, or in some other part of the spine, sometimes along its whole tract. He appeared sleepy to such a degree, that at first I was disposed to attribute this, in part at least, to the effects of opium given in the first period; but I was soon convinced that the cause of this symptom, and of another strongly characteristic of this form of the disease, namely, the filling of the vessels of the sclerotica with red blood, was a congestive sub-inflammatory state of the brain and spinal chord." "This state of the patient generally ended in complete coma."

These extracts shew how much the brain was affected, and give rise to the inference, that disordered action of that organ, produced by a specific poison, paralyzed the whole nervous system; suppressing the secretions, and extending to the action of the muscles,

both voluntary and involuntary: hence, the blood remained carbonized, and the heart and arteries so debilitated as hardly to propel that fluid, which became nearly stagnant, and thus is accounted for the blue and livid colour of the surface of the body; hence too, most probably, the congestion in the large viscera, from their loss of tone and contractility, resulting from their loss of nervous power. Again, the stage of excitement, or hot stage, followed the cold stage, both in India and in Russia; and in the latter country, according to the observations of Drs. Russell and Barry, the symptoms scarcely differed from those of typhus fever, and indeed are called by them "typhoid symptoms," *yet communicating* to the attendants the cold blue Cholera, and *not*, in the first instance, symptoms of the second stage. These facts clearly shew that both are parts of one and the same disease, and that disease a species of typhus. As, then, we have the typhus *icterodes*, and the typhus *pestis*, would not the blue typhus, or typhus *cæruleus*, be a fitter name for the disease than any hitherto proposed, and, by thus furnishing a clue to its nature, lead to a more successful treatment?

The appearances on dissection, as far as could be expected in a disease which runs its course so rapidly, strengthen the conclusions I have drawn from the symptoms.

When death occurred in a very early stage of the disease, the brain, stomach, and intestines, &c., were little altered*. "The bodies exhibited hardly any unhealthy appearance;" from which it seems fair to suppose, that death was caused by disordered action of the brain, disturbing the functions in general, and

* Bengal Report.

that the other symptoms were the result of its extensive sympathies, and that time had not been allowed for diseased appearances to take place. Afterwards, in addition to morbid changes in the brain, there was "a congestion in the whole venous circulation of the larger vessels" and the viscera* : of this common occurrence I have just given what I believe to be a satisfactory explanation. In the latter stages, it seems agreed on all hands†, that "those who died of the subsequent illness, shewed no appearances after death different from such as are usually observed in other cases of febrile disease, attended with corresponding symptoms."

Dr. Keir's account of the appearances after death strongly support the above view of the subject: "on opening the skull," he says, "the bloodvessels of the brain and its membranes were more or less turgid with blood, particularly towards the base; the arachnoidea had sometimes in several places lost its transparency, and adhered to the pia mater: a fluid was sometimes effused into the convolutions of the brain in some quantity, and more or less of serum in the lateral ventricles. The bloodvessels of the vertebral column and spinal chord were more or less loaded with blood, which was sometimes effused between its arachnoid and dura mater: partial softening of the substance of the spinal chord was sometimes met with, and marks of inflammatory congestion in the larger nerves. The lungs were generally gorged with dark-coloured blood; the cavities of the heart filled with the same." "Both stomach and intestines bore marks of congestion, and of a sub-inflammatory state." "The colour of those parts also varied a good deal; from dark-colour-

* Board of Health, 1st Pamphlet, p. 10. † Ibid. p. 11.

ed venous congestion to rose-coloured inflammation. In one case, the internal surface of the stomach was so strongly and so generally tinged of a very dark colour, that it might easily have been mistaken for gangrene ; but, on exposing the stomach between the eye and the light, it was evident that there was neither gangrene nor solution of continuity, but that the dark colour proceeded from a very general and great congestion of dark-coloured blood in the vessels of the organ. The subject of this case, I was told, had died with symptoms of a typhoid nature, after suffering from the usual symptoms of the epidemic. Excepting in this case, which was evidently one of congestion, and not of inflammation, I saw nothing in the morbid appearances from which a conclusion could be drawn, that inflammation was a very general morbid change in the alimentary canal, or a common cause of death ; however, by its presence in the second period of the disease, it might add to the general irritation, or, even as a consequence of preceding congestion, be itself occasionally the cause of the fatal event. Both stomach and bowels were frequently of a paler colour than natural, both on the outer and inner surface ; but neither thickening or condensation from inflammation, nor exulceration, destruction of substance, nor abscess, appeared in any of the dissections I was present at."

To sum up my conclusions, it appears to me established by the symptoms and dissections ;—1st. That the Indian malady is a disease very different, and indeed altogether distinct, from the common Cholera of this country. 2dly. Whatever may be the variations of the second stage, still the disease is, in its main features, everywhere identically the same, only

modified by the fevers incident to the countries in which it rages; shewing in its second stage many characters of a bilious fever in India, and of common typhus in the more northern countries; for few, I presume, will venture to assert that the second stage in either is a different disease, but, on the contrary, be ready to allow, that it constitutes with the first one and the same disease; and, lastly and chiefly, that the most important organ, the brain, "which exerts a paramount influence in the system, regulating the feelings and movements of every part"*, is severely affected, and that from its disordered action the whole system suffers; and that thus are produced all the phenomena of a specific fever, which is decidedly the nature of the present disease.

The fatality of the disease hitherto, in spite of the most vigorous practice, has been unexampled, and hence there is every reason to conclude that a change in the treatment is absolutely necessary. But before any new plan is recommended, it will be proper briefly to mention the remedies which have been hitherto principally employed.

The Indian method has been stated† to have consisted in bleeding,—and calomel from ten to twenty grains, with one or two grains of opium, or a drachm of laudanum in a dose; repeated, if necessary, every four, three, and in some cases every two hours, until the urgency of the symptoms abated; whilst some continued to give them "without regard to quantity," till the same end was produced. To these were added the liberal use of the most diffusible stimuli, as spirit of nitric ether, ammonia, camphor, and camphor

* Dr. Clutterbuck on Fever.

† 1st Pamphlet by the Board of Health chiefly.

mixture; hot arrack and water mixed with spices, essential oil of peppermint, the hot bath, and stimulant embrocations. Others depended exclusively, from the first, upon large doses of opium, and highly pungent and diffusible stimulants. Others, as soon as the vomiting ceased, gave purgatives, of which calomel was commonly the principal ingredient; some used the more ordinary laxative medicines. "An opinion was entertained by some, that calomel alone was the best sedative of the vomiting, and relieved the anguish occasioned by the burning heat at the præcordia; but the evidence in favour of this fact is met by so many contrary statements, as to leave the question in great doubt." Cajeput oil has been mentioned to the Board of Health, as having been used with beneficial effect in India. "Of external stimuli, blistering plasters of cantharides were applied to the scrobiculus cordis; or, in cases of great depression, boiling water, so as to cause an immediate blister; nitric acid was also applied, and neutralized by chalk, to prepare the skin for the application of the blistering plasters, and enable them to produce their effect with more expedition; sinapisms to the same part, to the feet, calves of the legs and arms; hot baths at the temperature of 112° of Fahrenheit's thermometer, vapour baths, fomentations, simple friction with warm flannels, bottles containing hot water, hot sand, frictions with various liniments," &c. Others gave "magnesia in milk, to the amount of a drachm or more every half hour or hour," but with doubtful advantage: "emetics were given by some practitioners, but not generally." "Almost every plan seems to have had its success and failure;" but if the patient's life was protracted for seventy-two hours, he almost always

recovered from the seizure. But the remedy described to have been most uniformly successful, when it could be used, was "bleeding, and this even in cases when the pulse was scarcely perceptible at the wrist." "In the lighter cases, or in those of a severe nature which came under medical treatment before the pulse at the wrist was lost, or had become fluttering, bleeding was attended with the most decided advantage. The oppression of the chest, the burning heat of the præcordia, the spasms, the vomiting and purging, are stated in some instances to have ceased at once; in others, on a repetition of the bleeding. In such as allowed a free extraction of blood, these effects very uniformly occurred; but even in some when the pulse was indistinct, bleeding was successful if it could be carried to the extent of eighteen, twenty-four, or thirty ounces; the pulse rising in power, and becoming more distinguishable, in proportion to the flow of blood. If the pulse, in this state of feebleness, was distinct enough to give the finger the feeling of oppression, bleeding was almost always successful. The blood drawn was almost always black, whether from a vein or an artery, and flowed with great difficulty, commonly at first coming from the vein in drops, and gradually in a stream; but before it could be induced to flow with freedom, the patient often required the warm bath, friction, and internal stimuli, to produce a sufficient quantity for his relief." This black blood was not inflamed. The quantity of blood required for relief "depended on the abatement of the symptoms," and "the change of blood from a black to a more florid colour."

"It is to be observed, that though sometimes bleeding was followed by immediate sleep, restoration of

the pulse, and natural warmth, and a speedy solution of the disease, it appears never to have been solely relied upon, but to have been followed or accompanied, more or less, by the other plans of practice above mentioned."

Comparatively little information has been afforded us respecting the treatment in Russia. As far as can be collected from the very imperfect accounts of it, the Russian practice has been chiefly borrowed from that of India; with, however, more reliance on the application of heat, and also on the excitement of diaphoresis, the occurrence of which has been considered to denote a favourable crisis. "No patient recovered in Moscow," says Dr. Hermann, "without this critical secretion." To produce it*, "after bleeding, vapour and warm water baths, warm drinks, aromatic and stimulant frictions, were applied." At Warsaw, poultices of hempseed, wrung out of warm water, were wrapped over the entire body as warm as they could be borne, and renewed as they cooled, till a profuse perspiration was produced. Drs. Russell and Barry mention Dr. Leo's remedy, the subnitrate of bismuth, and express a favourable opinion of it†. No method employed has, however, in any considerable degree, diminished the prodigious mortality of the disease; I will not therefore lengthen this detail of treatment, which, though occasionally followed by apparent success, has on the whole proved very unavailing. Gen. Wilson's letter, of August 9th, to Dr. Barry, mentions two non-medical men, one Pruhen, a stocking weaver, who cured three patients by

* Sir W. Crichton.

† M. Chamberet gives a different account of its success.—See *Lond. Med. Gaz., Oct.* 29, 1831.

giving warm milk till the vomiting ceased, and then a table-spoonful of olive oil, rubbing the extremities, &c.: and a Mr. David Bell, who had some directions from a medical man in the town, and had himself been benefitted by the following plan: "He had above one hundred cases," from the 1st of July to the 8th of August, "of whom he lost five. Some of these cases were slight, but many were very serious—only, being taken early, were relieved." Very warm water as an emetic, castor oil, with twenty to forty drops of laudanum, and afterwards a table-spoonful, once an hour, of a mixture composed of equal parts of castor oil, honey, and camphorated mixture, with some drops of ether, were his only internal medicines. Frictions of the joints and extremities, and blisters on the pit of the stomach, with the foot bath, sometimes taking the patient to the boiling-house, where the temperature is above 90° Fahrenheit, were the principal means employed by him, giving light nourishing food as soon as the attack yielded to his exertions."

M. Chamberet, one of the French medical commission at Warsaw, has recently stated*, at a sitting of the French Academy of Medicine, that the Physician General there affirmed, that the mortality was not greater among those left totally destitute of medical aid, than among those who enjoyed medical assistance; and that the mortality was probably, on the whole, about fifty per cent!!

I have now sketched the treatment hitherto most generally employed; still, before I enter on the description of that which I mean to propose in its stead, it may be thought necessary that I should make some apology for presuming to treat of a disease, which I

* London Medical Gazette, Oct. 29th, 1831.

have not had an opportunity of witnessing in practice. In so doing, however, I am not without precedents. Dr. Cullen and Dr. Fordyce, two of the most eminent teachers which this country has produced, both acknowledged they had not seen either the plague or the yellow fever; on which diseases, however, they wrote and lectured; and those who were taught by them were sent out to treat those diseases in the countries in which they were prevalent. On the present occasion, it seems to me imperative on every medical practitioner who thinks he has any thing important to state, to step forward and produce it, for, in the words of the immortal Nelson, "England expects every man to do his duty;" and therefore, as a pupil of Dr. Fordyce, as well as after fifty years' experience in the treatment of disease, I feel emboldened to lay before the public what I conceive will be found, as deduced from a rational theory, to be a more successful plan of treatment than has hitherto been employed; and the more so, as it may be used with some parts of the present treatment, which have been considered as founded on great experience.

Nearly all the articles of the materia medica have indeed been exhausted, and hitherto have unfortunately failed; but I think we need not despair: for, to use a remark of my friend Dr. Clutterbuck, "it is not so much new remedies we require for the cure of diseases, as the right application of those we already possess." From the view I have taken of the nature of this disease, the most successful treatment of which we have been informed, seems to me to depend on relieving the oppression of the brain, which causes the irregular distribution of the circulating medium; on allaying the spasmodic and other sympathetic affec-

tions; and on producing a new action to supersede the effect of the specific poison; upon the principle laid down by Mr. John Hunter, that two dissimilar diseased actions cannot subsist in the system at the same time. Bleeding seems to have answered the first purpose; heat, stimuli, and narcotics, have been employed for the second; and the powerful aid of mercury (when it succeeded, though intended for another purpose) effected the third. It is by regulating the treatment on these principles, and applying the remedies differently, rather than by the use of new ones, that I propose to cure the disease.

Bloodletting.—Before I enter on the subject of bleeding in this disease, I must remark on two forms of its attack: the first, in which nausea, vomiting, diarrhœa, or general disorder of the system, precedes for hours, or even days, the cold blue stage (although, if this period be neglected, the same severe stage takes place); and the second, in which the patient is at once struck down with the cold blue stage, with the pulse at the wrist scarcely if at all perceptible. These two forms of attack, apparently unlike, require a treatment similar in effect, though different in the mode of application. There are probably, however, all the gradations between them, in which the treatment must be varied accordingly. It seems well understood, that bleeding from the ARM can only be performed with the greatest advantage in the early period of the disease. When the disease was neglected, and the cold blue stage was fully formed, bleeding from the arm, except the system was previously excited, could not be performed at all: and the same observation applies where the cold stage came on suddenly, or very early, and before the patient applied for relief.

This is exemplified in the practice of Dr. Burrell, as described in his letters from Seroor, July 27th, and August 10th, 1818. "The soldiers of the regiment, not aware of the danger of the disease, did not report themselves for the first days after they felt unwell. These cases comprised the admissions of the 21st and 22d instant." The second stage was probably formed, and they appear to have nearly all died. After the 22d, when the men had been duly warned of danger from not reporting themselves sooner, I got into the hospital a different description of cases, viz., men with a full pulse, hot skin, constant vomiting of white matter, like thick conjee, but seldom any purging; if this existed, it was like the matter vomited." "On admission I bled in every instance, in general to a good extent: where universal spasms existed, venesection was carried on *ad deliquium*, the patients being at the same time in the hot bath at 110 degrees: the spasms were invariably relieved, and nausea and vomiting alleviated." "In a hundred cases, eighty-eight were bled, and twelve not bled: of the eighty-eight two died; of the twelve, eight died."

These cases were probably all men in the prime of life, well fed, well clothed, and well lodged in the cantonments; they were, perhaps, the reverse of the subjects usually met with in towns; for the greater number of victims to this disease have been persons either debilitated by previous diseases, bad habits, living in ill-ventilated habitations on an insufficient diet, or exhausted by fatigue: and the pulse in such was almost always feeble, and sometimes scarcely perceptible.

However expedient bleeding from the arm might be found in Dr. Burrell's cases, it does not seem to promise much after the blue cold stage is set in, when

it becomes a matter of difficulty to abstract blood freely from the arm. Dr. Kennedy's remark bears strongly on this point: he says, "I always feel it a subject of regret when I cannot bleed; it is, in my mind, next to the patient's death-warrant when I decide that the critical moment is passed, and he is no longer capable of undergoing it." But according to the theory I have advanced, that the essence of the disease is disordered action of the brain, producing derangement of the functions, I conceive abstraction of blood will still be absolutely necessary to relieve the oppression of the brain; but that it is desirable it should be drawn so as to produce a great effect, and yet the smallest quantity be lost to the system. I intend only to make a rapid impression on the vascular system of the brain, rather than to produce permanent debility. This can be best done by the rapid abstraction of a small quantity of blood from near the seat of the disease; and if more is deemed necessary, it may be allowed to flow from the same place*. For this purpose I would recommend *the method* reported in the Medical Gazette for January 1st (ult.) 1831, by Dr. Pritchard, as practised in the hospital at Bristol under his direction, in cases of hemiplegia, hydrocephalus, and "stupor or coma occurring in the course of severe typhoid fever, and in which the patients appeared to be sinking;" and which, he observes, "I believe to be applicable to all those disorders which are attended with stupor or a tendency to coma; and perhaps to all affections which depend either wholly, or in part, on increased action or increased fulness in the vessels of the encephalon." "I would advise an incision to be made completely

* It is not the quantity of the blood, but the effect produced by the rapid impression, that I am desirous of inculcating.

through the scalp, for the length of four or five inches, over the sagittal suture." Dr. Pritchard's object was "to separate the edges of the wound by a row of peas," and thus to convert it into an issue; which, of course, would not be required on the present occasion. But having practised Dr. Pritchard's plan, and observed how freely the blood was discharged, and how the headache of the patient was instantly removed (probably from abstracting the blood through the suture as well as from the vessels of the scalp), and the great facility with which the bleeding could be stopped, and how quickly the wound healed, I feel convinced, that, in severe cases of Cholera, this will be found more efficacious than any other method of bleeding. Dr. Pritchard speaks of his reluctance at first to use often what appeared a severe remedy; but he afterwards found that his issues, made in this way, did not occasion more suffering than setons; which observation my own experience confirms: and I therefore think that no hesitation can be felt in cases of such imminent danger as the Cholera constantly presents*. The advantage of bleeding in the cold stage of one class of fevers—the intermittents—has been proved by Dr. Macintosh and others.—*Lancet*, vol. i, 1828-29†.

Hot-air Bath.—Next to bleeding I would endeavour, after Dr. Armstrong's method (when treating of the cold stage of what he calls "common conges-

* If, however, the blood should possibly at any time not flow freely from the incision, cupping glasses to abstract blood from parts of the head or near it, in sufficient quantity to relieve the symptoms, should be used: leeches are too slow in their operation. The temporal artery may not be found, or if found may not bleed; and the jugular vein may be too flaccid to be opened, and compressing it may be very objectionable.

† Bleeding in the cold stage of an intermittent fever (a disease

tive fever"), to restore the heat of the body by the hot-air bath, in preference to a hot-water bath; because the latter, without any superior advantage in effect, is more inconvenient in use. The patient cannot, without exhaustion, be kept in it for hours, if the cold stage should continue so long; and in moving out of and into bed, he must suffer from fatigue, and also be exposed to cold when wet: few remedies too can be applied at the same time. The hot-air bath may be continued for any period during which the cold Cholera may last, and admits of the use of other remedies, particularly such as I am about to propose.

Dr. Armstrong's description of his hot-air bath is as follows* :—" It consists of a frame of basketwork, of an arched shape, and about six feet in length, open at one end, and at the other there is a piece of wood with a hole in the centre. This frame is laid over the patient when in bed, and over it is placed a blanket or two, and these are tucked under the patient's chin. A tin tube is then passed into the hole at the bottom of the frame, and in the lower part of this tube a little spirit-lamp is placed lighted, and the apparatus is complete. The air, heated by the lamp, passes up the tube, and is brought in contact with the surface of the body of the patient." Or, in a still simpler way,

always arising from a specific cause, though not contagious) has often carried off the fever; and even when the fever has returned, it quickly gave way to sulphate of quinine, which before had failed. So in contagious fever, bleeding has facilitated the introduction of mercurial action, which has removed the disease. Both diseases, I conceive, are excited by affections of the brain; both give rise to sympathetic affections: intermittent fever to diseases of the liver and spleen; the Indian pestilence, or Cholera, to diseases of the abdominal and thoracic viscera. It seems many local diseases were originally only sympathetic excitements of the organs, become permanent by continuance.

* *Lancet*, vol. v, p. 81.

the blankets may be supported by a cord fastened lengthways over the patient, as mentioned by Mr. Alcock. While using the hot-air bath, the patient may be surrounded with jars of hot water wrapped in flannel.

Mercurial Fumigation.—I might now speak of the use of stimulants and narcotics, for allaying the spasmodic affections, vomiting, &c.; but, as more immediately connected with the hot-air bath, I will mention, in the first place, the following method of mercurializing the system:—in a disease which runs its course so rapidly, time is of the greatest importance; I should therefore attempt to effect this object, mercurialization, in the least possible time by means of fumigation, with the powder recommended by Mr. Abernethy, and as particularly described in Mr. Cooper's Surgical Dictionary, edit. 1825. The formula for the powder is as follows:—"Two drachms of liquor ammoniæ are added to six ounces of distilled water, and four ounces of calomel are thrown into this liquor, and shaken up with it: the powder is afterwards separated by a filter, and dried." As Mr. Abernethy's mode of using it is not applicable to the state of the patient in this disease, and as it will be necessary to fumigate him in bed, I would recommend the following instrument for this purpose (if no better is in use):—It should have a receptacle like the inner part of an urn, to contain an iron with a concave top, the iron to be heated red hot; over this a cap is passed down fitting it closely, on the top of which are two openings, one to drop the powder through, which has a valve like the valve of a powder-flask; the other with a tube somewhat inclined, to conduct the fumes over the patient's naked body, on which they will be condensed. The whole instrument is placed in a

small wicker basket, which, if introduced under the blanket, raised, as already described, will secure the patient from being scalded. He should be turned from side to side, that every part of his body may be exposed to the fumes. In this way, during the state of collapse, the patient may be constantly exposed to the heat of the mercurial fumigation, with, or perhaps even without, the lamp of the hot air-bath, until the heat of the body is restored, and ptyalism takes place. If any interval of its disuse should be necessary, he should put on " a complete woollen dress, having its inner surface fumigated with the same powder." Mr. Abernethy, in his Lectures, has informed us, that two drachms of this powder so applied, produce an equal effect with the same weight of mercurial ointment rubbed in. He used it for the cure of syphilis. Mr. Pearson, who tried it for the same purpose, remarked, that " he found the gums become turgid and tender very quickly, and that the local appearances were sooner removed than by the other modes of introducing mercury into the system; but that it soon brought on debility, with a rapid and premature salivation, and, of course, that the medicine could not be steadily continued." Though this was an objection to its use in syphilis, where the system must be long kept under the influence of the remedy, it must be a very great advantage in the treatment of this disease, and others which only require it for a short time, and in which it is not necessary to continue the salivation; whilst its early appearance is of the greatest importance. If this method of mercurial fumigation be used, there will be no risk of increasing the irritation of the mucous membrane of the stomach and bowels, which must be the case if large doses of calomel are given; as clearly depicted by the dissec-

tions in India, where even the undissolved calomel has been found in the "rugæ" of the stomach by Mr. White, Serroor, August 11, 1818.

Those who wish to compare this safe and effectual method of mercurial fumigation with the administration of immense doses of calomel, should read the Reports published under the authority of the government of Bombay, 1819: they will there find it recorded, that there were given "fifteen or twenty grains of calomel, followed by two grains of solid opium, or sixty or one hundred drops of laudanum; and, if the first dose was immediately rejected, it was repeated, and continued, *without regard to quantity*, according to the urgency of the symptoms: the disease, it is added, in *favourable cases*, yielded in the course of a few hours, and the next day the *gums* were *affected**". Next, let them examine the dissections of *fatal cases*, and observe the congested, perhaps inflamed, state of the mucous membrane, throughout the whole alimentary canal, as well as the congested state of all the thoracic and abdominal viscera; let them recollect also the black, the green, the slimy, the bloody evacuations often produced by large and frequently repeated doses of calomel (though in very moderate doses when compared with those just stated), which must have been observed by all medical practitioners. Surely, if the disease should have yielded after such treatment, an unprejudiced spectator would be apt to exclaim,—What an escape the patient has had! Perhaps many of the severest symptoms occurring in Cholera may be fairly attributed to the inconsiderate manner in which calomel has been administered, which, I conceive, has often defeated the object, by increasing the irritation of the mucous membrane, in-

* Quarterly Journal of Foreign Medicine, &c., May, 1820.

stead of hastening the ptyalism, which is proved by all experience to be the counter-irritation, or, at least, the indication of it most to be depended on, by which mercury acts to supersede the *febrile irritation* caused by specific poisons. Thus Dr. Chisholm, and a host of other practitioners, when relating the treatment of the yellow fever, observe that "the fever vanished, as if by a charm, as soon as the ptyalism took place;" and not in yellow fever only, but in typhus, and even in the plague (all kindred diseases), numberless instances have been adduced where the ptyalism has marked the removal of the disease*.

Still, it seems extremely probable, that the universal practice of exhibiting calomel in large doses in the diseases of India, has, even when the inflammatory affection has been carried off by it, so far irritated the mucous membrane of the alimentary canal, that much of the broken health, which those returning from India to this country often suffer through life, may be attributed to it; whereas, had mercury been applied externally, and particularly by fumigation, no such ill effects might probably have taken place. My friend, Dr. Davy, in his work on Ceylon, 4to, 1821, p. 488, says, "Calomel in large doses has been strongly recommended in the dysentery of India."

*See "Medical Sketches of the Expedition to Egypt from India, by James Macgregor, Esq. (now Sir James Macgregor)," 1804.—"Observations on the Plague at Malta, by Mr. Stafford, Surgeon." *Edinb. Med. and Surg. Journal,* 1816.—"Treatise on the Plague, by Sir Brooke Faulkner;" in which he corroborates Mr. Stafford's success in thirty or forty cases treated by mercury.—And, for mercury in typhus, see Mr. Hammick's account of Dr. Geach's practice, in *Western Med. Contributions,* 1799.—Cases of Typhus, by Dr. Pritchard, St. Peter's Hospital, Bristol: both for mercury and free ventilation, he says, "I have always observed those patients whose mouths have been made sore, recover."—*Edinb. Med. and Surg. Journal,* 1816.

"From numerous dissections, I infer, that the disease is not commonly and essentially, but rarely and accidentally, complicated with disease of the liver. But, laying aside all theoretical views, I may briefly state, that in a few instances in which I have seen calomel administered in large doses, it appeared to aggravate the complaint."

To judge of the ease with which mercury can be introduced into the system by fumigation, I will contrast it with the application of mercurial ointment, as used to produce a speedy effect, by M. Tonnelle and M. Desormeaux, in the epidemic puerperal fever at Paris (see Edinburgh Medical and Surgical Journal, October 1830), in which, after the failure of bloodletting, leeches, emetic of ipecacuan, &c. the typhoid symptoms occurred, and in which mercurial salivation saved many of their patients, who otherwise must have perished. The mercury was used in these cases in the way of friction, two ounces of the ointment being commonly rubbed, in the course of twenty-four hours, into the skin of the abdomen and thighs, in portions of two drachms at a time; the amendment occurring with the customary mercurial affection of the mouth. When the length of time which the absorption of two drachms of the ointment would require, necessarily increasing with the number of applications, is considered, I can have no doubt but that the corresponding quantity of the fumigating powder might be absorbed in very much less time than is required to absorb the ointment; whilst the patient would be kept as warm as could be desired during the state of collapse, and would not be exhausted by the fatigue consequent on the rubbing in, but would be allowed to indulge in sleep, if that should happily occur. When the mercury has performed its office, the inconveniences at-

tending it can be far more easily removed (by warm spongings) than when the mercurial ointment has been used, and particularly than when calomel has been employed; because more irritable parts have then taken on inflammatory action, and a part of the calomel may still be retained in the rugæ of the stomach, and the valvulæ conniventes of the intestines.—When ptyalism has failed to remove the diseased action, it seems to be from having been produced too late, that is, when morbid changes had already taken place, which forbad all hope of recovery.

Mercurial fumigation is not only not likely to produce irritation of the mucous membrane of the alimentary canal, but it possesses all the real advantages of the internal use of calomel, producing ptyalism in a more rapid manner, and admits the application of other remedies.

Internal Treatment.—It is not my intention to omit internal treatment, whilst I am attempting to mercurialize the system; but I must remark on the too great anxiety of practitioners to carry off the cold fit of the disease by dint of the most violent stimulants (a practice most probably *increasing*). This seems to be confirmed by the remarkable fact mentioned in Drs. Russell and Barry's third report from Petersburgh, July 17th, as received from "a most intelligent physician, Dr. Reimer, of the Merchant's Hospital," already quoted, viz. "that of twenty cases treated under his own eye, who fell victims to the disease, seven died in the cold stage and thirteen in the consecutive fever. On the contrary, "the proportions of deaths in the cold stage, compared with those in the hot, was far greater in India, according to Dr. Russell's experience, than in Russia." The symptoms which I consider sympathetic, but which, by their ex-

treme violence, have blinded the profession as well as the public to the real nature of this dreadful pestilence, and obtained for it the name of Cholera, I would endeavour to check and control by the remedies used, or analogous to such as are used, in the common Cholera of this country; all the while, however, keeping in mind, that I am here combating symptoms only, and not subduing the disease in its strong holds; and careful lest by stimulating beyond a certain point, I may render the patient's case more hopeless in the second stage.

Stimulants and Narcotics.—The use of internal stimulants appears the most difficult part in the treatment of the disease; and I must claim to be considered as speaking generally. Very little advantage would seem to have been derived from them, if we consider the appearances on dissection, which shew great injury in organs disposed to take on inflammatory action; for what else can we understand by "the sanguineous congestion, and even active inflammation, more frequent in the bowels than in the stomach,"—of Mr. Scott; and "the intestines bore marks of congestion, and of a sub-inflammatory state,"—of Dr. Keir? These appearances would seem rather to indicate depletion than simple stimulants. After the premised bleedings have, in some measure, relieved the oppression of the brain, some stimulants, employed with caution, seem likely to be attended with good effect. Thus, at first I would permit the patient to drink freely of warm, or rather hot, slight liquids, as mint tea, barley-water, gruel, or the like; with the view of providing for the gentle discharge of the common contents of the stomach and bowels. I should then administer forty minims of tincture of opium, in a wine-glass full of hot spirit and water (any spirit to which

the patient is most accustomed would appear the best), and calomel, in half grain doses, every half hour. If the opiate were rejected, it should be repeated after an hour; and were that also thrown off, a drachm or more of tincture of opium in two ounces of thin starch should be administered as a clyster. If the symptoms, and especially the cramps, continued, and the opiate was discharged, it should be repeated once; and, if not discharged, again after four hours. I prefer this clyster to a suppository, because the opium, being in a state of solution, will produce its effect more quickly; nor do I think the quantity will be so large as to excite its discharge. If the vomitings should continue severe, a drop of hydrocyanic acid may be given every two hours, for a few doses. If, after the vomitings and purgings have ceased, it appears desirable to use a stimulant, hot spirit and water alone in small quantity, or a teaspoonful of ether or sal-volatile in water, would seem the most proper. Should the spasms continue severe after the vomiting and purging have ceased, a clyster, with an ounce of oil of turpentine, so useful in spasmodic diseases, might perhaps be given with advantage.

External Remedies.—Mustard cataplasms made with the flour of black mustard and hot water only, after the manner of MM. Trousseau and Blanc, and applied to the epigastrium for three quarters of an hour, but not long enough to vesicate, would probably afford a sufficient local stimulus. Blisters of cantharides are too slow in their operation. General frictions with stimulating liniments, might be used. I would recommend also the trial of dry cupping on the spine. I have been in the habit of applying as many glasses as the space permitted, from the occipit to the sacrum, and letting them remain on till they fell off, with ex-

tremely good effect, in removing severe pains of the head and oppression of the chest; and I think they promise to be of much use in this disease.

Purgatives.—With respect to purgatives, I am convinced they should be of the mildest kind, otherwise they may re-excite the former symptoms. When the severe symptoms have subsided, and the heat is restored to the surface, and the hot stage may be supposed approaching, a tablespoonful of castor oil may be given, and if necessary, repeated, until the bowels are opened. At this time, to abstract the stimulants as much as possible from the alimentary canal, a clyster of gruel and oil would seem desirable.

Ice, or other refrigerating applications to the head, particularly if heat was complained of, would be a probable means of relieving the distress.

General Remarks on the Treatment.—I have now enumerated the different remedies which appear to me desirable in the treatment. It remains to point out, as far as I have omitted to do so, at what periods they may be used. Bleeding and mercurial fumigation will, I think, be necessary and desirable, in whatever stage of the disease the patient may be first seen. The hot-air bath, stimulants, and narcotics, will be restricted to the cold stage. Ice to the head will probably be used in the hot stage. But I chiefly rely on striking at the root of the disease, by the division of the scalp, to relieve the brain. This, with the hot-air bath, mercurial fumigation, and the very moderate and judicious use of stimulants and narcotics, will probably cut short the disease during the first stage, the cold blue cholera, and save the patient from the second and greater danger that awaits him in the hot stage.

Particular Observations.—Having offered these ge-

neral observations on the treatment, I will briefly consider a few particular cases.

Where the disease is rife, many cases are represented by Drs. Russell and Barry as coming on mildly, perhaps only with diarrhœa, which have soon afterwards changed to the attack of cold blue Cholera, and become as fatal as those which invade more suddenly. It seems very proper in such cases, after having abstracted blood from the arm, to submit the patient to a slight degree of ptyalism by means of mercurial fumigation, which would promise to avert the disease without any serious consequences.

In cases of sudden attack, in which the patient seems struck down as it were by lightning, in the way already quoted from Mr. Orton, and mentioned also by Dr. Keir, where the latter remarks, "all human aid was vain, the patient often dying before there was time to try any remedy," the scalp should be divided, and, if any signs of life should appear, the patient should be submitted, as soon as possible, to the hot-air bath, and mercurial fumigation; and, if unable to swallow, the contents of the stomach should be abstracted by means of the pump, and some stimulant forced in: if so far successful, the treatment should go on as before described*. Again, for patients lying in a pulseless state, as was the case in Dr. Killett's and Dr. Keir's patients, I should recommend proceeding in the same manner as abovementioned; and if the pulse should still be not perceptible, galvanism might perhaps be worth trying. This has been already done by Dr. Anderson†, with some effect; but his patient did not seem to have had any

* Here the use of croton oil, as recommended by Dr. Abercrombie in apoplectic seizures, seems to be indicated.

† Edinburgh Medical Journal, July 1819.

attempt made to relieve the oppressed state of the brain, which might have rendered the result more successful. I am the more induced to mention the treatment of these severe cases, from having remarked, that some have been reported as shewing convulsive motions, even for hours after apparent death.

Specifics.—The public mind seems intent on the discovery of some specific for the disease. I conceive it is not to be found in ether, ammonia, camphor, cajeput, or other essential oils, or any other stimulants; but if any thing is to be considered as specific, mercury alone, in the safe method of fumigation, promises, by producing a new action, to supersede the disease. I very much fear that the excessive use of stimulants, in the first or cold stage, is a principal cause of the extreme severity of the second or hot stage of the disease. It seems unfortunately to have been very much the practice to treat the disease experimentally, and without the guidance of any rational theory. The random practice of merely combating symptoms, may be compared to fighting phantoms, whilst it does nothing towards the cure of the disease; and hence perhaps, in great measure, the prodigious mortality.

Contagion.—It is unnecessary here to discuss, at any length, the question of contagion. The disease may have been produced by some peculiar condition of the atmosphere where it originated; and some states of the atmosphere may be more favourable than others to its propagation. The first opinion may furnish an exercise for the conjectures of curiosity; the second must be proved, or otherwise, by future observers. It seems, after all, of very little consequence how the disease arose, if it be now contagious; and that it is so, the evidence before us does not leave a

doubt. It fully bears out the conclusions of the Russian government, "That the exciting cause of the disorder (and the only one well proved) is a specific contagion;" of which the proofs are, "1st, The progress of the Cholera along the high roads: 2d, The remarkable circumstance that the first who died of it, wherever it appeared, were individuals who arrived from some infected place: 3d, That the places where immediate precautions were taken, were not attacked by it: 4th, That in Moscow, which contains at least 200,000 inhabitants, there have been, since the 16th of September up to the present instant, 6th of January, only 6000 or 7000 sick, or one twenty-ninth of the population, an incredibly small number, if we look to the general cause of Cholera Morbus, in atmospheric influence." To this I will add only two remarks: 1st, That the observations of Drs. Russell and Barry, of the great mortality among the medical men and attendants, in the hospitals, prove its effect upon those within the reach of the contagion; while, 2dly, the numerous instances of the exemption of families and large bodies of individuals, for instance (to quote a few from a host of facts), at Alexandria and Aleppo, where the Europeans adopted the same precautions as against the plague, and in a Russian town, where, whilst it was extremely fatal on one side of the street, the inhabitants on the other side were completely preserved from its attacks by a barricado and a rigid quarantine, shew the advantages of insulation, which can only be explained by the admission that the disease is contagious, and most probably communicated by goods* as well as persons. It is not, however, difficult to account for the opinions broached by the non-medical anti-contagionists. But the com-

* See Dr. Russell to Mr. Allen.

munity at large, who will be the sufferers by the abandonment of the safe side, must determine whether or not their lives shall be sacrificed to the views of the interested opponents of cordons and quarantines. The spreading of this pestilence in the way described, and its wide wasting devastation, whilst they support the belief of its contagious nature, tend to confirm another proposition in my Essay ; for the widest spreading and most mortal diseases have always belonged to the family of fever.

Ventilation and Cleanliness.—The principal causes of the spread of contagion, appear to be a want of ventilation, of personal cleanliness, and of caution with regard to the use of clothes of the sick ; crowding many persons together in close apartments, and a predisposition induced by meagre diet ; want of proper clothing ; and, in short, whatever tends to debilitate the body or sink the spirits*. To these may probably be added, causes over which we have no control, as certain states of the atmosphere. We may also remark the operation of other natural causes which oppose a check to the spread of contagion ; and though we have no means of producing such results in the open air, yet, following the analogy in lazarettos, hospitals, and private apartments, we may institute processes which, to a certain extent, will have similar effects. Sir Gilbert Blane observes†, " the difference of a dry and a moist air cannot be put in a more striking point of view than by the two following facts :—the first is, that there is a periodical wind on the coast of Africa, called the Harmattan,

* The general instructions of the Board of Health are most appropriate.

† Observations on the Diseases of Seamen, 1799.

which, by its extreme dryness, in consequence of blowing over hot sandy deserts, absorbs moisture with so much avidity as to destroy vegetation, if it continues many days, &c. It is, however, so salubrious, that fevers and fluxes soon recover while it blows; a stop is put to epidemics, and the infection even of the small pox will not take effect." Influenced perhaps by this circumstance, Sir Gilbert Blane directed the clothes worn by the sick to be baked in ovens. The second fact is, that "the Dutch colony of Batavia, while it is the most unhealthful of all places, is also the most moist, in consequence of the great number of canals," &c. He also remarks on the good effects of hurricanes on the health of the inhabitants of the West Indies, and on the insalubrity of long-continued calms. It is generally understood that "the febrile miasm has a short range; yet, by its tenacity, adheres to clothes, &c., and an impure atmosphere is necessary to extend the specific poison; while, in a pure atmosphere, the miasmic materials easily become dissolved or decomposed; but slowly, and with great difficulty, perhaps not at all, in a corrupt atmosphere already saturated with foreign corpuscules*".

If, then, in ventilating lazarettos, hospitals, and private apartments, we can imitate what is going on in the great laboratory of nature, it would appear that little would be omitted which is within the compass of human power. The method I would propose to attain this object, is by the employment of a blast-engine, such as is used at iron foundries. I am informed that the blast-engine at Merthyr foundry in Wales is of immense size, having a cylinder of one hundred and forty inches in diameter, making a long

* New Mode of Ventilation.

stroke, and is driven by the force of a large steam-engine. If a lazaretto or depôt for suspected goods had a long gallery for the goods to be opened in, and if the nozzle of such a blast-engine, terminating in pipes on which were proper cocks, was introduced into one end of such a gallery, having proper apertures for the air to pass out through at the other, a much greater effect would be produced in disinfecting them, and in one-tenth of the time it would require in the open air; and as the warm air is supposed to render the miasm more volatile, and thus more readily removed, the pipes from the blast-engine might pass through a furnace, and any degree of temperature be given to the air that would not have the effect of injuring the colours or qualities of the goods, as the disengagement of the acids or other agents might do; and yet, if no such effects were to be apprehended, the chlorides might also be employed in the usual manner, and interposed between the pipes of the blast-engine and the goods. So in fever-hospitals generally, the same method and similar pipes might be introduced into every ward, to remove infectious effluvia: a comparatively smaller engine would be sufficient for such a purpose; while, for ventilating an apartment in a private house, in times of contagious diseases, so that the family might be exposed to the blast loaded with the fumes of such substances as are most approved of as disinfecting agents, a smith's bellows might be sufficient. It remains to be observed, that the several engines may be worked by the power of steam, or of water; by the labour of animals, or manual power, according to the size of the apparatus. Mr. Sylvester, in his "Treatise on the Philosophy of Domestic Economy*," after no-

* Edinburgh Medical and Surgical Journal, April 1820.

ticing the well-known fact, that, "at a very little depth below the surface in all countries, the earth is of the average temperature of the climate, as may be ascertained by the temperature of springs," observes, "it will hence appear, that if the air which is requisite to supply a house in the winter of cold countries were made to pass along a subterraneous cavity, it would become considerably warm. It has been found by experiment, that a passage of two hundred feet in length has had the effect of warming the air of the atmosphere passing through it, to much above the arithmetical mean between the outer air and that of the earth: such a provision, aided by the power of two turncaps (the opening of one being always turned towards the wind by a vane, like the wind-sails of a ship), would be the means of increasing the comfort of dwellings in countries where severe long winters are experienced. The same advantages would apply to the cooling of apartments in hot countries. The air, which is sometimes heated to 100°, might easily be cooled down to 80°, by passing through a tunnel at a considerable depth. The cold-air flue in the Derbyshire Infirmary is about four feet square, its length seventy yards; and when the thermometer in the shade in the outer air stood at 80°, the current, after passing through the flue, was found when it entered the stove-room to be 60°, and was of sufficient force to blow out a lighted candle." However desirable for ventilating hospitals this method may appear, yet it seems deficient, inasmuch as in a calm, when the current is most wanted, less effect would be produced; but if the pipe of a blast engine *drew* its air from the tunnel, the necessity of obtaining a different temperature by other processes would, in part, be lessened.

Compton and Ritchie, Printers, Middle Street, Cloth Fair, London.