An enquiry into the origin, propagation, and prevention of infection : with some remarks on the recent introduction of cholera into this country / By a member of the Board of Health.

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Publication/Creation

Edinburgh : Waugh & Jones, 1832.

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AN

ENQUIRY

INTO THE

ORIGIN, PROPAGATION, & PREVENTION

OF

INFECTION:

WITH

SOME REMARKS

ON THE

RECENT INTRODUCTION OF CHOLERA

INTO THIS COUNTRY.

BY A

MEMBER OF THE BOARD OF HEALTH.

EDINBURGH:—WAUGH & INNES,

2. HUNTER SQUARE AND 31. HANOVER STREET.

1832.

Price One Shilling.

ANDREW JACK AND CO. PRINTERS.

ADVERTISEMENT.

PART of the following Enquiry was written several years ago, for a very different purpose than that of publication; but it does appear to the author to contain some plain and unsophisticated truths, which may not be altogether without their use to the uninitiated, especially during the present alarming crisis, when perhaps one of the most malignant distempers that ever desolated our country, is so near our doors.

The theory regarding cholera may to some appear rather fanciful; but several gentlemen to whom it has been communicated, are of opinion, that it is at least as plausible as any thing that has been hitherto offered to the public. Indeed, some of the evidences are so obvious and striking, as likely to have occurred in some sort of shape to many individuals. To advance a theory in opposition to facts, is rash and impertinent; but

surely it implies no such charge, modestly to propose a solution of a difficulty which has been invested with so much mystery, when that solution is accompanied with such facts, as to strike every one the least acquainted with the matter.

AN ENQUIRY,

&c.

Of all the calamities which afflict mankind, there is none more odious in its appearance, more desolating in its effects, or more incapable of being resisted by human skill or ingenuity, than that arising from contagious distempers. "The bare mention of this name," (the plague) says Morveau, "presents the image of the most dreadful of all the evils which afflict humanity. The sword blunts its edge upon the body which it pierces; poison remains inactive in the organ which it has deprived of sensation; fire removed from its aliment, dies of itself; but contagion derives additional force from the number of its victims." The annals of all ages and countries, have borne testimony to the desolation which it sometimes occasions among the human species; it breaks asunder the very ties of consanguinity, and frequently deadens all the charities of the heart. Its name is associated with whatever is loathsome and repulsive; and human language has employed it to denote all that is odious and revolting in the extreme. The miserable victim of the malignant pestilence, whatever be his circumstances or situation in life, is often denied the common offices of

kindred and acquaintance; and, deprived of all those consolations which can alleviate the miseries of a death-bed, is left in solitude and silence to brood over his melancholy fate; or dies amidst the most excruciating agony of body, unconscious of the dreariness of his situation, or of the inevitable destiny which awaits him. Surely such a disease, accompanied with such frightful circumstances of aggravation, demands our most serious attention, and calls upon every individual of society to use every mean to crush the hydra in its embryo, before it has attained such a magnitude as to baffle alike the ingenuity or the experience of mankind.

It is astonishing with what pertinacity some men have resisted the doctrine of contagion in all diseases which afflict the human frame, asserting even that the plague, the yellow fever, the small-pox, and measles, are not more contagious in their nature than the gout or ague; and all this in opposition to facts so obvious, and so uniform in their appearance, as to lead but to one wide and universal conclusion in every mind that has not been wedded to some previously adopted theory. At Marseilles, for example, in the year 1720, when that city was almost depopulated by one of the most dreadful plagues which ever appeared in Europe, the medical profession were divided by two opinions;—the one party contending that it had been imported from the Levant in a merchant vessel; and the other, that it merely had its origin in local causes, such as irregularity of seasons, poor and scanty diet, accompanied with those debilitating affections of the mind, which invariably pre-

dispose to the reception of an epidemic. "If, however," says Dr Russell, who long resided at Aleppo, during the prevalence of the plague, "of a hundred persons exposed to the infection, ninety should fall sick, shall inability to assign satisfactory reasons for the preservation of the other ten, be converted into a positive argument against the disease having been caught by contagion?" If persons retired from all commerce with the infected, or their attendants, yet breathing the same atmosphere with the rest of the inhabitants, and nourished by the same food, remain untouched during the ravages of the plague, so long as they continue secluded, but who, upon unguarded communication, are taken ill like others, can any rational doubt arise about the cause of their former security? Who can doubt that disease to be contagious, or infectious, or both, which rages with the greatest virulence in an adjacent village, and which is confined solely to that spot, in consequence of the severe and vigilant restrictions which are put upon all communication between it and a neighbouring district, or which, if it has ever broken out unequivocally in the uninfected district, has uniformly been traced to communication with the contagious quarter? Still more, who could doubt its malignity, when a family living next door to one that has been infected, escapes, merely by preventing all communication, and keeping themselves shut up from the world, as was the case with many families during the great plague in London, and as happened lately at Kirkintilloch, when cholera was committing fearful ravages in the next house?

The truth is, that all malignant distempers, which commit great and sudden devastations in the ranks of human society, seem to propagate themselves either by contact with the diseased patient and his clothing, or by breathing the contaminated atmosphere of his chamber, while the virus which propagates the disease, acquires additional vigour, at the expense of every victim, and becomes more and more virulent, and more susceptible of destroying, according to the number of its sacrifices. Different malignant distempers may assume different phases, and may be more or less rapid in hurrying their victim to the grave; but they all depend for an increase of their pestilential energy, to the number of suffering individuals. To suppose, because a person may acquire the disease of cholera, or plague, without coming into direct contact with the diseased patient, that therefore the disease must be originally in the atmosphere, and independent of any pestilential effluvia emanating from the animal body, would be about as absurd as to say, that a man who was suffocated in bed by the sulphureous smoke issuing from his chimney, had died in consequence of an original deterioration of the atmosphere of his room, because his body had never come into absolute contact with the solid materials which composed his fire. To imagine, that because the subtle particles, or gaseous matter, which is continually evolving from a diseased body, is inappretiable by any of our senses, and can neither be seen, smelled, nor handled, that therefore it does not exist to poison the surrounding air, is an argument that can only be supported by those who are

too indolent to enquire, or too weak to argue. It surely does not strike such anti-contagionists, who refer every thing to a predisposing cause in the air, that the air is a great ocean of fluid, continually undergoing changes, and liable probably to more mighty fluctuations than the ocean of water; and that consequently no original predisposing cause could remain long stationary in one place, or hang for weeks over some devoted town or village, while another, at only a few miles distance, had never once been subjected to its sway.

There are only two arguments of the slightest plausibility, or that are worthy of any notice, advanced by those who favour the doctrine of non-contagion: the one is, Upon what principle of a disease being contagious, can we account for the fact of so many escaping, who are continually among the sick, and exposed to the full force of its malignity? Now, it does strike the writer of this, that from an enumeration of instances, this apparent objection may be easily answered, by referring to the peculiar habits of body and mind, and strength of constitution of those who thus escape.

If out of a company of twenty individuals, who drink an equal quantity of ardent spirits, sixteen should become intoxicated, while the remaining four, who were equally exposed, retained their wonted sobriety, are we to deny a more vigorous constitution to the one party, who could thus resist the inebriating influence of the liquor; or a more enfeebled and predisposing one to the other? But in reality this is no argument with the anti-contagionists at all; or, if it is an argument, it is as

much an argument on the one side as the other; and the escape of those who do not happen to be seized with the malignant disorder, is as difficult to be accounted for, whether we suppose it to be conducted by atmospheric influence and local causes, or communicated from person to person, either by contact with the body, or by means of *fomes*. The other argument is, Why does the disease take such leaps, frequently to the distance of thirty, fifty, or even an hundred miles, and leaving, in the intermediate distance, many towns and hamlets totally unhurt; and all this without one sick person having been conveyed from the one place to the other, or any means of communication kept up, that could cherish the disease? To this it may be answered generally, that the means of communication are so many, both by obscure and dirty passengers, as well as by goods, and various kinds of merchandise, that elude all detection and observation, that we have no right to affirm absolutely, that such means of conveyance are not possible, because we do not perceive them, or because they are not detected in their successive stages of transmission.

But the most appropriate answer to this apparent objection is, That all malignant disorders are known to travel the great thoroughfares of human intercourse, and to avoid those solitary and insulated regions, that are separated by impassible mountains, by untravelled deserts, or vast tracks of ocean. It would seem as if the strength of the pestilential virus was expended in long distant journeys by sea or land, and required continual

resting places, where population abounded, to recruit its enfeebled energies, and again to carry on its devastations with renewed force. A strong proof, for example, that cholera is contagious or infectious, arises from the route which it has pursued since it entered Sunderland. It has followed the high road to Edinburgh as directly as the mail; it has scarcely turned either to the left hand, or to the right; it has committed no devastations upon any lonely detached farm-houses, or upon any upland villages that were removed from the great public line of communication; but all its fury has fallen upon those unhappy towns and villages that lay along the great line of public intercourse.

WHAT ORIGINATES CONTAGIOUS DISEASES?

One of the great nurseries for contagious disease, is nastiness and confined air. In fact, it will be found, that almost all malignant distempers, upon minute enquiry, arise from quarters that are exposed to the noxious exhalations emanating from neglected filth, dunghills, and the remains of animal and vegetable matter, which has been suffered to become putrid. The malignant fever which made such havoc in Glasgow about thirteen years ago, first made its appearance in a part of the city which was notorious for its nastiness, and the low, confined structure of the houses, and for the promiscuous mingling together of crowds of human beings, pent up so closely in their miserable apartments, as to render it literal suffocation to a per-

son to enter, who had not been accustomed to such scenes. To sweep away the accumulations of filth, seemed the task of a Hercules with his fabled stream; yet, so unconscious were the miserable inmates, of their dangerous situation, as never once to have made an effort to rid themselves of the nastiness which fastened upon every part of their hovels. Their more retired apartments were literally converted into dunghills; bones, ashes, old rags, and frequently, remains still more abhorrent to the senses, were permitted to accumulate, and rot till they had become one mass of putrefaction, without being swept away for months together. This is no exaggerated fancy picture; it is an enumeration of facts collected from the most accurate investigation, and equally accessible to every one who will have the hardihood to make a similar enquiry. The police of a town seldom make investigations into the interior arrangements of a house; it is only external appearances that come under their observation; but surely a regard to the salubrity of the atmosphere, and the health of the community, ought to dictate the establishment of means better calculated to expose and bring to light these interior manufactories of disease. A number of individuals should actually be appointed to make regular and minute enquiries into every suspicious quarter, especially during the prevalence of a malignant disease, and to lay the result of their investigations before a committee appointed to watch over the safety of the community, and crush the latent enemy in its very birth. Every species of nuisance should carefully

be taken out of the way. It is not merely the more offensive remains of animal matter, that seems capable of generating the pestilential virus; rotten eggs, cabbages, and every species of vegetable substance give out an affluvia, which, there is every reason to believe, is highly noxious to human life. It is a fact pretty generally agreed upon, that the plague which broke out at Philadelphia in 1793, arose from a great quantity of vegetables that were scattered along the shores of the Delaware, and which were permitted to remain till they had contaminated the surrounding air. The same cause is said to have given rise to an epidemic disease at Delft in Holland.

Improper ventilation is another fertile source of infectious distempers. This is a circumstance which should be powerfully impressed upon the minds of the lower classes, as they seem scarcely ever to be aware of the consequences arising from the neglect of it.

It is no uncommon thing to see persons confined for months together, to an apartment which has never once been cooled by the pure air of heaven. The patient labouring under the most malignant fever, may be seen loaded with as many bed-clothes as are sufficient to suffocate a man in health, and panting for a mouthful of fresh air, which his mistaken friends are at the utmost pains to exclude from him; and all this frequently during the warm and sultry months of summer. Every aperture and chink which would admit fresh air, is industriously shut, as though it were loaded with the pestilential malignity of the plague itself. Jails,

hospitals, and cotton mills, are great nurseries for contagious diseases. The close contaminated air, and the hot steam and vapour perpetually arising from so many breaths, and so many processes carrying on, impart to their inhabitants all that susceptibility of disease, which is sufficiently indicated by their wan and emaciated aspects. Notwithstanding the admirable arrangements which are enforced in some of these establishments, we may venture to affirm, that more contagious diseases are generated out of their little communities, than out of any other equal proportion of population of the same grade in society. In cotton mills, and jails, in particular, it is to be feared, that very little attention is often paid to that most useful of all preventives—fresh air, and to the frequent washing the walls with lime, which, unless subjected to this operation, must be continually accumulating offensive particles. The epidemic which affected the British army during part of the American war, was in general ascribed to the hasty raising of raw recruits, who had been thrust into the ranks without sufficient examination. The greater part of them had been long pent up in jails, cotton mills, and workhouses; and having acquired a susceptibility of disease from their confinement, they were unable to withstand the debilitating effects arising from change of habits, and of climate. The history of the slave trade from the coast of Guinea to the West Indies, illustrates, in a very striking point of view, the horrible consequences resulting from a number of human beings cooped up in a narrow apartment, without being supplied with a sufficient

quantity of wholesome air. The dreadful mortality which sometimes raged among these unhappy Africans, ought to operate as a precautionary admonition upon all who have the charge of any establishment. The disease under which these wretched beings laboured, was not always of a harmless kind; but by evincing a tendency to communicate its virulence to the rest of the crew, who were not under the same restraints, completely demonstrated its malignant character, and pointed out the way in which infectious diseases may be sometimes generated.

Another source of contagion is supposed, with great probability, to be in stagnant marshes, acted upon by the heat of the sun, and made to give out their noxious qualities in the form of vapour. Dr Cullen believes this to be the great cause of malignant fevers; and the reason why countries that are situated in low and humid ground, that is frequently covered with water, having no regular outlet, are so hurtful to strangers. The various vegetable matter, which grows so luxuriantly in such situations, being left to rot and putrify, may be the reason why the exhalations which are raised into the atmosphere by the action of heat, are so extremely noxious. It is well known how fatal the rice districts of Italy are to those who labour among them, —districts which are regularly flooded with water for a great part of the year. Egypt and Syria, and the other countries which stretch along the south shores of the Mediterranean, are considered the great nurseries for the plague. The greater part of Lower Egypt is literally a marsh, produ-

cing every thing that is rank and luxuriant among the vegetable tribes, while the periodical rotting of their substances reduced into a putrid mass, must render the atmosphere to a great distance highly dangerous to human life. The British troops have been twice attacked with an epidemic, as soon as they approached the coast of Holland,—a country that is exposed to the full influence of all these causes which operate in low marshy situations.

It may be enough just to mention another cause, which may be said to originate malignant diseases, namely, irregularity in the seasons, and poor, and scanty diet. It is known, that the plague at Aleppo in the year 1760, which is so accurately chronicled in the records of Russel, was preceded by great irregularity in the seasons, and by a very severe famine. The seasons, observes this faithful recorder, had been observed for some time before to deviate from their wonted regularity; while an extensive commerce with infected places, and a total inattention to the means of preservation, set open many channels for the reception of the distemper, while the present period had also been preceded by a famine, by uncommon diseases, and by earthquakes. Relating the progress of this disease before it had reached Aleppo, he remarks, "through the summer of the year 1757, grain of every kind bore a very high price; and as the winter approached, became scarcer and scarcer, insomuch, that from the month of December in that year, till the following June, most part of Syria and Mesopotamia may be said to have suffered all the misery of extreme famine. In the month of Feb-

ruary 1758, a malignant fever broke out at Aleppo, and advancing rapidly with the spring, raged throughout the summer, and part of the antumn. This fever raged with a fury no less extensive than the famine; and both together produced every where a mortality little inferior to that of the true plague." Monsieur Bertrand also, in his history of the same disease at Marseilles, observes that it was occasioned by a deficiency of food, and by a too great quantity of unwholesome fruits, which being received into the stomach, generated humours and diseases in the frame.

From all these facts, as well as others that might be very easily added, we are entitled to draw this fair and inductive conclusion, that either a deficiency of food, or what is in itself bad, accompanied by all the debilitating affections of grief, fear, despondency, &c. predispose great masses of human beings to certain diseases, which may ultimately terminate in others of the most malignant character.

WHAT ARE THE MOST APPROVED PREVENTIVES IN CHECKING THE PROGRESS OF INFECTIOUS DISEASES?

Two of the most obvious and efficient preventives, are ventilation and cleanliness; indeed the neglect of these most essential requisites for the preservation of health, may be said to be the chief sources of all those more common diseases, which may be sufficiently mild at their commencement, but generally give rise to others of a more danger

ous nature. It is an unquestionable fact, that almost all fevers have their origin in seats of neglected filth and nastiness, either confined to the persons of the individuals, or to their houses. Wherever crowds of human beings are promiscuously huddled together, without regard to the dimensions of the apartment, or the salubrity of their atmosphere, there may we first expect to hear of the commencement of malignant diseases. The air in such places must necessarily be contaminated to a hurtful degree; and it must only be matter of wonder to persons who have experienced all the comforts arising from fresh air, and cleanliness, that more frequent instances of pestilential distempers do not occur. In all establishments where crowds of human beings are collected together,—such as jails, workshops, cotton-mills &c.—ventilation and cleanliness constitute a most essential requisite in their interior arrangement. In all these buildings the windows should be so constructed as to be raised, or drawn down at pleasure; by this means the contaminated air, which naturally sinks down, from its greater specific gravity, would rush out at the bottom, while a fresh stream would pour in from above, and thus an interchange would be kept up till the apartment was thoroughly ventilated. In every crowded room this operation should be performed at least once a-day; and even in jails, except in places expressly set apart for extreme delinquency, every apartment should be so formed as to admit a regular supply of fresh air at pleasure. Another thing that ought to be attended to in the construction of all large establish-

ments, is, that a general passage of communication should be made to wind through the whole, or part of the building. No room should be so formed as to conduct from one to another, unless it were of very small dimensions, but each door should immediately open upon this general passage.

By this arrangement a fresh stream of air would be carried directly within; and besides supplying the apartment, would drive out all the offensive effluvia, that might be floating in the atmosphere. A vent should likewise be formed in all, so as to subject them, in case of necessity, to the rarifying influence of fires. I know that it is a common opinion with people in authority, that such accommodation would destroy the design of confinement altogether, and no longer act as a check to crime; but although this were in some measure to hold true, which can hardly be entertained, still the interests of society, and the health of the community, are paramount to all such considerations, and imperatively demand, that all subordinate notions of theoretical utility be sacrificed to its benefit.

The same thing holds true of private dwellings, as of large public establishments; nor should the interior arrangement of houses be always left to the caprice of the possessors, who are often ignorant of the necessary precautions to prevent disease, and who, if not ignorant, are seldom at the trouble of maintaining a constant watchfulness on all the possibilites of generating and spreading infection. Every corner and crevice of a house, which is suspected of harbouring contagion, or which, from its peculiar appropriation, has any chance to generate

it, should be carefully and frequently washed with lime, which is known to possess the power of preventing putrefaction, and possibly too of destroying the pestilential miasma of a room. Tubs filled with quick lime and water, might be placed in every corner of a house in which an infectious disease has broke out; and this, along with the necessary attention to be paid to cleanliness and ventilation, might of itself go far towards arresting its farther propagation.

Explosions of gun powder, and nitre, have been often recommended; but their influence must be very limited, and of short duration, since they can only act against infection by agitating the air; although upon a magnificent scale, such as has been sometimes exhibited at a battle, they might be of vast consequence. Kindling fires has been a still more common expedient for destroying infection, and in some cases they may certainly be of use; but their effects are much more limited than what seems generally believed. The evident advantage to be derived from fires, is, that by rarifying the air, they necessarily cause part of the neighbouring atmosphere, which may be presumed to be of a healthier and purer character, to rush in and restore the equilibrium. But the situations in which they might be supposed to be chiefly useful, is not along streets, but in confined and damp apartments, where, by rarifying the air, and raising the moisture of the walls and floor to an æriform state, they might thus let escape the contagious matter concentrated in the humidity around. Hippocrates, we are informed, made use of fires, not without

considerable advantage, during the great plague at Athens, 330 years before the birth of Christ.

Vinegar has been long esteemed one of the most convenient, as well as powerful agents, which can be employed for purifying contaminated air; and notwithstanding some recent attempts to depreciate its value, appears, from the experiments of Morveau, to be of considerable advantage. We shall give the result of one of his experiments. "To appreciate," says he, "the method of fumigation by vinegar springled on hot iron, I poured a quantity into a tubulated recipient filled with putrid air, (air contaminated with putrid animal exhalations,) and under which I had introduced a small iron vessel, made red hot; on turning up the recipient after being cooled, a faint disagreeable odour was exhaled from it, in which the smell of the vinegar was no longer distinguishable. I repeated the experiment, and employed an apparatus of the same dimensions; and substituting for the common vinegar, an equal portion of acetic vinegar, the effect immediately took place—the fetid odour had entirely disappeared, while the agreeable smell of the acid was very little diminished." In situations where Morveau was exposed to the influence of contagion, and in going to the beds of the sick, or entering a house that was suspected, he was in the constant habit of moistening his handerkerchief with the strongest vinegar, and applying it frequently to his mouth and nose. He generally carried about with him a small phial filled with this acid, which he could apply again to his handkerchief when it became dry by evaporation.

Various other expedients have been resorted to, calculated to destroy the noxious quality of effluvia emanating from a diseased body; such as aromatic odours, fumigations by sulphur, &c.; but it is to the discoveries of chemistry that we must look, for those powerful and certain agents, whose application may always be relied upon as more or less certain in destroying contagion.

The knowledge of some powerful chemical principle, that might operate in destroying, or neutralizing the virulence of putrid miasma, was long considered a desideratum in the management of infectious distempers. The ordinary methods of fumigation by aromatic odours, or even by vinegar, were found to be totally powerless in arresting their fatal march. Men viewed them with a sort of hopeless despondency,—equally at a loss to account for the manner of their appearance, as to afford an agent, that might act as a counteractive to their farther progress. From the plague down through all the gradations of the milder fever, every thing which the light of science or experience had produced, might be said to have fallen impotent before their resistless fury. In this hopeless condition of suffering humanity, chemistry kindly lent her aid, and became a powerful auxiliary to the healing art. It was Monsieur Morveau who, from his knowledge of a few chemical facts, first endeavoured to turn the attention of mankind towards the resources of this useful science. Some have indeed said, that Dr Johnson of Worcester first discovered the use which might be made of muriatic-acid in destroying contagion; but be this as it may, it is

certain that Morveau first gave a complete and practical demonstration of its decided superiority to every thing else that had been hitherto tried.

Morveau founded the importance of muriatic-acid upon two facts in chemistry: 1*st*, That all putrid decompositions produce ammonia; 2*d*, That the muriatic-acid, and the ammonia in a state of vapour, unite, and form a neutral salt. He had several times rendered this phenomenon visible, by placing under a very large bell-glass filled with common air, and immersed in water, two small gallipots, one of them containing concentrated muriatic-acid, or common salt, sprinkled with sulphuric-acid, the other ammonia in a liquid state; white fumes were instantly seen to arise, fill the capacity of the vessel, so as to render it opaque, and then become condensed, so far as to permit the enclosed air to resume its transparency. In order, therefore, to make a complete trial of the effects of muriatic-acid in purifying contaminated air, he employed it on a large scale in the church of St Stephen's in Dijon, which had been filled with the most noxious effluvia, in consequence of the vast number of dead bodies which had been thrown into the vault beneath. He accordingly took six pounds of common salt, and two pounds of concentrated sulphuric-acid, and having put the whole into a capacious bell-glass inverted, placed it on a bath of cold ashes, which were gradually heated by means of a large chafing-dish. With this apparatus he entered the church, and having carefully stopped up every hole and opening, through which the muriatic-acid gas could escape, commenced the process of fumigation.

In a short time the whole church was filled with vapour, and not the slightest vestige of offensive odour could be felt. Four days afterwards, divine service was performed in it without any danger, or the slightest apprehension: So much confidence had the celebrity and experience of Morveau imparted to the people. He made a second trial of this acid in destroying febrile contagion in the jails of Dijon, where a most malignant fever had swept away a great many of the prisoners; and met with the same happy success. One of the cells was so completely filled with a putrid effluvia, that no person durst approach it; and with only five ounces of common salt, and one and a half of sulphuric-acid, he completely succeeded in destroying the offensive odour. By adding to the preparation a small quantity of the black oxyde of manganese, oxygenated muriatic-acid gas is produced, which may be considered an almost infallible agent in destroying the virulence of contagious matter.

SOME REMARKS

ON THE

RECENT INTRODUCTION OF CHOLERA INTO THIS COUNTRY.

That the malignant Cholera, which has been recently introduced into this country, is infectious,

and propagates itself by the same means as any other malignant distemper to which we have been long accustomed, seems an opinion now gradually gaining ground, especially among those of the medical profession who have lived where the disease was prevalent, and who consequently have had the best opportunities for observation. Dr Barry, and many others who might be mentioned, were at first averse to the doctrine of contagion, till brought into closer contact with it, when they at once relinquished their former opinion, and adopted that which seemed best justified by the number of facts occurring before their eyes. Indeed to doubt of its being infectious, (meaning by that term, the power which any diseased body has, of communicating the same distemper to another body, either by direct contact, or by the transmission of *fomes*, such as clothes, bones, and goods of any description, &c. or through the medium of the surrounding air) would seem to indicate a mind that was more influenced by the love of mystery and theoretical speculation, than guided by the sober process of inductive reasoning. If you press an anti-contagionist, and desire him to tell you how the disease is carried along from place to place, and from house to house, he will tell you of something that is travelling along through the air, from south-east to north-west, but of which something he has no more distinct idea, than he has of the inhabitants of the moon. He will tell you too, that it sometimes travels even against the wind, and is neither to be subdued by heat nor cold; so that in one breath he declares, that it is a general deterioration of the air,

or something like *malaria*, and at the same time, that it holds a different course from the ordinary currents of the air, just as if air and wind were two different things. Another anti-contagionist, who wishes to be more explicit, and to present you with something more tangible for your belief, asserts that the disease is produced and propagated by myriads of animalculæ floating in the atmosphere, or swimming in the waters; and that these inhaled by the lungs, or received into the stomach, produce all those marvellous appearances which the human body assumes, during the successive stages of the disease. It may not be impossible, that there are sometimes animalculæ in the air and water, that are very pernicious to human life; but to assert, that such are the cause of the present malady, without proof, resembles very much the Indian's mode of getting rid of a difficulty, when he placed the earth upon the back of an elephant.

Granting, then, the disease to be infectious, what, may we ask, is the nature of the infection; or how is it at first generated, or carried along?

To answer this question, certainly involves a difficulty, which no one, in the present state of human experience and discovery, will venture absolutely to solve; nevertheless, in the absence of any thing better, one may be justified in advancing a theory which has certainly some probability to support it, and is connected with such analogous circumstances, as at least to exonerate from the charge of rashness, the individual who may venture to propose it.

Every one who is the least acquainted with science, knows something of the characteristics of carbonic gas,—an element which is widely diffused through nature in its various stages, from the solid to the liquid, and from the liquid to the gaseous. Let us therefore shortly enumerate some of the known properties of this principle, and observe if they are not identical with the acknowledged characteristics of that subtle element, which propagates the virus of malignant cholera.

First, then, Carbonic gas is considerably heavier than the common air of the atmosphere, and necessarily sinks to the lowest situations; hence it is often found at the bottom of wells, and coal pits, when there is none above. Does not this disease likewise,—when it reaches a town, or village,—always seek out the lowest parts? This is indeed found to be universally the case. *Secondly*, Carbonic gas is rapidly absorbed by water; the latter at the temperature of 41° taking up its own bulk of the former. Cholera is always found to settle down upon low marshy situations, and to be conveyed more easily along the course of a river, or canal; its greatest virulence is always felt where humidity abounds. *Thirdly*, Carbonic gas is inodorous, and invisible: So is the principle which propagates this disease. It has never yet betrayed its presence, either by addressing itself to the organs of vision, or the sense of smelling. *Fourthly*, Carbonic gas is copiously generated by the human lungs, and must consequently be always in considerable quantity in crowded rooms, and among a dense population, that is shut out from a plenti-

ful supply of fresh air. Cholera, upon the same principle, is always most virulent in crowded streets and lanes, and in camps where soldiers are promiscuously and closely huddled together; so much so, that Sir J. Malcolm lately observed in the House of Commons, that when he commanded an army in India, where the disease was raging, he was obliged frequently to change their situation, and to prevent them living too closely together. *Fifthly*, Carbonic gas is an extremely bad conductor of heat; so also the human body, when it may be said to become super-carbonized under the worst stage of cholera, absolutely refuses to conduct heat, and frequently resists the most powerful stimulants that can be applied. *Sixthly*, And what need scarcely be mentioned, they are both alike destructive of human life.

If therefore the disease called Cholera assume all these characteristics in its transmission from place to place, and from patient to patient, so as to identify itself with carbonic gas, or with any modification or composition of carbonic gas, we have some foundation upon which to rest our conjectures, and are furnished with the means of repelling, or neutralizing, this powerful enemy. Reasoning upon this hypothesis, I predicted to a medical friend upon Saturday the 4th day of February, that if it were true, the disease at Musselburgh would soon assume a milder form; and my reason for saying so was this: upon that night, it will be recollected, there fell for several hours a very heavy rain, which continued the greater part of the night,—the only rain indeed of the least consequence, that had fall-

en since the disease had reached that town; and as water absorbs its own bulk of carbonic gas, the heavy rain would necessarily carry along with it whatever carbon might be floating in the atmosphere in the form of gas. Betwixt Sunday and Monday following, there fell again a great quantity of rain; and the rapid subsiding of the disease, which, up to that period had attained its *acme*, is a fact as notorious as it is gratifying. The circumstance of this coincidence of the heavy rain, with the almost immediate abating of the disease, has scarcely been taken notice of; but it is a circumstance certainly worthy of being remembered.

After a great battle fought in Poland, between the Russians and the Poles, the disease which had been raging dreadfully in the Russian camp, suddenly ceased for several days. This circumstance has been generally attributed to the explosion of gunpowder, and its influence upon the air; but may it not with as much probability be ascribed to the heavy rains which generally fall after any great engagement.

If the virus of Cholera be identified with carbonic-gas, or with any modification of carbonic-gas, we are fully justified in drawing the following conclusions:—That low, marshy, and crowded situations, and those which are destitute of vegetation, are the most dangerous to live in during the prevalence of this disorder; while, on the other hand, the most healthy places are those, which are dry, and airy, and elevated considerably above any lake, or river, or marshy ground:—That water,

which remains any time in an infected apartment, ought never to be used as drink, as it must necessarily be charged with a considerable quantity of the carbonic-gas which was floating in the atmosphere, and consequently must produce very opposite results from those connected with the recovery of the patient:—That tubs filled with water, and frequently changed, in an infected room, must tend to purify the surrounding air, by absorbing the carbonic-gas:—That frequent immersions of the patient in tepid water, and rubbing him dry the moment he is removed from the bath, will tend to destroy the super-carbonized state of the system, which so strongly marks the disease:—and lastly, That the disease should be most virulent in winter, or during long continued droughts, when vegetation is languid, and consequently absorbs slowly the carbon in the air.

Assuming this hypothesis to be the true one, there is no great difficulty in accounting for the transmission of the disease from town to town at considerable distances from each other, without the necessity of supposing some general deterioration of the atmosphere, or some pestilential current, that is carried mysteriously and unaccountably along. Let us suppose this deadly gas to be manufactured in some crowded room, from the lungs of a diseased person, or from some other agency capable of producing it; it may in this state be easily conveyed from one apartment to another, or from one house to another; but before it can be carried to any considerable distance, it must change its gaseous state, and be reduced by damp, and condensation of cold, to a

liquid or concentrated state. In this way it will attach itself to the clothes of individuals, who have been in infected places, or to any other medium of communication; it will continue in this state without mixing with the oxygen of the air, which it does with great difficulty, until it is subjected to a certain degree of heat, when it will again assume a gaseous form, and by infecting the atmosphere of an apartment, again commence a new career of devastation. In such a manner the virus of the disease may be conveyed to any possible distance, if it be not previously washed away by drenching rains, or by being long soaked in water, and provided it be not exposed to a certain degree of temperature. The disease is said to commence generally when the person is in bed; upon this hypothesis, the heat of the bed would change the carbon from its concentrated state into its gaseous state, wherever it might be; and the pores of the body being open, it would then more readily be received into the system.

The whole of this theory with regard to malignant Cholera, may be summed up in a few words,—That carbonic acid gas is copiously manufactured in the animal system, and that unless it finds vent, it accumulates to a degree that endangers the life of the individual,—That it becomes a source of infection to others living and breathing in the neighbourhood of a diseased person,—That the common channels through which it naturally escapes, are the lungs, and the secretions of urine, as sweat, &c. which are known to contain a certain portion of carbon—and that a human

body subjected to this distemper, having all these secretions sealed up, becomes as it were super-carbonized, from want of the common outlets through which the carbonic-gas naturally and regularly makes its escape.

FINIS.

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