

MONETTE (J.W.)
THE EPIDEMIC YELLOW FEVERS OF NATCHEZ.

—
"IN MEDIO VERITAS."
—

AN ESSAY,

READ BEFORE THE

JEFFERSON COLLEGE AND WASHINGTON LYCEUM,

DECEMBER 2, 1837.

—
BY J. W. MONETTE, M. D.
—

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AN ESSAY.

Notwithstanding the great diversity of opinions, entertained by medical men, relative to the nature and production of yellow-fever miasm, and its operation upon the human system in producing that disease epidemically; some points are admitted, on all hands, as facts attending its production, extension, and destruction, in cities, and certain other localities.

It is admitted on all sides, that, at certain times, a peculiar miasm is generated, which will excite, in healthy individuals who breathe it and who are not naturalized to it, a peculiar malignant fever, or disease termed by common consent, *yellow fever*: that this miasm, or aerial poison, may be confined in houses, rooms, and other similar places, with all its deleterious properties, even after the surrounding general atmosphere, which is unconfined and free in its circulation, has become entirely healthy: that this poisonous malaria, in rooms, ships, &c., insinuates itself into every opening, recess, or interstice, into which common air can penetrate, especially near the surface of the ground: that when diffused in a *hot and sultry* atmosphere, it has a property of extending itself gradually, and sometimes rapidly, and of imparting to that atmosphere a deleterious property, which will excite yellow fever:—or that it assimilates a sultry, hot atmosphere to its own nature, or impregnates it with the miasmatic poison, so as to produce yellow fever, and in this manner spreads through a city: that this miasm may become so concentrated, as to produce yellow fever in unacclimated persons who breathe it, even in very *small quantities*: or it may be so far diluted by *pure, com-*

mon air, as to produce no sensible effect in those who respire it freely: that it is heavier than the common air, and settles in the evening dews, and accumulates in low, damp places, near the ground; that it is more rarified by the sun, and destroyed entirely by cold, or the abstraction of heat down to 32_o Fah. Then it must be admitted, that if it can be confined in a house, a ship, or a balloon, it can also be carried from one place to another, where it will be equally deleterious as before it was transported, provided its temperature be not reduced too near 32^o of Fahrenheit, and provided it be not too much diluted with *pure*, common air. If so, then it must be admitted, that it can produce yellow fever in any place to which it may be carried and breathed in accordance with the above conditions: or, a portion of it may be introduced into a hot, confined, and contaminated atmosphere, and produce there the assimilating process; and thus in some degree extend itself: and the miasm or infection thus generated, will be equally efficient in producing the disease, as the original source from which it was taken. This principle is exemplified in the infected air which is shut up in houses during an epidemic yellow fever. A storm, or gale of wind, may so completely carry off the out-door infection, that the epidemic will almost cease: yet so soon as the "leaven" of infection which is retained in the houses and enclosures, can diffuse itself, and again effect the assimilating process in the general air, the epidemic will again break forth, with renewed virulence. The malignity of the disease is in direct proportion to the virulence of the infection; and if, after such a change of weather, the disease again becomes equally malignant, the newly generated infection is equally deleterious with the original: and this, we believe, is the result of an assimilating process, which the infection can, and does effect, in a suitable atmosphere.

It is admitted that yellow fever is endemic all the year within the tropics, and in some places more than in others:

that, although its habitation is properly intertropical, its greatest ravages are among northern strangers, and that it would not be known as an epidemic in the tropics, were it not for the constant influx of northern strangers, who, when numbers of them are attacked, sometimes cause the infection to become so concentrated that it will produce an epidemic even among the indigenous or acclimated inhabitants. This increase, or concentration of miasm, or infection, is apparently owing solely to the further vitiation of the local atmosphere, by the number of bodies laboring under that disease: for, in the West Indies, and other places subject to yellow fever, it is known to prevail generally among unacclimated persons or strangers, and does not attack the natives, until after a large number of strangers have died. Hence, in those countries and cities where it is endemic nearly all the year, it is called the "*strangers' fever.*" It is known also, that when the infection (or miasm) is sufficiently concentrated to produce yellow fever, in its most malignant forms, among strangers and unacclimated persons, the natives, or naturalized inhabitants, if attacked at all, will be affected with it in a much milder form.

It is generally admitted by all parties, when a city, or certain district in a city, is attacked with *yellow fever*, that there exists in that district the peculiar miasm of yellow fever; and that strangers, or non-residents, or a portion of them, who pass into the infected district, and breathe the atmosphere so infected with yellow-fever miasm, will contract that disease; and that it will develop itself in their systems in five or six days, as a general rule: and that this disease may be developed in such persons, even in its most aggravated forms, at any place to which they may have travelled in the interim, whether it be far or near. It is also admitted, that those who reside in an infected district, and have continued to breathe the air while the infection or miasm was weak, or generating in small quantities, acquire a partial immunity, by becoming

naturalized, or acclimated to it; but that they also will take the disease, and die from it, when the miasm becomes more abundant, or more virulent. This is exemplified every year; for healthy, unacclimated persons have contracted the disease in cities and places, while the resident inhabitants were healthy, or not affected with *yellow fever*.

It is also known and admitted by all parties, that when yellow fever is epidemic in any part of a city, that the infected atmosphere, when confined in a close room for several days, at a temperature of not less than 80° of Fahrenheit, loses none of its properties, but often acquires a new degree of virulence. As before observed, it is known that this miasm, or infection, when it exists in abundance, as it does in all infected places, diffuses itself into every recess and interstice into which common air can penetrate. Hence every chamber, every alley, street, avenue and cellar, within its limits, becomes alike infected during an epidemic. It diffuses itself also in beds, bedding, and bales of blankets, and other porous articles, which always contain much air: and when retained in these, in a suitable temperature, it often acquires an increased virulence, in like manner with that which has been confined in close rooms. But when, in addition to the infected air of the rooms, the beds are saturated with the secretions and exhalations of human bodies in disease, it is called *fomites*, or *fomes*, and is, decidedly, in all infectious diseases, more morbid than the infection diffused in the open air. In yellow fever, the exhalations from the diseased body unquestionably add to the virulence of the infected air, when so confined: hence this *kind* of infection, (or *fomes*,) is more deleterious to all who breathe it, than the infection of the open air.

By a careful estimate and calculation, it will be found, that a common feather bed, when stirred up loosely, contains from twenty to twenty-five cubic feet of air, varying according to its size; and each pillow will contain from two to four cubic feet of air; the feathers, if reduced to a solid, constitute less

than one-twentieth of that bulk. Blankets, and other clothing, contain air likewise in proportion to their texture. Now all these articles, in an infected district, become charged with the infected air of that district, just as they do with common healthy air, in a healthy season. The confinement of the infected air, so as to prevent its dispersion in the general atmosphere, increases its power of producing disease, in proportion to the closeness and the temperature in which it is kept: and as yellow fever miasm and infection are destroyed by a temperature below 40° Fahrenheit, it will acquire new virulence only when its temperature is above that point, and most at a temperature between 85 and 90° Fahrenheit. Now, if the open air of a certain district be capable of producing a certain disease in those who breathe it, and if the air contained in beds, &c., be of the same quality, but more virulent, why should not this infected air, transported in such articles to another place, be capable of producing the same disease in those who there breathe it, as well as nearer the source of infection? It would be a paradox if the mere act of transportation should neutralize its morbid properties.

When a person sleeps upon a bed, or upon porous articles of bedding, whether charged with healthy or infected air, he of necessity breathes more or less of it: his body presses out of a feather bed an equal bulk of air, which settles around him, and is respired with the common air of the room. Other portions of it are likewise pressed out by each movement, or change of position, and are likewise respired. Thus, in sleeping upon a bed one night, in all probability an individual presses out and respire all the air which it previously contained, whether healthy or infected.

Thus far it matters not from what source, or in what manner the poison of yellow fever is produced; or in what manner it produces its effects upon the human system. We will call it infection, and, for the sake of argument, admit that it is produced from any source which may suit the fancy of our

readers; still it must be admitted that it can produce the disease called yellow fever, wherever it is respired in its undiluted state; or when only moderately diluted with sultry, contaminated air.

As to the peculiar *nature* and *composition* of this malaria, or poison of yellow fever, we know nothing, except by its effects upon the human system. Of its qualities, we know only by induction; and some of its general laws are deduced from repeated observation. In its effects upon the system, it is supposed by Baron Larrey* and others, and the supposition is sustained by my distinguished friend Dr. Cartwright,† of Natchez, that it is respired, and from the lungs, through the medium of the ganglionic system of nerves, produces its deleterious effects upon all the functions of animal and organic life. Those deleterious effects, taken together, constitute *yellow fever*.

Whether bodies laboring under yellow fever, are capable of throwing off any exhalation or effluvium possessing or deriving morbid properties, is a point yet disputed, although the general practice and the precautions inculcated, even by those who profess to believe it strictly non-contagious, tend to convince the unprejudiced, that all parties admit the principle, although they deny the fact. The general admission, of those who disclaim either side of the question, is that, when yellow fever makes its appearance as an epidemic in a city, or in a district of a city, each additional case tends still further to contaminate the air, or in other words to increase the virulence of the infection which is abroad. None but those who have been much conversant with yellow fever in the southern part of the United States or in the West Indies, should hazard an opinion to the contrary; even then their observation and discernment might be questionable. If a body, or any number of bodies, laboring under

* See Quarterly Jour. of For. Med. for April, 1832.
 Medical Recorder, vol 9, pp. 37, 38, 39.

this disease, can have any agency or influence in rendering the infected air more morbid, it must be by some exhalation *thrown off* from the lungs or skin; for it is hardly possible that the general infection should be rendered more active and morbid by the loss or *consumption* of those portions of it required to produce the disease in those attacked. The consumption, or taking away a part, certainly cannot change the qualities of the remainder; and the only inference remaining is, that each body laboring under the disease, becomes a new source of contamination to the local atmosphere, however small may be the influence of each.

The lungs and the skin are two of the greatest emunctories of the human system, and carry off more fluids in a gaseous form, than all the other excretories together. The fluid which passes off by insensible perspiration from the skin alone, in the form of gas or vapor, is equal to about five pounds in twenty-four hours; the same from the lungs, in the same time is about seven pounds—besides which each respiration deprives the air breathed of a part of its oxygen, and imparts to it a portion of carbonic acid gas or other gaseous compounds. The effluvia thus thrown out by a healthy body, or by a number of healthy bodies, are more or less pernicious to those who respire them;—how much more so then are they from bodies laboring under a pestilential disease? A portion of these exhalations is diffused in the air and wafted and lost by free ventilation in the general atmosphere; another portion is absorbed into the beds and bedding used by the sick, which in close air acquires a new degree of virulence. This is evidently admitted by the non-contagionists, when they enjoin free ventilation and cleanliness as a precaution for safety, to those who nurse yellow fever patients. If this effluvia were not thrown off; or if it were not morbid, why enjoin the necessity of cleanliness and ventilation about the sick chamber?

This may be infection, or it may not be. But all dis-

eases, and especially epidemics are in some degree infectious, and require more or less the precaution of cleanliness and ventilation. There are two kinds of morbid matter eliminated from bodies diseased; which is by some called contagion, or infection: the one is a gaseous exhalation, and the other a palpable matter of secretion. Some diseases throw off one kind of infection, and some the other: and some, such as small-pox, plague, and malignant erysipelas, throw off both kinds of infection. Others, such as vaccine pock, are communicated only by a palpable virus. Of those infections thrown off a gaseous form, some are so mild as scarcely to be estimated; others are more active, but still controllable by proper care to obviate the circumstances of close air, concentration of the effluvium, by maintaining cleanliness and a proper temperature: others, as small pox, throw off a subtle exhalation, which, under nearly all circumstances, is infectious to the distance of a few feet, in all states of temperature. The same may be said of typhus and jail fever, which requires a cool or cold damp air for its dissemination. The matter of *contagion* is originally morbid *per se*: other diseases give off an effluvium which *becomes* morbid, or infectious, under certain circumstances: thus of yellow fever.

In relation to yellow fever, the great error of both the contagionists and the non-contagionists, is *ultraism*. The non-contagionist, because he believes that personal contagion has no agency in the extrication of the *miasm* in the first instance, seems to think he would be inconsistent if he admitted personal infection possible in any case. The contagionist, because he believes the disease capable of reproducing itself by an infectious exhalation, thinks he would be inconsistent, were he to admit the possibility of the disease being produced otherwise. In this, as in many other disputed questions, we believe our motto indicates the correct course, "*In medio est tutissimus*:" or a disease may certainly be epidemic, and in some degree

infectious also : and a disease may sometimes originate from some peculiar exciting circumstances, and yet, when produced, possess properties slightly infectious. For the *first* case of the most infectious disease, must have originated without personal contagion. If a disease be capable of reproducing itself once in a hundred times, under the most favorable circumstances, it is certainly infectious. The infection is specific, because in all cases it produces the same disease as that from which the infection was produced. A disease which spreads alone by personal infection or contagion, makes but slow advances from one individual to another ; while epidemic infectious diseases, attack a number of individuals in close succession. If yellow fever possess no infectious qualities, or impart none to the air, or clothing, to beds, blankets, &c. why use the precaution of cleanliness and ventilation?

Dr. Rush is the author of the most enlightened views on the subject of yellow fever ; and when he wrote, a very general belief was, that it spread *by contagion alone* ; or by the exhalations from one person to another, exclusively of an infected atmosphere. Under this state of things, the sick were often deserted to their fate, by those who believed in the doctrine of specific contagion. They believed that it was produced solely by communication with those sick of yellow fever, and from their infected clothes, &c. Hence it was believed, that the great precaution for safety, consisted in keeping as remote as possible from the sick ; and where this belief obtained generally, the sick were neglected and abandoned by those who entertained such views. Dr. Rush, in his zealous and philanthropic labors to remove this error, frequently carried his arguments even beyond the point at which he would have rested, had such prejudice not obtained so generally. He strove to convince the people, that the disease was the result of local causes and circumstances ; and not produced solely by the emanation from a diseased body, or from a secret contagion brought from the West Indies ; by which

one man was infected; to whom all other cases were to be traced. In his efforts to disabuse the public mind on this point, it was not necessary to stop and discuss the exceptions to the general rule; it was politic in him to pass them by, and direct all his efforts to establish the great fundamental truths which he was inculcating. Hence, nearly all his writings go to show, that it was of *domestic origin*, and spread from an *infected atmosphere*, more or less local. It was his business to break down the general prejudice, and prepare the way for calm and impartial reasoning: this he did: and left it to his successors, and to other times, when public sentiment should be prepared, to define the precise nature and extent of the exceptions to the general rule. It is in this track we presume to tread. In pointing a local cause sufficient to contaminate the air of a city, or district, it became him to urge upon them the agency of those prominent causes which they would most readily admit, until such time as more light might be let in upon the subject; and when the preconceived opinions of contagion might be so modified as to ensure a patient hearing and consideration. Hence he directed public attention especially to *putrid animal and vegetable* matters in the city, about the wharves and shipping, and to city filth:—matters which were perceptible, and withal revolting to their senses, and which of course would chain their attention. But now, when the barrier of error has been broken down, we may begin to examine the subject more minutely, and, if possible, fix the precise limits where truth and error meet. To contribute to this end is our object, and we hope we shall be heard patiently and with a desire to arrive at *truth*, more than to establish or confute any particular theory or set of opinions. The grand fundamental point contended for by Dr. Rush, is, that the yellow fever *is* and *has* often been generated by the local circumstances in our *commercial* cities. But he admits, that, under certain circumstances, it may tend to *reproduce* itself. He admits that it

will not spread from a few cases in a pure air, and that in an *impure* or *miasmatic air* it will spread. This *miasmatic* air he contends is produced from animal and vegetable putrefaction, in certain states of weather. We also say yellow fever will spread, and become epidemic in an air strongly charged with miasm; but we ascribe the miasm to a different cause.

Dr. Rush says, "yellow fever is not contagious (infectious?) in its simple state, and spreads exclusively by means of exhalations from putrid matters, which are diffused in the air. That it does not spread in the (pure air of the) country, when carried thither from cities in the United States: That it does not spread in yellow fever hospitals, when they are situated beyond the influence of the impure air in which it is generated. * * That it generally requires the co-operation of an *exciting* cause, with miasmata to produce it." Med. Repos. v. 6, p. 156, &c.

In relation to yellow fever patients, confined in close, sultry, filthy rooms, where the exhalations and excretions are suffered to accumulate, he admits it to be infectious. He says, "I have heard of two or three instances in which the *yellow fever* was propagated by *these means, in the country*, remote from the place where it originated, as well as from every external *source of putrid exhalation.*" Ibid. p. 157.

Dr. Rush says, or admits, that yellow fever may be contracted by "a person sleeping in the sheets or upon a bed impregnated with the sweats and other excretions, or by being exposed to the smell (breathing?) of the foul linen or other clothing of persons who had the yellow fever." "That it was once produced in Philadelphia from the effluvia from a chest of unwashed clothes, which had belonged to one of our citizens, who had died with it in Barbadoes: but it extended no further in a large family, than to the person who opened the chest." He accounts for this happening so seldom, by "the *superstitious dread of contagion*, which has generally produced great care not only in washing sheets and clothes,

and airing beds supposed to be infected, but frequently the *total destruction of them by water or fire.*" Ibid. Here the most eloquent champion of the non-contagious nature of yellow fever, and one of the most learned ætiologists admits all that we contend for: that an effluvium is generated from a yellow fever patient, which is capable, under favorable circumstances, of reproducing *that disease* in those who breathe it. His explanation of the *modus operandi*, does not accord with our views of the subject: the fact is important. Still we do not consider it essentially a contagious disease, notwithstanding these facts, which our own experience and a mass of authority might swell to a volume: but it convinces us of the necessity of cleanliness, ventilation, and precaution.

Another important fact admitted by Dr. Rush, is one furnished him by Dr. Otto: viz.—“In the autumn of the year 1798, it (a malignant remittent fever) prevailed upon the shores of the Delaware, in Gloucester county, New Jersey. A *mild Remittent* prevailed, at the same time, on the *high grounds*, a few miles from the river. During this time, the Doctor observed, if a person who had taken the yellow fever in Philadelphia, afterwards came into a family *near* the river, the same disease appeared, in several instances, in one or more branches of that family: but where persons brought the fever from the city, and went into a family on the *high grounds*, where the mild remittents prevailed, there was not a single instance of a yellow fever having been excited by them in any of its members.” Med. Repos. v. 6, p. 160. This is an important admission, and one which every unprejudiced person, who has been conversant with yellow fever, will also admit: and in substance it is precisely what I contend for; viz: that, in an *infectious* air, yellow fever may spread, without proper care. And Dr. Rush further says, that “the city of Philadelphia has furnished, in all our yellow fever years, many additional proofs of the correctness of Dr. Otto’s remarks” What is it but personal infection, added to an *infect*

tious state of the atmosphere? For when, as Dr. R. observes, the atmosphere is highly infectious, or "charged with the miasmatic effluvia, or 'pestilential exhalations,' a single case of yellow fever will excite it in a whole family." *Ibid.* p. 160.

Dr. Tilton, an old physician of great celebrity, during and soon after the revolutionary war, in speaking of the yellow fever which prevailed at Wilmington, Delaware, August, 1798, says, "no one doubted it having been brought from Philadelphia, in infectious or bad air, in boats, shallops," &c. He says it began about the water's edge, and spread gradually up to the highest streets: having first appeared early in August, it became epidemic by the middle of September.* Dr. Geo. Monroe, speaking of the same epidemic, says it was clearly traced to an infected vessel from Philadelphia, then at the wharf, and that part of the town near the wharf suffered most severely.† The atmosphere being in a suitable condition for propagating the disease, the air from the vessels acted as a leaven. It must be borne in mind, that these facts are *not* adduced as evidences of *contagion*, nor do the persons who detail them consider them as evidences of contagion, but as showing clearly that the bad, infected air of ships, as well as other localities, may be so diffused about a wharf, as to produce yellow fever in those who are highly predisposed, by a strongly miasmatic or infectious atmosphere. They contend, that the infection, or infected air, of ships and other places, will diffuse itself, and produce disease in those who breathe it, provided the general atmosphere in which they live is highly morbidic, or predisposing to disease, but that it will not otherwise: that when such a condition of air exists, the infection will gradually spread, and finally, without a change of weather, produce an epidemic: and that, in a healthy state of the air, this infected air, or infection, does not extend itself.‡ That a ship, when so infected with yellow fever miasm, may be as much a source of miasm, or that it

* *Med. Rep.* vol. 3, p. 128-130.

† *Ibid.*, p. 136.

‡ *Med. Rep.* vol. 3, p. 200.

may be disseminated from a ship upon the contiguous population, as well as from a pile of oysters, or putrid coffee, or any other source of miasm. That this infected air from ships, in a healthy state of the atmosphere, will not produce the disease in those near the wharf where it lies, unless they go on board; or it will not infect the contiguous atmosphere, unless that atmosphere be highly contaminated, and have already predisposed the population to disease. Dr. Rush, and others, who were compelled to admit these facts, affirm that this infected air acts only as an *exciting cause*; and that, in this respect, it sustains the same position that dissipation, exposure, fatigue, and the like, sustain to disease. We do not object to this either; but if it thus becomes an *exciting cause*, which is *unavoidable*, and produces or excites disease in those who would avoid *the other* exciting causes, it is certainly as much to be deprecated as if it were called by another name; for it causes the death of those who might otherwise escape.

Another great point of difference among medical men, is in relation to the source or *origin* of the malaria of yellow fever, as an epidemic. As to its nature or properties, as before observed, we know nothing except by its effects upon the human system. It is an invisible, inodorous, aerial poison, which cannot be perceived by any of our senses; and has not been detected by any chemical analysis. Yet most men seem to look for it in the fætor which arises from the putrifaction of animal and vegetable substances: and these substances are looked upon as the only true source of the miasm of yellow fever. Hence, whenever yellow fever makes its appearance in any portion of a city, they immediately commence a search for the source of the infectious miasm; and the first matters of the animal or vegetable kingdoms, in a state of decomposition, with which they meet, are at once unequivocally declared as the source of the pestilential miasm. If nothing purely animal or vegetable be found in a state of putrifaction, they seize upon whatever, in their opinion, is most nearly

allied to them. And this continues to be the case, notwithstanding these fœtid effluvia have been tested, and found to contain no principle particularly deleterious to health: each one, in reference to the cause of an epidemic, looks alone to those matters which are most offensive to their *olfactories*; notwithstanding experience teaches that the infected atmosphere cannot be distinguished from common air, by any of our senses. In searching out the source of this disease, instead of being directed by reason and experience, it is too frequently the case, that they are "led *by the nose*" alone; and where nothing else can be found sufficient, all the pestilence is traced to a filthy back yard, a wet sewer, a dead rat, or a rotten potatoe.

As we before observed, the immediate cause of yellow fever as an epidemic, is a subtle gaseous poison in the atmosphere: but how it is generated, or from what it is thrown off, we are not certainly informed. The medical faculty have been constantly engaged in efforts to detect its origin and explain its nature; they have manifested zeal and industry worthy the cause of science, to search out and expound the hidden, if not mysterious cause. In unnumbered instances, they have supposed they had traced the monster to his den: but when they have attempted to place the shackles upon him, he has vanished. The difficulty of arriving at the true knowledge of such a mysterious agent, has only stimulated the zeal, and excited the industry of the medical faculty, whose province is to search out the physical causes of morbid phenomena. Hence the great diversity of opinions entertained and advanced on the origin of this pestilential miasm. At onetime, it has been traced successfully, as was believed, to putrefying and putrid vegetable matter, sometimes of one kind, and sometimes of another. At another time, it has been as clearly traced to putrescent *animal* matters of one kind or another: at another time, it has been as clearly traced to the *union* of animal and vegetable matter in a state of putrefaction; at an-

other time, it has been traced as clearly to a source differing widely from either, and apparently entirely independent of all of them; at another time, it has been traced to some atmospheric phenomena, independent of any cause under our control; at another time, it has been traced to increased and continued temperature of the seasons; at another to vicissitudes of weather, which were perceptible to our senses, as changes from heat to cold and *vice versa*; and, at another time, to changes of which we can form no definite idea, such as a mysterious epidemic constitution of the atmosphere. Other circumstances, again, have carried, as was believed, incontestible evidence that it has originated from personal contagion alone; others, again, seem to show, that personal contagion has no agency in the matter, but that it is a poisonous air generated in ships at sea, with or without putrescency. In every instance, the facts and arguments arrayed to sustain one theory, have militated equally against all others; and thus of each in turn; so that nearly every theory is opposed, if not controverted by all the others: and whatever ground is taken, there is ten to one against it. Under these circumstances, we must take a middle course; for, although it is not probable that all are true in the whole, it is equally improbable that all should be entirely erroneous. All these different circumstances or relations may have had some agency, at different times, in modifying the action of the poisonous miasm: although all of them certainly could not have been actual sources for its production. Some of these circumstances may have increased or diminished the susceptibility of the system to its action, or so modified it as to render its effects apparently more or less direct from the efficient malaria.

Great solar heat is one circumstance which invariably precedes, and is certainly an essential requisite to generate the miasm or infection of yellow fever; and the fact that the absence of heat, or *cold*, as invariably destroys it, shows that its production is effected by some unknown combination of solar

heat, with some unknown principle in the atmosphere; and we infer that the numerous other sources to which it has been ascribed, have had their agency only in modifying the effects of this poison on the human system. To enter into a detailed explanation of the *manner* in which these various causes may effect the susceptibility of the system, is beyond our present purpose. We will only remark briefly on some of the most prominent theories, in relation to the source and production of this miasm, or malarious poison.

Those who contend for its origin in *vegetable putrefaction*, have ascribed it to putrid coffee, to putrid potatoes, to putrid oranges, to rotten corn, to putrid sour crout, sour porter, and the like; in warehouses, on board ships, or lying exposed upon the wharves.

Those who believe it originates from *animal putrefaction*, have ascribed it to the opening of old burial grounds, to putrid fish, to putrid bacon, to putrid pork, to putrid animal carcasses, to putrid hides, to putrid oysters, and to similar matters discovered about the wharves and shipping, or in other parts of cities.

Those who contend for its origin in *effluvia* generated by the sun from the surface of the earth, have ascribed it to exhalations from stagnant water in marshes; to the exhalations of marshy ground, when all moisture is evaporated; to exhalations thrown off by loose earth exposed to the sun; to exhalations thrown off by mud, and common city filth, in sewers and back yards; and, when these are wanting, to any thing their fancy may suggest.

Those who believe it to originate in *sensible changes* of the atmosphere, have ascribed it to a dry, heated air; to moist heated air; to a continued *mean temperature* at or above 80° for forty days together; to sudden vicissitudes from hot to cool weather, and the reverse; to the absence or presence of much electricity in the atmosphere, and absence of thunder, &c.; others ascribe it to a peculiar insensible "*epidemic constitution*" of the atmosphere.

To nearly all of these causes have the yellow fevers of Natchez been ascribed, by the advocates of those different theories; and each have adduced certain facts to sustain their opinions. Upon each of which we shall make a few remarks, and pass on to the history of the epidemics of Natchez.

1st. *Of animal putrefaction.* Dr. Bancroft, in his work on yellow fever, to prepare the way for establishing his theory of marsh-miasm, has adduced an array of facts and evidence incontrovertible, proving that animal putrefaction may exist to any extent, and under all circumstances, without producing yellow fever; and consequently, that it is not a *necessary* source of the miasm; and that, of course, yellow fever miasm is, or may be, produced from some *other* cause. He has shown, that this kind of putrefaction, is not even a frequent concurring circumstance; and that animal putrefaction has existed in cities, and other localities, under the most favorable circumstances for its production, according to that doctrine, without having produced yellow fever, either epidemically or sporadically. He has shown conclusively, that putrid pork, putrid bacon, putrid fish, &c., fresh or salted, will not generate this miasm; nor will dead bodies of any kind, without salt, in a putrescent state, produce it; not even the putrefaction of human bodies, by hundreds, upon the burning sands and marshes of Egypt; nor is it produced by the intolerable stench produced and kept up by animal matters in cities, or about factories of glue and catgut; about butcheries, tanneries, chandleries, &c. These facts, which are incontrovertible, all confirm the opinion sanctioned by experience, that the miasm or infection of yellow fever, be it what it may, is not, in any sense, dependent upon, or connected with the *fætor* of animal putrefaction, either in its incipient state, or in a state of complete decomposition. It has been placed beyond doubt, that the miasm, or infection of yellow fever, has been generated abundantly in the holds of ships at sea, where no putrid animal or vegetable matters have existed; a good ex-

ample of this kind is found in the United States brig "Enterprise," hereafter referred to. There are cities or towns in the tropics, where abundance of putrid animal and vegetable matters are combined with effluvia from mud and marshy bottoms of shallow harbors, and yet they enjoy uninterrupted health: an example of this kind is found in the town of Campeachey hereafter cited.

2d. *Of vegetable putrefaction.* That this is not the essential cause of yellow fever miasm, is proved by the same array of facts and arguments which are brought against that of animal putrefaction. Vegetable putrefaction of the most offensive kind, and in the most extensive degrees, have occurred, without producing a single case of yellow fever in those frequenting them; and the most devastating epidemics have prevailed, where no mass of vegetable putrefaction could be detected. In our own neighborhoods, how often do we find cotton seed in a rotten state, to the amount of several hundred bushels together, with a stench almost intolerable, where no fever of any kind, much less yellow fever, is produced on the plantations? During the hot weather of summer, this is a common occurrence; yet, in no instance has it produced yellow fever among the swarms of negroes, and often white men, who are daily about them. In the last epidemic of Natchez, no masses of vegetable putrefaction were even suspected. When vegetable putrefaction or decomposition is carried on most rapidly, or in seasons with regular vicissitudes of rain and sunshine, there is *no yellow fever*: but it makes its appearance often when all moisture is dissipated from the face of the ground; and when the process of vegetable decomposition, must have entirely ceased, for want of moisture. The whole weight of testimony is against the probability of vegetable putrefaction being an active cause.

3, *Of marsh miasm.* Dr. Bancroft has labored much to prove that this is the *true* cause of yellow fever; but his labors on that point have all been in vain. We find this dis-

ease prevailing equally in the vicinity of marshes, and on the dry and barren rock, where no marsh is near. We find it equally prevalent on high and on low situations; upon the high bluff at Natchez, and on the still more elevated hills of Washington, as well as in the low marshes of Charleston and the quagmires of New Orleans; upon the sandy beaches of Pensacola and Mobile, and upon the rocks of Lisbon, Cadiz, and Gibraltar: we find it equally in the alluvial delta of the Mississippi and Orinoco, and upon the sterile shores of Curra-coa, where marshes are unknown. On the other hand, in many alluvial and marshy regions on the lower Mississippi and elsewhere, which ought to be most favorable to the production of marsh-miasm, yellow fever is unknown. In the West Indies, where it is endemic all the year, it prevails alike on the fertile, and on the barren shores; but it is unknown in the *interior*.

4th. *Arid and humid atmosphere* are alike non-essential to its production. For, under every variety of aridity or humidity of the atmosphere, has it appeared in our own country, as well as elsewhere. It has made its first appearance in New Orleans as an epidemic, in cloudy, damp, and wet weather; it has appeared there also in the driest weather; it has appeared also in other southern ports, in dry and in humid weather; after a wet and a dry spring; after a warm and a cool spring; it has prevailed at Natchez, after a wet and a dry summer; and, again, when the same months have not been either unusually wet or dry. It prevails in commercial places, equally where the air is habitually humid, and where it is habitually arid: no less in Charleston and New Orleans, than on the parched shores of Curra-coa.

Dr. Peixotto informs us, that the yellow fever is endemial in the island of Curra-coa at all times and seasons, but it occurs more especially in the *calm and sultry months* of the year. New comers from northern latitudes are its appropriate subjects: the natives and seasoned inhabitants being exempt from

its attacks." * On this island, it becomes epidemic only when large numbers of northern strangers arrive during the *sultry months of the year*. Yet the air of this island is proverbial for its *dry*, elastic qualities. Dr. P. informs us, "The *air is pure and dry*, and seldom or never darkened with mists and fogs, so frequent at the north. * * * During the droughts, which are common, the leafless desolation of winter reigns under a tropical sun: ordinary wells are exhausted; animate and inanimate nature suffers under the burden, and seems nearly ready to waste away and perish." † On this island, there is no marsh, or scarcely a stream of fresh water.

5th. *Sensible changes of temperature, alone*, have no material influence over the generation, or accumulation of this miasm. The general views, entertained by those who advocate the theory that a certain unremitted *mean temperature* is the chief cause of yellow fever, is embraced in Dr. Caldwell's "Dissertation upon Yellow Fever;" ‡ viz. that whenever the *mean heat* or temperature is steadily up to 80° Fahrenheit, or above, for forty days or more in succession, yellow fever will be produced; but if the same mean temperature be maintained for only twenty, thirty, or even thirty-five days, there will be no yellow fever, provided there be no "epidemic constitution in the atmosphere," which he has not explained. This, at first sight, might appear plausible; but facts completely confute the arguments. We need not go further than to our own city for the facts. According to a meteorological table given by Dr. Perlee, || the *mean* temperature of July and August, for sixty-two days, in 1814, 1816, and 1818, was steadily from 80° to 83°, yet no yellow fever occurred in Natchez in either year. In 1817, the mean temperature of July was 80° for thirty-one days, and August 77° for thirty-one days, giving a mean temperature of 78½° for sixty-two days

* New York, Med. and Phys. Jour. vol. 1, p. 411, 412.

† Ibidem, p. 398, 400.

‡ See Med. and Phys. Memoirs, Lexington, 1826, p. 141, 2. &c.

§ Chapman's Med and Phys. J. v. 3, p. 17.

and yet the yellow fever prevailed malignantly. In 1819, the mean temperature of both July and August, sixty-two days, was up to only 79° each month, and the mean of September for thirty days, was 75° , and yet the yellow fever prevailed with great mortality, having become epidemic on the 14th of September. We might cite authority without end, to show the same facts in other places every year; but we will adduce only one more from Natchez, as obtained from the tables of Dr. Tooley and others. In 1824, the mean temperature of July was 86° for thirty-one days; of August, $82\frac{1}{2}^{\circ}$ for thirty-one days: together sixty-two days, averaging 84° , and yet no yellow fever occurred in Natchez that year.* In 1825, the mean temperature of July was 81° for thirty-one days; and of August $83\frac{1}{2}^{\circ}$ for thirty-one days: averaging 82° for the whole, or 2° less than 1824, yet the yellow fever prevailed with great mortality. If the miasm of yellow fever were the result of any change of moisture, or of **TEMPERATURE** *solely*, which the thermometer would indicate, then we might avert it by watering the streets, to reduce the temperature: or, at least, we might be able to foretel its appearance, and escape in time. But this has not yet been done.

There is, doubtless, more or less of a general "epidemic constitution of the atmosphere" existing at certain times, over an extensive scope of country. This peculiar state of the atmosphere, will doubtless predispose the inhabitants to diseases of a certain type, and they will be afflicted epidemically, where the particular locality is favorable, and the requisite *exciting* causes are brought into action. But as regards yellow fever, we believe the peculiar condition of the general atmosphere, which precedes it, can be observed, and guarded against, by proper and timely precaution, and the avoiding and removing what are admitted to be *exciting causes*. This

* In 1824, there were 12 days with rain in July · 9 days in August, and 5 in Sept.
 In 1825, there were 12 " " " 11 " " 5 "

“epidemic constitution of the air,” can be nothing else than the *το θιον* of Hippocrates; or the “*seminarium e celo dimissum*” of Diemerbræck, if it be not from some physical cause; and the present state of medical science is such, that we are not satisfied with an explanation which implies mystery.

Whether yellow fever infection can be *imported*, and disseminated in an impure air, is a point upon which there is less difference of opinion, than upon the origin of the miasm: for, although many contend for its local origin, and the non-contagious character of the disease, yet there are but few who cannot perceive, and must admit, that when the miasm, or infection, is once generated abundantly, it may be introduced into impure air, and there spread the disease. But few remain who are not able to perceive, that persons may be infected with yellow fever, who sleep in beds or blankets, taken from highly infected air, or which have likewise been used as the death-bed of yellow fever patients.

As we have said that yellow fever is a *commercial disease*, we will show to what extent it is so, and in what manner it obtains that character. In our citation of authority, we have been careful to depend upon those who range themselves as the advocates of the domestic origin of the disease, and not upon those who have been steeped in the doctrine of contagion. This fact, we hope, will give due weight to the authority which we adduce.

All testimony tends conclusively to establish the point, that ships which have been long at sea in tropical latitudes, have occasionally become thoroughly infected with yellow fever miasm or infection, either while at sea, or while in port: and that this infection has occasionally been so concentrated as to have produced yellow fever in its most aggravated form, in those who have gone on board from shore; and that such persons have taken the yellow fever, and died of it in from five to ten days after they breathed the infected air of the ship; although, at that time, none of the sailors or hands on

the ship, were laboring under that disease. In this manner doubtless, in some instances, has yellow fever begun to prevail in sea-ports, among the many who daily, unconscious of the infection, visit such ships while in port. In this manner, in many instances, have the first twenty or thirty cases been traced to intercourse with an infected ship, or to goods from the same. These first cases are generally persons near the wharves, draymen, day-laborers, and others who are engaged in assisting to unload the cargo. It is perfectly immaterial whether the ship brought the infection from a *foreign port*, or generated it during her voyage. If the air in her hold can be disseminated about the wharf, or even if it will cause those who visit the ship to die of yellow fever, it certainly is an *imported* disease to those who suffer.

A ship can certainly become infected, and much more completely than a house, or a district of a city. On shipboard, the air below is necessarily close for want of ventilation.— We will not travel over all the mass of testimony which might be adduced: but will cite only a few instances in our own country, which are conclusive: for one unquestionable case, is as amply illustrative of the principle, as twenty.

Dr. Tully,* one of the most scientific physicians of Connecticut, gives an account of a number of cases of yellow fever at Knowles' Landing, in August, 1796. This is a village on the Connecticut river, about six miles below Middletown, containing a population of about two hundred souls, and situated on a steep declivity, with spacious and airy streets, and not crowded with houses. The number of cases that occurred at this place was eleven, of whom nine died. Every case was clearly traced to communication with a vessel which had recently arrived from Havana, on board which one of the sailors had died with yellow fever on the voyage. The whole number of cases occurred and terminated in the course of a fortnight; for the alarm excited by the appearance of

* See Med. and Phys. Jour. of New York, vol. I, p. 153-8

a malignant disease among them, caused a complete and speedy desertion of the village, and non-intercourse with the ship. This village has always maintained the character of uncommon salubrity. Up to the arrival of the infected ship, no disease of any kind prevailed; and immediately the ship was abandoned by the inhabitants, the disease ceased. The infection on board this ship was not generated by putrefaction of either animal or vegetable matters, as none existed on board; and Dr. Tully declares that she was perfectly clean; no such matters were found in the town, or suspected by any as the cause of the disease: the ship was the undoubted source, and none were attacked but such as had been on board. In this case had the weather been such as generally *precedes epidemic yellow fever*: and had the inhabitants not fled, but remained, and continued their intercourse with the infected ship, the town would doubtless have been visited with *epidemic yellow fever*.

Dr. Tully informs us, that as many other cases occurred at the different places at which this vessel anchored in ascending the river, and always in those only who had been on board. He also informs us, that, for the last twenty-five years, scarcely a year has passed, in which one or more similar cases have not appeared at different points on the Connecticut river; all of which are clearly attributable solely to intercourse with vessels from the West Indies, or from southern ports of the United States.

Dr. Bayley,* health officer of the port of New York, gives an account of a number of cases of yellow fever which occurred, in the autumn of 1821, at the "quarantine establishment," on Staten Island, six miles below the city. From the 8th of September until the 7th of October, twenty-nine cases and twenty-one deaths occurred; of the latter, fourteen had black vomit. These cases were clearly traced to intercourse with infected vessels then lying at the wharf, and re-

* New York Med. and Phys. Jour. vol. 1, p. 27, 28, &c.

cently from the West Indies and New Orleans. The health of those about the "quarantine establishment" never was better, both immediately before and after these cases: nothing like bilious or remittent fever had been seen: neither marshes, nor filth, nor vegetable putrefaction existed any where in the vicinity. The cases were traced clearly to the ships, and to them alone: and each case occurred just five days, and one on the sixth day, after the particular exposure to the infected air of the vessels. A washerwoman and her two daughters, took the disease, without having been on board the vessels. They contracted their disease by handling and washing the foul clothes and bedding of four men who had died of yellow fever about four days previously. The bedding and clothes had been thrown aside until taken to her to be washed. She took the disease just five days after she had handled the clothes, and died on the fifth day of her disease; her daughters were attacked afterwards. In this case, a favorable condition of the air would, no doubt, have caused it to become epidemic.

Dr. Bayley* also gives us the case of the United States' brig *Enterprise*, infected with yellow fever, at the "quarantine ground," in 1822. This vessel was perfectly clean, and free from any animal or vegetable putrefaction. She arrived from Havana with ten cases on board; and immediately the sick were removed to the hospital, and the well were quartered on shore, to avoid the infected air of the vessel. She was then thoroughly cleansed, ventilated, washed, and white-washed with lime, in a tenfold degree; lime was slaked in her timbers in large quantities. Yet, after this purification, she retained the infection, and communicated the yellow fever to those who afterwards went on board; of whom five, out of eleven, died. The process of purification was again instituted. Artificial ventilation with windsails was constantly performed; water, to the depth of several feet, was daily let

* New York Med. and Phys. Jour., vol. 1, p. 426-7, &c.

in, and pumped out: lime was strewed in the hold, and her timbers thoroughly whitewashed, and still the infection was not destroyed, until cold weather. In this case, her own crew having taken the disease first, the people from shore avoided the vessel, and escaped the disease.

Another case is given by Dr. Kollock, and quoted by Dr. Rush, in which a vessel at sea, in tropical latitudes, engendered on board a malaria which finally produced yellow fever. This is the case of the United States' frigate General Greene, which became infected while on a cruise in the West India seas, and did not become disinfected until she reached the cold climate of Rhode Island. During the time, she retained the infection, every kind of cleansing, fumigation, and ventilation, were used freely, but ineffectually. In this case, the vessel was new, and perfectly clean and healthy, when she left Newport, Rhode Island, on the 3d of June, 1799. She had on board a complement of two hundred and fourteen souls, besides large quantities of provisions for a cruise in the West India seas. Having encountered a storm, soon after she put to sea, the vessel became leaky, and a noxious malaria was generated, during a subsequent period of unusually *hot weather*. At first, and for some days, the disease assumed the symptoms of a violent bilious fever, with no deaths until they arrived in the port of Havana; when immediately several cases began to assume symptoms of *yellow fever*. "After this period," says Dr. Kollock, "three, four, and five new cases occurred daily; and the violence of the symptoms seemed to *increase with the multiplication of cases*, during the six days she lay in port." † Cases and deaths continued to multiply daily, until she passed the capes of Virginia, when the disease became gradually milder. The whole number of the cases was forty; and twenty of them died. In this case, an infectious air was generated in the ship's hold, by the number on board, during the hot weather and leaky condition of

† Med. Rep. vol. 4, p. 3.

the vessel; and it appears that the "leaven" of infection was superadded at the port of Havana, either by persons going on shore, and contracting the disease there, or by the introduction of infected air, &c. Many other cases might be cited, in which infection has been generated and carried in ships into ports, and there produced yellow fever in those from shore who entered on board, although the crew of the vessel, being acclimated, remained free from disease.

The only point remaining, to establish the importability of epidemic yellow fever in ports, is whether the dissemination of the infected air of the ship in the vicinity of the wharf, among the crowds that frequent them, and reside near them, together with ten, twenty, thirty, or more cases, which were contracted by going on board such vessels, be capable of causing the disease to spread, among those contiguous, who do not go on board, and this when the temperature of the season, and the sultry, and if desired, the miasmatic state of the air, is in the most favorable condition for disseminating the disease. Of this, we think there can be no reasonable doubt. Dr. Rush, and his coadjutors in favor of the domestic origin of yellow fever, admitted that it might, and had occasionally, spread from ships in an impure air.

Dr. Mitchell,* one of the most able advocates of the local or domestic origin of yellow fever, in a report made to Congress, February 25th, 1803, admits, and even contends that vessels often become highly infected, while at sea; that an impure air is generated in the holds during *hot, sultry weather*, in tropical climates: that this infection may be communicated, not only to those who go on board, but that the infected air may be diffused in the atmosphere about the wharves and shipping, and thus excite the disease more generally. He contends, very properly, against useless and idle detention at quarantine, when no disease or infection has been on board the vessel; but he urges the necessity of detention, and tho-

* See Med. Repos. vol. 6, p. 460, &c.

rough ventilation and cleansing, in case of infection, until the infection is destroyed. In all this he denies the *foreign origin* of infection. But is it not immaterial to those in sea port towns, whether the infection be generated on board, or contracted in a foreign port? If it can *spread* among those where the ship arrives, it is as important to guard against it, as if it were of *foreign origin*. Dr. Rush unequivocally admits that there is much danger to be apprehended from "the foul air of ships," where cases of yellow fever have occurred. He also admonishes us, "to prevent the landing of persons affected with the ship fever, in our cities, and the *more dangerous practice of ships pouring streams of pestilential air from their holds upon the citizens, who live near the docks and wharves.*" Med. Rep. vol. 6, p. 166.

Again, in a communication from Dr. Rush and others to Gov. Mifflin, in relation to the yellow fever of 1797, in Philadelphia and Kensington, it is maintained, "that, *in addition to the filth and putrefaction about the city, the foul air issuing from the holds of two ships, (designated,) produced the yellow fever, independently of foreign contagion.*" Again, the authors declare, that "the close, unventilated holds of ships, after *long voyages in hot climates*, with perishable matters on board, thrown open in a *heated, sultry atmosphere*, are a fruitful source of miasm: although they infer, that "yellow fever has not been *so often* propagated by *contagion*, as has been supposed." See Med. Repos. vol. 2, p. 95, 96.

Without multiplying authority, we will cite one case which is full of instruction to those who preside over the port police of our cities. We mean the "Yellow Fever" of New York in the summer and fall of 1822. This epidemic, if it could be so called, commenced by scattering cases from the 15th to the 20th of July, and cases multiplied gradually until the 15th of August, when it was considered epidemic. The whole number of yellow fever cases, from the 15th of July until the 1st of November, when it ceased, was about four

hundred and thirty, of whom about two hundred and fifty died. It began in Rector street, near the wharf, where four ships' cargoes had been discharged from infected vessels, a few days before. From this point, it spread very slowly over several squares in the vicinity, having extended only a few squares in thirty days: while the remainder of the city was unusually healthy. The squares over which it prevailed most fatally, were bounded by wide, clean, and airy streets, and the most substantial buildings in the city: no filth could be found in the vicinity; the infected air from the original infected point having been wafted thither by the winds.

These are the facts without speculation; viz: the first cases began between the 15th, and 20th of July. Between the 1st and the 9th of July, the cargoes of four infected vessels from Havana, were discharged at the wharf at the foot of Rector street, and stored in warehouses. Two of these vessels had lost some of their crews by yellow fever, on the voyage; the crews of the other two were Spaniards and acclimated sailors. During the first two weeks of July, the weather was very warm, the sun cloudless, and the air "*very calm and sultry.*" During the months of July and August, there were almost daily arrivals of other vessels from Havana, and other ports where yellow fever was known to be prevailing. During this period, the number of vessels from West India ports was unusual; because, on account of the terror of pirates, they came in companies, under the convoy of battle ships. The following are the arrivals at the quarantine ground, between the 11th of June, and the 17th of October; viz: From Havana, eleven vessels, having, or having had on board, forty-four cases of yellow fever and twenty-one deaths; from Matanzas, one vessel, with three cases of yellow fever; from St. Jago, two vessels, having had three deaths from yellow fever; from Port au Prince, St. Domingo, four vessels, with six deaths from yellow fever: from Vera Cruz, between July 17th and 28th, three vessels, with nineteen

cases and two deaths from yellow fever, before arrival. Besides these, there were, during that time, about forty other vessels from southern and West India ports, whose crews, being Spaniards or acclimated seamen, had no cases during their voyage, although the air in some of the vessels proved infectious to those who were unacclimated.

If any one will take the pains to examine the accounts of this epidemic, as detailed by Dr. Townsend,* Dr. Bayley, and Dr. Walters, and after making every allowance, especially to Dr. Townsend for his views of contagion, of that charity which the advocates of the *exclusive local origin* of yellow fever are so ready to bestow, he will find ample reason to admit, that the atmosphere about the wharves was contaminated by the infectious air imported in ships from tropical climates.

To those who are at all conversant with the history of nautical diseases in hot climates, it cannot be a matter of doubt, that vessels frequently become infected, while cruising in tropical seas, and lying in tropical ports, and the sailors and passengers, especially when they are unacclimated natives of northern latitudes, will sicken and die. An infected air also accumulates gradually, in some manner, in the holds, which will infect strangers, although the crew may not suffer.—When large quantities of this air is brought into our ports, in hot, sultry weather, as was the case at New York in 1822, it will certainly infect the contiguous local atmosphere; or act as a morbidic “leaven” to it, just as the infected air of an “infected district” gradually extends itself over other parts of a city. It does not change the nature of the case, whether the infected air depend, in any degree, upon personal “contagion.” But if the yellow fever, as an epidemic, depend solely upon “an epidemic constitution of the atmosphere,” we would inquire, why it does not affect every part of a city indiscriminately, and not that part only near the shipping?

* See Townsend on Yellow Fever of New York, in 1822.

If any one admits that the air of a city can be infected from a pile of putrid matters or filth, why can he not perceive that it can be much more readily infected from a source where the infection is completely formed, and virulent, and only requires diffusion in the air? Let not the specious term "contagion," mislead.

If these sources of miasm or infection be capable of exciting yellow fever in those persons who reside near the landings, although highly predisposed by the impure air of the city, but who might otherwise escape, it is but poor consolation to be informed, that it is not "*contagion*," or that the infection is not brought from a *foreign port*. *To them it is imported*, although it may have been generated only three days, or twenty-four hours before the ship arrived in port. If only the *exciting cause* is thus imported, would not all cities do well to prohibit the introduction of this exciting cause?

We have said yellow fever is a commercial disease; and that it prevails mostly in ports which carry on extensive trade with tropical countries or ports. Those towns and cities which do not carry on such commerce, are mostly exempt from yellow fever, although in the same latitude with those afflicted by that disease, and under the same general circumstances. To say the least, they are exempt from the *exciting cause*, whether it be infected air from ships, or the simple fatigue and exposure of seamen about the ships. In certain years, a general predisposition exists, as the effect or result of continued hot, sultry weather, from New York, or even from Boston, along the whole sea-board, to New Orleans.— This general predisposition, which may, however, vary in degree at different places, finally, in most places, passes off without any epidemic yellow fever, except in a few towns or ports, which, have fine deep harbors, and enjoy extensive commerce with tropical countries. In others not possessing these advantages, it does not prevail. Hence we find it prevails in Philadelphia, New York, Baltimore, Norfolk,

Charleston, Mobile, and New Orleans; but why does it not prevail, at the same time, in Harrisburg, at Troy, at Washington City, at Richmond, at Columbia, at Opelousas, at Tuscaloosa, and other inland towns? The same general predisposition, or "epidemic constitution of the air," exists in all these places; but only a few of them are exposed to the "*exciting cause*, necessary to produce an epidemic:—the "leaven" from the infected air of ships, or goods from infected places, are wanting to complete the train. Those towns that are destitute of these, avoid the pestilence. Sporadic cases may occur from high exciting causes of another kind, but in a free, pure air, it passes off without exciting other cases.

A case presents directly in point, on this subject, as well as in relation to the agency of putrid exhalations and marsh miasm in the production of yellow fever. The town of Campeachey is situated on the Gulf of Mexico, in latitude $19^{\circ} 45'$ N.—Vera Cruz is situated about three hundred and fifty miles distant, but in about the same latitude. Campeachey is healthy, and Vera Cruz is visited annually with yellow fever. The circumstances generally considered most favorable to the production of yellow fever, are equal in both places. Campeachey is built mostly of stone, upon a substratum of limestone rock; the soil of the surrounding country, as well as a part of the town, is a sandy loam, and often becomes very muddy; the town is surrounded by a stone wall about ten feet high; the streets are wide; the houses are large and airy; on the back part of the town, there is a high hill, or moderate mountain, which greatly interrupts ventilation, so that the inhabitants suffer greatly, from "all the inconveniences of a sultry, confined air." "In front of the middle of the city, is a large wharf or mole, extending one hundred yards into the water. Along this mole, there is constantly deposited large quantities of filth of every kind, together with "large quantities of *putrid fish*." "When the tide, (which rises and falls two or three feet,) retires, all these matters are

left exposed in the mud, and on the shore, to the direct rays of a vertical sun, until the stench is intolerable to strangers." Besides these things, there are also other "accumulations of filth in other parts of the town." Yet "the inhabitants are very healthy": there is only one physician in the place, and he has not half employment in his profession, although "the population is about ten thousand." See Med. Rep. vol. 4, p. 5-8. Vera Cruz is situated upon a sandy plain, with sand hills in its rear; contains no more filth than Campeachey; the air is no more confined or sultry; the inhabitants are no less temperate; yet Campeachey is healthy, and Vera Cruz is annually visited with yellow fever of the most malignant type. See Med. Repos., vol. 4, p. 7 and 8: also, vol. 3, p. 46, &c. A. D. 1800.

How is this paradox explained?—Campeachey has an extensive, but shallow harbor, so that large ships cannot approach near the town; only boats and small craft can enter the harbor, such as do not exceed fifteen or twenty tons.—Hence, so far as commerce with remote regions, and the foul air of large ships, from long tropical voyages, are concerned, it is equivalent to an inland town: and it is also free from the crowds of *strangers*, who infest large commercial ports. But Vera Cruz carries on an extensive commerce, has a fine deep harbor, and thus does not lack for infected air from ships, and crowds of strangers upon whom it operates. These, when attacked, contribute to the infection, which is like "leaven" in the contaminated atmosphere, and assists in producing the epidemics. *Ibid*, p. 78.

Although the yellow fever is endemial all the year in Cuba, it is almost exclusively confined to the commercial ports. The elevated savannas of the interior are as much a stranger to it, as our own interior towns. In the ports, it attacks principally strangers, and prevails mostly from the beginning of July to the middle of November. When there is a great influx of strangers, it becomes more malignant, and finally at-

tacks many of the acclimated inhabitants, especially such as are exposed to the ordinary exciting causes of fevers. It is believed, among the people of Cuba, that the influx of strangers, and their numerous attacks from yellow fever, contaminates the air, or infects it, and causes it sometimes to become epidemic, when otherwise it would not have prevailed.

To produce yellow fever as an epidemic in our cities, we conceive three grades or stages of action in the production of the infection:—first, the miasm, or simple basis, which alone is innocent. 2d. Its combination with impure, or exhausted air, or with air deprived of its healthy, respiratory properties, and charged with animal exhalations:—in this state, we call it *infectious air*, or malaria. In this state, it is a strong predisposing cause of disease, and a suitable “*nidus*” for the reception and extension of personal infection. 3d. Infection, or the union of personal infection with infectious air, or malaria. In this state, it is an aerial ferment; and, when respired, becomes the active, predisposing, and exciting cause of yellow fever. These views we will further illustrate:

I. THE MIASM OF YELLOW FEVER.—This we consider as a subtile, gaseous, invisible, and inodorous matter, generated by the action of the sun, or by solar heat, upon the *atmosphere*, independently of any effluvia or fætor from the decomposition of animal matters, and independently of any exhalations from marshes, dry earth, or vegeto-animal compounds, or any thing of those kinds. We believe it to be the result of some unknown combination of the solar rays, with the atmosphere, which takes place at all times and in all places, while the temperature in the shade is steadily between 88° and 98° of Fahrenheit, or between 110° and 130° in the open sun: that its specific gravity is much greater than that of common air, and that it possesses the common properties of aerial fluids. We think it probable, that, in its *simple state of miasm*, it is innocuous; but becomes morbid by combination with impure air; that commonly it becomes separated from pure air, and settles

near the ground; that it is partially neutralized by a temperature of 55° or 60° ; and is entirely destroyed by a temperature of 50° or 45° at the lowest. The degree of its morbid qualities depends upon the nature and degree of combination.

Hence, in our opinion, it can accumulate in dangerous quantities only when the weather is steadily between 88° and 98° during the day, and above 60° or 70° at night, and during a period when there is but little wind to disperse it, or only sufficient to waft it gently in the air, and cause it to settle in low confined places, in a manner similar to the collections of carbonic acid gas. We think, unless the weather is unusually calm and sultry, or remarkably warm, to cause its rapid formation, that it requires from ten to fifteen days for it to accumulate sufficiently to be in any wise prejudicial; that strong winds sweep it away, or diffuse it in the general air; and heavy rains wash it partly off, or cause it to settle in low, damp places, and deep bayoux; where, in a long succeeding calm, hot period of weather, it will accumulate until they overflow, and spread it over the surrounding grounds near their margins: that it assumes a level surface, like water, and hence is deeper in some points than at others, in proportion to their relative elevation: that it cannot accumulate on steep declivities without a barrier below, when it rises only to the level of the barrier. On perfectly level surfaces, it seldom raises its surface more than three or four feet above the ground, and most commonly not more than two or three feet. A cold night, with a temperature below 50° , would destroy all that had previously generated; a strong wind or tornado would sweep it out from bayoux, ravines, or low confined places. Hot weather favors its formation; calm weather favors its accumulation, as well as the contamination of the air requisite to form a morbid union with the miasm.

We believe it requires for its formation an extreme temperature above 88° , because unless the temperature has been up to that point during the hottest period of the day, for many

days, no yellow fever has occurred; whereas, although the temperature of the nights may have been up to 80° or above, so that the mean temperature is 80° or 82°, yet if the greatest heat of the day has not been up to 88° at least, there is no yellow fever. Again, a few days may give an extreme temperature of 90° or 95°; yet if one or two cool nights, at a temperature of 50° or 55° succeed, there will be no yellow fever for ten days subsequently at least. Again, there might be thirty days in succession, with an extreme temperature as high as 93° or 95°, and yet two cold nights, ten or fifteen days apart, would neutralize all the miasm previously formed; and although the *mean heat*, for a month or longer, might average more than 80°, there would be no yellow fever. Hence the *mean heat* should not be taken into our estimates; but the actual temperature by day and by night. The winds may be fresh from the south, so as not to reduce the temperature below 90° by day, and yet they may carry off all the miasm, or all the contaminated air: or a calm, hot day, may be succeeded by a gale at night, which will carry off the miasm. This miasm is not injured or neutralized by damp air: on the contrary if calm, damp, foggy, cloudy, or misty weather, succeed many days of intensely hot and sultry weather, the miasm previously formed, remains, if it does not accumulate; damp, moist air is congenial to it, and seems to attract it: or it settles over low, damp places, in preference to dry ones of the same elevation. Hence it accumulates in deep ravines or bayoux. Upon these principles, we perceive why yellow fever is most prevalent in low, damp sections of cities, near the wharves and about the shipping. These places attract and retain the miasm already formed: as well as favor its generation and preservation. The temperature about such places, from their exposed situation, is often at least two or three degrees higher than in other parts of the city. The reflection from the water adds to this effect by day, and moderates the cold by night. The temperature of the country air

is generally at least two or three degrees less than it is in any closely built parts of cities, not only during the day, but at night; country air is necessarily much cooler, because there is not such an accumulation of heat in radiating bodies.

Although it requires a temperature above 88° to generate miasm, we find that it requires a reduction of nearly one-half to neutralize or destroy it. Hence yellow fever is often endemic all the year in the West Indies; for there the temperature of the air is seldom below 55° of Fahrenheit, and where *infection* exists, even that temperature will not destroy it. These facts may be illustrated by similar ones in relation to another fluid. Thus water, for example, under the common atmospheric pressure, will not boil at 200° or 205° Fahrenheit; but it will boil at 212° . At the latter temperature it passes off rapidly into vapor; and a much lower temperature is required to condense this vapor again into water. To effect this, it must be reduced to a temperature but little above one third of that which has been necessary to convert it into steam; and by reducing the temperature to one-half of the last, it becomes solid. Somewhat similar may it not be with the miasm of yellow fever? It seems to require a temperature of 120° in the sun, or 88° or 90° in the shade, to generate it; although it is destroyed by a temperature as low as 50° .

We suppose this miasm innocuous, when uncombined, because we find during the hottest weather in cities, when the thermometer at mid-day ranges between 90° and 95° in the shade, there will be no yellow fever, while the air is sufficiently agitated with winds to carry off the air which has been freely respired, and is freely charged with exhalations from living bodies: for, although the miasm may be generating rapidly at such times, there is no tendency towards yellow fever, until the air becomes stagnant, and often respired, and charged with animal exhalations: when it seems to acquire new properties and new virulence. We know that but a short time before an epidemic begins to prevail, the most

perfect health often prevails among those who become the first victims; although, at other times, cases of common bilious remittents are the harbingers of the epidemic. The latter, we believe, occurs only after much hot, damp weather, and the former after hot and *dry* weather.

We suppose that this miasm is not morbidic *per se*; that it separates itself from pure, free air, and settles to the lowest places; but that it combines actively with impure air, especially such as has been frequently *respired*; and thus it becomes a more active cause of disease. When thus combined, we call it *malaria* or *infectious air*; and in this state it is a predisposing cause of disease, as well as a suitable nidus for infection. In this infectious air, infection will spread, and yellow fever may be disseminated among the people, by *exciting causes* of a mild kind, or without any. When thus combined with contaminated air, it becomes more volatile than before, and diffuses itself more generally in the atmosphere, although it is still heavier than common air, and remains about those places which collect and retain the miasm.

II. INFECTIOUS AIR OR MALARIA. This combination, when not concentrated, or when moderately diluted with free air, conveys a very slight predisposition to yellow fever: but when concentrated by close, sultry weather, in a dense population, the predisposition will be so strong that sporadic cases, under *highly exciting* causes, will occur; especially among strangers, and those who are unacclimated. Those who are acclimated escape. If many sporadic cases occur, we may infer the existence of *malaria* or *infectious air*, and without a change in the weather, such as a reduction of temperature, winds, or a rain-storm, we may expect yellow fever to become epidemic. Each case appears to hasten on the epidemic, as if it were by imparting some deleterious property to the impure air at different points, and thus forming finally a fermentative coalescence. If several of these sporadic cases occur in the same vicinity, as it will do if there be many unacclimated

foreigners together, the disease will begin to spread from that point. Others who are unacclimated, will be attacked *without* any *highly* exciting cause, and finally without *any* exciting cause except the infectious air about them, which has gradually become *infected*. When the air becomes highly infected, it appears to be more volatile and in some manner diffuses itself more readily than when in the form of miasm alone, or even of malaria, and it doubtless does possess the power of extending or reproducing itself.

The impure air, which unites with miasm, and forms the infectious air, which is the proper basis for receiving and extending the infection, is dependent, we think, chiefly upon the effects produced upon common air at a high temperature, by respiration and animal exhalations, especially from human bodies. This prepares it for the union with miasm. Thus from miasm the *first degree* of contamination is effected by exhalations from healthy bodies in a high temperature: the *second* by the accumulated exhalations from bodies laboring under high grades of yellow fever; or, by a much greater concentration of the morbid properties, which appears to take place after, but not before the sporadic cases occur.

Our reasons for believing that respiration and cutaneous exhalations effect the morbid change in the air, to form malaria, are principally as follows:

1. That sultry weather is always necessary to produce malaria, and to cause yellow fever to spread when infected air has been introduced. I have in no case found yellow fever to become epidemic at any place shortly after it had been thoroughly swept out by a storm, unless in cases where infected air had been previously generated and retained in the houses. Stagnant air, when exhausted by men and animals, is as destructive to health and life in them, as stagnant water is to fish, when overstocked. Running water always affords a change for fish; and in the large masses of water, they change their places in it. So with air, where from the con-

fined situation of a city or district, or from the nature of the buildings and enclosures, or from a general and protracted stagnation of the atmosphere, the air is not sufficiently renewed, it becomes more or less morbidic, by being breathed repeatedly and charged with animal exhalations.

2. When there are sufficient winds to sweep out the avenues and streets of cities frequently during summer, there is no yellow fever generated as an epidemic, although the actual heat, as indicated by the thermometer, may be at least three or four degrees higher, than it is in sultry weather, when yellow fever begins. This is confirmed by the history of every epidemic yellow fever which we have been able to examine, either in the United States or the West Indies.

3. We know that yellow fever, during our epidemics, prevails especially along the margins of the large and deep ravines or bayoux, which originate around the city, and spreads mostly in the space embraced in the declivities towards these ravines. The miasm settles in them at all times; and the air contaminated by exhalations and respirations of the contiguous population, in sultry, calm weather, settles in these declivities, and the infectious air becomes more concentrated near the margins of the ravines, and especially in their channels. Gentle breezes, after a long, sultry, calm spell, will sweep over the tops of the houses and points of the hills, but will not sweep out these bayoux; at most they will agitate and waft it upon those who were before out of its reach. In proportion to the distance and the range of elevation above the declivity to the margin of the ravine, so is the immunity of persons.

4. There are other bayoux and ravines, equal to those about Natchez, in the country, but, although they may and do generate miasm as fast as those near, and in Natchez, they do not produce *yellow fever*; because they have not the population to contaminate the air, and cause it to combine with the miasm, so as to produce yellow fever malaria. On those

bayoux or deep ravines in the country, we find only common grades of bilious fever; which is produced by the union of marsh exhalations with miasm.

5. The same principles are illustrated by the facts connected with epidemic yellow fevers in cities differently situated from Natchez; where, instead of bayoux, there are other low surfaces to accumulate the malaria.

6. The same principle is fully sustained in the production of yellow fever on board large ships at sea, crowded with human beings, as line of battle ships: these become infected at sea, only when there is a continuation of hot, calm, sultry weather. At other times, only bilious fever will occur in them. This malaria, in common seasons, may generate so slowly, or be so slightly concentrated, as to produce no active disease. While in this state, like other poisons, the whole population of a city may be respiring it in such small quantities, that they not only feel no inconvenience, but they actually, by habitual exposure to it in its diluted state, acquire an immunity to its effects, even when it becomes more concentrated. The same immunity to its action is obtained by the development of the disease, provided it be so mild as not to destroy life. This effect is produced by blunting the sensibility to its action, similar to that produced by a continued use of ardent spirits. Those who have undergone this acclimating, will remain unharmed during an epidemic, while strangers and non-residents will be cut off rapidly by the disease. When the malaria of common seasons becomes concentrated by a continuation of hot, *sultry* weather, or by numerous sporadic cases of strangers, or by infected air introduced, the epidemic follows. Sometimes, doubtless, an epidemic might be avoided, were it not for imprudent exposure to common exciting causes, which, in such a time, give additional power to the malaria, by preparing the system to its action; or by diminishing the powers of the system to resist its operation.

We have said the air was *exhausted* by respiration in sultry weather, in addition to the animal exhalations with which it is charged. Doubtless respiration is one of the most potent sources of contamination to the air, when confined. Whether this contamination proceeds from any new principle or property imparted to the air from the lungs, as carbonic acid gas, ammoniacal gas, or nitrogen; or by depriving it of any property known to chemistry, we presume not to decide. But we believe it is *exhausted*, to a certain extent, of the vitalizing principle, the "*pabulum vitæ*," and at the same time contaminated with animal effluvia. Hence the necessity of winds and storms to carry off these matters and replace fresh air. Air exhausted by respiration and charged with animal effluvia *without* miasm, will produce fever; and the same at a low temperature will produce common typhus, jail, and ship fever. The same with miasm in a hot climate will produce yellow fever. The most rapid effects from exhausted air on record, are those of the hundred and forty-six Englishmen, confined in the "black-hole" at Calcutta, of whom all but twenty-three died in less than eighteen hours, with all the symptoms of a most malignant and ardent fever, produced solely from exhausted air charged with human effluvia.

The general atmosphere sometimes in hot, sultry weather, seems to possess this vivifying property in a less degree than common. This state of the atmosphere is indicated by a sense of oppression under which all animals appear to labor, as evinced by the relaxation of the skin, and profuse perspiration; and the rapid respiration or panting, especially after even moderate exercise.

When this sensible condition of the air exists longer than a very few days, with a temperature during the day ranging between 88° and 95° in the shade, and from 80° to 85° at night, with a calm or serene atmosphere, whether cloudy, foggy, smoky, or hazy, we may be sure the miasm is accumulating, and especially in cities, the air is rapidly becoming

contaminated, and will lead on to an epidemic yellow fever, without a change. This crisis may be expedited by the introduction of infected air, or of patients laboring under yellow fever. Or if many persons in the city go on board a boat or vessel which is infected, and subsequently are attacked with yellow fever in the city, during the continuance of such a state of the weather as we have alluded to above, we may expect other cases to spring up in their vicinity; and, without a timely change of weather, the local air will become so infected as to spread the disease to others. This is what is termed by some "an epidemic constitution of the air"—for all admit that, at certain times, infection of yellow fever, as well as of other diseases, will spread rapidly—and, at other times, it will not spread at all.

Thus we believe that the union of miasm with air exhausted by respiration, and charged with human and animal exhalations, in a hot temperature, produces the malaria of yellow fever; and that this may be more or less concentrated, and of course more or less morbidic: that when to this is superadded a sufficient portion of the morbid exhalations of yellow fever patients, it produces the third degree of the morbidic agent of yellow fever; viz:

III. INFECTION. This appears to possess properties differing from those of the malaria in several particulars. It seems to possess, in addition to its morbidic properties, the property or quality of assimilating to its own nature any impure or confined air into which a suitable portion of the infection is introduced. Thus the whole air in a room or ship's hold, when properly prepared for the prolific reception of the infection, will, in a short time, be converted into an infected air equally as strong and active as the small portion first introduced. From its analogy to common ferment, I have called it a *gaseous ferment*, meaning that change which my friend Dr. Cartwright expresses by the phrase "assimilating process." *

* Med. Record, vol. ix-x.

There appears a striking analogy between the common process of carbonic acid gas fermentation and this gaseous ferment, viz: in the former it is requisite to have a suitable vegetable basis, of a certain consistence, at a certain temperature, for a longer or shorter time, to produce the effect. This effect will be greatly expedited by introducing into the basis so prepared a portion of ferment or leaven; although the same effect would be produced without it after a longer time. When the fermentative process is complete a portion of the fermentated basis introduced into another basis in a suitable temperature, will excite the same action; and so on *ad infinitum*. This ferment, although it require a temperature from 70° to 80° for its production, is not destroyed when once produced, by any moderate change of temperature. If a portion of this leaven be introduced into an unsuitable basis, at an improper temperature, it will be neutralized and lost.

So it appears to us is the gaseous ferment of yellow fever. It requires a basis of impure air, exhausted by respiration, and charged with human effluvia, at a regular temperature for a certain time, to produce it in the first place: but when a portion of the infection already formed in another place is introduced, the assimilating process takes place much sooner, and probably without the same degree of heat or contamination that would be necessary to generate it *ab initio*. This "leaven" of infection when introduced into several points of a malarious district, will much more certainly institute the assimilating process, than if it were introduced at one or two points only, and in small quantities. If introduced into pure air it becomes neutralized and lost.

Upon this principle we may explain why it is so necessary to desert an infected district, to check the spread of the disease; for thereby, we not only prevent the formation of the malaria, or basis, but likewise remove the sources of infection or "leaven." The air becomes more pure by re-

moving those who contaminate it, and new cases of fever in the contaminated air, or malaria, are prevented. If this precaution is taken soon after the first few cases, before the general air of a district becomes infected, the spread of the disease may be arrested: for in ten or twelve days where respiration has been suspended or intermitted, the air loses its peculiar adaptation for supporting the assimilating process. The fermentative process ceases for want of a suitable basis; and the miasm settles down near the ground in its simple, harmless state, or is wafted off by winds. But if the population remain contaminating the air at such time, until it becomes infected, rains may wash portions of it into bayoux, and winds may sweep all infected air from the streets, but there will remain sufficient of the infected air in the houses and enclosures to institute the fermentative process again from a hundred sources.

The properties of *infection*, or infected air, so far as can be ascertained are as follows, viz :

1. It is a gaseous poison which is diffused in the air at certain times, or may be contained in confined air of houses, ships, and even in bales of goods. It is more volatile than simple miasm or infectious air; and diffuses itself further and insinuates itself more intimately and extensively in the atmosphere of a city; and when concentrated produces yellow fever in its most malignant forms, in from three to five days from the exposure, without any *exciting* cause. To bring the system under its influence, it is necessary only to breathe it for a few minutes, or an hour or two, according to the degree of concentration. It so acts through the nervous system, upon the whole of the vital functions, as to produce a malignant fever, which mostly terminates in death, after from one to five days.

2. When a suitable quantity of it is introduced into the proper kind of air, at a suitable temperature, without the free admission of pure air, it acts as a ferment, and re-produces

a larger amount of infection, equally efficient with that first introduced. In this way it will assimilate the contiguous air and diffuse itself as extensively as the malaria. A large amount of it introduced, will be diffused in an atmosphere less contaminated than actual malaria, and assimilate, or render infected a much greater amount of air. Although a small quantity diffused in a pure atmosphere so as to become much diluted, loses its fermentative properties, as well as its morbidic.

These properties we find indicated by the infection having become as virulent as ever in a few days after a severe gale or storm must necessarily have swept off all the loose infection from the open air. The infected air in each house is a source for re-infecting the general air of the city or infected district.

3. When air is moderately infected, so as not to produce active disease, by being closely confined, at a temperature between 85° and 95° it becomes more virulent in a few days.

This is confirmed during every epidemic, in this known fact, viz: that a house may be deserted early in the epidemic, when the infection in the general air is weak so as not to have excited disease in any of its occupants: yet when they have fled, and the house has been closed for a month or longer, if any of those same members, or others from the country return to that house, occupy it, and sleep in it without proper ventilation and exposure to cold or frost, they will contract yellow fever of a high grade and probably die. The air contained in beds left in such houses has been more closely confined than the free air of the room, and at a more regular temperature, and of course is more virulent.

It is upon this principle as well as that of section 2nd, that cleanliness and ventilation are so essentially necessary about patients laboring under yellow fever, lest it may accumulate in a stagnant air and become a new source of infection. For, as Dr. Paloni, of Naples, observes, of the yellow fever of

Leghorn, which swept off seven hundred souls in that city in the autumn of 1804: "The infection of this fever is of such a constitution, that *pure and renewed air* decomposes its *fomes* at a small distance from the sick: on the other hand, air that *stagnates and is replete with animal exhalations*, easily becomes a vehicle for it. Hence it happens that as soon as the disorder broke out, we saw it rage most fiercely in the most filthy and *least ventilated* parts of the city. *Pure, fresh, renewed air destroys its infection.*" Med. Repository, vol. 8, p. 426—7, &c.

In this case the Doctor's views are correct, and unusually discriminating; and we would suggest that the manner in which the infection was *decomposed*, was for want of the malaria or *infectious* air, which alone will afford it a suitable *nidus* for the fermentative process. Hence the wisdom of free ventilation with the sick, as inculcated by all who have been conversant with this fever; and the reason why it is not known to spread, in a country air; and why in a city the malignity of the cases and the succession of cases increase with each case attacked in sultry hot weather, unless the people fly.

4. When infected air is confined in rooms, &c. it is not destroyed by any degree of cold short of 40° Fahrenheit; and to destroy it entirely nothing short of 32° will suffice.

Hence it often occurs that the infected air of houses produces yellow fever in those entering them even after frost and ice; for a mild frost will take place at 40° —and although the temperature in the open air may be reduced to 32° , yet the temperature in closed rooms is most probably not below 40° or 45° . To destroy infection requires the temperature reduced 15° or 20° lower than is requisite to neutralize simple miasm.

5. This infected air is supposed to be more volatile than *miasm* to be volatilized by the sun and partially condensed in the cool dews of night: hence when there is much in-

fection in the air it may be more dangerous to be out at night than in meridian day. Thus the night-watches generally suffer severely.

6. The infection insinuates itself into blankets, featherbeds, woollens, and other porous articles, and in this way may be carried from one place to another. But the infected air thus transported will produce the disease only in those who breathe it before it is diluted with common air: it might spread when taken into a close room and kept in stagnant warm air.

7. Like *miasm* it is heavier than common air; and settles in low damp places, and bayoux; so that when there is but a moderate quantity in the general air it abounds in such places, in proportion to their depth and width, and the declivity to their margins, until its surface comes upon a level with that diffused abroad. Thus when abundant it may be ten feet deep near the margin of a bayou, and not more than three feet deep one hundred yards distant.

8. It is supposed to adhere in some manner to wood and such like bodies, especially, more than to brick, stone, plaster, &c. Hence we find wooden houses more frequently become infected and remain so even after one or two frosts; because it is more tenacious of wood, which maintains a higher specific temperature than stone or brick walls. Hence the great difficulty of disinfecting ships until cold weather completely neutralizes the properties of the infection.

We will here make a few remarks again upon the generation of miasm on board ships in tropical climates. The confined air in the holds of ships is more likely to be exhausted by respiration, and charged with human effluvia than even a city; especially where there are many souls on board, who are often confined below on account of storms and winds. In them thorough ventilation is extremely difficult, and the temperature is almost constantly up to the miasm point. The infectious air is thus rapidly formed in many

cases, and in this state, a vessel arriving at a port where yellow fever prevails, will be ready to receive the leaven from the infected air of the city, either by the crew visiting the infected districts on shore or by the introduction of the infection in the form of *fomes* in goods. The United States frigate General Greene, before referred to, is a good illustration.

The temperature at sea in tropical latitudes is seldom below 80° of Fahrenheit, and often from 90° to 100° according to the degree of reflection and concentration of the sun's rays. By a register kept by Dr. Thos. Rodman,* embracing thirty observations between the first of November and the fifth of December, at 12 o'clock M. each day, between latitude 22° north, and 22° south, it was ascertained that the lowest temperature of the air was 79° and the highest in the shade 86° . The lowest temperature of the sea below the surface was 78° , and the highest 84° . The mean temperature of the air during that time, at 12 M. was 83° , and of the water 81° . Thus the temperature within vessels while in tropics cannot be low enough to *destroy* or neutralize miasm, much less infection: the former requiring a temperature of 50° and the latter of 32° Fahrenheit. Thus, however slowly it may be generated, it continues to accumulate until the ship enters a northern climate. This register was kept during a cool healthy season, when no disease was generated on board, by hot, calm and sultry weather: of course a much higher temperature in these respects is often experienced on board ships in the tropics; and the miasm and infectious air is often generated where no animal or vegetable putrefaction exists.

The generation of miasm in cities, as has been before remarked, has taken place under every variety of circumstance as regards animal or vegetable decomposition; as well as where neither existed. Under all the circumstances which

* Vide Coxe's Medical Museum, vol. I, p. 83-4.

have been presented to our view, we cannot conceive it possible for such a general morbid agent, to be eliminated from such a diversity of sources and each so limited in their nature and extent as those to which it has been ascribed. As well might we expect to see a territory inundated by a rivulet as to believe the atmosphere of a city should be infected with a pestilential miasm from a few bushels of rotten coffee, a few barrels of oysters, a dead horse, or a filthy back yard. The cause is inadequate to the effect. If so small a cause could produce such general effects it would be an anomaly in nature.

Besides, it would be strange beyond comprehension if a *peculiar miasm* could be generated from a hundred *different* sources, and under as many different circumstances: for the causes and circumstances necessary for the production of yellow fever, as generally maintained by the advocates of vegetable or animal putrefaction, are almost innumerable. In medical investigations as well as in some others, we are too apt to direct our attention exclusively to a few apparently prominent circumstances, which strike some of our senses, and make all our deductions from them; as if all the operations of nature were *known to us*; or as if nothing was carried on in the natural world, except the few comparatively gross operations which are cognizable to our few and imperfect senses. Hence it happens, that in attempting to trace the secret cause of yellow fever miasm, as it is called, we have been led so often to those things which are *offensive to our senses*; notwithstanding the same exist equally when no yellow fever prevails; and notwithstanding the poison of yellow fever cannot be detected by any of our senses.

We doubt not, the precursor most essential to yellow fever epidemics, at Natchez, as well as elsewhere, will be found to be *hot, calm, sultry weather*, for ten or fifteen days in succession, *immediately before it breaks forth*. If no infected air be introduced, the disease will not manifest itself in so short

a period as otherwise, nor in air as slightly contaminated as otherwise. We conceive the vicissitudes of weather, whatever they may have been a month or six weeks previously, have no immediate effect upon its production. In all probability, the effects necessary for an epidemic are elaborated principally within twenty days or less, immediately previous to the appearance of the epidemic. Although the miasm is elaborating continually during hot weather, it never accumulates in such quantities as to produce disease, until after several hot, calm, sultry days, during which time also, the air, being stagnant, becomes exhausted and charged with exhalations. If, after a week or ten days of clear, hot, sultry weather, calm, cloudy, or foggy weather succeed, at an extreme temperature during the day, of 85° to 95° , the miasm still continues to accumulate, though more slowly, until strong winds or cold nights succeed. Upon this principle, do we account for yellow fever having prevailed in calm, cloudy, or wet weather, although it did not appear during the previous hot and dry weather.

The most common appearances observed in the weather, immediately preceding yellow fever, are as follows; viz: the temperature in the shade, from 88° to 95° at noon, with warm nights, for ten or fifteen days, at least, in succession. During this time, whether the weather be clear or cloudy, or attended with moderate rains, the air is not agitated by any strong winds, such as sweep out every part of a city; the air feels oppressive, and respiration is oppressive. During such times, especially in August and September, every precaution should be observed, until a change of weather ensues; a portion of the population should disperse; strangers and unacclimated persons should leave the city, all unusual exposure should be avoided, all fatigue, debauch, or intemperance, or irregular hours, should be strictly avoided, at least until after a favorable change of weather. Every precaution necessary to keep up a proper equilibrium of the healthy functions

should be punctiliously observed by those who value their lives above a few dollars, or above temporary sensual gratifications. This remark is especially applicable to those who are properly unacclimated.

I shall now proceed to give a sketch of the history of the different yellow fever epidemics of Natchez, with a few remarks relative to each.

I. **THE EPIDEMIC OF 1817** is considered as the first in the history of Natchez; although I have been very credibly informed, that individual cases were often seen previously, some of which, I have been informed, appeared to have originated in the city; and others derived their infection from New Orleans, or from infected boats. Dr. Tooley informs me that occasional cases occurred about the city in 1817, as early as July and August; it did not become epidemic, however, until the 28th of September. Dr. Perlee* says the state of the weather had been such as predisposed very strongly to violent disease, even in the early part of September, and "required only a small concentration of power to produce a sweeping epidemic." "At this time," says he, "when the population was highly susceptible, the Washington steam-boat reached us from New Orleans, with persons on board ill of yellow fever; some of whom were landed; and several young men from town went on board, who were all taken sick soon after and died. The disease spread rapidly, and with most destructive malignity. For some time it had its sway over the whole city. On the 28th of September, the physicians publicly announced the existence of yellow fever; and a large portion of the population retired to the country." On the 1st of October, the President of the Selectmen, Edward Turner, issued a circular, advising the citizens to seek refuge in the country, and regretting, at the same time, that the disease had been in the city several days before it was announced. The disease continued to prevail among those who

* Chapman's Med. Jour. v. 3, p. 6.

remained until about the 9th of November; and several cases occurred among those who returned as late as the 15th of that month.

The whole number of deaths in the city during this epidemic, was one hundred and thirty-four, besides some who contracted the disease in the city and died in the country. Dr. Perlee states that the number was estimated about three hundred: but that is doubtless an exaggerated estimate. The population of the city at that time was comparatively small. The epidemic commenced late, and terminated rather early.

From a meteorological table given by Dr. Perlee, it appears that the mean temperature of July was 80°, of August 77°, of September 73°. The quantity of rain up to the first of September, was rather more than usual; being in July 3.95 inches; in August 4.41 inches: in September 1.92 inches. I have not been able to ascertain what was the daily extreme temperature of September; although Dr. Perlee informs us it was a hot, sultry, and humid month.

The "predisposing causes," to which Dr. Perlee ascribed this epidemic, are exhalations from city filth; from grounds newly made in leveling the streets; from stagnant water in the streets and cellars; from the old grave-yard near the centre of the city. These various exhalations, he supposed, produced a high state of "general predisposition," and with "other causes of insalubrity" prepared the inhabitants for an epidemic, so soon as any exciting cause should occur, or so soon as any concentration of power should take place in the predisposing cause. This he leaves us to infer, was effected by the introduction of infected air and yellow fever patients from the steamboat Washington:—for besides several yellow fever patients landed from her,—the air in her cabin was so highly infected that of "several young men from the city, who went on board, all took the disease, and soon after died." Immediately after these cases the disease manifested itself in various parts of the city.

The yellow fever prevailed severely in New Orleans, in 1817, for several weeks previous to its appearance in Natchez.

II. THE EPIDEMIC OF 1819. The first alarm of yellow fever was given on the 4th of September, at which time several cases had occurred, and a portion of the citizens immediately fled to the country. Cases became more frequent, and more malignant in their type until the 14th of September, when it was considered epidemic. It continued to prevail with great mortality until the first of December. At this time about 200 persons of all kinds had fallen victims to its ravages, and the total number of cases was over 400. Some, as in 1817, died after they had fled to the country; and others after they had returned to their homes, and imprudently slept in their houses and beds before they were perfectly disinfected by cold weather. The total deaths as given in the sexton's reports, during the epidemic, in the city, were about one hundred and eighty. On the 3d of October, when only about seventy-eight deaths had taken place, a census taken showed the entire population, including blacks in both the upper and lower parts of the city, to be only five hundred and sixty-eight souls. Subsequently about one hundred of this number died; of whom about fifty died in the month of November. Several cases and deaths by yellow fever were reported as late as the 3d, 4th and 5th of December.

A report made by the board of health during the epidemic states, that the inhabitants of the country, and in the immediate vicinity of the city, were as healthy as usual at that season.

The meteorological table given by Dr. Perlee shows that July and August were very wet, and September very dry. The rain-gauge gave in July 12-27 inches; in August 8-05 inches; and in September 0-95 inches. The mean heat of July was 79°, of August 79°, and of September 75°. Thus July and August exhibited a lower mean temperature, by 3° than the same months in 1818, which was a healthy year. The mean heat of September, 1819, was the same nearly as

in 1818. Hence we see that the yellow fever in 1819 prevailed under the same temperature, or less, and with more than double the quantity of rain which preceded the epidemic of 1817.—The month of November, in 1819, exhibited a higher mean temperature than the same time in the preceding ten years; being 65 $\frac{1}{2}$ Fahrenheit, or three-fourths of a degree higher than the mean temperature of November, 1837.

Dr. Perlee ascribes this epidemic to the same general causes which, in his opinion, produced that of 1817. He supposes the excessive rains in July and August caused a stronger "predisposition," as during the healthy summer of 1818 it was comparatively dry and healthy.* As to the particular portion of the city in which it prevailed in 1817 and 1819, we are not informed; but doubtless it occupied that part of the city in which it has prevailed in each subsequent epidemic.

The yellow fever had prevailed to a most alarming extent in New Orleans, for about two weeks before it appeared in Natchez. There had been scattering cases about the shipping, boats and wharves, as early as June; but it did not become epidemic until about the middle of August. It raged severely among the shipping, and spread to the adjacent streets, as also among the boats which had descended the river. Not a ship escaped one or more deaths, and some lost their whole crews; many steamers became infected, and lost many of their passengers and hands. It did not entirely cease there until near the last of January, 1820.†

During the years 1820, 1821, and 1822, yellow fever as an epidemic, was unknown in Natchez. Yet, in each of these years, especially in 1822, there were several sporadic cases, and some whose infection was derived from New Orleans, by handling, opening, or sleeping on blankets, &c.,

* In 1818, the rain of July, August and September, together, being only 10.30 inches, or less than that of July, 1819.

† In Med. Rep., New Series, vol. vi. p. 6, 7, 8, 9, 10, 15--20.

from the infected district of that city. The state of the weather during these summers I have not been able to ascertain.

THE EPIDEMIC OF 1823.—This was probably the most extensive and terrific epidemic yellow fever which has visited this or any other city of its population. It commenced in scattering cases in the south-western part of the city on both sides of a large gully or ravine, which heads on the north-west side of the town, and also in the vicinity of other bayoux of the same kind, which extend up to the block of the city at several points on the south side. During the prevalence of the epidemic, those sites, near those bayoux and in the declivity towards them, from the adjacent hills, were the chief seats of the disease; although it finally extended over a large portion of the city. It was about two weeks after the epidemic appeared, "on the hill," before it extended to that portion "under the hill," at the landing. [Med. Record, vol. 4, p. 6-8.] The first cases which excited alarm, occurred between the 9th and 12th of August. About the 20th, it became so alarming, that the Board of Health, after receiving the reports of the medical faculty, declared the existence of yellow fever in the city as an epidemic. The mass of citizens immediately fled, with their necessary moveables, as before an invading army. They crowded into Washington, and dispersed by hundreds through the country; many of them remaining in temporary shelters and camps. Many fled across the Mississippi, into the alluvial lands of Louisiana. The disease continued to prevail in the city, from the 20th of August, until it was checked by the cold weather near the last of October. During this time, few who visited the infected district from the country escaped the disease. Notwithstanding the number of persons and families, as well as the large quantities of goods, &c., carried to Washington, there was no case of yellow fever contracted in Washington, although there were about ten deaths in the town, besides recoveries, of persons who had contracted the disease in Natchez.

On the 15th of September, a census of the city was taken, by which it was ascertained that there were within the limits of the city, seven hundred and eighty-four souls. On the 19th of September, the official report gave the number of deaths at two hundred and six, from August 21st to September 19th, inclusive. From the commencement to the close of the pestilence, the whole number of deaths within the city, was about three hundred and twenty. Nearly twenty persons died in the city late in October, and during the first two weeks of November, by returning to their houses and beds, after they had supposed the infection destroyed by frost.—Some of these deaths occurred as late as the 15th of November. Although the frosts had destroyed the out-door infection, still it was virulent in the houses, which had been closed, and in the beds, which had not been exposed to the frosts.

On the 10th of September, after the epidemic had prevailed about three weeks, the equinoctial gales sprung up, and continued for two days, with such violence as to cause much damage among the shipping at New Orleans, as well as along the coast, and in the Gulf of Mexico. In the region of Natchez, it was so severe, that the standing corn and the cotton crops were leveled and much injured. This wind appeared to have swept off all the out-door infection; and, for several days, the disease appeared to have been arrested. But, after a week of warm weather, it broke forth with renewed violence; and was finally checked only by the cold weather and frosts in the last of October and in the first week of November.

The state of the weather immediately preceding this epidemic was excessively oppressive. The month of July had been agreeably diversified with sunshine and showers of rain. August was hot and sultry, with occasional showers, followed, as Dr. Cartwright observes, "several hours at a time, by a *breathless* state of the atmosphere."

New Orleans, this summer, was not unusually sickly, until the first of August, although some cases of yellow fever had previously occurred. About the middle of August, cases multiplied rapidly, and that city suffered severely for two months.

At Mardez's, one mile from Washington, on the Natchez road, several houses and several temporary huts and sheds, were crowded with families and individuals, to the number of about sixty persons of the common people, who had fled thither. Their apartments were small, close, and ill ventilated. Several persons died at this place within a week after they arrived from Natchez. About two weeks after their arrival, the yellow fever broke out most malignantly among them, and about twenty of the whole number died. An infected air was generated, and several persons from the vicinity contracted the disease by visiting that place. Nearly all the persons from the country who contracted the disease, by visiting Coonville, as the place is called, died of the most malignant symptoms. Among these were Messrs. Glasscock, Thompson, Norman, and others. The infection in these sheds and houses was doubtless as concentrated as that in the city.

Several cases occurred, in like manner, at Haughton's tavern, one mile from Natchez, and situated near the margin of the main trunk of all the bayoux or ravines which head around the city. Many of the cases at Haughton's were supposed to have had no intercourse with the infected district.

As to the causes of this epidemic, there are various opinions. Dr. Cartwright, in a very able and lengthy essay, ascribes it to the combined operation of a lot of putrid bacon in the south-west part of the city, putrid oysters, and putrid fish, and to the effluvia from putrid carcasses deposited on the extreme western limit of the city.* These, however, we think, were only contingent circumstances, which

*Med Record, vol. ix, p. 5, 6, 7, &c.

have often occurred to the same extent in previous years, without producing yellow fever: and other epidemics have since prevailed, when all these circumstances did not exist: indeed, when those which have been considered most essential were entirely wanting. We believe it is a miasm which accumulates in these ravines, until they are full to overflowing, and in the declivities towards their brinks; and that gentle winds waft it over to situations which would otherwise be healthy.

IV. THE EPIDEMIC OF 1825 commenced "under the hill," by a few very malignant cases in and near a certain warehouse at the landing. The first cases occurred about the 20th of August: and nearly all of them were carried up into the city after they were attacked, where they died. Several deaths had thus occurred in the upper city, as well as in the lower, previous to the 29th of August, when the Board of Health, upon the reports of the Medical faculty, announced the existence of yellow fever as an epidemic, and advised the citizens to disperse; notwithstanding most of the cases were ascribed to intercourse with the infected district under the hill. A great portion of the citizens fled to Washington and the surrounding country; and for nearly three weeks, but few cases occurred in the upper city, although new cases daily appeared near the landing.* About the 20th and 22d of September, after the yellow fever had made its appearance at Washington, most of the refugees returned to the city, believing the epidemic to have subsided. After their return, the population of Natchez amounted to nearly fifteen hundred souls, during the remainder of September and all October. About the last of September, soon after the return of those from Washington, the disease began again to prevail in the upper city with great malignity; and continued its ravages until checked by frost and cold weather about the 28th of October. As the cold weather and winds appeared to have

* Vide Med. Rec., vol. ix, p. 226, &c.

put a stop to the disease, the inhabitants returned from the country about the first of November, about which time it had been so cold as to freeze water. It was, however, not more than four or five days after their return, when new cases began to occur among those who had returned; and ten or twelve deaths took place between the 5th and 18th of November, exclusively among those who had been absent during the month of October. The infection, no doubt, was destroyed in those houses which had been open and exposed to ventilation, as well as in the general atmosphere of the city; but in those houses which had been closed for several weeks, it was as virulent as at any time during the epidemic. Had those houses been opened and ventilated for a few days during the cold winds and frosts, no danger would have ensued from entering them.

The whole number of deaths during the epidemic of 1825, in Natchez and its vicinity, from the 20th of August to the 18th of November, was about one hundred and fifty; of whom several died in the country after they had fled from the city, having contracted the infection before they retired. Several cases occurred likewise at Haughton's, one mile south-east of Natchez, near the junction of the two main branches of the bayou.

The spring of 1825 was not uncommon in any respect. During the months of June and July, the weather was agreeably diversified with fair weather and with showers. July, towards the latter part, was, however, rather dry; August and September were quite dry, and vegetation began to languish for want of due moisture. The temperature of July and August averaged 77° at 5 o'clock, A. M., and 91° at 4 o'clock, P. M. The temperature of September averaged only 72° at 5 A. M., and $85\frac{1}{2}^{\circ}$ at 4, P. M.: although, during the first twenty-two days of that month, the thermometer was often up to 91° and 93° Fahrenheit, as the extreme heat, and the air often very sultry. During the first ten days of Octo-

ber, the mercury was often up to 87° , 90° , and 91° , as extreme heat.

The infected district on the hill, was in the south-west and the south-east parts of the city, to which the generality of cases were confined. Dr. Cartwright informs us, that while the yellow fever was raging in this part of the city, the northern portion of it was free from yellow fever, and exhibited only a few cases of common bilious fever.

The yellow fever of Natchez, in 1825, has been ascribed to "spoiled porter," and "sour pork," and "putrid fish, and putrid sour crout," in a certain warehouse at the landing; also to "a sunken flat-boat containing a quantity of rotten corn," and to other vegetable and animal matters in a putrid condition, in the mud and stagnant water near the wharf, and in the cellar of the aforesaid warehouse. [Med. Record, vol. ix., p. 226, &c.] In the upper city, it was ascribed to "city filth in the sewers, alleys, and back-yards," which was suffered to accumulate in the city, after the disease first made its appearance at the landing. [Ibid. p. 246.]

Dr. Merrill* ascribed it to loose earth, thrown up and exposed to the sun, in digging down and filling the uneven streets in the upper city, and in making an embankment for a wharf at the landing. Others have assigned other causes, but in nothing different from the assigned causes of former epidemics.

As we believe that the causes which have been alleged as the sources of yellow fever miasm or infection, are insufficient for the production of the epidemics of Natchez, we will briefly state our reasons for entertaining a different opinion from those above cited. We believe that the cause, or essential agent of yellow fever miasm, is beyond our control, and our only safety is to mitigate its effects, observe its approach, and flee from it. We fear the public attention and our city authorities have been too much drawn to matters which have

*North American Journal of Med. and Phys. Sciences, v. 1. p.

no agency in the production of yellow fevers; or at most only a subordinate and contingent agency. As a necessary consequence, they have entertained a fallacious hope that security would result from the removal in time of such causes as were supposed to generate the pestilential miasm. They have thus been lured into a false security, which has often resulted in their disappointment. We have no preconceived theory to sustain; our views are such as are the result of an unprejudiced inquiry into the different circumstances of the many epidemics which have occurred in various cities of the United States and of other countries. If the alleged causes are not the true source of the disease, we shall at least prevent a false security being placed in such means as really afford no safety; while we urge the necessity of speedy flight upon the first appearance of the pestilence. If it can thus be avoided, that fact alone will in some degree disarm it of its terrors.

We contend that yellow fever, as an epidemic, is not dependent for its production upon animal or vegetable putrefaction, or upon the union of both; and that when these matters have been observed to precede an epidemic, it was only a contingent, and not essential circumstance. My views on this subject are ably expressed by Dr. Cartwright, in his essays on the "Malignant fevers of Natchez." After alluding to "some of the circumstances which are necessary for the production of yellow fever," he observes, "although yellow fever may not occur any two years in succession, yet the *effluvia to which it is erroneously attributed*, may exist every year in an equal degree. Effluvia, as mere effluvia, are *innocuous*, and should not be confounded with *miasm*, which is the real cause of yellow fever. We all know, that when yellow fever has become epidemic in a city, it continues to prevail until it is checked by frost, in defiance of all precautions which can be taken to arrest its progress. All the materials which are in a state of putrefaction, may be removed;

the air, before moist, may become dry; the evaporating process may be suspended; and the mercury may fall 30° or 40° below the point at which it stood when the disease first appeared; yet it will continue to prevail after every one of its *supposed* causes have been removed. * * * If effluvia produce it; if evaporation or moisture produce it; or if all these combined produce it; what should give rise to the disease when each and every one of these supposed causes are removed?" [Med. Recorder, vol. x., p. 229, 230. We answer, nothing but a subtle, invisible, and imperceptible miasm, which is produced independently of all such circumstances. Some have supposed that a peculiar miasm is generated during the putrefactive process, but not necessarily fœtid. In our opinion, neither fœtor nor putrefaction are at all concerned in its production: for we have shown that not even the putrefiable materials are necessary. The advocates of animal putrefaction admit that the epidemic of 1825, "on the hill" ~~was produced without putrid animal matters~~ of any kind; and no one pretends to ascribe the epidemics of 1829 and 1837 to such causes. These two epidemics are ascribed to city filth, to filthy and wet sewers and back yards; the same causes which were said to have produced the fever of 1825, on the hill; causes which were not called into requisition at all in 1823, although the most extensive and fatal epidemic which has yet visited the city. According to the theories heretofore advanced, no two epidemics have ever been produced by the same cause: and upon the same principle, every succeeding epidemic, if we should be so unfortunate as to have others, will depend upon a new cause. The inference is, clearly, that the causes of yellow fever are innumerable. We leave our readers to determine whether the premises are tenable.

But we have testimony incontrovertible that city filth is not necessary to its production; nor is it at any time an auxiliary cause; as the disease prevails generally when there is

least of this existing; and often where it is most abundant, there is no yellow fever produced. Dr. Rush* even declares that the city filth in the sewers, alleys, and streets of Philadelphia, appeared to absorb the pestilential miasm, and thus to produce a partial protection against it. He declares that during the memorable epidemic of 1793, in that city, scavengers seemed especially exempt from its effects; as only one out of forty was attacked with yellow fever. This is confirmed by the experience of Dr. Tilton.† He states that it is injurious to remove city filth during an epidemic, as the filth seems to absorb the miasm, while the exposed pavements from which it is removed augment the reflection of the solar rays, and increase the miasm. On the same principle, it is believed by some, that fresh earth, strewed over the streets, might be beneficial to a certain extent. A mass of authority might be adduced, to show that common city filth or offal is not a cause or source of pestilential diseases. Natchez is not more filthy than hundreds of other cities where no yellow fever exists. If city filth were a cause, we know not how it could ever occur in the cleanly and scattered village of Washington.

We cannot believe that the removal and exposure of fresh earth in digging down the streets and filling up low grounds, are essential or even auxiliary to the generation of yellow fever miasm. More or less of this has been done in Natchez every year; yet, for the last six years previous to 1837, there has been no epidemic yellow fever in the city. And, again, we know that yellow fever prevails much more frequently, and more extensively, in New Orleans and other cities, where no such digging is done, or is even practicable. Extensive excavations and embankments have been carried on in different parts of this State, during the last year; yet in no case has yellow fever been generated from it. One

* Med. Inquiries, vol. ii., p. 198, edition of 1815.

† Med. Repos. v. iii., p. 134.

rail-road enters Natchez by a deep cut of fifteen or twenty feet; yet that was the most healthy part of the city during the last epidemic. The same road passes through Washington, with a cut ten feet deep in the centre of the town; and within one hundred yards are extensive embankments, besides two hundred yards of the main street, which was filled up to the depth of about two feet, and two large lots of one hundred and fifty feet square, which were dug down on one side and filled up on the other, to the depth of six or eight feet: yet the health of Washington never was better than during the existence of the epidemic of 1837 in Natchez. The same embankments and excavations extend twenty miles beyond Washington, through some of the largest plantations, yet not a single case of yellow fever has been produced by them. The same is true of the rail-roads from Grand Gulf, Vicksburg, and other points. Again, within the last two years, extensive embankments of alluvial earth and vegetable matters, have been made along the lower Mississippi, to the height of from five to thirty feet, for the purpose of protecting the low lands from the inundation of the river. Yet in no instance have they produced yellow fever among those who were engaged in the work, or in others; although the laborers, in many instances, were unacclimated Irishmen and Germans, who would be most liable to the disease.

On the other hand, some medical men of eminence have become satisfied that fresh exposed earth is decidedly healthy, and is in some degree a protection from infectious diseases. In addition to the facts stated by Dr. Rush, it is the opinion of Dr. Tilton,* before cited, that the infection in a city might be arrested in some degree, by covering the streets freely with fresh dug earth, by which the miasm might be absorbed, or neutralized. He says, that persons fleeing from yellow fever, as well as those laboring under it, are less apt to carry with them and accumulate an infecting air, in tents and

* Med. Repos. v. iii., p. 123 to 134.

open grounds, than in wooden houses with plank floors; and that dirt floors in wooden houses are preferable to plank. He gives this opinion as the result of extensive observation. He thinks that pure earth is the best purifier of infectious clothing, and articles of any kind, as has been frequently experienced from burying such articles for a short time in the ground.

As we conceive the epidemic yellow fever of Washington in 1825, to be a branch of the Natchez epidemics, we will give a sketch of its history and origin. It may be proper to premise, that Washington is an inland town, six miles east of Natchez, on high, rolling, or undulating lands, about fifty feet higher than the site of the city. It is a village thinly scattered over three streets, of which the middle one is a mile in length; the entire width of the town is nearly half a mile. It is remote from any marsh or stagnant water; only a small branch of running water passes within a quarter of a mile of the Main street. The population, previous to the epidemic of 1825, was about four hundred whites, and about one hundred blacks. The houses are mostly detached, surrounded with open grounds and commons, and finely shaded by the "Pride of China." During the first fifteen days of September, 1825, while the town was crowded with the people and goods from Natchez, the population must have been nearly double the ordinary number, or about eight hundred or one thousand souls, besides the unusual number from the country, whose business was done altogether in Washington. For this purpose, large quantities of dry goods, blankets, &c., were carried out for the fall and winter use of the planters; besides the beds, bedding, &c., taken out by about forty families,* who were crowded into every vacant apartment that could be procured in private houses; and often temporary partitions were erected to make separate apartments of one room. Several families kept boarding houses, which were crowded by

* Med. Record, v. x., p. 227-9.

clerks and young men from Natchez. The town has no large manufactories of any kind, where animal or vegetable accumulations could take place, nor are the houses crowded together, so as to accumulate the materials of common city filth.

Previously to the present epidemic, Washington had been noted as a healthy retreat from the yellow fevers of Natchez, and that disease never spread among the citizens before; although there had previously been numerous cases and deaths from yellow fever brought from Natchez. High grades of fever have and do still occasionally appear in the village during the months of August and September, but nothing like yellow fever, unless it has been contracted in Natchez: nor has the number of cases previously introduced from Natchez ever infected the air of the village. It is but justice to state, that Dr. Branch, one of the oldest practitioners in the county, declares that in the fall of 1821 there were a number of sporadic cases of yellow fever in Washington, although there was no epidemic in Natchez at that time. Those cases I did not witness, but I have occasionally, within the last fifteen years, seen sporadic cases of yellow fever in the vicinity, when no epidemic prevailed in Natchez: but they were always the effects of extraordinary fatigue or exposure to the sun at that season, or of being for several hours among the boats at the Natchez landing in the hot sun. During the first two weeks of September, 1825, there was no violent grade of fever in the town, until it broke out as yellow fever about the 15th.

Such was the condition of the place, when the yellow fever in Natchez, caused the citizens to seek refuge in Washington and the surrounding country. On the 1st and 2d days of September, the latter place became crowded with the people and goods from Natchez. During the first ten days of September, there were about ten cases of yellow fever in Washington, and several deaths; all of which were unequivocally

traced to Natchez as the source of their infection. During this time, there were also fresh supplies of goods brought out, and a free intercourse kept up with the city by those who affected not to fear the disease. On the 15th of September, the first case of the Washington fever occurred, and five days afterwards the disease was considered epidemic; when the greater part of the proper inhabitants, as well as those from Natchez, deserted and fled to the country; but many of those from Natchez returned to the city, believing the epidemic there had subsided. In the first out-breaking of the Washington fever, the inhabitants of Natchez were much less liable to it than those of Washington. The disease prevailed with great malignity among the citizens of Washington who could not leave, as well as among those who contracted the disease before they left the town, until the change of weather and frosts about the 28th of October. After this change, there were no new cases in Washington, until after the return of the inhabitants during the first week of November. Between the 1st and 10th of this month, about ten cases occurred, and only in those who returned to town after an absence of five or six weeks. Of these ten cases, five proved fatal on the fifth and eighth days.

The whole number of deaths by the Washington fever, from the 18th of September to the 12th of November, was about sixty; and the whole number of cases were about one hundred and twenty-five. Out of the proper inhabitants of Washington, about forty died.

To many, the cause of epidemic yellow fever in such a clean, healthy village as Washington, is unaccountable. Dr. Cartwright* ascribes it to "a quantity of putrid bacon and fish," in a certain grocery on Main street; together with effluvia from the decomposition of vegetable matters, which may have collected at the head of a water drain near the grocery. Others believe a more rational mode of accounting for it may

* Med. Record., v. ix., p. 246, &c.

be given by supposing the general atmosphere was highly excitable by the accumulation of miasm during the previous hot weather, and which became contaminated to a certain degree, so as to form malaria during the sultry weather of September previous to the 15th; and that in this state it formed a proper "nidus" for the spread of infected air, or yellow fever infection: that this infected air was carried out in large quantities in the goods, blankets, &c., as well as new sources in the beds and bedding, which were distributed in almost every house: that the crowded population, during hot, calm, sultry weather further contaminated the air, and the cases of yellow fever taken to the town, also gave out their infectious exhalations, in a suitable atmosphere: that, under these circumstances, the "leaven" introduced expedited the process, which otherwise might have been indefinitely postponed.

It is unnecessary to inquire into all the contradictory statements which have been made in relation to the putrid bacon alleged. We doubt not they who gave the information contained in the Medical Recorder, were mistaken as to facts. It was my fortune, previous to the outbreaking of the epidemic, to have occupied and slept in an office only three doors from said grocery, which I passed often every day, yet I never perceived any indication of putrid animal matters: and it is probable that the bacon was not so completely putrid as to destroy its sale. But we have shown that putrid animal matters *do not produce* yellow fever, even had they been present in this case. It might moreover be shown, that among the first and most malignant cases were those who lived most remote from the grocery, or infected district; who had not visited the grocery at all; some of them being ladies: that there was really in this case no "infected district," but the whole town was one entire infected district. The ravine near the grocery is only a gentle declivity, in which the rain water collects, and passes off down a deep ravine, or bayou as they are often called, which begins about one hundred and twenty yards north-east

of the grocery. Accumulations of any thing like city filth is absolutely out of the question.

The inquiry might be made, why the yellow fever was not carried from Natchez to Washington in 1823? To which I would reply, that in 1823 there were fewer porous woolen goods taken out than in 1825; and in 1823 they were not so much crowded. Besides, in 1823, about the 10th of September, a very severe gale sprung up, and continued as an equinoctial, for two days, with rain, thunder, &c.; but in 1825 the first two weeks of September were warm, calm, and sultry. Thus in 1823 the miasm was wafted away, and the formation of malaria prevented; hence the infection of yellow fever did not spread.

As to the cases which occurred at Haughton's, one mile from Natchez, we think it more plausible to suppose the miasm which was generated and accumulated in the bayoux, settled along down them, until they reached the junction, near Haughton's house: where also the banks overflow with the miasm, or malaria, and thus produce yellow fever in those who resided there, even if we believe they had never been in Natchez. This we think more likely, than that the putrid animal and vegetable matters, collected into the bayoux near Natchez, should remain there perfectly innocuous, until rains should wash it down to Haughton's, where it would first commence to extricate the malaria or gas.

During the years 1826, '7, and '8, there was no epidemic yellow fever in Natchez. However a few sporadic cases were seen each year, and especially in 1827, when a number of cases were known to exist, so as to cause alarm in some who fled to the country. There were about fifteen deaths in Natchez and vicinity, from yellow fever in 1827, some of which were traced to New Orleans for their origin.

V. THE EPIDEMIC OF 1829. This was the mildest epidemic of the kind which has prevailed in Natchez. The summer of 1829 was generally healthy, until about the last

of August and the first of September, when some cases in Natchez began to assume malignant symptoms. Several deaths by malignant fever occurred in the city, as well as at the landing, between the first and sixth of September. On the 8th of September, considerable alarm prevailed in the city, and the Board of Health, after receiving the reports of the medical faculty, advised the citizens to disperse. The reports of the physicians showed that there were then about twenty cases of malignant fever under treatment in the upper city and at the landing. The majority of the citizens immediately retired to the country and to Washington. The disease continued to prevail moderately among those who remained until about the last of October; a few cases occurred in those who returned into closed houses, as late as the 8th and 10th of November. During this epidemic, the whole number of deaths in the city, by yellow fever, did not exceed eighty-five or ninety. The whole number of cases was probably near three hundred; although many of them were mild, and assumed the character of high grades of bilious fever, attended with profuse discharge of yellow bile.

The summer was rather wet, until the latter part of August: in September there was less rain; the heat was often oppressive, and the air sultry. No unusual form of disease prevailed in the country; but the health of the country generally was as good as common at those seasons.

This year the yellow fever did not prevail much in New Orleans, until the 24th of August; and it first appeared in Mobile about the 26th of September.

So far as I have been able to learn, all seem at a loss to ascribe this epidemic to any adequate cause. Some, however, seem inclined to ascribe it to the old, exploded one; viz: exhalations from earth recently exposed by digging down and leveling the uneven surface of the city. Doubtless the same general causes which produced the other epidemics of Natchez in other years, produced this, independently of any local

accumulations of filth or putrescible matters; and of the removal of earth in leveling the streets of the city.

From 1829 to 1837, there was no epidemic yellow fever in Natchez; although a few sporadic cases were seen occasionally under peculiar exciting causes; and frequent cases were landed from steamboats direct from New Orleans, and carried to the hospital.

So long had been the intermission of epidemic malignant fever in the city, that the inhabitants began to entertain the hope, if not the belief, that the strict attention of the police to the cleanliness of the city, would finally redeem it from other visitations of the pestilence: especially was it believed, that lime, which had been freely used, was an important prophylactic.

VI. THE EPIDEMIC OF 1837, began by a few sporadic cases about the 8th and 9th of September, and became epidemic about the 15th. Yet the cases were not numerous or very malignant until about the middle of October. In the first ten or fifteen days of its prevalence, many cases were so mild or so modified as to create doubts in minds of many whether the disease were really malignant yellow fever. During this time, if efficient means had been taken to cause the population to disperse, and desert the city, we doubt not the pestilence might have been stayed: but it was not until near the 25th of September, that the Board of Health or the city authorities, could determine, from the opinions of the medical faculty, as to the actual danger which the citizens would encounter by remaining in the city. For want of timely notice of the danger, the dispersion was gradual and slow, even until the middle of October. The disease continued to prevail, with occasional abatements, until the 25th of November; although the prevalence of the disease was much checked by the cold winds and frosts which occurred early in November.

During the prevalence of the disease, from the 8th of September to the 25th of November, when the last death occur-

red, the whole number of deaths, of all diseases, was about two hundred and eighty, within the city and at the hospital. Several of those at the hospital, were patients landed from steamboats direct from New Orleans. Besides those, there were ten or fifteen who died at different places in the country, whither they had retired, after having imbibed the seeds of the disease in Natchez. So that the entire number of deaths from this epidemic, might be near three hundred. In the early period of the epidemic, especially, the number of recoveries were much more numerous than the deaths: probably two to one; which shows a more manageable type of disease than was experienced in 1823 or 1825. During the month of October, the type of the disease was more malignant and fatal. Several cases which occurred in Washington and the country, from having visited the city, assumed the character of a high grade of *bilious fever*; and, we are informed, many of the more manageable cases in the city, were of the same character.

The first cases and deaths occurred in that part of the city, south, south-east, and south-west of the intersection of Commerce and Main streets, near the heads of several large ravines and the flat surfaces above them. About the middle of October, it had extended over the greater part of the city; but prevailed mostly in the declivities leading towards the several large ravines which put up on the south, south-west and south-east parts of the city. The north-eastern half of the city could hardly be said to have been visited by the epidemic. The squares in which it first and most prevailed, were occupied mostly by low, small, wooden hovels, and numerous cross fences of plank, immediately off the streets; where every facility is afforded by them for stagnant air, which cannot be swept out by moderate winds. It extended itself in almost every instance towards the immediate vicinity of the bayoux or ravines, or in the low grounds contiguous, which are protected from moderate breezes by an adjacent hill.

From the brinks the ground rises gradually, in one or two hundred yards, to the height of from twenty to forty feet. The bottoms, and often the sides of these ravines, when not perpendicular, are carpeted with a short, fine grass, called the "Bermuda grass," which admits of no spontaneous accumulation of filth. The disease prevailed much in the same vicinity in 1819, as I have been assured by an eye witness.

The weather, for several weeks previous to the middle of August, had been attended by frequent showers and heavy rains. The spring had been very late and cold. From the middle of August to the first of October, the weather was dry and very hot, with occasional showers. The thermometer, in the coolest situation of the open air, averaged, for the last fifteen days of August, at 6 o'clock, A. M., 76° ; and at 3 P. M., 91° : for the first fifteen days of September, at 6 A. M., 72° ; and at 3 P. M., 91° : during the first fifteen days of October, at 6 A. M., 68° ; and at 3 P. M. 78° . The first fifteen or twenty days of November, likewise, were nearly up to summer heat, being often above 80° . The cool weather which occurred for a few days about the last of October and the first of November, appeared to have put a check to the disease; but it broke out again during the warm weather of the first twenty days of November. Several of those who returned to the city as late as the 15th of November, fell victims to the infected air contained in closed houses, after there had been several frosts. Of this class were the deaths which took place on the 17th, 18th, 19th, and 20th of November; on each of which days the burials were from four to seven. A severe rain, followed by cold winds, and freezing on the night of the 20th and 21st of November, finally destroyed the infection. The last death of those previously attacked, or infected, took place on the 25th of November.

The health of the city, previous to the first of September, was very good: no uncommon degree of sickness prevailed in the vicinity, showing the disease in the city from causes ope-

rating locally. The yellow fever had been prevailing with great mortality in New Orleans for nearly six weeks before it broke out in Natchez, during which time many patients with yellow fever, were received into the hospital, direct from New Orleans, no quarantine restrictions being imposed.

The only cause assigned for this epidemic, so far as I have been able to ascertain, is the old one of 1817 and 1819, viz: digging down and filling up the low parts of the city; and, also, city filth in certain back yards, sewers, &c. On both of these, as a cause of yellow fever, we have already remarked freely.

Without entering into a close argument to prove the point, we believe the circumstances connected with the epidemic of 1837, as well as of previous years, show, that when the malarious contamination of the atmosphere has attained its maximum, as a predisposing cause of disease, a few cases of sporadic yellow fever, excited into action by any exciting cause, will furnish an infectious matter, which, in this malaria, will gradually extend itself, and become more active by accumulation; when it becomes both an exciting and predisposing cause of yellow fever; and thus brings on the epidemic. The same effect, *ceteris paribus*, will be produced by the introduction of infected air, or of patients laboring under yellow fever.

As to the locality of the origin of the yellow fever in Natchez, a few remarks may be added. The city is situated upon high, broken ground, near two hundred feet above the ordinary stage of water in the river, and covers an area of about one mile square. As the ground rises towards the river, there is no drain in that direction: and the whole drainage of the city passes off in a south-west direction, through a large and deep ravine or bayou, whose two main branches originate on opposite sides of the city; one on the north and north-west, and the other on the south and south-east. From each of these principal branches, there are other late-

ral branches, which originate in three of the lowest parts of the city, and carry off the water to the main trunks of the bayou. The main bayou and its principal branches, where they assume that character, are deep, jagged, precipitous, and crooked ravines, from ten to thirty feet deep, and from twenty to fifty feet wide, formed by the washing and undermining of the loose, friable earth. When the yellow fever has made its appearance as an epidemic, in the upper city, it has always broken out and spread in the vicinity of some of these deep ravines; or a little higher up, where they spread out into low, flat grounds. In every instance, it has spread about and near these localities, varying its particular locality according to the direction of the winds, until it has gradually spread over a great portion of the city. At the time it first breaks out, if the winds blow gently from the north-west, the fever will appear on the south-east of the bayou; if from the south-east, it will appear on the north-west of the bayou, and *vice versa*. These points and facts are confirmed by the knowledge of our oldest citizens, who have witnessed all these epidemics. They are likewise confirmed by the unqualified testimony of Dr. Cartwright, in his able essays on the malignant fevers of Natchez. In direct proportion to the vicinity of any part of the city to these bayoux, and the exposure to the gentle winds at the time, so will be the prevalence of the disease in that section. In 1825, a heavy north-west wind, late in the epidemic, carried the infected air nearly a mile out of the south-east part of the city, and produced the yellow fever there. Dr. Cartwright says, "the vicinities of these bayoux are the points most infected, where the fever was more malignant and continued much later than other points to which the infection had extended."* In those houses, in 1825, which were nearest the bayoux, especially the south-eastern one, he thinks few or none of the inhabitants escaped yellow fever: although in other remote parts of the city, only com-

* Med. Record, vol. ix., p. 8, 9.

mon bilious fever was prevailing.* The bayoux serve as reservoirs for the miasm and malaria, from which the latter is wafted upon the contiguous population by winds, and thus the disease is carried from these points to those which have become disinfected.

For the accumulation of this infectious air or malaria, in these bayoux, in its most virulent degree, after they have become charged with miasm, we suppose the contaminated air of the city in hot, sultry weather, to be wafted by the only breezes which occur, and to settle in these bayoux, and thus unite with the miasm there existing : after this union, a gentle change of winds agitates it out of the bayoux and low places, and wafts it back upon the contiguous population ; others, in remote parts of the city, often contract it by passing into these points. When the yellow fever breaks out as an epidemic, it will be found that the winds, if there be any, are in a direction nearly the reverse of what they were probably ten days previously. So that there will not be yellow fever in and about the south-east parts of the city, unless there should have been gentle winds previously from the west or north-west ; and, in like manner, there will have been no epidemic yellow fever in and about the north-west parts of the city, unless it has been preceded by gentle breezes from the south-east. We might extend the illustration of these facts to a much greater length ; but we deem it unnecessary.

We think it has been shown, that these bayoux are either directly or indirectly a fruitful source of yellow fever malaria, when the proper kinds of seasons have preceded. We cannot conceive it possible, that this malaria is generated from *filth* in these bayoux : our reasons have been given at length ; and the subject is left to the discriminating observations of those who may be so unfortunate as to reside in the city when it may be again visited with this epidemic.

* Med. Record, vol. ix., p. 8, 9.

COROLLARIES.

If the views herein advanced be correct, the following are legitimate deductions.

I. That the miasm, or gaseous matter which is essential to the production of epidemic yellow fever, is generated only while the extreme temperature in the shade, is at least up to 88° of Fahrenheit; and that so long as there is sufficient agitation and change of the air by winds, it will not accumulate in sufficient quantity to produce yellow fever as an epidemic: that when sufficient miasm is produced and accumulated, the malarious combination, which likewise requires several days of calm, sultry weather, will proceed at a still lower temperature.

II. That the miasm of yellow fever, is, *per se*, in a pure atmosphere, probably innocuous; but acquires active morbid properties by combining with sultry, hot air, which has been exhausted by respiration, and charged with human exhalations; and that it then becomes *malaria*, or infectious air, which is an active predisposing cause, as well as a proper "*nidus*" for the reception and evolution of the infection of yellow fever.

III. That this malarious condition of the local atmosphere of any city, or portion of a city, may be so concentrated as to produce a strong predisposition to yellow fever in many of the inhabitants, without actual disease, until a few cases are excited into action by highly exciting causes, when *infection* is generated, and speedily the malarious district becomes the infected district: which result would have been prevented by a storm, or change of weather previous to those cases.

IV. That when the malarious combination is sufficiently concentrated for this purpose, a large quantity of *infected air*, brought from an infected district, or a large number of cases of yellow fever introduced from another point, will convert that malaria into infected air, and produce an epidemic likewise.

V. That, consequently, although yellow fever is very often a disease of local origin, it *may*, under peculiar circumstances, be carried from one city to another, and there propagated.

VI. That accordingly epidemic yellow fever may be averted sometimes by one or all of the following measures, enforced at a time, when, according to the principles herein set forth, the malaria is forming rapidly; viz:

1. By a dispersion of the greater portion of the citizens to the country.

2. By removing from the city, and especially from the districts usually infected, all *strangers*, or those who have not become acclimated by a residence of two or three years, and who would in course be the first attacked.

3. By prohibiting the introduction from foreign places of infected air, or *fomites*, or patients laboring under yellow fever, during the prevalence of malarious accumulations.

VII. That the vicinity of any of the large bayoux, or gullies about Natchez, is more dangerous as a residence than more remote points: that these ravines are the reservoirs in which the malaria mostly accumulates before it is dispersed through the city by gentle winds: of course persons should avoid them in the sultry, autumnal months.

VIII. That this miasm, or even the malaria, is not the result of animal or vegetable decomposition; or of exhalations from city filth and such like sources.

IX. That the general atmosphere in the country may be as healthy as ordinary, while in the city yellow fever may be sweeping off the population like a pestilence: of course, that the disease is the result of some local atmospheric contamination.

X. That when the infection has spread, or is beginning to spread, the only safety for those who are strangers, or unacclimated to yellow fever infection, is speedy flight: for no disinfecting agents heretofore known, or tried, possess any

power to destroy the infection of yellow fever in the general air, cold alone excepted.

XII. That those who seek safety in flight, should carry with them as few bulky, light articles, of a woolen or porous texture as practicable, lest they might generate an infected air in their retreat: That they should not return to their houses until after cold winds and frosts, during which their rooms, bedding, &c., have been freely exposed to ventilation and to the action of the frost.

