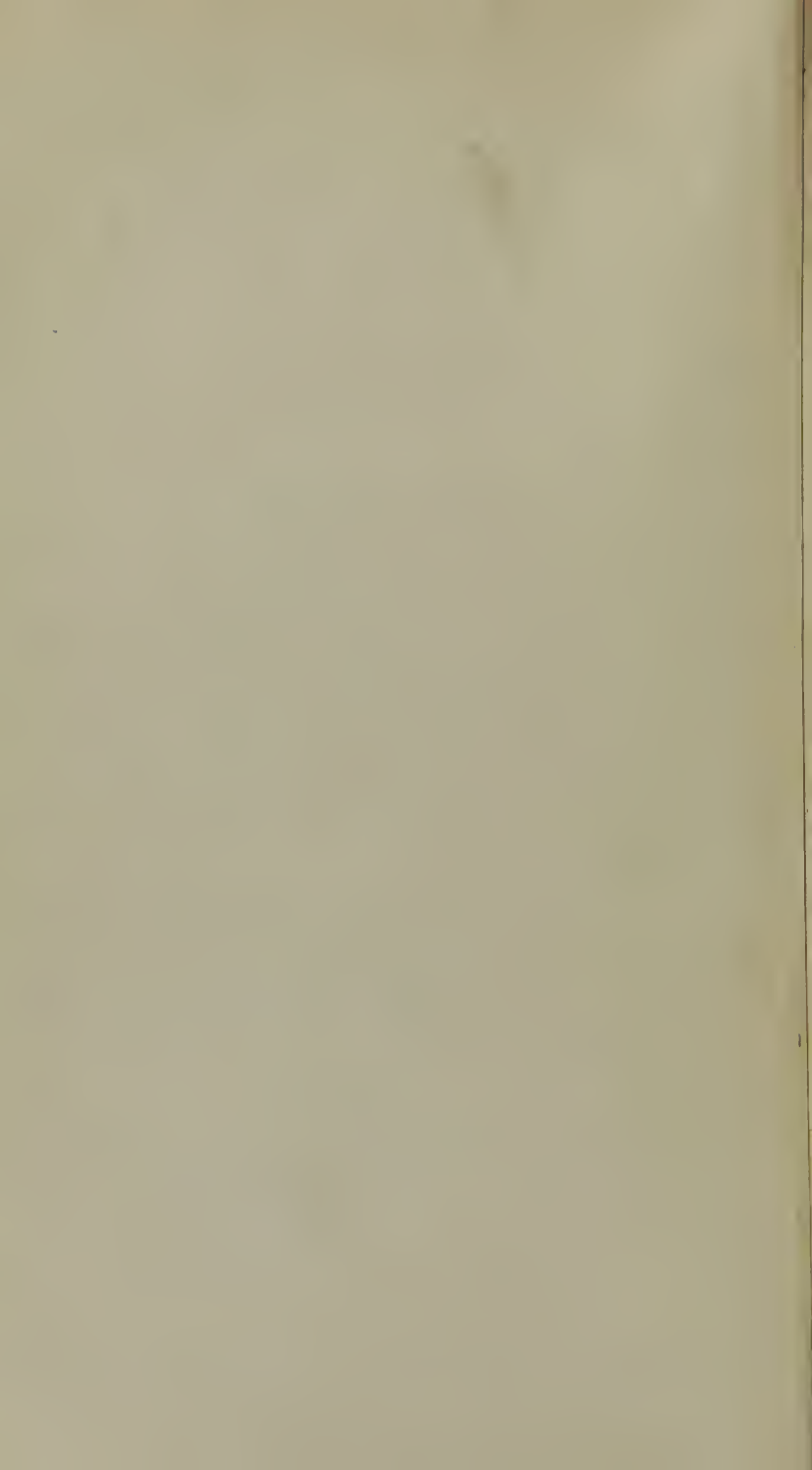


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Caldwell (61)
PRIZE ESSAY.

AN ESSAY

UPON THE

NATURE AND SOURCES

OF THE

MALARIA OR NOXIOUS MIASMA,

FROM WHICH

ORIGINATE THE FAMILY OF DISEASES

USUALLY KNOWN BY THE

DENOMINATION OF BILIOUS DISEASES;

TOGETHER

WITH THE BEST MEANS OF PREVENTING THE FORMATION OF MALARIA, REMOVING THE SOURCES, AND OBTAINING THEIR EFFECTS ON THE HUMAN CONSTITUTION, WHEN THE CAUSE CANNOT BE REMOVED.

OFFERED

As a "Prize Essay," according to the conditions prescribed by "The Medical and Surgical Faculty of Maryland, at their Annual Convention held in the City of Baltimore, on the 7th and 8th of June, 1830."

Dies errorem delet, veritatemque illustrat.

BY CHARLES CALDWELL, M. D.

PROFESSOR OF THE INSTITUTES OF MEDICINE AND CLINICAL PRACTICE IN PENNSYLVANIA UNIVERSITY.

33.
PHILADELPHIA:
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1831.

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At the Annual Convention of the MEDICAL AND CHIRURGICAL FACULTY OF MARYLAND, held in Baltimore, June 6th, 1831, the following report was submitted by the Prize Essay Committee, and accepted by the Convention.

JOHN FONERDEN, *Rec. Sec.*

The Committee appointed by the Medical and Chirurgical Faculty of Maryland, at the last convention to award the medical prize—

Report, That in the performance of their duty, they selected for the subject of the Prize Essay, “The nature and sources of MALARIA, or noxious miasma, from which originate the family of diseases, usually known by the denomination of bilious diseases; together with the best means of preventing the formation of malaria, removing their sources, and obviating their effects on the human constitution, when the cause cannot be removed.” As was expected, from the great importance of the question, many highly respectable essays were presented. Several of them deserve special commendation for ingenuity and research. Your committee, in the execution of their assigned duty, have adjudged the prize to that bearing the superscription—

“*Dies errorem delet, veritatemque illustrat.*”

The committee, however, respectfully suggest that the other competitors for the prize be requested to give publicity to their productions. The subject of malaria is one of great concern to the world at large, and the results of concentrated investigation are too valuable to be lost, when so much information remains unsupplied. CHARLES CALDWELL, M. D. of Kentucky, is the author of the successful essay.

THOMAS E. BOND, M. D.

JOHN BUCKLER, M. D.

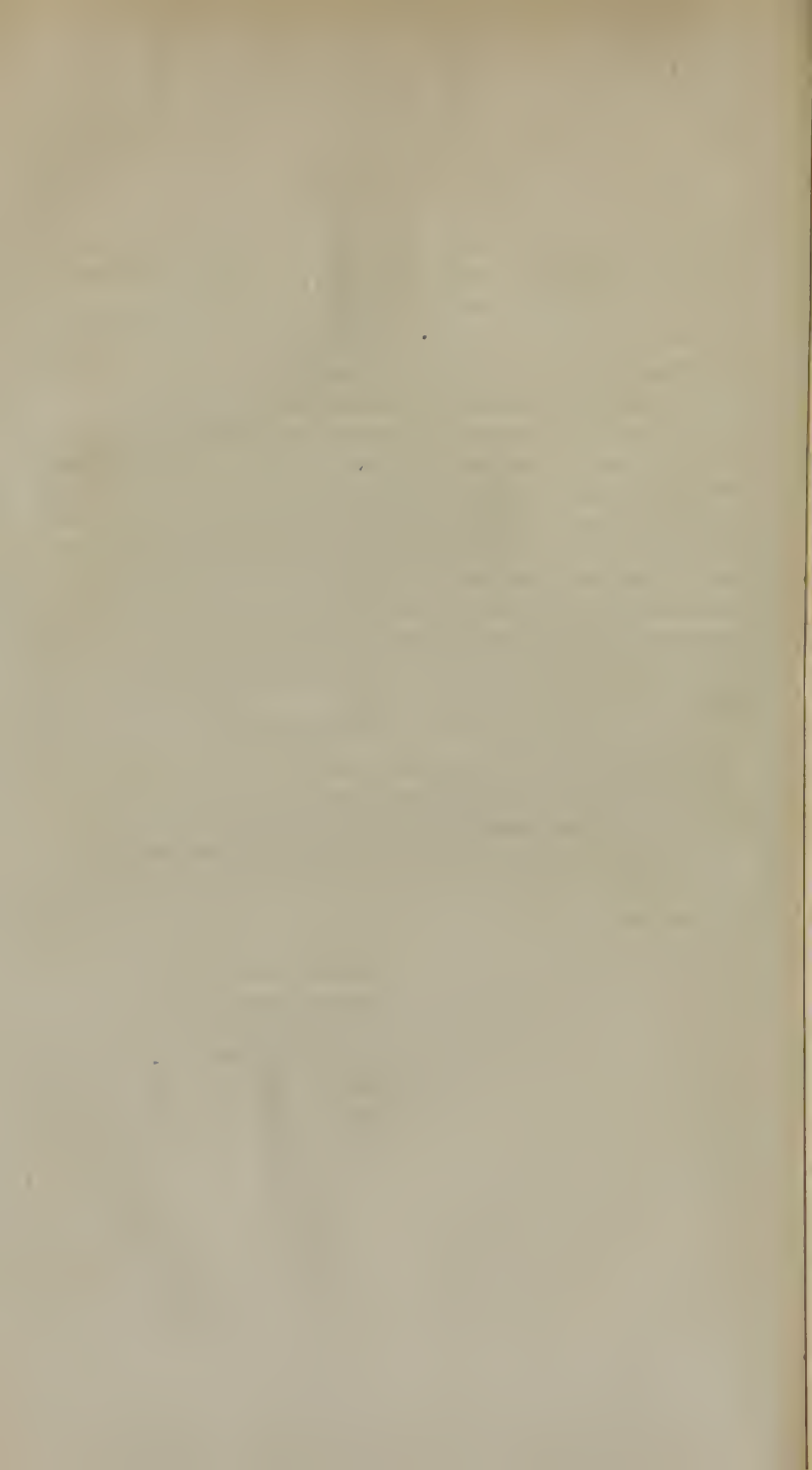
JOHN FONERDEN, M. D.

H. WILLIS BAXLEY, M. D.

EDMUND G. EDRINGTON, M. D.

JOHN L. YEATES, M. D.

PETER SNYDER, M. D.



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INTRODUCTION.

NO age within human remembrance, or the reach of history, has been so fruitful as the present in schemes for improving the condition of man. Nor have the efforts of former times, to this effect, been so generally successful as many of those that have been more recently instituted; a proof that the true interests of our race and the means of promoting them are becoming better known. Indeed, usefulness of design, and a practical character and tendency in all things, as contrasted with the abstraction and hypotheses of former periods, constitute one of the most prominent features of the day, and mark, in a special manner, the projects of our own country. Mere beauty and ingenuity, however pleasing to the few, have but little attraction for the great mass of the American people. Preferring the fruit to the blossom, their delight is in something useful. Whether they make at times an excessive sacrifice of embellishment to usefulness, it is not my province now to decide.

The deepest interest that man has at stake, is in the right cultivation of his intellect and morals. Let that be attained, and carried as far as his faculties admit, and all that is most desirable to him will grow out of it. While it furnishes him with knowledge to direct him in the transaction of his affairs, both public and private, it strengthens his motives to the practice of virtue, and the promotion of general and individual happiness. When raised to this condition, he has no further improvement, as respects his mind, to look or wish for, in his present state of existence.

Second only as a matter of interest and a means of usefulness, to a sound and well disciplined intellect is a healthful and vigorous body. Were I to say that the two are inseparable, facts would not be wanting to confirm the position. An entire person, including the brain and nerves, well-formed and organized, and in a condition of health, is never unaccompanied by a sound mind; and the reverse. If the body be seriously diseased, or defective in any of its fundamental organs, the mind participates in the malady or privation. It may be, therefore, laid down as a maxim, sustained alike by observation and principle, that *mens sana* is to be found only *in corpore sano*; a consideration which adds incalculably to the value of health.

Yet singular as it may appear, it is notwithstanding true, that mankind set but a moderate estimate on this invaluable blessing. Such, at least, as relates to the protection of it, is the only rational interpretation their conduct can receive. Hence the recklessness with which they risk it, and the innumerable instances in which they sacrifice it, on trivial points, for momentary gratifications, and in useless and degrading practices. In projects of ambition, wealth, or pleasure, there is nothing too difficult or dangerous for aspiring minds and bold and ardent spirits to encounter. Yet to preserve health, without which success is joyless, hope sickens, and life is a burden, they will neither incur trouble, nor forego gratification. They will not even so far controul their appetites, as to satisfy them with food and drink like rational beings, but with the heedlessness and voracity of the inferior animals, swallow, in quantity and quality, what their experience, a thousand times repeated, has proclaimed to be fraught with the seeds of disease. Nor will they deny themselves the pleasure to be derived from a crowded evening party, an interesting excursion, or any other scene of amusement, although admonished almost to assurance, by the past, that the indulgence will visit them with a fit of sickness.

But neglectful of health, as individuals are, public bodies are still more so. The sentiment has become a proverb, that "Corporations never feel." Were another formed, declaring that, as relates to health, they "never think" it would be scarcely less true. On that subject they have hitherto done little else than indulge their fears and exercise their imaginations, or collect antiquated prejudices, obsolete hypotheses, and opinions at open war with science, and, weaving them into statutes, miscall them health laws. They certainly therefore think on it to very little purpose. Quarantine establishments founded in error, and ill-contrived schemes for purifying cities excepted—both of which, as now conducted, do more harm than good—it is not within my recollection, that States have devised and put in practice any measures of moment for the preservation of the public health. The ordinances which corporations occasionally pass to guard against small-pox, canine madness, and a few other maladies, are unworthy of notice. Almost all that has been done by vaccination, for the prevention of the former complaint, has been the work of individuals. And it is a matter of regret, that even that has been overvalued. At any rate, it does not amount to the preservation of health. It is only the substitution of one disease for another—a less evil for a greater. Even that, however, is a deduction from the sum of human misery, and is so far to be commended and encouraged.

Vaccination moreover mitigates small-pox, if it does not always prevent it.

States and corporations have indeed done much for the restoration of health when lost, and the alleviation of disease and injury, when too deep to be cured. Some of the most invaluable, I had almost said glorious establishments on earth, are public hospitals. No one can visit those of London and Paris, and other large European cities, without receiving an impression to this effect, which no time can erase. Nor has our own country, or rather the people of it, been unmindful of them. Some of the hospitals in the United States would be distinguished, if not for their size, at least on account of their excellent administration, in the great capitals of which I have spoken. But they are not, I repeat, the work of States, or other public bodies. They are the product chiefly of a more sacred and endearing source, the munificent charities of benevolent individuals. As far as I am informed, neither the nation nor the individual States of America have done any thing for hospitals that deserves high commendation. Considering their means, and the nature and strength of the claims on them for aid, the donations they have occasionally made have been any thing but liberal. A more severe and narrow policy, not to call it unjust, can scarcely be imagined, than that of the government of the United States, in withholding from mariners a portion of their wages, to provide accommodations for them, in case of sickness. There is a frigidness in it, united to an act of heartless authority, that chills and offends, and seems to proclaim to the world, that the fountains of our public gratitude and benevolence are frozen up; that, as a nation, we look only to the future, forgetful of the past, and do every thing for interest, and nothing for gratitude. Our seamen toil for their country and give her wealth, fight her battles and glorify her flag. In return for this, they are richly entitled, free of expense, to comfortable quarters, during suffering from sickness and wounds, and the infirmities of age. On these points the conduct of the British government is worthy of all praise and imitation. The mariners that have been the main prop of Britain's power, by ministering to her opulence and giving her the empire of the seas, are objects of her tenderest regard, in the hour of distress. They can point, as they glide along the Thames, to the groves and magnificent edifices of Greenwich, and claim them as their own—the glorious reward from a just and grateful government, for dangers encountered, and services performed. Nor, in conferring such a reward, has the government manifested less of sound policy, than of correct feeling. But to return from this digression.

I have alleged that the process of vaccination has not conferred on man the full amount of the benefits that were anticipated from it, or that report has ascribed to it. It has not, as many of its advocates so confidently predicted it would, erased small-pox from the catalogue of disease. Nor is there the least probability that it ever will. The positive benefits, moreover, of vaccination are diminished not a little, by the well-known fact, that, under inoculation skilfully conducted, small-pox is a disease not much more severe and dangerous than cow-pox. I know that a belief to the contrary of this very generally prevails. But that does not move me, because it does not constitute authentic testimony. My reliance is on observation and experience, not on popular opinion; on what I have myself seen, not on what I have only heard or read. Out of several hundred children that I have inoculated, but *one* died of the complaint; and that was a child whose constitution was so infirm that I communicated the disease to it with great reluctance, and warned its parents of the danger of the operation. Let the weather be temperate, the atmosphere free from any endemic or epidemic taint, and the child healthy; in an especial manner, let its chylopoietic organs and skin be in a sound condition, and I repeat, that the danger from inoculation, under skilful management, is far from being serious. Severe cases arise much more from some sort of mismanagement, than from the nature of the disease. Nor is it within my recollection that the face of a single child I ever inoculated was pitted by the pustules. I am sure the beauty of the countenance was never marred by them. By judicious treatment, that effect can be prevented. But let it not be imagined that I am an enemy to vaccination. Far from it. The practice of my life has proved the contrary. I am willing to take the discovery for what it is worth; but for nothing more. And it is not worth the price that has been set on it. Extravagant praise never fails to injure its subject.

But admit that small-pox had been exterminated, and its virus destroyed by means of vaccination. The event would have been surely of great value, and a source of high and well-founded rejoicing to the human family. But it would not have been the *most* valuable that might have occurred. A febrile poison of much elder date, greater power, and wider compass, would have still remained, to baffle, for a time, the efforts of science, and continue, as it long has done, one of the heaviest scourges of the human race. I allude to the malaria productive of bilious fever; that miasm, whose nature, origin, and prevention, with the best mode of obviating its action on the system of man, are to constitute the subject of this Dissertation.

It has just been observed that the miasm of bilious fever is a much more ancient evil than the matter of small-pox. For proof of this, reference may be had to general history and the records of our profession. The latter poison can be traced through the annals of medicine only to the sixth or seventh century. But the former is coëval with the present order of things. Its birth was no doubt anterior to that of man. Ever since vegetable substances, such as now cover the earth, lived, grew, died, and passed to dissolution, its production was as necessary a result of the laws of nature, as the descent of ponderous bodies, or the refraction of light. Our records of it, moreover, extend to a period of great antiquity. Every fact and consideration that bear on the subject concur in proving, that it is the miasm of the true plague of Asia and Africa no less than of the bilious and yellow fevers of Europe and America. That, in fact, it is the cause of the diseases of hot weather, through all time, by whatever names those maladies may be known. We clearly trace its being and ravages, therefore, to the days of Sesostris, Busiris, and the Pharaohs. It was the breath of the "Python of the Nile," which produced then, as certainly as now, the "pestilence that walked in darkness," whether through the palaces of kings, among the tabernacles of Israel, or elsewhere in the midst of the surrounding nations. As far then, as positive history, and fair inferences from the nature of things may be confided in, it more than trebles, in antiquity, the date of variolous matter, and all other febrile poisons. It has been employed, therefore, a much greater length of time in the work of havoc. Compared to it all other miasms are of recent origin.

Nor does it surpass them less in the extent and constancy of its ravages, than in their duration. Does the virus of small-pox, measles, and other febrile complaints, appear occasionally, and spread disease, for a few weeks or months, over certain limited districts of country? That of bilious fever produces sickness, in some form, during a part of every year, in every country inhabited by man, and, over an extensive portion of the earth, throughout the whole year. Wherever and whenever vegetable substances perish and decay, in the usual manner, there and then it springs into existence, and begins its mischief. It produced, in ancient times, the pestilential and other summer and autumnal complaints, not only of Egypt, but also of Asia Minor, Greece, and Italy, as well as of Carthage, Syracuse, Iberia, and other places, of which history informs us. And there is reason to believe that, in modern days, the sphere of its action is still wider, because the earth is more extensively peopled. It certainly presents itself to us on a broader scale. In the old world, from

the northern limits of Siberia to the Cape of Good Hope, and from the Pillars of Hercules to the Eastern ocean, we are acquainted with no peopled spot that has not suffered from it. And, on the American continent, its devastations reach from the extreme north to the heights of Cape Horn, and from the shores of the Atlantic to those of the Pacific. Nor is there, in any ocean, a peopled island, however healthy, that does not feel occasionally its deleterious influence. Such is the earthly ubiquity of this malaria.

But it has been also represented as a poison of greater power than the matter of small-pox, or any other febrile miasm. For evidence in proof of this, I may confidently refer to the history and character of plague and yellow fever, as well as to those of the cholera of the east. That these are the most gigantic diseases to which man is subject; and that, in their highest grade, they extinguish life most certainly, and in the shortest period, cannot be denied. In point of strength, small-pox is doubtless a very formidable complaint. When it attains its highest degree, and assumes its most malignant character, it is exceedingly intractable, and often terminates fatally in a short period. Of measles, influenza, typhus fever, and scarlatina, the same is true. Their malignity and ravages are sometimes appalling. But no experienced physician will contend, that they are equal, in these respects, to plague and yellow fever. The consternation and flight, with the suspension of business, which the latter occasion wherever they appear, and the Lazarettos erected to prevent them from spreading, prove satisfactorily that mankind at least concur with me in opinion. An invading army, irritated by battle, and flushed by victory, is scarcely more terrific to a crowded city than one of these calamities. Another consideration which adds not a little to the formidable character and destructive influence of bilious malaria is, that when it has once taken possession of the atmosphere, no human means have been yet discovered, competent either to extinguish it, or put limits to its range. Experience testifies that it sets at defiance all efforts to that effect, and ceases from its ravages only with a change of season. It yields obedience to the laws of nature, but refuses to acknowledge the supremacy of man. As relates to the poison of small-pox, except when the disease is epidemic, which is but seldom the case, the reverse is true. It so far submits to human controul, that it can, by judicious measures strictly executed, be circumscribed within given limits, and prevented from propagating disease through the community. To the truth of this also experience testifies.

But the forms of disease justly attributable to the miasm I am con-

sidering, are not more violent and destructive than they are numerous and diversified. Besides plague, yellow fever, and the cholera of India, which have been already mentioned, the following belong to the formidable catalogue. The bilious fever of every country and climate, in all its modifications, including in particular intermittents and remittents, the same complaint under a more continued type, but not amounting to yellow fever, and bilious ophthalmia, endemic in Egypt and some parts of Europe, and not uncommon in our own country. Dengue would also appear to be nothing but a modification of bilious fever. To these add dysentery, bilious diarrhœa, the common cholera of adults, cholera infantum, rheumatism, bilious colic and hepatitis, acute and subacute, with enlargement and induration of the liver and spleen, jaundice, dropsy, neuralgia in all its forms, elephantiasis, and several other chronic affections incidental to the inhabitants of hot climates. Of these, some are said to be but sequelæ, or secondary complaints, arising from neglected or mismanaged bilious affections, and therefore not fairly attributable to the malaria in question. The reply to this is plain and conclusive. But for the influence of this miasm, neither could bilious fever exist to suffer mismanagement, nor the sequelæ arise from it on that condition. The primary and secondary complaints, therefore, are equally its offspring, the former immediately, the latter remotely. Like parent and child, they descend from a common ancestor, whose being alone gave being to them. These chronic affections, entailing on the subjects of them all the miseries of cachectic habits and ruined constitutions, last for years. By their means, therefore, some of the terrible effects of bilious miasm are rendered every where perpetual. Although in temperate climates it has itself an actual existence but for a few months every year, it lives perennially in its offspring and their product, and is to human comfort the worm that never dies. It is the source of a much greater amount of chronic disease, with its dismal register of consuming anguish, and the withering wretchedness of "hope deferred," than all other febrile poisons.

To make up the aggregate of mischief and suffering, there are not wanting other elements of peculiar moment. By a transfer of its morbid action from the chylopoietic organs, which are its principal seat, to the brain, marsh miasm is not unfrequently the cause of madness, especially the *melancholy* form of it. Thus is life rendered a cup of unmixed bitterness, and the wretchedness of the victim is complete.

But all the evils this poison inflicts on man are not yet recited. It produces in time a deep and humiliating degeneracy of the race. In

our own country this result is already visible; but those who would witness it in its highest degree, must visit some of the marshy and sickly districts of Europe, more especially of France, Holland, Italy, Spain, and Portugal. In those places, where, by the operation of the poison, through a long and unbroken line of generations, its effect has reached its maximum, the issue is deplorable. Besides being deteriorated in complexion, figure, and general aspect, the inhabitants are lamentably curtailed, not alone in corporeal dimensions and strength, but in the duration of life and the powers of the mind. There is a foundation in nature for the belief, that those who are borne and reared amidst dense and noisome fogs, and deleterious exhalations, have saturnine imaginations and clouded intellects. Hence there was much more of truth than is generally imagined in the opinion held by the Athenians, which attributed Bœotian dulness to Bœotian mists. In some of the fenny tracts of country just referred to, vigorous health is scarcely known. During summer and autumn disease is acute, and chronic throughout the remainder of the year. Hence enlarged and indurated spleens and livers, preternatural and unsightly abdominal distentions, dropsied limbs, pale and often bloated countenances, unelastic movements, a listless look, and a drawling mode of expression every where present themselves. These marks of wretchedness and degeneracy in man, united to the heavy incumbency of morning and evening fogs, streams creeping slowly along their muddy bottoms, and the general monotony of a flat country, are sufficient to make "genius sicken and fancy die," even in a traveller passing through the place. What, then, must be their effect on those who are born and reared amidst their baleful influence; whose susceptible infancy is moulded by them from the cradle; and whose blood is never vivified by a better atmosphere, their vision cheered by a fairer sky, nor their torpor broken by brighter prospects? whose sun in winter shines dimly on them, through a haze, and generates, in summer, exhalations to poison them? In these abodes of misery, the decrepitude of age begins to be seriously felt before the fiftieth year of life; and real longevity is never attained. Idiotism prevails here much more than in healthier regions. Nor when man suffers so fearfully, do his domestic animals escape. In size, form, action, and all the higher qualities of the races, their degeneracy is also striking. Their chylopoietic organs generally, especially their livers, are usually unsound. This bespeaks in them chronic disease, and they are often swept off in great numbers by acute epidemics. Lancisi and other distinguished writers concur with observation in testifying to this.

Of the numerous evils, *physical* and *moral*, inflicted on the human family, by the malaria I am considering, the foregoing make a part. But, of the latter class, many grievous ones remain to be told. Such are the distresses of relatives and friends on account of the sufferings of the sick, their fatigues in attending them, their deep solicitude for the issue of their complaints, the sorrows of the living for the loss of the dead, and the heavy privations which communities and nations often sustain, in the death of individuals distinguished for their talents and public benefactions. Add to this account the disasters produced in commercial cities by visitations from plague and yellow fever, and its amount will be appalling. This latter calamity can be appreciated only by those who have witnessed it. The spectacle it presents is often in the highest degree tragical and afflicting. The tumultuous flight of the inhabitants, without either friends or homes to receive them, and the destruction of property which this produces, the anguish of those who have not the means to fly, while the seeds of pestilence and death are around them, the interruption of trade and business, with the bankruptcy, ruin, and want, that inevitably follow, the pernicious effects of this on commercial transactions in other places, and the general gloom and despondency that prevail, constitute but an outline of it. It must be left to the memory of those who have beheld it, and to the imagination of those who have not, to fill up the picture.

Such is the minister of mischief, which the "Medical and Surgical Faculty of Maryland" would deprive of his power. The enterprise is creditable to those who conceived it. It is to disarm, in modern times, and in another quarter of the globe, the Python of his poison, a work which the ancients assigned to a god. Be its issue what it may, the spirit of patriotism in which it originated, must enhance the standing of the medical profession. It shows the members of it to be in the highest degree disinterested; capable of labouring with zeal for the accomplishment of that in which they not only have no interest beyond that of others, but of that which is manifestly hostile to their interest. All of them subsist in part, and many of them almost entirely on the ravages of malaria. Extinguish that poison, or teach the mode of obviating its effects, and half of the physicians of the world must abandon their profession. The enterprise then, I repeat, is eminently creditable to its public-spirited authors. Should it succeed, the gain to science and philanthropy will be immense. The amelioration of the process of education, I say, and its happy influence in the culture of the mind excepted, no projected improvement of the day can compare with it. What are the excava-

tion of canals and tunnels, the construction of rail-roads, locomotive engines, and steam-boats, and the opening of coal mines and quarries, to the preservation of the lives of innumerable millions from the destructive influence of marsh effluvia? What, to the protection and redemption of whole districts of country from desolation, actual or impending, by that formidable poison? Weighty and numerous as are the interests concerned in both schemes of improvement, it will not be denied that those of the latter infinitely preponderate. In one case the end aimed at is convenience and wealth; in the other, existence, with all that belongs to it. Between objects so different in their import there can be no rivalry. It would be superfluous, therefore, to consume time in tracing the contrast.

But what is the prospect of success to the scheme projected by the Faculty of Maryland? This is a question of great moment; and the experiment alone can satisfactorily answer it. *Practically* speaking, the project is new. It has been indeed thought of, and talked of, but never tried. Nor is that the worst. The task imposed by it is as difficult to be accomplished, as the views that suggested it were liberal and praiseworthy. But this constitutes no just ground of discouragement; much less of despair. Projects are not to be deemed impracticable, and to be therefore abandoned, merely because they are difficult. Man knows not the extent of his powers until he has fairly tried them. And for the attainment of important ends, he should try them boldly. In an especial manner, nothing but the experiment skilfully made and duly persevered in, can determine the issue of the efforts of numbers, acting in concert or uninterrupted succession. Under the most discouraging circumstances it has been frequently astonishing. History and observation testify, that much more good has resulted from enterprises deemed, at the time, even rash and perilous, than ever has from cautious forbearance. Under prospects thus disheartening was the new world discovered, and its independence from European thralldom achieved. The human mind should despair of nothing calculated for the promotion of human happiness. This sentiment which, serving as a ground and principle of action, so often saved the Commonwealth of Rome, has been an abundant source of improvement in science. The more arduous the task to be performed, the higher the zeal and the firmer the resolution with which it should be encountered; and the brighter the glory of him who may accomplish it.

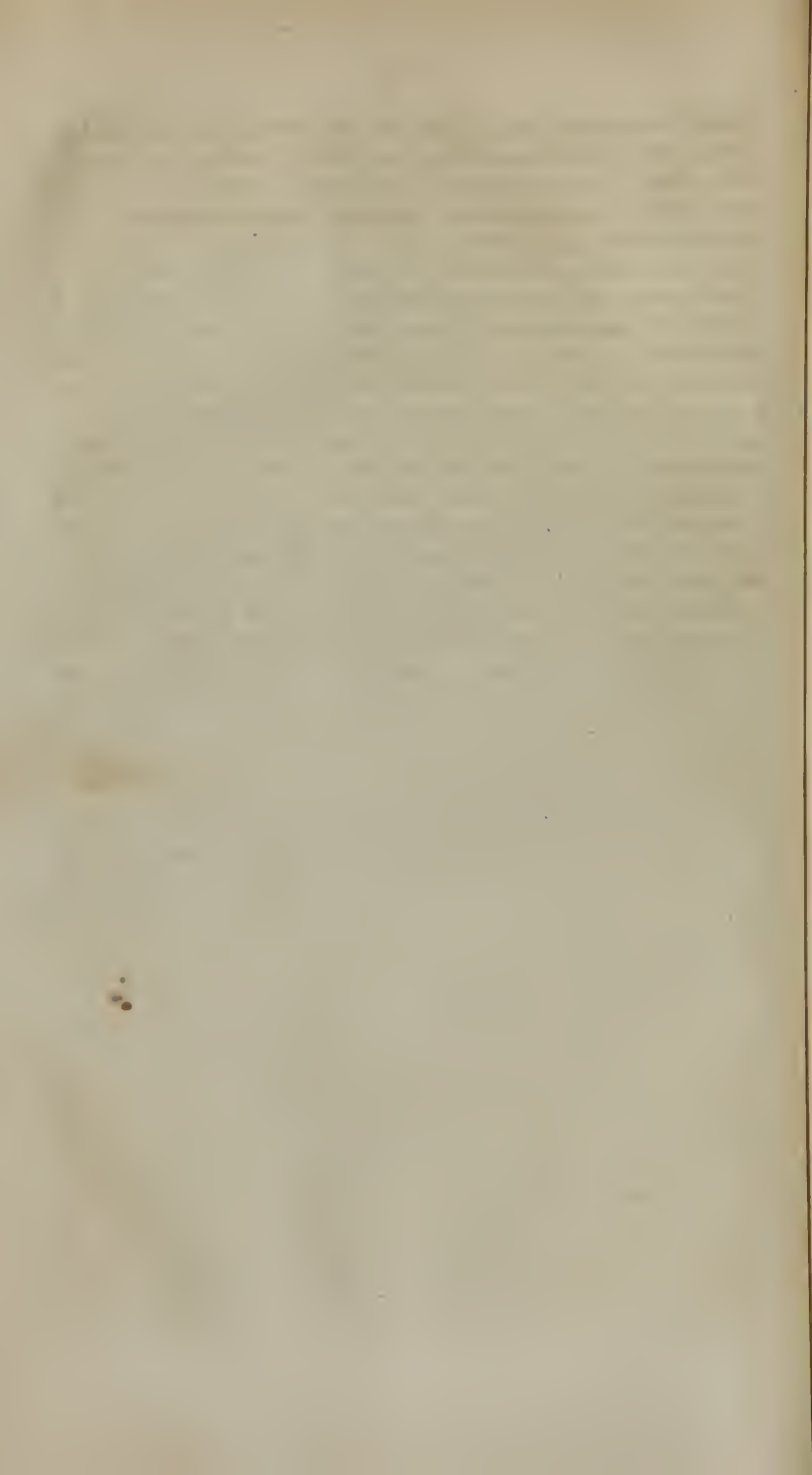
In the present enterprise, the adventurers, I doubt not, will be numerous and distinguished. An invitation so honourable from a source so respectable, and designed to subserve an end so important, cannot

fail to be eagerly accepted by the votaries of medicine and the friends of our race. Although the object contemplated, therefore, may not be attained to the entire satisfaction of those who proposed it, something will doubtless be done in promotion of it. By the offering of each labourer, however limited, to the common stock, an aggregate will be formed, that must facilitate the task to future adventurers. *E pluribus unum* is a motto as important in defence of truth, as of States. Nothing can resist the human powers, when they act in well-trained masses, successively and steadily. They form a perpetual phalanx, to which, in time, every thing must yield. As relates to the object of this discussion, therefore, should one set of adventures fail, another set, coöperating under more propitious circumstances, will prove successful. And, in this case, a portion of the glory will belong to the first. They had commenced the breach, which their successors completed, and passed it in triumph. It is under the influence of these sentiments, and from a wish to contribute my quota, however small, toward the completion of the great work, that I respectfully submit to the Faculty of Maryland the present Dissertation. That it will contain any thing new or instructive to *them*, I ought not perhaps to flatter myself. Nor do I know that it will be a repository of such matter to any of my fellow citizens. Its entire contents may have been, for aught I know, already anticipated by other inquirers. All I promise or pretend to is, faithfully to embody in it such facts and thoughts, bearing on the subject, as I now possess, or as may occur to me while engaged in composing it. I trust, however, it will be permitted me to add, without incurring the charge of vanity or presumption, that the matter it shall contain, whether useful or otherwise, is the fruit of many years observation and research, matured by a corresponding degree of reflection. I have visited and examined many sickly spots, in other countries as well as my own, with a mind awake to the condition of the inhabitants, and an earnest wish to see it amended. The subject is not, therefore, new to me.

But I entreat the Faculty not to misunderstand me. It is not my intention to trouble them with a dissertation ponderous in learning, and encumbered with authorities. Such a production would be alike unworthy of them and the subject. They are not now to be informed any more than myself, that the terms *learned* and *useful* are neither synonymous, nor always convertible into each other. They are unfortunately very often directly the reverse. Nor are there many subjects in connexion with which this would be more likely to be the case, than that which I am now considering. Learning, as respects

it, would be little else than another name for a useless citation of vague conjectures and antiquated hypotheses. Much indeed has been said and written *about* the malaria of bilious fever, but, as far as I am informed, very little directly *on* it. In the course of my reading, it has fallen in my way to look into the works of almost every writer of note, who has treated of it since the days of Lancisi, its great discoverer; and I regret to say, that the labour has far over-balanced the reward. True, I have enjoyed what the world calls the pleasures of variety; for no two authors I have ever examined, have thought and written alike about it. Each had his own dream, and his own method of relating and interpreting it. In one I encountered a battery of unrelenting dogmatism; in another, a methodical array of what he called "facts," but which appeared to me to be nothing but *fancies*; and in a third, I was compelled to thread the brake of what admiring readers denominate *ingenuity*; a term which occupies the entire space from profound and resolute sophistry, to the frothy surface of dexterous trifling. But, as respected sound and useful information, all was to no purpose. I rose from my task precisely as I had sitten down to it, with the exception, at times, of disappointed feelings and an aching head. Seriously, as far as my inquiries have extended, the crude views and indefinite expressions of writers on malaria are incompatible with accurate information and practical results. I allude chiefly, though not wholly, to speculations about the *nature* and *modus operandi* of the poison. Occasionally useful facts are presented to us scatteringly, like oases in the desert. But, from being insulated, they are almost lost. They want the force of system and concert. They resemble a disjointed assemblage of militia-men, whose power during action being exerted individually, is wasted without effect; while well-trained regulars act in masses, and achieve victory. Even professed writers on hygiene and medical police are exceedingly defective in their remarks on malaria. Much more is this the case with common writers on the diseases of the East and West Indies, and other warm climates and marshy countries, most of whom are mere practitioners, rather than philosophers, and whose object is cure, rather than prevention. Indeed, as relates to the true philosophy of malaria, I do not know that any additional light, worthy of notice, has been thrown on it, since the time of Lancisi. That illustrious physician discovered and proved the existence of the poison, and pointed out some of its laws; and I am unacquainted with any subsequent writer that has done more. The abundant succession of hypotheses we have had, has obscured and retarded truth, rather than brightened or advanced it.

But I must have done with these digressions and prefatory remarks, and hasten to my subject, lest others should say of me, as I have done of my predecessors, that I write "about it," rather than "on it." I am indeed aware that the freedom of comment I have indulged on the productions of others, invites the same in relation to my own. And my wish is to that effect. Free discussion is essential to truth; and that is the object at which I aim. It shall be my endeavour, therefore, as it is my wish, to proceed on the ground of fact and fair induction. With hypothesis I have no concern. I shall erect none myself, nor consume much time in subverting those erected by others. Such toys of the fancy are suited only to the slumbers of the cloister. It is my desire to have my sentiments scrutinized with strictness and candour. If they pass an ordeal thus conducted, they will be worth possessing. If not, the sooner their mistakes are detected and refuted, the better. The issue will instruct myself as well as others, and so far free me from the thralldom of error, and that is the freedom to which I aspire. Under all the circumstances of the case, I have nothing to ask or expect but justice; and that, as relates to the present discussion, I doubt not I shall receive. I shall, therefore, proceed in it without further deviation.



SUBJECT DISCUSSED.

THE entire subject of this dissertation, as proposed by the Faculty of Maryland, is included under the four following questions:—

1. What is the nature of the malaria that produces bilious fever?
2. From what source or sources does it arise?
3. What are the best means of preventing its formation and removing its sources? and when the sources cannot be removed, nor the formation prevented,
4. How may its effects on the human system be most certainly obviated?

These questions I shall now consider in the order in which they are here proposed, treating each of them as succinctly as the subject will admit.

1. *What is the nature of the malaria that produces bilious fever?*

To this question my answer is brief. *I do not know.* Nor is any one better informed about it than myself. The present state of science does not admit of better information. By no other test than its deleterious effects on the animal kingdom, more especially on man, can even the existence of the poison be established. Of its nature or composition, or the species of matter to which it belongs, no more is known than is of the poisons of small-pox, measles, or rabies canina. Here the matter, for the present, might be suffered to rest, were it not that multiplied errors respecting it are afloat, the exposure of some of which would seem, in its beneficial effects, to be second only to the discovery of truth.

The malaria of bilious fever is supposed, no doubt correctly, to be the product of chemical agency. The votaries of the laboratory, therefore, have endeavoured to make it the subject of chemical experiment. But in no instance have they succeeded. Virtually they have sought a phantom and found nothing. Their efforts have been as unavailing as those of the child that pursues its shadow or grasps at a moon-beam. I speak from personal observation. I have often witnessed these attempted experiments, and sometimes engaged in them myself, with equal interest and disappointment. They were

tried on the atmospheres of different places, where bilious diseases prevailed in every grade from a slight intermittent to malignant yellow fever. But they were tried to no purpose. In the air where man contracted disease soonest, more certainly, and of the worst character, no more poison of any kind was discoverable than in the healthiest atmosphere of the hill top or the mountain. Nor could any extraneous matter, in the form of gas or otherwise, be detected in the one body of air more than in the other. In each, all the common atmospherical components were present in their natural proportions; and nothing else appeared. Neither a deficiency of oxygen, therefore, nor a superabundance of carbonic acid gas, or of any other known chemical compound, could be indicated as the cause of the prevailing sickness. That evil was the product, as already mentioned, of a lurking agent, whose very existence could be recognised only by the injury it inflicted on animated nature.

But, as relates to the nature of bilious malaria, the influence of chemistry has not been merely negative. It has not only failed to confer any benefit on the medical profession; it has proved to it a source of positive mischief. This it has done by becoming a hot-bed of hypotheses, to the exclusion of observation and sober inquiry. During the late domination of ultra chemistry, when the entire system of man was considered a chemical laboratory, and almost every science was adulterated by the caloric of the crucible or the fumes of the retort, it was impossible that malaria should not be considered a product of the same source. And as some chemists affected a knowledge not only of all the elements, but also of all the combinations of matter, it was inevitable that they should attempt to identify the poison in question with one or other of the gases formed by their experiments. From this arose a state of things which seemed to proclaim that the only province of *chemical* physicians was to deal in *conjecture*. And their art was practised indiscriminately on the phenomena of living and dead matter. Hence, as respected malaria, the brain of every member of that school, brought forth its own peculiar fancy, until, collectively, the motley brood almost equalled in number, and quite in ludicrousness, the fables of *Æsop*. Every single gas, with every imaginable mixture of gases, was proclaimed, in its turn, or rather in a simultaneous and promiscuous uproar, (no candidate for the honour of discovery waiting for or listening to a competitor,) to be the miasm productive of bilious fever. But as far as I remember, (for I was not so much edified or delighted by the tumult

as to treasure up all that transpired in the course of it,) public attention was longest and most forcibly attracted by the claims of the nitrous oxide or some other nitrous compound, and carbonic acid gas. These found many advocates, some of them distinguished for ability and eloquence, who made it, for several years, their daily study and nightly toil, to prove them the source of bilious complaints. Yellow fever was, at the time, prevailing annually in our large commercial cities. An effort was made, characterized by much ingenuity, and urged with a degree of industry and perseverance worthy of a better cause, to derive that malady from nitrous oxide or some other gas whose base was nitrogen. The New York Medical Repository contains many papers in defence of this hypothesis, some of which were marked with much research, and an unusual share of strength and dexterity in argument. But they were written to no purpose. Nature has decided that fact must prevail, and that all else is perishable and evanescent. However attractive and imposing the form and colouring that talent and labour may bestow for a time on hypothesis and error, they cannot establish them on the ruins of truth. The nitrous oxide notion, therefore, had its day. But it was short. Records only say of it that it *was*. Present opinion says it is *no more*. Two well known facts ought to have been sufficient to stifle it in its birth. No mode of applying nitrous oxide or any other nitrous compound to the human body, can produce yellow fever. The experiment was repeatedly made during the period referred to, and uniformly failed. Nor could a particle of the gas in question be detected in the atmosphere of the places where its supposed product prevailed. Other objections might be added; but they would be superfluous.

Although still more palpably erroneous, not to say absurd, the hypothesis attributing bilious fever to carbonic acid gas has yet some advocates. But they are not numerous. Why they ever had an existence among physicians possessing any knowledge of that gas, is to me unaccountable. Its presence in the atmosphere is easily detected. But experiment proves that it does not exist in unusual quantities, in places where bilious diseases prevail. Much less does it exist in quantities proportioned to the amount of disease. If the report of a distinguished physician may be credited, the reverse is sometimes true. It is found in a comparatively diminished quantity in places of sickness. Fort Fuentes stands in a marshy and sickly district, at the mouth of the Valentine. Mount Legnone, one of the chain of the Grison mountains, which rises 8640 feet, French measure, above the level of the sea, is peculiarly healthy where it is in-

habited, and its summit is covered with perpetual snow. In these places, when fever was raging in the low country, GATTONI made repeated experiments, and found, to his surprise, that, chemically speaking, the sickly atmosphere was the purest of the two. In other words, it contained the greatest amount of oxygen, and of course a diminished proportion of its other elements. The positive quantity of carbonic acid gas in each place was the same. For the accuracy of these experiments I am unwilling to vouch. I have already mentioned that those of a similar nature, in which I have been myself concerned, gave a different result. They indicated no difference between a healthy and a sickly atmosphere. The result of a series of experiments by MOSCHATI was the same.

But this is not all. Every one knows that, in whatever way it may be applied, the effects produced on the human system by carbonic acid gas, are totally different from those that result from bilious malaria. No two classes of phenomena can be more dissimilar. Measles and influenza, scarlatina and small-pox, are much more alike. Were the hypothesis I am opposing true, the attendants on lime-kilns, where immense quantities of carbonic acid gas are hourly evolved, would never be free from bilious fever. Nor would the complaint fail to attack us by our fire-sides, especially in winter, when we consume oil in our lamps, and spermaceti in our lustres. Every Laplander's hut, moreover, during his long night of winter, would be a fruitful laboratory of febrile malaria. Yet throughout that period, in particular, he is a stranger to the complaint which that poison produces. Even the chemist in *his* laboratory, when preparing carbonic acid gas, would frequently suffer from his own experiments. In a more especial manner, were the notion true, what would become of our porter, ale, cider, champaigne, and soda-water drinkers, who are swallowing by the hour, deep potations of the reputed miasm? In that case, every butt of beer would be fraught with the seeds of bilious fever, and every brewery and soda-water fountain, as rich in poison as the Pontine marshes. The hypothesis is ludicrous, and were it not that it has received the sanction of physicians of standing, would be unworthy of a moment's serious consideration.

Another chemical notion respecting the cause of bilious fever, deserves, perhaps, a passing notice. It is that which attributes the disease to the hypercarbonation of the blood. This again, I say, is as empty a conjecture as has ever issued from the dreams of a visionary. The blood of patients in bilious fever, say its advocates, is always preternaturally dark-coloured, from holding in mixture a super-

abundance of carbon. Neither this position itself, nor the attempted explanation of it is true. As a *general rule*, the blood of patients in bilious fever is not preternaturally dark. It assumes that colour only under particular circumstances, which have no connexion with the amount of carbon in it. They are explicable only on a very different ground; and on that their explanation is easy. I venture to say, moreover, that the venous blood in bilious fever is more frequently preternaturally florid, than preternaturally dark. During the stage of excitement, if the re action be strong, and the circulation free, its colour is always too high. Nor am I the first writer who has said so. The fact is recorded by RIVERIUS, CLEGHORN, and HUXHAM; and, if I mistake not, also by SYDENHAM and RUSH; and I am confident it must have been witnessed by thousands of others. I doubt whether there is a practised bleeder in the United States, to whom it is not familiar. During the access and cold stage of intermitting fever, the blood is always dark, but becomes florid again in the stage of excitement. It is also dark in deeply congestive bilious fever, where re action is suppressed; but in open fever of high excitement, the reverse is true. In fact, in every case where the circulatory system is torpid, or in any way wanting in action, and respiration deficient, the blood is, and by the laws of the animal economy must be preternaturally dark. But it never is, nor can be so, when circulation and respiration are vigorous and free. Were it admissible for me to dwell on it, all this is perfectly explicable, on principles which no physiologist would controvert. Nor has carbon any more connexion with the phenomenon, than it has in giving fragrance to the rose, or lustre to the sun. That it should, by intelligent physicians, be supposed to have, is matter of surprise.

Have chemists detected, by a fair and satisfactory analysis, a superabundance of carbon, in dark venous blood? Have they detected in it a particle more than is found in the florid blood of the arteries? The annals of their profession cannot reply to these questions in the affirmative. Or if they can, I know not where the record is to be found. Conjecture indeed has said yes; but fact has not concurred with it. Again: does a mixture of carbon with bright arterial, convert it into dark venous blood? No physician of reputation will contend that it does. I, on the contrary, assert that it does not. I have witnessed the experiment, and know that I speak correctly. The hypothesis is but an abuse of animal chemistry which should receive no countenance from real physiologists. Were I to say the same in general of chemistry, as applicable to the functions of living matter, I might set opposition at defiance. It neither performs any

of them, nor aids in the performance. Within its proper sphere, that science is delightful and important. None can be more so. But it is concerned exclusively with dead matter. With life and all its attributes it is at war. It is the great antagonist of life, and life of it. It is no more suited to explain a single function of living matter, than the laws of life are to explain the formation of carbonate of magnesia, or Glauber's salt. When an attempt is made to expound by it a vital phenomenon, it is dislocated and misapplied; and that dislocation, like every other, proves a source of mischief. The harmony of nature consists in every thing producing after its kind. Abrogate this law, and chaos is recalled. Chemical causes, therefore, can produce only chemical effects, and vital causes vital effects. They are not transmutable in themselves or their action. Physiologists would escape an infinity of trouble, and the profession no less confusion and error, were chemists to confine themselves to their proper laboratories, and to dead matter. The living body of man is as completely without their sphere, as its structure and economy are beyond the imitation of the manufacturer of chess-playing automatons, and rope-dancing harlequins.*

* It is in vain for M. Broussais, and other animal chemists, to endeavour to explain away the error they propagate and the mischief they do, by the terms they employ. To tell us that, by "animal and vegetable chemistry," they mean the mutual action, in the form of decomposition and recomposition, of the "radical molecules of organized matter, *under the controul of the vital principle,*" is of no avail, as to the object they profess to have in view. Chemistry is a technical word, possessed of a definite meaning. For centuries it has been the representative of certain changes in the composition and qualities of matter, produced by affinity and repulsion, under the influence of given laws. Nor is there between those changes and the phenomena of life the slightest similarity. They are, on the contrary, the antipodes of each other. Dissimilitudes stronger than those which exist between them can scarcely be imagined.

Yet when the changes in living matter are said to be produced by "animal chemistry," nine persons out of ten, I might say ninety-nine out of a hundred, attribute them to the agency of the *common* chemical affinities; I mean the chemical affinities of the laboratory. They consider respiration, digestion, and other vital functions as belonging to the same class of processes, with the combustion of charcoal, the decomposition of water, and the formation of neutral salts.

Thus is error propagated by an *improper use of words*. Nor does there exist for that use the slightest necessity. The expressions, *animal action*, *vegetable action*, or the more general one, *vital action*, would be much better than *animal*, *vegetable*, or *vital chemistry*. The former, although not explanatory of any thing, do not mislead; whereas the latter do. I need scarcely add, that every phrase which propagates error ought to be erased from the language of science.

There are not wanting chemical physicians who would identify yet other gases with the malaria productive of bilious fever. Of these substances some are sulphureted hydrogen gas, phosphoreted hydrogen, and I believe carbonated hydrogen, with perhaps a few others. As relates to all of them, a single remark is sufficient to subvert the hypothesis which embraces them. Not one of them can be detected in the atmospheres of places where bilious fever prevails. Agitate, with a stick, the bottom of a pond, where masses of vegetable relics exist in a dissolving state, and some of them will indeed rise to the surface of the water, and may be ignited. But examine the atmosphere only a few feet distant, and no trace of them will be found in it. To this may be added, as another objection, that no application of these gases to the human body can produce any form of bilious disease.

Another hypothesis respecting the malaria in question, which has found advocates of some respectability is, that no such poison exists; but that bilious fever results exclusively from heat, moisture, and vicissitudes in temperature. My reply to this notion shall be brief, but I trust satisfactory.

When yellow fever prevails in a city, it is often arrested, in its progress, by the interposition of a street not more than sixty feet wide. It advances to the east or the north line of the street, but goes no further. Almost all the inhabitants on that side suffer; and all those on the opposite one escape. Such a case I have repeatedly witnessed, and therefore speak confidently of it. Many others have witnessed it also. Of oriental plague the same is true.

How is this phenomenon to be expounded? Place on each side of the street a thermometer, a barometer, a hygrometer, and a pluviometer, and they will show the atmosphere to be, in both places, precisely alike in temperature, weight, and moisture, as well as in the changes it undergoes, and the rain it precipitates. To no difference, in these respects, then, can the difference in healthfulness be ascribed. But one source of solution remains. The disease arises from a subtle poison, which reaches the street, but does not cross it. A stream of water of moderate width has arrested the progress of sickness on the same principle.

Again. Yellow or common bilious fever is raging along the bank of a large river, or some other body of navigable water, and a ship is lying in it, at cable's length from the land. Provided the vessel be kept clean, and her government be judicious, the crew will continue healthy, unless they are permitted to visit the shore; in which case they will suffer from the prevailing disease. This is a common oc-

currence, which no difference in the sensible qualities of the atmosphere can explain. No difference indeed exists in them. At the edge of the water, and seven hundred feet distant from it, where the ship lies, those qualities are the same. But there is a miasm at the former place, which does not reach the latter; and hence the difference, as relates to disease.

Some of those who deny the existence of malaria, attribute bilious fever to the deleterious influence of atmospherical moisture alone. Were this hypothesis true, no maritime situation could ever be healthy. The atmosphere of such places being necessarily surcharged with humidity, bilious fever would be an annual scourge to them. It would be rather perennial, prevailing during the winter as well as the summer; the atmosphere being humid throughout the year. But if free from swamps and marshy ground, maritime situations are peculiarly healthy. Of insular places, especially small ones, the same may be said. The marine air sweeping entirely across them, their atmosphere is saturated with moisture, and often darkened by fogs; and yet they are among the healthiest spots on earth. Bermuda, the Bahamas, and particularly most of the Scottish isles are of this description. The atmosphere of a vessel at sea is necessarily very humid. Yet, provided she be clean and well-governed, she is always healthy. To neither humidity, then, nor any other sensible quality of the atmosphere, can bilious fever be reasonably ascribed. It is the product of an aerial poison, significantly enough denominated malaria, whose effects alone on the animal kingdom proclaim its existence.

2. *From what source or sources does bilious malaria arise?*

From vegetable and animal matter, more especially the former, in a state of dissolution. I say "dissolution," not putrefaction; because there is good reason to doubt whether that process, in the technical meaning of the term, be necessary to the result. Bilious fever, in all its varieties of type and degree, often prevails in places where no putrefaction is discoverable. But dissolution, by which I mean the decomposition of dead organic substances, and the reünion of their elements, producing new compounds, is present. In no other way can the malaria be formed. At least it never manifests itself, except in situations where traces of the process referred to appear. That my remarks may be the better understood, when I shall speak hereafter of the prevention of this miasm, I must treat of its production somewhat circumstantially.

The medical world is in the habit of referring to LANCISI as the discoverer of the malaria of bilious fever. In a certain view of the

subject, I have already admitted that the reference is correct. He was so far the discoverer of it as to be the first to pronounce it the *azotic* or lifeless result of the chemical dissolution of vegetable and animal substances, and to bestow on it a name expressive of what he considered its nature. Others, who had spoken of it, believed it to be, as will appear presently, not *dead* matter, but a countless brood of animalculæ, infinitely small. He called it *paludum effluviium*—marsh exhalation—because he believed a marsh, lake, or some other form of stagnant water necessary to its production. But he was far from being the first to indicate fens and marshes as sending forth, directly or indirectly, vapours and other kinds of matter productive of bilious and pestilential diseases. In expressing their conviction of the pestiferous influence of such places, the ancients were as clear and decided as he was. But they spoke in poetry, he in prose; they in the language of fiction, he in that of philosophy. Each treated the subject in the spirit of the age in which he lived. Had he been an ancient Greek or Roman, he would have derived the poison from the breath of the Python, or the Hydra, (two words which, united, signify *putrid water*,) and had CELSUS or GALEN lived at the beginning of the eighteenth century, either of them would have pronounced it the result of the dissolution of organic matter. So true is it that men often attain to high renown, for promulgating opinions and doctrines believed to be entirely their own, but which, in fact, belong, in a great measure, to the periods in which they live. Their predecessors had sown the seed, and they appeared at the proper season to reap the harvest. Had they not been born to do it, others more fortunate would. This is true of every discoverer, however illustrious. Had neither COLUMBUS, NEWTON, nor FRANKLIN seen the light, others would have appeared about the same times they did, to discover a new world, unfold the laws of material creation, and prove the identity of electricity and lightning.

Centuries before the time of Lancisi, true poetic fiction, respecting the cause of the pestiferous influence of marshes, had given place to what might be called philosophical hypothesis; I mean certain views or notions, which their authors believed to be true, but of which they had no substantial evidence. They were the grave but visionary conjectures of the cloisters, sanctioned by the solemn dogmas of the schools. They marked the transition state of the human intellect from real fiction to real philosophy. Many writers, before the age of Lancisi, declared the cause of bilious fever to be the offspring of putrefaction. But, as already observed, they deemed it animalcular. They were believers in equivocal or elementary generation. In their

opinion, therefore, putrefaction in marshes produced myriads of animalculæ, too minute to be detected by our senses, or to become cognizable in any way, except by their effects on larger forms of living matter. These monads of life, as small and as numerous as particles of air, made their way into the human body by the pores of the skin, or in some other manner, mingled with the fluids, pierced and poisoned the solids, and spread corruption through the whole. Then, propagating their like with wonderful fecundity, they issued from the bodies of the sick to invade those of the well, and thus the disease was rendered contagious. This hypothesis of animalcular contagion, however wild and irrational it may be deemed, has its advocates even now. Lancisi had only to exchange the generation of poisonous animalculæ by putrefaction, for the generation of a poisonous gas, and his work was done. Nor does the exchange seem difficult. On the contrary, it was easy and natural, because all things were prepared for it. If he had not made it, therefore, somebody else would have done it in his place.

Let it not be imagined that I mean by these remarks to detract from the just reputation of the illustrious Italian. Far from it. No one does homage more sincerely than I do, to his talents and services. He was one of the great promoters of medical science of his day. But, had he lived at an earlier and darker period, he would have been less fortunate, because all things would not have been matured for the discovery. He would not, therefore, have been the author of it, but it would have been reserved for another. Hence, in what I have said respecting him, I only mean to give a correct representation of the progress of the human mind in the attainment of knowledge. This concerns the history of general science as well as of discovery, and should be known to every student of nature.

Lancisi, then, finding opinion in the state just represented, advanced it another step, by pronouncing the poison which had almost desolated the country around Rome, the issue of putrefaction, in the form of gas, instead of animalculæ. Nor did he issue his belief in the shape of mere conjecture. He sustained it by an array of facts and arguments, which all his enemies and competitors for fame were unable to shake. He was as fortunate in proving that bilious fever is the product of a poison resulting from the dissolution of dead organic matter, as HARVEY was in proving the circulation of the blood; and he had certainly a more intricate subject to handle. As relates to the mere establishment of the fact, nothing material has been since added; nor do I know that any thing such remains to be added, to what is contained in his admirable work, "*De nocivis paludum effluviis.*"

The substance of all that has been said in support of the doctrine by subsequent writers, is there condensed in a style and manner that bespeak alike the strength and independence of the writer, the accomplishment of the scholar, and the resources of the philosopher.

But was Lancisi correct in the name he affixed to the malaria he discovered? Is it really *paludum effluviium*? Is a marsh or fen necessary to its production? No, it is not; and much evil has arisen from the mistake of looking to such places alone for its formation. Thousands of individuals have fallen victims to the error. The Italian discoverer convinced himself that it issued in abundance from the Pontine marshes, and the Campagna di Roma with its numerous ponds, and thence inferred that such collections of stagnant water were essential to its generation. But he was mistaken. The most terrific calamities it has ever produced, have occurred where there were neither fens nor marshes. Witness yellow fever in the cities of the United States, of the West India islands, of tropical America, and the south of Europe, and true pestilence in those of Asia and Africa. That the miasm is generated along the borders of marshes is true; but perhaps the bodies of such places never produce it. Or if they do, their water absorbs it again, and prevents it from doing mischief. That fluid has a strong affinity for it. Hence the centre of large swamps is often a place of health. Labourers in cypress swamps rarely suffer from bilious fever; the more especially when they are remote from the borders of them.

Am I asked then, what is essential to the production of malaria? I answer, four elements, dead vegetable matter, a high temperature, atmospherical air, and water in moderation. What particular part of the process depends on atmospherical air I know not. But there is reason to believe that some part of it does. When speaking of the generation of the miasm, therefore, I shall always suppose the presence of air. In citing vegetable matter as one of the elements in the production of malaria, it is not my intention to exclude entirely animal matter, especially that of animals of the lower classes. It is quite probable that that may unite with vegetable matter in the process of dissolution, and aid in the general effect. My only object is to express my belief, that the latter is greatly superior in quantity, and therefore more extensively tributary to the formation of the poison.

Whenever these elements meet in due proportion, and continue together a sufficient length of time, malaria is the issue. But if one or more of them be absent, the miasm is not formed. Is heat wanting as in winter? No poison is generated. Is moisture wanting, as is the

case during part of the summer, in the Delta of the Nile? Malaria is also wanting, and health prevails. Is perfect cleanliness preserved by the removal of all dead vegetable and animal matter? The production of the poison is impossible. The same is true, if water super-abound, so as to flood the vegetable mass. Too much water is as fatal to the process, as perfect dryness. Hence, Egypt is healthy, while inundated by the Nile; and when, in consequence of inordinate rains, a marsh is entirely overflowed, it ceases for a time, to be a source of sickness.

That malaria may be generated, it has been pronounced necessary that its elements be together "in due proportion," and "a sufficient length of time." But facts are wanting to warrant a decision, what either the exact "proportion," or the "time" should be. Observation seems to teach us, that in the United States, the production of yellow fever requires at least a month's continuance of tropical heat. After that duration of such a temperature, unless the general constitution of the atmosphere forbid it, the danger becomes threatening. Such was certainly the case in the city of Philadelphia, during the pestilential period, which lasted from 1793 until 1805. Records can be produced to show, that throughout that term of years, yellow fever never failed to appear in greater or less extent, after the above mentioned continuance of tropical heat. Nor did it ever occur under a temperature of less intensity and duration.

Does any one doubt whether the agents here cited are the real elements of bilious malaria? I reply, that the evidence to that effect appears conclusive, and that the doubt is therefore groundless. As already stated, wherever the agents referred to exist, the poison manifests itself in the production of some form of bilious disease. And where they do not exist, no such manifestations are made. The more abundant the agents are, in due proportions to each other, the more extensive, and usually the more violent is the complaint; and nothing but themselves is known to be necessary to the effect, or in any degree auxiliary to it. Add, that the disease prevails more certainly and generally in their vicinity, than at a distance from it, and the evidence I repeat would seem to be conclusive. But perhaps it may be the wish of some to have a few exemplifications on the subject; if so, the following are submitted to them.

In all large and crowded cities in the United States, and other warm climates, heat, moisture, and dead vegetable and animal substances abound in mixture with each other, and unite in their action. The consequence is known. In such places, bilious complaints are an annual evil; and they are usually graduated by the amount of the

agents which the places contain. It is believed that they would be always thus graduated, did not a peculiar constitution of the atmosphere at times interfere. Of the borders of swamps, marshes, and large rivers that overflow their banks, the same is true. There the elements of malaria are found in sufficient abundance; and there also disease prevails. Alluvion is composed, in part, of vegetable and animal relics; and in no portion of our country is either heat or moisture wanting. In every alluvial district, therefore, in the United States, the agents necessary for the production of miasm exist. Here again the issue is the same. Such places are visited annually by bilious complaints. The condition of health during summer and autumn, in the low grounds of all large rivers may be safely offered in proof of this. Again. Rich soil of every description, whether it be alluvial or not, contains, of necessity, a considerable portion of animal and vegetable remains. On these alone its fertility depends. Such soil then, is copiously impregnated with one material of miasm, greatly comminuted, and in a state of high preparation to coöperate with the others. Nor is there any climate where heat and moisture are always wanting. Hence, in every region, fertile districts are visited at times by bilious complaints. To this it is believed that the chart of the world does not present a single exception. The event occurs more uniformly and distressingly, and is therefore more noticed in warm climates. But it occurs more or less in every region inhabited by man. Although the fervours of the line peculiarly favour it, the rigors of the north do not forbid it. Were I inclined to moralize, I might say that it seems like an impartial provision of nature, to counterbalance the advantages of a fertile soil and render all places nearly equal, as respects the enjoyments and happiness of their inhabitants.

The reverse of the picture here presented is not less favourable to the opinion I am maintaining. In the soil of sandy plains, remote from rivers, lakes, and other large bodies of water, and somewhat elevated, vegetable and animal relics have scarcely an existence. Nor are malaria and its effects the scourge of such places. Whatever may be the amount of heat and moisture they experience, the inhabitants are exempt from bilious fever. The reason is, the absence of vegetable and animal remains. In proof of this, the pine lands of the Carolinas, Georgia, and Louisiana, which are elevated plains of sand, afford, during the summer and autumn, a healthy retreat from the diseases of the maritime and fluvial districts. Further; hilly and mountainous regions are not more remarkable, throughout the world, for their barren soil, than their salubrious atmosphere. Hence,

in contrasting the poverty, health, and hardihood of the Swiss, with the luxurious ease and effeminacy of the Italian, the poet expresses himself in the following strain, whose sentiment is as correct, as its diction is nervous.

“ My soul turn from them, (the Italians) turn we to survey
 Where rougher climes a nobler race display,
 Where the bleak Swiss their stormy mansion tread,
 And force a churlish soil for scanty bread;
 No product here the barren hills afford,
 But man and steel, the soldier and his sword.”

Of all this the reason is plain. The soil of hills and mountains contains but a small portion of vegetable and animal remains in a dissolving condition. It is wanting, therefore, in one of the elements of febrile miasm. The issue is in conformity to a law of nature. The cause being absent, so is the effect. No malaria in the atmosphere, no disease among the inhabitants. Such is the case, throughout the world. Withhold from any place heat, moisture, or vegetable and animal remains in a state of dissolution, and it will be exempt from miasm and bilious complaints. Unite them under the circumstances already indicated, and the reverse will be the consequence. Malaria will be generated, and disease will prevail.

Am I asked whether large masses of animal matter alone, especially the matter of the higher orders of animals, such as corpses in crowded cemeteries, and the carcasses of men and horses in besieged towns, and on the field of battle, ever produce bilious fever? To this question I can reply only as a reader of books, and a listener to reports; and those sources of information are self-contradictory; being, in some instances, affirmative, and in others negative. From personal observation I know but little of the matter. If I am not mistaken, I have seen yellow fever produced in a city, by putrid oysters, fish, and hides; the last of which articles belong to a high class of animals. Whether the same result would be produced, on a field of battle, in the free and open air of the country, some may deem doubtful. Many reports, however, not unworthy of credit, are strong and positive in affirmation to that effect. Were I to hazard an opinion on the subject, it would be, that wherever found, large masses of animal matter, in high putrefaction, may generate a poison productive of fever. That such is the case in the semi-stagnant atmospheres of cities, does not, I think, admit of a doubt. Had I leisure to dwell on the subject, it would be easy to show, that the immense exhumations of dead bodies in Dunkirk and Paris, with

other analogous facts related by Dr. BANCROFT, furnish no evidence subversive of this belief. But I am not persuaded that the poison is the same with that of common bilious fever. Facts seem to justify a contrary belief. The latter being chiefly of vegetable, and the former exclusively of animal origin, they can scarcely be identical. The diseases, moreover, which they produce, differ not a little in type and character. Fevers resulting from an animal miasm are more continued in their form; those from a vegetable one less so. Other evidences of a difference between the two miasms exist. But as the point is not essential to the present inquiry, I shall not dwell on it.

Different opinions are held respecting the influence of the exhalations from slaughter-houses, and from soap, candle, catgut, and glue factories, on the health of the neighbourhoods in which they stand. Most persons pronounce these effluvia deleterious; while a few have contended that they are not only innocent, but actually salutary. I am but little inclined to become the advocate of either opinion. That any exhalation from dead matter mingling with the atmosphere, is positively healthy, I do not believe. I am not sure that even the fragrance of incense or the perfume of flowers is so. On the contrary, I apprehend they are not. The freer the air is from every foreign mixture, the fitter it is for respiration, and the more subservient to the preservation of health. But while I admit that the exhalations under consideration do harm rather than good, I have no reason to believe that they produce yellow fever, or any other bilious affection. I have repeatedly examined the slaughter-houses, and the factories just designated, of some of our large cities, with a view to satisfy myself as to the influence of their effluvia. The odour they emit, though offensive, is not sickening. Nor is it the issue of that far-gone putrefaction, which, in the substances concerned, would seem necessary to the production of a febrile poison. Such putrefaction would render the articles subject to it unfit for use. They are therefore worked up, before they reach it in the changes they undergo. Nor is this all. There are yet stronger reasons for doubting the pestiferous qualities of the effluvia I am considering. Those persons most subject to their action are not injured by them. Butchers, and workmen in the factories mentioned, enjoy as good health as any of their fellow citizens. Be the cause what it may, the former are even proverbially healthy and robust. Nor is the health of the neighbourhoods immediately exposed to the exhalations, in any measure harmed by them. Throughout the year, it is no less

perfect than that of other places. For these reasons, I cannot concur with those, who denounce the places referred to as sources of malaria.

The precise degree of moisture most favourable to the production of bilious miasm has been lately a theme of inquiry and discussion. And perhaps the question is not yet decided. An article on the subject was published about ten years ago, by Dr. FERGUSON, of the British military staff, in Vol. IX. of the "Transactions of the Royal Society of Edinburgh," and republished, with commendations, in Vol. VII. of the "Philadelphia Journal of the Medical and Physical Sciences." In that paper, which has attracted more attention than it deserves, the author professes to teach physicians something new, as respects the production of febrile malaria, more especially as relates to its connexion with vegetable and animal matter, and the amount of moisture requisite to the process. But as far as fact and useful information are concerned, he professes only. Actual performance, in any part of the effort, is looked for in vain. The only thing new contained in his article, consists in a few inferences and notions, which are manifestly erroneous. Many of his facts are indeed *individually* new, because they had not been previously reported. But, *in kind*, they are as familiar to the enlightened portion of the profession as any others connected with medicine. They tend to show that but a small proportion of water is requisite to the formation of bilious miasm, and that therefore marshy and flat alluvial situations, which are healthy in wet seasons, because they are flooded, are sickly in arid ones, because they are drier. Such, I say, is the only purport of his *facts*; and it was as well known to the faculty half a century ago as it is now. Almost every author of reputation that has written within that period on the connexion between bilious fever and the character of the weather, has recorded his testimony to that effect. Nor does daily observation withhold its concurrence. Those who live near mill ponds are perfectly aware, that in wet seasons, when the ponds are full, the neighbourhoods around them are much healthier, than in dry ones, when their waters are low, and a line of alluvial deposit along their edges is exposed to the sun. Respecting swamps; marshes, and rivers, the same is true.

When flush in water during rainy seasons, they do no injury to the health of those who inhabit their vicinity. But when their waters are deficient, in consequence of a drought, and their alluvion uncovered, they become sources of miasm, which produces disease.

Such, I repeat, is the amount of all that Dr. Ferguson's facts are

calculated to teach us, in case we had been ignorant of it. But it is not all he professes to teach. If he has not expressed himself in a way to conceal or pervert his meaning, he wishes to establish the notion that bilious malaria may be generated without the agency of either water or vegetable and animal relics. Speaking on this subject, he says, "as is the *dryness* of the soil, so is the *quantum* of sickness." In other words, the drier the soil is, the more miasm it produces. Render it therefore perfectly waterless, and you raise to its *maximum* its productive power. If this be not a correct interpretation of the doctor's expression, and a fair inference from it, the fault is not mine. He ought to have used a less equivocal form of diction. Again, says our author, "One only condition, then, seems to be indispensable to the production of marsh poison, on all surfaces capable of absorption, and that is the paucity of water, where it had previously abounded." If this sentence has any definite meaning, it is as follows. Wet sufficiently any surface capable of absorption, and suffer it to dry again, (in doing which you have in it a previous abundance, and a subsequent paucity of water,) and you will produce bilious miasm by the process. Is this true? No, certainly, every sophomore in medicine knows it is not. A bed of pure alumine, of calcareous or silicious earth, or even a pure but porous sand-stone constitutes a surface "capable of absorption." But the mere wetting and drying again of these will produce no malaria. The fancy is absurd. When thus presented in its nakedness, Dr. Ferguson will not himself advocate it. Mix vegetable and animal relics with those articles, and then wet the impure masses, and suffer them to dry again, exposed to a hot sun; and, in the course of the process malaria may be generated. But to produce it by our author's process is impossible. Other parts of the doctor's paper are also at war with science. But being less relevant to the present inquiry, I shall not notice them. It may not, however, be amiss to observe, that an article of more merit, from an American pen, would have been less valued by a great body of American physicians. Our professional spirit is still colonial. It retains not a little even of the nursery. An offering of food from the "mother country," no matter how indifferent its character and cooking, is prized above all that can be prepared at home. Although this is not true in every case, it is so to an extent that is humiliating. Thus the visions of Dr. BARRY, about "venous circulation," became for a time, and perhaps still continue, the "paramount law," with many physicians of the United States. Yet never were fancies more unfounded. But to return.

3. *What are the best means of preventing the formation and removing the sources of malaria?*

To this great practical question, *on whose solution*, and the measures founded on it, depend the health and lives of millions, an answer may be rendered in a single word—*cleanliness*. Nothing further than the preservation of this can be done, nor is any further necessary, to “remove, (or destroy,) the sources of malaria,” which will, of course “prevent its formation.” All real filth consists in a mixture of two of the elements of bilious miasm; water, and vegetable and animal relics. It has been already shown, that without such mixture that poison cannot be formed. The removal or destruction of the mixture constitutes cleanliness. By that process, then, I repeat, and by that alone, can the production of bilious malaria be prevented. Over atmospherical heat in the warm climate of the United States we have no controul. It *will* visit us in the summer, and part of the autumn. Nor could we subsist without it. Our exemption, therefore, from the effects of the poison, can arise only from the adoption of proper measures, as to the other two elements of it.

Am I asked in what way the requisite cleanliness can be preserved? I reply that the process is different in different cases. Nor is it possible for me to treat the entire subject in detail, without extending my dissertation to a volume. I can do nothing more than speak in general terms of the means of preserving cleanliness in a few instances. Nor is more requisite. The same principles are applicable in every case. When fully understood, therefore, they can be employed universally, without further instruction.

Man works wisely and successfully only when he imitates nature. As often as he opposes her, or deviates from her economy, he suffers disappointment; if not misfortune. Let him receive his lessons and procure his means of operation from her, and he will rarely fail to attain his ends. Her chief agents in producing and preserving cleanliness are four; pure water, pure air, fire, and active vegetation. Add to these, certain large voracious animals, and hosts of small ones, that feed on carrion, offal, and other sorts of filth, and the catalogue is sufficiently full for my purpose. She never employs, with this intention, smoke, suffocating fumes, or strong and offensive odours. Nor ought man to do it. By the judicious management of the agents just enumerated, he can do all that is required of him, in the removal and destruction of nuisances injurious to his health.

Is personal cleanliness the object in view? By water, soap, and towels, it is easily compassed. And in the removal of the causes of

disease, and the general maintenance of health, it is a measure of much more importance than it is commonly supposed to be. I wish there were less ground to add, that it is too much neglected in the United States.

Is a house or ship to be cleansed? Unite to the means just directed, brushes, sand, and free ventilation, and success, in most cases, is certain. Foulness beyond the reach of these can be subdued only by fire, which is competent to the purification of all things combustible. Smearing with lime, commonly called whitewashing, is but a slovenly substitute for real cleanliness. It conceals filth, but does not remove it. It is indeed but the substitution of one evil for another; a less for a greater; but still an evil. Yet it is one of the best means, in cases where the employment of water is forbidden by causes that cannot be controlled. But it should never be used for the purification of any thing constructed of wood. Painting is a mode of covering filth equally effectual, and more durable. In all wooden fabrics, therefore, it is entitled to a preference. Whitewashing is a common expedient for the purification of foul ships, in quarantine establishments. So is fumigation by the combustion of certain substances, some of them odorous, as well as by gases otherwise produced. The practice is in both cases empirical. I know that this sentiment is not considered orthodox. Legitimacy and fashion, which too far sway the world, are against it. No matter. It is not, on that account, the less true. Orthodoxy is but opinion sanctioned by authority; but, in the present case, there is no divine right to dictate. What is the avowed object of whitewashing and fumigating? To neutralize febrile miasm, real or imaginary. If no such miasm exist, the practice is superfluous, and the time and means spent in it are thrown away. If it does exist, what are its nature and affinities? No one knows. To pretend to neutralize it, therefore, without such knowledge, is palpable empiricism, not to call it imposture. It is as bad as the exhibition of a patent remedy to cure a disease, of whose seat and character the exhibitor is ignorant. The nostrum is as likely to destroy the patient, as to remove the complaint. The whole is haphazard and deception, and ought to be discountenanced by the friends of science. It checks rational inquiry, and retards improvement. Confidence in imaginary means is hostile to the discovery of real ones. It renders men content with the present, and improvident as to the future. True, we see certificates from physicians, of the efficacy of fumigation, in cleansing foul and sickly ships and hospitals, and rendering them sweet and healthy. So do we of the infallibility of Swain's panacea, in the cure of disease. And the tes-

timony is as valid in the one case as in the other. In both, it is an outrage on rational medicine. Combustion excepted, I repeat, that thorough washing and ventilation are the only certain means discovered, to purify foul and sickly ships, and render them the abodes of cleanliness and health. Of hospitals and infirmaries the same is true. In them also painting and whitewashing are the best substitutes for real purification. They are, however, only substitutes, and should never be adopted but in cases of necessity. And they should be preceded by cleansing with soap and water, in every instance where no paramount reasons forbid it. As far as real purification is concerned, they are much more ornamental than useful. The cleanliness they produce is seeming rather than real.

There is no edifice that may not be kept sufficiently pure by the means here indicated. It is not only useless then, it is injurious, to fill the wards of receptacles of the sick with suffocating and irritating fumes and gases, to the annoyance and distress of patients with tender eyes and weak lungs. I have never seen a place thus fumigated, without exciting among the sick painful coughing and other disagreeable affections. And if disinfection seemed to be the result of the process, it was owing to the other means used at the same time, and not to fumigation.*

Is a city to be depurated of the filth which threatens to produce a pestilential disease? The work must be done by scavengers, carters, and watermen. The two former must remove the filth that lies in masses, and the latter must follow them and wash away the remains. Mere scraping and shovelling do but little good. They remove what is unsightly, and some of that which offends the smell, and there their action ceases, much of the nuisance still remaining. Water

* Shall I be told, in objection to my opinion on this subject, that chlorine gas and some others destroy the fetid exhalation emitted by putrid animal matter, and in that way contribute to purity? The fact is known to me, but it is also known that such exhalation is not the febrile miasm of which I am treating. That poison exists in its most virulent and destructive condition, unaccompanied by any odour. It does not follow, therefore, that because chlorine gas destroys the fetor arising from the dissolution of animal or vegetable substances, it will also destroy the poison. This loose substitute for reasoning is an abundant source of error and mischief. Nothing but an accurate and successful experiment is competent to prove that any known gas is capable of uniting with febrile malaria and neutralizing it. And as far as I have been able to inform myself, such an experiment has never yet been made. Hence the belief in the antimiasmatic properties of the gases referred to is nothing but hypothesis.

alone can carry that away. And, to be efficient, the washing must be executed with a degree of care and accuracy greatly beyond what is generally observed in it. It might as well be entirely neglected as performed in the usual slovenly manner. Forty-nine times out of fifty, filth enough is left in the streets and gutters of *one* city to infect and sicken a *dozen*. Hence our constant summer and autumnal complaints. The process of cleansing fails in preventing disease, not because it is imperfect in its *nature*, but because it is *imperfectly performed*. Such indeed is the ground of most failures; faithless and defective execution, rather than unsound principle. Many more persons die from a partial observance or an actual violation of medical directions, than because the directions are erroneous or unwise. Even a bad system, judiciously administered, is a less evil than the wisest system mismanaged or neglected. To the truth of this, experience in every kind of government, whether public or private, abundantly testifies. Hence the lines of the poet may be received as a maxim:

“For forms of government let fools contest,
That which is best administered is best.”

Nor is this more obviously true, in any case, than in the cleansing of streets. If they be not thoroughly purified, they might as well be left untouched. Filth, thinly spread over a wide space, is much more deleterious than when lying in a denser layer over a smaller space. This, with the reason of it, must be obvious to every enlightened physician. And as practised by scavengers, the cleaning, so mis-called, is but little else than a *spreading* process. It extends the limits of the nuisance which it is designed to remove, by drawing feculence from the gutters into the streets. If the filth, being half an inch deep be reduced to the twentieth of an inch, its power to injure is not lessened. It is from its surface, on which the heat immediately acts, and not from any distance beneath it, that the miasm issues. I speak from oft-repeated observation in declaring, that I consider street cleaning, as usually performed, one of the most serious abuses committed against the inhabitants of a city. It begets confidence only to betray, and promises health only to destroy it. To be convinced that I speak truly, it is only necessary to follow and examine attentively the track of a gang of scavengers when they are removing filth. They have evidently no correct knowledge of the purpose for which they are working; or if they have, they wantonly disregard it. In violation of their duty they leave much filth behind them, and thus endanger the public health. Unless this grievance be remedied, and real instead of pretended purification be practised, we shall look in

vain for any marked amendment in the health of our cities. Nothing but a thorough lustration will serve. True, compared with former times, the condition of cities, in point of cleanliness, is much improved. And the fact amounts to an argument that nothing can shake in favour of the position for which I am contending. Their health is improved in an equal ratio. Authentic records tell us, that when London and other large European cities were visited frequently by pestilential diseases, their streets, squares, and dwellings, as well as their environs, were filthy almost beyond conception. I hazard nothing in stating my belief, that there exists not on earth a single city, that may not, by a strict observance by its inhabitants of a judicious course of diet and regimen, and a degree of cleanliness perfectly practicable to an efficient police, be rendered a safe habitation to man, I mean throughout the year. To this neither Grand Cairo, Aleppo, New Orleans, Havanna, nor any other city in tropical America constitutes an exception. But to attain an end in all respects so desirable, the police must be enlightened, faithful, and vigorous. It must be administered by officers who know what cleanliness is, how to appreciate it, how to produce and maintain it, and who will be vigilant and resolute in the performance of their duty. And this is a spectacle I have never yet witnessed. Never have I seen the health of a city under the guardianship of a police that seemed either to understand the true meaning of *purity*, or to be willing to encounter the labour and trouble necessary to enforce it. I say "enforce," for unless compelled to the observance of it, adults are as negligent of cleanliness on and around their premises, as children are; or as if they took delight in associating with filth. Nor does their carelessness escape with impunity. To this negligence much of their suffering from sickness is to be attributed.

No large city can be effectually purified, except under an arrangement by which clean water can be made to flow actively along the gutters several hours every day. The degree of inclination of the streets, therefore, should be carefully suited to this purpose. Nor, during warm weather, should this mode of washing them ever be neglected. By means of it much filth will be carried off, which would otherwise remain, to discomfort the inhabitants, and injure their health. There is, moreover, in the view of cool, limpid, running water, something exceedingly pleasant to the eye, and exhilarating to the spirits; a condition of things much more favourable to health than offensive prospects, with dejection and gloom. It betokens purity; the very idea of which is valuable, and tends to produce the thing suggested. There is a much stronger and closer connexion be-

tween internal and external purity than is generally imagined. The one is the natural expression of the other; and they impart to each other mutual strength.

Is the city checkered by vacant squares, public or private? Unless it be forbidden by insuperable causes, let them be enclosed with palisades, or some other kind of open work, sodded, or otherwise covered with grass, and suitably shaded and ornamented with shrubbery and trees. The addition of fountains and open reservoirs of water will greatly enhance their usefulness and beauty. Improvements of this description, when well regulated and turned to the proper account, are not places of mere pleasure and luxury; they are means of real comfort and sources of health. They are eminently useful as a resort of children, for air and exercise, under the care of their nurses and attendants. Adults also may advantageously avail themselves of them, for the same purposes. Nor should their benign influence on health, as places of amusement, social enjoyment, and pleasing contemplation, be overlooked. Considered in all their qualities and bearings, they constitute a *rus in urbe* peculiarly desirable. Of the decorating of wide streets with rows of cleanly and beautiful trees, I am inclined to think favourably for similar reasons.

Although, as heretofore mentioned, I know of no instance in which cemeteries, slaughter-houses, tan-yards, or factories of soap, glue, or candles have injured the public health, yet they ought not to be situated in central or thickly inhabited parts of cities. To say the least of them, they are unsightly and disagreeable establishments; and admitting that they do not send forth *febrile* miasms, they certainly adulterate the atmosphere by their effluvia. It is alleged, moreover, and I apprehend not without cause, that cemeteries sometimes contaminate the waters of adjacent wells. Prudence, therefore, concurs with a love of cleanliness, in admonishing that all such places be without the city.

Much has been said and written to prove the bad effects of privies on the health of cities—more, perhaps, than, within the last and the present century, is true. When those places were above ground, and openly exposed, as was the case in former times, their pernicious influence could not be doubted. But constructed under ground, as they now are, and securely covered, they can scarcely, I think, be considered injurious to health. But they must be kept clean. I mean that their contents must not be suffered to rise near to the surface of the earth. If they be kept five or six feet, or perhaps even a shorter distance below it, and are sufficiently covered by a well-constructed building, the temperature of the air in contact with them will be

too low for the production of miasm. The amount of liquid, moreover, which they usually contain, is too great for that effect. But if not properly constructed, privies are much more likely than burying-grounds to adulterate the wells that are near to them. To prevent this, they should be lined with stone or well-burnt bricks, cemented with water-lime. This will form an impervious barrier to the escape of their contents, and render them harmless.* As relates to this point, however, a general system of water-closets, such as that which exists in London, is preferable to every other mode of cleanliness.

I know it is contended by many, that, whatever may be its accumulation or degree of exposure, human ordure cannot, under any circumstances, be converted into a source of febrile miasm. But I also know that the opinion is destitute of proof. All the facts adduced in support of it are necessarily of a *negative* character. Nor do they bear the slightest resemblance to negatives in grammar. No number of them that nature may present or industry collect, can ever make a *positive*. They therefore prove nothing. To establish probability is the utmost they can effect. As relates to the present topic, in every negative case that can be adduced, circumstances may have been wanting, which, had they been present, would have altered the result. But admit that human ordure alone cannot be rendered productive of malaria, the fact does not militate in the least against my position. It is well known that in cities, privies are made receptacles of other kinds of filth and feculence that may produce it. By neglecting them, therefore, health is endangered.

Is the city commercial and situated on navigable water? Let not the wharves be built exclusively of wood. Their facing at least

* To common-sewers, in cities, similar remarks are applicable. When skillfully constructed they are not dangerous as sources of disease. Give them sufficient depth, width, and descent, line them with brick or stone and water-lime, and make no more openings into them than are necessary, and they will send forth no miasm to adulterate the air. Their depth and covering will protect their contents from summer heat, and their width and descent will prevent stagnation. Under these circumstances, putrefaction cannot take place in them. Nor, if it did, could the gas produced by it escape in any injurious amount, except by means of too many openings. Sewers thus prepared may be kept so clean by currents of water being made to pass through them, that they can create no sickness. Nor will they contaminate wells or fountains in their neighbourhood, by the percolation of their liquid contents. Let them be sufficiently numerous to convey from the city its foul waters, and other recremental matter, and they will contribute greatly to the preservation of health. They will act like drains in marshy ground, the benefits of which will be spoken of hereafter.

should consist of stone or brick, else they will become in time masses of dissolving vegetable matter, and abundant sources of febrile miasm. That the cities of the United States suffer in their health, from this cause, cannot be doubted. Piles of decaying timber, alternately wet and dry, and exposed to the ardour of an American summer sun, must produce malaria as certainly and naturally as the influence of spring promotes vegetation, and the rigours of winter suspends it. In places where the tide rises and falls six or eight feet, it is not uncommon for the docks to be so shallow, that the immense beds of filth they contain become bare, and are exposed, during low water, to the action of the sun. While in this condition, the exhalation from them is often intolerably noisome and sickening. The filth accumulated in them, moreover, is usually of the very worst character. It consists of the vilest feculence, washed from the streets, alleys, and other places still more foul, by rains and water from other sources. When exposed, therefore, and acted on by the sun, it were superfluous to say, that it constitutes a laboratory of malaria, as fertile and threatening as imagination can conceive. I could name a city that has suffered greatly from this cause. The docks should be so deep then, as to have their bottoms always covered with eighteen inches or two feet of water. Nothing short of this can protect the city from the nuisance referred to. Appealing so strongly and offensively as it does to our sight and smell, to say nothing of our reason and sense of danger, the neglect in relation to it is surprising. The importance of remedying the evil, where it exists, cannot be too frequently or forcibly impressed on the guardians of the public health. It is believed that wooden wharves exposed to *fresh* water, are more pernicious in their influence on health, than when the water is *salt*.* But they are pernicious in every case, and should be therefore exchanged for brick or stone. Although they are not individually so serious a nuisance as foul and shallow docks, they are oftener met with. Their excess in number, therefore, so far tends to make the balance even, that perhaps they constitute, in mass, as great an evil.

* It is contended by some, on the authority of Sir John Pringle, that a small quantity of salt accelerates putrefaction, and that therefore timber and other vegetable matter wet with the water of seas and bays pass to dissolution more speedily than when wet with the water of rivers. This is a mistake. Salt never accelerates putrefaction, but always retards it. In its mode of effecting this, I take at present no concern. The fact is sufficient for my purpose; and that is certain. It is known to mariners that ships decay sooner in fresh water than in salt.

Tile and slate make a much better covering for city edifices than shingles. To say nothing of their greater durability, and the superior protection they afford from fire, they are exempt from dissolution, and do not contaminate the atmosphere around them, nor the rain that falls on them, to be afterwards received into cisterns for use. Of wooden coverings the reverse is true. Under the process of decay, they adulterate both air and water. Shall I be told that this is a very limited source of mischief? I know it; but it *does* mischief; and that justifies my reference to it. I do not call it great; but I say that masses are composed of molecules, and that it therefore adds to the aggregate of the evil. The collective mischief done to us through life, by small evils, which we neglect because they are small, surpasses that we experience from larger ones.

Is a fenny or marshy tract of country to be cleansed from the materials productive of malaria? A process must be instituted, founded on the same principles, but different in form and mode of execution from those just described. The entire scene being dissimilar, the success of the attempt to cleanse must depend, as in all other instances, on its correct adaptation to the nature of the case. It is to consist in sufficient draining and banking, and the judicious cultivation of the soil. The channels formed in the process, therefore, must have such an inclination, that the water they contain shall flow freely. Marshes and fens must be thus converted into fields, meadows, and gardens; and places where filth lay exposed and reeking with poison, must be clothed in dense and vigorous vegetation. This mutation of surface moreover must be general. To make it only in parts is but little better than lost labour. A few neglected spots, although they are small, will baffle hope and frustrate expectation founded on the cultivation of many larger ones. By the process here directed, man subserves a two-fold interest. He accumulates riches, and secures health. That from which neglect would distil a poison, industry turns to gold; and the vegetation sustained by masses of pollution, renovates the atmosphere, and renders it healthful. For vegetables not only feed on air that is foul, but send forth an abundance of that which is pure. In the course of improvement it is often found necessary to narrow and deepen wide and shallow streams by artificial banks. This change not only confines the water within more circumscribed limits; it accelerates its motion, and in that way contributes to the general effect. Other things being equal, the swifter the current of a stream, the less febrile miasm arises from it. To aid in forming that poison, water must stagnate.

Am I called on for an example to prove, that the mode of cultiva-

tion here recommended, can give health to the inhabitants of a sickly district? The summons is fair; and I answer it by pointing to what is called the Neck; a large body of land adjoining the city of Philadelphia, on the south. Half a century ago, that tract was but little better than a great morass. It was cultivated and inhabited only in spots. Nor did the Pontine marshes surpass it much in the extent and violence of its annual disease. It filled the Pennsylvania hospital with dropsies and other sequelæ of neglected or unskilfully treated bilious affections. But time and labour have converted it into meadows, fields, and gardens, rich in the products of the several kinds of cultivation pursued. It is grazed on, in parts, by herds of cattle, as fine as any the world exhibits. And the Philadelphia market receives from it an abundance of the choicest kinds of fruit and vegetable. Nor does it flourish more in vegetation than in health. Its population is now dense. "Every rood" of it may be almost said to "maintain its man." And instead of the pallid cheek and languid movements, which characterized their predecessors, its present inhabitants exhibit as much of the sunburnt bloom, and vigorous limb, as belongs to the healthiest of their upland neighbours.* Add to this, that instead of being poor, as formerly, they are prosperous and comfortable. Such is the happy result of draining and banking, planting and sowing. In many other parts of our country that might be mentioned, the same process has uniformly led to a similar result. Nor can it fail to do so every where, until the laws of nature change. While filth shall continue a source of disease, and cleanliness the reverse, so long may the inhabitants of any place do, what those of the Neck have already done—redeem health, and render fens and marshes more profitable than mines of gold or silver.

Another very impressive instance of the happy effects of cultivation in reclaiming a swampy and sickly district to healthfulness and prosperity, is derived from the history of Calcutta and the country around it. That city, built in a morass, on the banks of the Hoogly, was originally a speedy and almost certain grave to the Europeans who resorted to it for purposes of commerce. But a well-regulated police within, and the thorough cultivation of the environs without, have rendered it as healthy as any other city in a warm climate. The same is true of Barrackpore, Serampore, Chandernagore, and many other places in the province of Bengal. They were once sickly, but have been rendered healthy by means of cultivation. Bourdeaux furnishes another memorable example to the same effect. When surrounded, as it once was, by marshes, it was one of the

sickliest cities in France. Bilious fever prevailed in it as regularly, and almost as violently as it does in the vicinity of Rome at present. But the marshes became cultivated, and it and the country around it are healthy.

In fine then, there is not on the shores of the Chesapeake, or the banks of the Mississippi, nor on any other shores or banks in the United States, a tract of fenny land, susceptible of redemption from the water by drains and *levees*, that may not be rendered inhabitable and healthy.* But to effect this, the cultivation, as already mentioned, must be complete. Half done business, I repeat—and it can scarcely be too often repeated, is generally worse than neglect. It allures and encourages only to disappoint, and begets confidence only to betray. When the country around Edinburgh was in a half-cultivated condition, it was visited annually by intermittents and remittents, but in its present state of high cultivation, it is free from them. Of the country in the neighbourhood of London, the same is true.

Is it required of me to present a picture the reverse of that exhibi-

* It is not contended that all places susceptible of draining and cultivation, can be rendered equally healthy. But they can be rendered places of comfortable abode. The lowlands of the Carolinas, and I believe also of Georgia, are much healthier now than they were at the close of the revolutionary war. The cause is obvious. They are under higher cultivation. At the period referred to, white men could not labour in them and retain their health. Negroes were therefore necessary. But they are less necessary now. In twenty or thirty years more, perhaps within a shorter period, they will not be necessary at all. White men will do their work to much more advantage. By that condition of things, the abolition of slavery in our country will be greatly facilitated. Like other evils, human bondage will disappear under the progress of improvement. But, in the present case, the event, however desirable, cannot be hurried without producing a worse evil.

As relates to North Carolina, a fact has been ascertained, which proves the uncommon healthfulness of the state. By the last census it appears that the population of that commonwealth amounts to 738,470. Of this number of individuals, 304 have attained the age of 100 years and upwards. This gives a centenarian in every 2425 persons throughout the state! What will Mr. Godwin and other Europeans who deny American longevity, say to this? Will they persevere in proclaiming us a degenerate race? Can 304 centenarians be found in every 1,000,000 of the inhabitants of Great Britain and France? I do not possess facts sufficient to justify me in speaking positively on this point. But I doubt exceedingly whether the proportion of persons who attain to the age of 100 years, is half as great in either of those countries as in North Carolina. Yet that is not the healthiest state of the union.

bited in the case of the Philadelphia Neck, and the region in which Calcutta stands? I find it in the Pontine marshes. That spot was once the paradise of Italy—perhaps of the world. It was studded with resplendent villas, the summer residence of the wealth and fashion of Rome, and the chosen abode of health. Its halls were, therefore, crowded with blooming inhabitants from the city, and mirth and music resounded through its groves. May records, moreover, be credited, scarcely did its clustering roses exceed in freshness its native daughters. But, mark the contrast. It is now, as its name imports, a waste of marshes, its palaces overthrown, and replaced by the huts of a few wretched peasants, whose only refuge from poverty and sickness is an early grave. The human voice is scarcely heard in it, except to moan. Such are the pictures, past and present, of that celebrated place. And to what cause is the contrast to be ascribed? Difference in cultivation at the period referred to. When it was the abode of health, it was the abode also of industry and enterprise, which drained it of its waters, and clothed it in vegetation, and thus prevented the formation of the seeds of disease. But indolence and neglect succeeded, and their kindred train of evils followed. The waters resumed their ancient places, ornamental and protecting vegetation perished, and in its place arose aquatic plants, to turn to dissolution, and aid in the production of febrile miasm, and disease again prevailed. Similar changes have occurred in the town and settlement of Fultah, on the banks of the Hoogly, below Calcutta. In consequence of a high state of cultivation, that place, rescued from a marsh, was once as healthy as any in India. But through neglect, its original uncultivated condition has returned, and the jungle fever renders it now almost uninhabitable. A similar misfortune occurred to *la ville neuve les avignon*, which is situated on one of the branches of the Rhone. In former time, that town was celebrated alike for its healthfulness and beauty. But the embankment of the river on which it stands giving way, its environs were flooded and converted into a marsh. This event soon rendered it as remarkable for sickness as it had been previously for health.

Such, in obedience to the eternal laws of cause and effect, are the changes in salubrity, which must always accompany similar changes in the cultivation of marshy tracts of country. Industry and thorough cultivation will be rewarded with health and plenty, while the lot of neglect and defective cultivation will be sickness and poverty. Allow the Philadelphia Neck to fall back under the dominion of water, weeds, and mud, and, like the Pontine marshes, it will be again under the dominion of bilious fever; and its inhabitants will, a

second time, suffer alike from disease and indigence. It is worthy of remark, that, in redeeming a marshy district from sickness, it should be put under a covering of vegetables that require but little irrigation. For this reason the rice plant is unsuitable; and a dense mat of meadow-grass is the best. Next to this are timothy, wheat, and rye. Clover is also admissible.

The bad effects of an immature cultivation of the soil are further manifested in the succession of events that usually marks the settlement of new countries. The land being fertile is covered with a heavy growth of grass, underbush, and forest timber, which protect it from the sun. Under these circumstances no febrile malaria can be formed, because the surface of the earth, where the vegetable relics and moisture abound, is wanting in temperature. The settlers arrive, erect their cabins, and, for the first season, continue healthy. But this state of things cannot last. The earth is to be cultivated; and the cultivation must be at first immature. The axe and the mattock having removed the larger and smaller growth of timber, and the plough having furrowed the surface of the soil, the sunbeams get access to the moist vegetable mould; because as yet the crop of cultivated vegetables is not sufficiently dense to protect it. All the elements of malaria being thus brought together, the consequence is obvious. The poison is formed, and enters on its work. Hence, during the second summer and autumn of their residence in their new places of abode, the emigrants begin to suffer from the sickness called *a seasoning*. Nor does the evil immediately cease, inasmuch as the causes continue to operate, for a time, with a force but little diminished. At length, however, the condition of things changes. The cultivation of the soil being matured, its rawness and superabundant humidity disappear, and the growth of domestic vegetables becomes sufficiently close and heavy to protect the surface of the ground from the rays of the sun, and perhaps to appropriate to its own use the matter that would otherwise turn to miasm. For that matter becomes no doubt the food of the plants. The issue has been already told. The malaria of defective cultivation disappears with the state of things that produced it, and the primitive healthfulness of the country is restored. If fens or marshes exist, they are drained and converted into meadows, which more completely secures the salubrity of the place. In further illustration of the principles here maintained, it may be observed, that hurtleberry and cypress swamps, with all fens and marshes deeply shaded, never produce malaria. Why? Possibly for two reasons. They contain too much water; and the protection of their surfaces from the rays of the sun renders

them too cool for the process. Admit the sunbeams by the removal of their leafy covering, and miasm will be formed.

Mill-ponds are often a fruitful source of malaria. Can any alteration be made in the mode of forming them, calculated to lessen or prevent the evil? I think there can.

The amount of mischief done by a mill-pond, other things being alike, is in proportion to the quantity of vegetable matter, which it subjects to dissolution; and that again is usually determined by the extent of land that is flooded by the obstructed water. Two measures, therefore, present themselves for diminishing the evil; and either or both may be adopted, according to circumstances. In all cases the forest timber and underbush, covering the ground to be overflowed, may be cut down, grubbed up, and burnt, or otherwise removed, before the erection of the dam. Under this regulation much less vegetable matter will be dissolved. And in many instances, the construction of a *levee* or artificial bank, of a moderate height and extent, will confine the stagnant water within narrow limits; and thus will only a small portion of land be flooded. That these measures would prove useful, cannot be doubted. The erection of *levees* would even add to the efficiency of the establishment, by giving a better head of water, than could be had without them. Nor do I perceive that any objection to them can be reasonably urged. The expense attending them would rarely be very heavy. And if, in some cases, it should be so, what is the pecuniary interest of a few individuals, when balanced against the health and lives of thousands? That the removal of the timber and underbush from the flooded ground would be salutary, is proved by the fact, that old mill-ponds are much less deleterious than new ones. The reason is plain. From the former, vegetable matter is removed by decay. In the latter, it abounds; and while undergoing dissolution, produces malaria. To the precautions here suggested, add the planting of rows of shrubbery and trees along the *levees* or edges of mill-ponds, the benefits of which will be again referred to, and it is believed that the evils of those establishments will be greatly diminished. They will be rendered not only innocent, but ornamental. They will resemble the willow-fringed lakes and fish-ponds of European parks, and pleasure grounds, and be no longer dreaded as laboratories of poison.

4. *When malaria is already formed, how may its effects on the human constitution be most certainly obviated? In other words, what are the means by which the inhabitants of a city, or a district of country, subject to bilious fever, may best preserve their health?*

Are these questions proposed to an honest and enlightened physician, by those who have confided to him the care of their health? He can render to them, in conscience, but one answer, "withdraw from the sickly region, during the sickly season. Nothing short of this will certainly protect you." But the few only can follow the advice. The many being destitute of the means of removal, or prevented from it by indispensable business, must abide the evil. To these, therefore, the following remarks may perhaps communicate some useful information.

It is a maxim in pathology, that during the prevalence, whether endemic, or epidemic, of a bilious fever, every inhabitant of the sickly district is predisposed to the disease. Nothing but an exciting cause is necessary to its production. Let such excitement, therefore, be strictly avoided. Am I asked what I mean by exciting causes? I reply, every thing that can produce fatigue, or any kind of exhaustion; every impression out of harmony with the system. In other and plainer words, improper exposure, intemperance, and all sorts of excess. Some of the most powerful exciting causes are, fatigue from severe or protracted exercise, or long endurance of inordinate heat, sudden and great vicissitudes in the atmosphere, especially from a higher to a lower temperature, and from dryness to moisture, unguarded exposure to a current of cool air, a shower of cold rain, the evening dews or the common humidity of the night air, more particularly if the person be exposed in a posture of rest, in which case, should he fall asleep, the evil is increased; stunning and weakening injuries from blows or falls, inordinate indulgence in love, the influence of the other passions generally, more especially the passion of fear, and the action of intense and long-continued study. To these add excess in eating, drinking, and watching, the use of crude and indigestible food at any time, but particularly just before retiring to rest, deep anxiety or dejection of mind, and the swallowing of irritating and nauseous pills and potions, as preservatives of health. Such, I say, are some of the most dangerous exciting causes, which should be studiously avoided by all who are anxious to escape disease. But these are only passive duties of prevention. There are also active ones to be performed.

If individuals escape a prevailing epidemic, next to their avoidance of exciting causes, they owe their safety to the prophylactic power inherent in their constitutions; that power denominated by the schools *vis conservatrix naturæ*, whose province is to resist the influence of deleterious agents, and preserve health. Nor is this conservative attribute, as many have pronounced it, a creation of fancy. It as

certainly belongs to the human system, as the power to breathe, to secrete bile, or to digest food. If it did not, health could not be maintained a single hour by individuals living, breathing, and swallowing in the midst of a virulent atmospheric poison. On this point I am anxious to be clearly understood. By the *vis conservatrix naturæ* I do not mean any separate and peculiar entity or principle attached to the constitution as a guardian of health. I do not identify it with the *anima medica* of STAHL. That would be a hypothesis too fanciful for the sober sense and practical views of the present age. I mean only a given and peculiar mode of action of the general powers of the system, or rather of its organs possessing power adapted to its existing exigency. As are the exigency and demand of the system for the time being, so is the mode of action. Is food to be digested? The brain and all the other leading organs combine to aid the stomach in its work. To prove this would be easy, were it admissible in me to dwell on it. If those organs are feeble or diseased, and unable to furnish aid, the work is not suitably performed, the stomach alone not being competent to it. Is matter to be secreted to produce the reünion of a broken bone? The general system must aid the part immediately affected, and especially destined to the work of secretion, or the process will fail. Hence, under the existence of constitutional disease or debility, a broken bone does not reünite; at least it does so, if at all, slowly and defectively. Does any other form of disease exist? The powers of the system must concur to remove it, or it will not be removed. Medicinal substances, unaided by those powers, cannot cure it. To enlightened physicians this is but a truism. They know that medicines are literally but the handmaids of nature. In like manner, when the system is assailed by febrile miasm, its powers must confederate to resist the poison, or disease will ensue, as certainly as ponderous bodies, when unsupported, fall to the ground, and those that are lighter than the atmosphere pass upward. And this confederacy is what I understand by the phrase *vis conservatrix naturæ*. The philosophy of all this I waive, the fact alone being sufficient for my purpose. I do not know that this explanation is necessary on the present occasion. I trust, however, it will not be deemed irrelevant or improper. My chief reason for offering it is, that, when speaking on the subject, I have been often misunderstood; and I am solicitous that this should not be the case now. On this topic I shall only add, that, were it not for the attribute of which I have spoken, no exciting cause would be requisite for the production of bilious fever. The poison alone would be competent to the effect.

Man escapes then, I say, from the influence of bilious malaria, when he does escape, in consequence of the resistance of his conservative power. And, other things being equal, the more perfect his health is, the more successful will be the resistance. This may be considered another axiom in pathology, whose applicability to the subject in question is plain, as will appear presently.

Different, and even opposite opinions are entertained, and corresponding directions given, with regard to the kind of diet and drink most suitable to individuals, as relates to their protection during the prevalence of a bilious epidemic. Some physicians advise the entire abandonment of animal food and stimulating liquors, and the substitution of vegetable aliment and water in their place. This, we are told, is to purify the blood, and render it insusceptible of the febrile poison. Others pronounce this course too debilitating, and therefore calculated to invite disease. Accordingly their directions are, to eat more animal food, accompanied by more stimulating condiments than usual, and to drink more freely of vinous and spirituous liquors, in order to escape the sickness, by "living above it."

I apprehend both sets of directions are equally wrong. Sudden and great changes of diet and drink are hazardous at all times, and under all circumstances. But they are peculiarly so during the prevalence of disease, when the constitution requires all its stability and firmness to enable it to resist the febrile miasm. But an immediate and striking change in food and drink necessarily deranges the constitution, unsettles its economy, and weakens its powers. It requires of it a new order and degree of action, to accommodate itself to its new condition. It alters, moreover, its susceptibilities. In conforming to this *new* state of things, the constitution must abandon the *old*; and, in its transition from the one to the other, it cannot fail to be temporarily enfeebled. In the mean time, the malaria, plying its powers, gains an ascendancy, and disease is produced. The condition of the human system, when in this transition state, resembles that of an army engaged in action, whose battle array an unskilful commander imprudently changes in the face of an enemy, who, taking advantage of it, makes victory sure; or it may be likened to the condition of a ship in a gale. Her storm-stay-sails are set, and her helm lashed fast, and she is riding out the blast in safety. But the wind suddenly shifts, and renders another state of preparation necessary. Her present array, therefore, is broken up, that the other may be formed, and she is thrown loose, for the time, into the wind. The peril is great, and the issue often fatal. Before the new ar-

rengement can be completed, the vessel may be overwhelmed and the crew lost.

I do not think it safe for those exposed to it to make any material change in their mode of living, during the prevalence of a bilious epidemic; I mean, provided they have lived temperately. For the intemperate I have no other advice but to return to sobriety, at every hazard. Better to die in temperance, than live in debauchery. Let the temperate, I say, adhere to that mode, which they have found, by experience to be most subservient to perfect health, and that will give them the greatest security against the influence of malaria. It will impart to their preservative power the greatest degree of vigour. Have they lived on vegetable food and water, and have these articles proved most salutary to them? Let them adhere to them. Has their food been animal, and their drink fermented or distilled liquors; and have these given them the highest health they have enjoyed? It would be indiscreet to change them. Nor, under the same proviso, ought they to make any alteration in diet and drink of a middle character, more stimulating than the former, and less so than the latter. The end aimed at is entire health, and whatever kind best secures that should be steadily persevered in. This, if I mistake not, is the dictate of common sense and experience; while the directions to change, as just specified, are the offspring of hypothesis. They are predicted on the assumption, that their authors know what state of the blood gives a liability to disease, and what a security from it; whereas, in fact, they know nothing of the matter. They do not even know that any one state of the blood, independently of the condition of the solids, is preferable to another, as relates to the liability of the system to be injured by malaria. Nor have they the least knowledge how that fluid is affected by different kinds of aliment and drink. The whole is conjecture. But we do know that the more perfect the health is, the more vigorous is the resistance of the system, when assailed by any deleterious agent, and the less, of course, its liability to be injured by it. Should any slight alteration, however, in diet and drink be made, let the change be to articles that are lighter and less stimulating, rather than to those that are heavier and more so. In an especial manner, let heavy and stimulating food and drink be abstained from, during a state of exhaustion from excessive exercise, or long exposure to intense heat. In such a case, every thing taken should be cooling, light, and easy of digestion. The system calls for quietude, that it may recruit itself, not for irritation by diet and drink, to exhaust it still further and more injuriously.

Clothing and exercise, judiciously regulated, are of great value, as safeguards from disease. The former should be such as may best maintain the healthy action of the skin, and protect it against sudden vicissitudes in the atmosphere. Let flannel or muslin, therefore, more especially the former, be worn next to it in preference to linen. The action of this kind of clothing is much aided, and its beneficial effects promoted, by perfect cleanliness of the skin, and the frequent use of the flesh-brush, or by frictions with a coarse dry towel, or a roll of flannel. The feet, in particular, should be carefully guarded against cold and moisture, which is also best done by woollen or cotton. The other articles of dress ought to conform to these. The end aimed at is to keep the body in an equable and comfortable temperature. Let the warmth preserved, however, be above the *punctum jucundum*, or point of pleasant feeling, rather than below it. Woollen clothing generally, therefore, accommodated in its texture to the character of the weather, should receive a preference.

Exercise should never be turned into labour. It should not, I mean, be so violent or long-continued, as to induce fatigue. The intention of it is to invigorate and strengthen, not to exhaust and enfeeble. When it is judiciously accommodated to this end, health is confirmed by it. It should be taken daily, in the open air, when the weather is favourable, and, if practicable, without the sphere of the malaria. Walking and riding on horseback are greatly preferable to "airings" in a carriage. The latter are well named. They are *mere airings* and nothing more. They do not amount to exercise, except for invalids, who can sustain no other sort of gestation. Sitting or lolling in a carriage is, at best, but a sedentary occupation. Exercise should be taken in the cool, but not the humid portions of the day. During the heat of the day it may prove dangerous, and should, if practicable, be avoided. Nor ought it to be indulged in immediately after eating, especially after dinner. Exercise, when the stomach is loaded with food, is never salutary. Nature herself admonishes of this. Hence the drowsiness and indisposition to motion felt, soon after meals, both by man and the inferior animals. The dog lies down to sleep, and the ox to ruminate; and man, if he has leisure, retires to his *siesta*.

Does bilious or yellow fever prevail in a city? There are yet other precautions which have been found useful as means of prevention. Respecting the malaria of those complaints, two important truths are known. It does not rise to the highest stories of lofty city dwellings; at least it does not reach them in a state of full concentration, and strength; and exposure to it at night, especially during the inaction

of sleep, is much more dangerous than exposure during the day. On these two facts, valuable measures of safety may be founded.

Are individuals compelled, by business or duty, to pass the day within the sphere of the miasm? Let them, if practicable, sleep without it, at night, and they may escape mischief. Or if unable to avail themselves of this precaution, let them adopt the next best, which is to pass the night in the upper stories of their houses, above the reach of the enemy. Let them indeed spend all the time they can in those stories, and they may be safe. This is no hypothesis. The practice recommended has been successfully tried. It is founded on principle, and, if generally adopted, cannot fail to do good; although it may not, and I presume will not, protect from disease in every instance. When Europeans, in the cities of the east, retire to their domestic quarantine to escape pestilence, they confine themselves strictly to the higher floors of their houses. Their real intention in this, is to maintain a position as remote as possible from such persons, affected with plague, as may pass along the streets. Thus, in their opinion, they escape contagion. But they act wisely from mistaken motives. There is no contagion in the case. Plague is no more contagious than yellow fever. Escape is to be accounted for on a different ground. The malaria of plague does not rise to a great height in the atmosphere. Europeans, therefore, confined to the upper stories of their houses, are above the reach of it. Those who reside on the lower floors, however strictly they may seclude themselves, do not so generally retain their health.

The same miasm which produces common bilious and yellow fever, produces also cholera infantum, a complaint which prevails most in our large cities, and might there be denominated *pestis infantum*. It is known that the best and only certain means to protect infants from this disease, is to allow them to pass the summer in the country. But there are not many cases in which this is convenient. In lieu of it, therefore, if the subjects to be protected cannot be allowed to sleep in the country every night, during the summer months, which would be the second best plan of security, let them enjoy the third, which is to pass their nights in upper stories. Let them pass the day there also, except during the hours of exercise in the open air, when they ought, if possible, to be removed without the limits of the malaria. A few hours every day spent in the pure air of the country, would aid much in maintaining the vigour of their systems, and in protecting them from disease. Again, it is known to every one who has attended to the subject, that, in districts of country where bilious fever occurs as an annual endemic, other things being alike, those who sleep

in upper stories are less liable to the disease than those who pass their nights below. Nor is this all. In the places of which I am speaking the inhabitants find no inconsiderable security from the endemic, by erecting their houses on artificial mounds thrown up for the purpose. This practice is pursued in some of the sickly portions of the United States. And were the mounds made higher than they usually are, the security derived from them would be greater. True, the professed object of the inhabitants, in thus elevating their buildings, is to raise them above the common humidity of the soil, and in part above the ascent of the dew. But they aim at one end that is good, and attain another that is better. They live, and especially sleep, above the flight of malaria; and hence chiefly their safety arises. To escape from the dew, and other forms of moisture, is advantageous; but to keep out of the reach of the miasm is much more so. The former is but an exciting cause, and can do comparatively but little mischief, unless the latter has invaded the system, and produced a predisposition to disease.

There are yet other precautions which may be advantageously practised by the inhabitants of places where bilious fevers prevail. They are especially applicable to sickly situations in the country. It is hazardous to go out in the morning with the stomach empty. Regular breakfast, or some gently stimulating and cordial beverage, accompanied by a cracker or a bit of bread, should be first taken. For the purpose in view, nothing perhaps is better than a cup of coffee, chamomile tea, or some other mild aromatic bitter. In the aguish counties of England, a glass of table beer, with perhaps some bread, is the usual substitute, and is no doubt a good one. In other places cider is used, it is said with beneficial effects. But wine and distilled liquors should be avoided. They are too stimulating for the end desired, and very often lead to intemperance. One of the most injurious and offensive practices in our country, and which brings down on us deservedly the reproach of foreigners, is that of morning dram-drinking. Nor does it afford protection from malaria. Nothing we swallow can do that, unless it gives real strength primarily to the stomach, and by sympathy to the conservative power of the system. But such are not the effects of morning drams. They rouse the stomach to preternatural action for a time, only to sink it the deeper in exhaustion. It is a disquieting sense of this that leads to a repetition of them, until intemperance is the result.

Is any one inclined to ask me, would not bread and cheese with a draught of water, or a breakfast of bread and milk, protect from malaria as well as coffee, beer, or cider? To this question I am not

prepared to answer in the negative. Perhaps an affirmative reply would be nearer the truth. But the experiment alone can answer definitely. And I know of no instance where it has been decisively made. For many years before his death, the late Dr. TILTON, of Delaware, breakfasted on the product of his own ground. If I mistake not, the meal consisted chiefly of fruit, bread, and milk. Yet he enjoyed perfect health, and attained a very advanced age. On this topic I shall only add, that were our "temperance societies" to denounce excess in eating as well as in drinking, marking with equal disapprobation the use of *improper* food, and setting correct examples themselves in relation to the whole, the prospect of a thorough reform would be much brighter than it is. A very frequent cause of intemperate drinking is intemperate eating, connected with the use of indigestible aliment. And for every drunkard in our country, we have a hundred gluttons, if, by that term, we mean those who eat too much. Nine hundred and ninety-nine out of every thousand persons in the United States eat to excess, and suffer by the practice.

Like other matters floating in the atmosphere, malaria travels with the wind. It therefore does mischief, on the leeward side at a much greater distance from its source, than on the windward. Suppose it indispensable that a dwelling, fortress, or town be built near to a marsh that cannot be immediately drained and cultivated, and that the prevailing summer and autumnal wind of the place is from the south-west. Let the buildings be erected on the same side. Why? Because the wind will carry the malaria *from* them, and their inhabitants will be healthy; while it will convey it directly *to* them, if they occupy the north-east side, and they will suffer from sickness. Hence the well-known fact, that in the southern section of the United States, where the prevailing winds of summer and autumn are from the south and west, the dwellers on those sides of marshes, swamps, rivers, and mill-ponds, are often in the enjoyment of good health, while the people on the opposite sides, although further perhaps from the laboratory of the poison, are victims to fever.

Another precaution by which a town or single dwelling may be protected from the malaria of an adjacent marsh, is the interposition of a cordon of trees and underbush. If a growth of such timber, therefore, be already standing between the marsh and the buildings, let it remain; and if it be wanting, plant it. Trees of moderate elevation, with bushy tops, and which throw out limbs and foliage along their trunks, are best suited to form the barrier required. Many places in tropical climates have been rendered uninhabitable by the felling of trees and the destruction of underbush between them and

neighbouring swamps and marshes; and their salubrity has been restored by the regeneration of the timber. In the United States similar events have occurred. The evidence on the subject is therefore complete. This mode of obstructing the march, and obviating the mischief of malaria, has been practised time immemorial in Persia and other oriental nations.

Would a lofty wall arrest the progress of malaria, issuing from a neighbouring source? I doubt not it would. Facts seemingly to that effect exist. The plague of Moscow found its way in but few, if any instances, within the walls of the Kremlin. I think, but cannot, on this subject, speak confidently, that the prisoners in the Philadelphia jail remained healthy, during the prevalence of yellow fever in that city, in 1798. Yet the disease, during that season, spread in all directions around the prison, where any inhabitants remained.

The uninterrupted health of the inmates of monasteries and nunneries, enclosed by walls, during the devastations of pestilence around them, is almost proverbial. It has been ascribed to different causes; strict temperance in diet and drink; general regularity of habit; exemption from strong and irritating passions; and a life of seclusion, leading to an avoidance of contagion from the sick. That the three former of these causes acted as means of protection from disease, cannot be doubted. But that the latter did not is equally certain, inasmuch as there was no contagion in the case. Others have regarded the escape of the meek recluses from pestilence, as a special blessing from above, on account of their piety. Persuaded that Heaven always stays natural calamities by natural means, I cannot abandon the belief, that the surrounding walls, which shut *in* those devout ascetics from the world, shut *out* malaria from them, and thus contributed to their safety. That those peaceful retreats of devotion may be the more secluded, the walls enclosing them are usually lined with rows of trees, and sometimes of shrubbery. These have therefore added strength to the protecting barrier. I have no hesitation in believing, that a rampart thus composed, provided the wall be lofty enough, and the rows of trees sufficiently dense; and provided also that the entrances be kept closed, will arrest completely the progress of malaria, and afford protection to the residents within.

A knowledge of the exact distance from its source, to which malaria can travel, may aid much in the selection of secure situations for residence. But that knowledge is not known possessed by any one; nor does it seem to be attainable in the present state of science. Well-established facts seem to render it certain that, under different circumstances, the poison travels different distances. It has been

already observed that it moves further from its source with the wind than against it. And it may be added, that it travels further with a current of air, than through the calm atmosphere. Is the country level? The poison fills a wider sphere than if it were bounded by hills. For although it can attain the summit of a hill of considerable elevation, it is weakened by the journey, and rarely does much mischief on the opposite side. The distance it can pass along water is very limited. As already mentioned, it never reaches a ship lying cable's length from the shore. This has been satisfactorily ascertained in innumerable instances. During the prevalence of yellow fever in Philadelphia, families have taken refuge in vessels, anchored in the ship-channel, not more than from two hundred and fifty to three hundred paces from the wharves, and escaped disease. I doubt whether marsh miasm has ever passed over a river the fifth part of a mile in width. Unquestionably the inhabitants along one bank of such a stream are often healthy, while those on the other are suffering from bilious fever. Of a river not more than a hundred paces wide, I have known the same to be true. Families residing immediately on the leeward brink of such a stream are often healthy during the summer and autumn, while those on the same side, but a few hundred paces distant from the water suffer from bilious fever. The reason of this is plain. The wind cannot convey the poison across the river, to the former, while it removes from them that produced on the same side, and carries it to the latter. Nor is this all. Between the margin of the stream and the families living a short distance from it, there usually exists an interval of low ground, which is itself a laboratory of febrile malaria. This is also borne by the wind from the inhabitants resident on the water's edge, and thrown on those a little remote from it. Bilious miasm is said, by some writers, to travel from one to three miles, and by others as many leagues, from its source, and produce disease. The assertion wants proof. No authentic facts can be adduced in support of it. I have never known an instance, in which malaria, even when *most abundant*, produced fever more than half a mile from its source, perhaps not so much. I say, "when most abundant;" and certainly its amount must affect materially the distance it may reach. A large volume of it must be more diffusive than a small one, for the same reason that a gallon of wine, mixed with water, will give taste and flavour to a greater quantity of that fluid than a gill. In cases where malaria is believed to travel so far, intermediate sources of it are overlooked. I have already stated, and now repeat, that wherever there exists a bed of alluvial soil, or fertile soil of any kind, there the

poison may be generated. And, in those instances, where it is supposed to travel so far, if a competent examination be made, such beds will be found between the most striking source of it, erroneously considered the only source in the case, and the extreme point to which it extends. It is exceedingly doubtful whether any wind can carry malaria a mile from its source, in a state of such concentration as to produce disease.

As relates to the means of ascertaining something of the mode and distance of the march of bilious malaria, the following facts may not, perhaps, be without value. Many years ago the late Professor WISTAR removed annually with his family to a summer residence, about half a mile, or perhaps a little more, in an eastern direction from the Schuylkill. Compared with the bed of the river, the ground he occupied was lofty. But several ravines of considerable depth ran from the edge of the stream toward his dwelling. None of them, however, reached it. Some of his neighbours, especially those between him and the river, were subject to intermitting fever. There was reason to believe, that the malaria productive of the disease came from the Schuylkill. While investigating the subject, the professor discovered that the morning fogs, which arose from the river, without reaching the summit of the heights on either side, travelled along the ravines to their termination, and then spread to given distances along the plain, in the neighbourhood of their mouths. This leading to further inquiry, his next discovery was, that the sickness which prevailed was confined almost entirely to the range of the fog. Those living without it were healthy, those within more or less diseased. Here, then, it would seem that the limits of the malaria and the fog were the same, and that the latter being visible, indicated the extent of the diffusion of the former. On the banks of the Ohio the same is said to be true. Is it not probable, then, that, as a general rule, habitual fogs from marshy ground may serve as a "cloud by day," to designate the places where human habitations may be safely erected? Let them be kept without the range of the visible exhalation, and they will be more likely to be without that of the invisible. Where it is practicable to avoid it, dwellings ought not to be erected on alluvial ground, especially modern alluvion. Such a situation may in time be rendered healthy, but not without much labour and skill, accompanied probably by no little suffering. When it is possible to avoid it, an alluvial situation should never be selected for the encampment of an army. Such a place has often produced sickness in a single night.

It was observed, in a former part of this dissertation, that, in a

distinct subject to bilious fever, night exposure is particularly hazardous. Is it equally so at all times of the night? I apprehend it is not. It is most dangerous during the descent of the dew; an event which occurs twice in the night; once soon after sunset, and again a little before daybreak. The hours at which this meteor falls, in different latitudes, and under different temperatures, are not the same. Observation alone can ascertain them, and enable those concerned to regulate their movements accordingly. Their safety consists in avoiding exposure during the fall of the dew. If their duty, therefore, calls them out at night, let them select the period between the times of the descent of that meteor. Another precaution of great moment is, to continue in action while in the humid atmosphere. Exposure at night, in a state of quietude, more especially in a sitting or lying posture, is full of peril, and should be strictly avoided. To fall asleep during the time is still worse.

Is any one wind more deleterious than another? I mean, is it more heavily charged with pestilential miasm? No; not in the abstract, and generally. If it is so, in any particular case, it is attributable to local causes. Much error, not to call it superstition, prevails on this subject, both in the minds of living physicians, and the writings of dead ones. The medical and poetic writers of Greece and Rome have said so much about the *humidus* and *pestifer auster*, that it almost makes a part of our professional creed, that the south wind is necessarily *moist* and *pestilential*. But nothing can be more destitute of truth. The sirocco, which blights and kills from a lack of moisture, but has no pestilential taint in it, comes as frequently from the south as from any other quarter. And, in many places, the south wind is peculiarly salubrious. Instead of being always, moreover, surcharged with humidity, it often beats back the haze and vapours that come from the north, and renders the atmosphere dry and serene. In Greece and Italy the south wind is humid, because it comes directly from the Mediterranean, bearing along with it much of the exhalation from that sea. It blows, moreover, during the hottest weather, when bilious and pestilential fevers most frequently prevail. Hence its supposed connexion with those complaints. But it is not the south wind, it is the high temperature of the atmosphere, that contributes to produce the febrile miasm. Let hot air stream in from any other quarter, as it does from the north, in the southern hemisphere, and the issue will be the same. Malaria will be produced. Wind derives its character, not from the point of the compass from which it comes, but from the nature and condition of the surface over which it passes. Is that surface moist? So is the wind. Is it dry? The wind an-

swers to it. Hot? The wind is also hot. Cold? Again the wind corresponds. And it carries malaria along with it, and may be therefore called pestilential, for a short distance after passing over a sickly morass. Such is the true philosophy of that meteor. On the Atlantic borders, in the United States, all winds from north-east to south-west, taking east in the semicircle, are humid; and all in the opposite semicircle, from south-west to north-east are dry. The reason of this is obvious. The former come from the ocean, saturated with exhalation; and the latter arrive from the interior of the continent, exhausted of their humidity by a long journey over land.

Dr. LIND speaks of a certain effect of the east wind on the eastern coast of England, in terms which prove him to have been more of a mere observer than of a philosopher. He says that this wind "raises a copious vapour from water, mud, and all marshy or damp places." And he insists that it does positively "raise" the vapour, and does not produce it in any other way; and that hence, that wind is peculiarly deleterious. An error grosser than this can scarcely be imagined. It is the counterpart of the belief, that the moisture which, in a hot day, settles on the outside of a bottle or pitcher, filled with cold water, has passed through the pores of the vessel, in the character of sweat. Hence, by the uninformed, it is believed that the vessel actually does sweat. The east wind does not "raise" vapours in the part of England referred to; it only renders visible those that are already raised. Coming immediately from the sea, it is cool and humid; and therefore robs the ascending exhalations of a portion of their caloric. The necessary effect of this is, to condense them immediately, and render them visible. On the west coast of England the east wind acts differently. By passing over the island it has lost a portion of its humidity, and received in return a portion of caloric. It is not therefore a condenser of exhalation arising from water, and does not reduce it to a visible form. On that coast, the west wind being more humid, is better fitted to produce a vapour. It is on the same principle, I say, that a bottle filled with any cold liquid, takes from the warm air in contact with it, a portion of its matter of heat, condenses the humidity it contains in a state of vapour, and renders it visible in the form of water.

Is there any particular period of the moon's revolution around the earth, at which bilious fever more usually makes its attack, than at others? Yes; at the times of her full and change. This is neither "hypothesis," nor "vision," although both terms have been affixed to it. It is a fact, as satisfactorily ascertained by observation, as any other connected with the complaint. The history of epidemic dis-

eases, when circumstantially given, proves that attacks and deaths occur most numerous at the periods referred to. Some of the most distinguished members of our profession have recorded their observations to that effect. Were my own testimony of any weight, I would say that it fully concurs with that of others, who advocate the doctrine of lunar influence. Nor is the reason of this concealed. The vicissitudes in the sensible qualities of the atmosphere, which are greatest and most frequent about the times of the full and change of the moon, act as the exciting causes of the complaint, in those who are already predisposed to it. Am I asked for the names of any of the writers to whom I have referred as high authority on this subject? I answer the demand by mentioning DIEMERBROCK, MEADE, BALFOUR, MOSELY, and RUSH; and I could add twice as many more, were it necessary. The prophylactic precept founded on this doctrine is plain, and not without its value. During the prevalence of an epidemic fever, let those who reside within the sphere of the malaria be especially cautious of exposure to the weather, about the periods of the full and change of the moon.*

Are there any medicinal substances calculated to obviate the effects of malaria? I know of none. All nostrums administered for that purpose, are but the fruits of empiricism. Some physicians speak with confidence of the beneficial effects of repeated purgatives in protecting the system from bilious fever. I consider the opinion

* There is not, in the science of meteorology, a single fact that rests on a broader or more solid foundation, than that a great majority of the most sudden and striking changes which occur in the atmosphere, from heat to cold, and from moisture to dryness, and the reverse, and an equal majority of tornados, tempests, and other violent atmospherical commotions occur about the periods of the full and change of the moon. This truth is supported alike by the records of the past, extending even to ancient times, and events that are constantly presenting themselves to our observation. That such vicissitudes in the atmosphere are uniformly prejudicial to the health of valetudinarians, is another fact which will not be controverted. But, during the prevalence of a bilious epidemic, every one exposed to the poison of it is so far valetudinary, as to be more than usually liable to disease. Exposure and unfriendly impressions of every kind, which would be innocent, at other times, produce sickness now. Such impressions are necessarily made by great and sudden changes in the sensible qualities of the atmosphere. It is on this ground that the atmospherical vicissitudes, occurring about the times of the full and change of the moon, act as exciting causes, and aid in producing new cases of the disease. Of all other epidemics the same is true, for the same reason. Hence, during the prevalence of every complaint of the kind, the same periods of the moon are most productive of fresh attacks.

unfounded, and the practice it recommends hazardous, not to say injurious. They are the growth of hypothesis. Sound science does not countenance them; and they derive no support from experience. Repeated purging, like the excess of any other evacuation, deranges the system, and enfeebles its conservative power. Instead of resisting, this invites disease. The alvine evacuations should be kept as nearly as possible in their state of habitual regularity. Change would be much more likely to prove injurious than useful. Medicinal substances are intended and suited, as their name imports, to restore health, when lost, not to sustain it when possessed. Let them be reserved therefore for actual indisposition, and then administered without loss of time, and with the skill and vigour required. Does constipation of the bowels occur? It threatens disease, if it is not the commencement of it, and should be promptly removed. But actual and continued diarrhœa, the result of the repeated administration of purgatives, is not the best substitute for it. Too much purging is as bad as too little. Let both be avoided. *Ibis tutissimus medio*, is here the precept of experience and wisdom. In fine, I say of the functions generally of the alimentary canal and the organs connected with it, as I did of diet and drink; let them be maintained in the condition that has been found most favourable to health and strength. As far as they are concerned, this will afford the best protection from disease.

The use of bitters, Peruvian bark, and sundry other articles denominated tonics, has been recommended as a security against a prevailing bilious epidemic. This advice does not rest on any sound principle of hygiene, with which I am acquainted; nor, as far as I am informed, does experience testify to the success of the practice it enjoins. I cannot therefore confide in its efficacy. By inducing an unnatural state of things, I apprehend it would be ultimately injurious.

A degree of cutaneous excitement somewhat preternatural, but not so high as to amount to disease, would seem to promise some security from bilious complaints. Children affected with prickly heat escape cholera infantum, unless from a sudden change in the atmosphere, or some other cause, the eruption disappear. The same is true of adults as relates to dysentery and bilious fever. Individuals who labour under elephantiasis are exempt from the fevers of hot climates; and the same is often the case with those who are troubled with cutaneous ulcers. Lazars of this description rarely suffer from oriental plague. Such, I say, are the facts; and the philosophy of the cases must be sufficiently familiar to every physiologist.

What then would be the effect of preternatural excitement of the

skin produced intentionally, as a means of prevention, during the prevalence of an epidemic fever? of one or two issues, or small perpetual blisters, for example; or of the irritation produced by tartarized antimony? These expedients I have never tried to such an extent as to enable me to speak of them from personal observation. But some of them are recommended on high authority. I shall only add, that they tend to the maintenance of centrifugal action, which is well calculated to prevent disease. Under proper regulation, therefore, they may possibly be found worthy of more attention than they have heretofore received.

It was my intention to have expressed my opinion, with the grounds of it, on the subjects of the two following questions, which are remotely connected with some of those discussed in this Dissertation.

1. Does the same malaria produce typhus and common bilious fever?

2. Is the malaria productive of yellow fever the same with that which gives rise to intermittents and remittents; or is it a different form of miasm prepared from the same elements?

In each case my present views would induce me to give a negative answer. I consider the malaria of typhus different from that of bilious fever, in both its nature and origin; nor, although formed from the same materials, do I believe the miasms of yellow and intermitting fevers to be identical. But as the consideration of these points is not essential to the solution of the questions proposed by the Faculty of Maryland; and as I have already trespassed on the limits I had prescribed to myself in this inquiry, as well, I fear, as on the indulgence of the Faculty, I decline further discussion, and close my Dissertation.

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Dr. M'Culloch's Essay on Malaria not read by the author of the foregoing Dissertation until after the Dissertation was written—coincidence of opinion on many points between the two productions.—Opinion of Dr. M'Culloch respecting preceding writers on malaria—his vivid picture of the degeneracy produced in man by malaria.—Style of "Essay" faulty—some opinions contained in, erroneous—its author too much influenced by *apprehension* and *credulity*—fears and believes imaginary things—dreads all ornamental forms of water as sources of malaria—this apprehension unfounded—such places, properly regulated, do not produce that poison—how they should be prepared and kept, to render them innocent.—Ponds to water cattle, in the western states not causes of sickness.—Woods and meadows pronounced unhealthy by Dr. M'Culloch—sentiment incorrect, provided meadows be properly cultivated.—Pine woods healthy—reason of.—Italy, Mediterranean Islands, and many other maritime places in Europe not so sickly as Dr. M'Culloch represents them.—The doctor's excessive credulity in believing malaria to be carried by the east wind, from Holland, across the German Ocean to England—mistaken in his views, generally, as to the distance malaria can travel from its source—does not understand the philosophy of the diseases of Egypt.—Plague and yellow fever but modifications of the same disease—evidences of this—subject briefly discussed.—Ancient Italy less sickly than modern—cause of this.—Increase of alluvion at the mouths of rivers not necessarily the cause of an increase of disease—may be rendered subservient to the subsistence of the increasing numbers of the human race—alluvion of the Mississippi will be made tributary to this.—Rome threatened with depopulation by malaria.—How this evil may be prevented.—Narrow streets and small crowded houses, where cleanliness is neglected, favour the ravages of bilious malaria, instead of checking them, as Dr. M'Culloch asserts they do—none of that author's preventive measures new, and some of them faulty and injurious—fires kindled to destroy malaria, remarks on.—Speculations of the doctor on the levelling of the earth and the draining of Lake Erie, visionary and extravagant—unfit to appear in a grave practical work.—Still his "Essay" a valuable book—will induce physicians to pay more attention to malaria than they hitherto have done.—Present project of the Faculty of Maryland important on the same ground.—Legislative inquiries on the same subject, remarks on.—Conclusion.



APPENDIX.

THE Dissertation to which the following pages are appended, had been written a considerable time before I had read "M'Culloch on Malaria." Had the case been otherwise, I would not have expressed myself as I have there done, respecting the writers who had preceded me on the subject. In a particular manner I would not have admitted into the Dissertation the two following sentences. "Much, indeed, has been said and written *about* the malaria of bilious fever, but, as far as I am informed, very little directly *on* it." "Seriously, as far as my inquiries have extended, the crude views, and indefinite expressions of writers on malaria, are incompatible with accurate information and practical results."

Of all I have ever read on the subject, Dr. M'Culloch's "Essay" excepted, these sentiments are true. But of that work my report must be different. To condemn it would be a sort of literary suicide; because it would amount to a condemnatory sentence on no small portion of my own dissertation. On many leading points, the coincidence of opinion in the two productions is striking. Were it not for this, and that therefore my praise of it might be regarded as self-commendation, I would pronounce the "Essay" a publication of great merit. But as to speak thus of it might be deemed exceptionable in me, it is fortunately also unnecessary. The work will not suffer from my silence. It speaks for itself in terms that are convincing, and the medical profession will listen to it, be instructed by it, and do it justice.

I am not dissatisfied to find that Dr. M'Culloch's opinion of preceding writers on Malaria is the same as my own. On that point I was apprehensive that, should I even escape the charge of presumption, in supposing myself better informed than others, I would at least be considered unnecessarily censorious. Still I deemed it right to incur the hazard, for the sake of representing things as they are, and thus aiding in the subversion of hypothesis and error, and the establishment of truth. It was therefore gratifying to me to meet in the following passages, with the support of a writer so extensively versed in medical literature; especially on that subject, as Dr. M'Culloch is. "As far as my reading extends, I have not found one luminous and philosophical view of the production and propagation of the poison, (malaria,) and little which can even serve the purpose of preventing diseases." "It is far too common to find entire volumes, (on the cause of bilious fever,) filled with idle hypotheses, respecting pyrites, and volcanoes and mines, and attributing to electricity, aurora borealis, magnetism, and similar visions, what the writers had forgotten to seek in that which ought to have been obvious to the most superficial and ignorant." p. 87.

Another topic on which I was somewhat apprehensive of being considered an extravagant colourist, is the picture I have drawn of the degeneracy of man, produced by malaria in many of the sickly districts of Europe. But here again I am amply supported by the vivid and graphical representation of the same subject by the same author. Indeed, although I well knew that truth would fully sanction the effort, I did not dare to paint as boldly and brightly as he has done, lest I might be supposed to be delineating the creations of a heated fancy, rather than the results of sober observation—recording what I had imagined or dreamt, not what I had seen. Hence my portrait falls short of truth instead of exceeding it.

But, notwithstanding the merit of Dr. M'Culloch's "Essay," it is not faultless

in either manner or matter. I regret to add, far from it. A few pages excepted, which are composed with uncommon spirit and elegance, its style throughout is periphrastical, involved, and indefinite, in a degree rarely witnessed in any publication. Nor is this the worst. It is, in many passages, so obscure as to render their meaning exceedingly doubtful. Were it not that the author has proved himself capable of fine writing, it might be deemed hypercritical thus to censure his style, especially in a work devoted to science rather than letters. But no writer should be indulged in broad negligence. He is before the public, and from respect to them no less than to himself, ought not to appear in the character of a sloven. If he does not choose to be in full dress, he ought at least to put off his rags. Besides, a style strikingly faulty, especially if obscure, detracts not a little from the value of the work. It prevents it from being read with the same amount of either pleasure or benefit that would be readily derived from it, were it suitably composed.

But, if I mistake not, there are in the "Essay" other faults, which much more seriously concern the profession. As they relate to the subject of the foregoing dissertation, a brief notice of a few of them will not, I trust, be deemed inadmissible. But as this appendix must not be protracted, my remarks on them can be but little more than hints.

As respects sundry points of which he treats, Dr. McCulloch appears to be inordinately influenced by *apprehension* and *credulity*. He fears and believes imaginary things, and earnestly discusses them, and admonishes with regard to them, as if they were realities. This renders him, as relates to such topics, an alarmist and an enthusiast, in a degree far beyond the warranty of facts. To be particular.

He has too deep a dread of *moisture*, as if it alone could generate malaria; although he expressly denies it that power. He would prohibit the formation of all fountains, basins, fish-ponds, lakes, canals, and other sorts of water ornaments, in gardens, parks, and pleasure grounds. His apprehension as to such improvements is a professional hydrophobia. He would shun, in warm weather, especially about eve-fall, the vicinity of a crystal rivulet, purling over pebbles and sand, and bedewing with its light and glittering spray the verdure and blossoms on its banks, as if it were exhaling the poison of pestilence. Of the effects of every pool or other body of water, whether it be pure or foul, stagnant or in motion, and whether it cover miles, acres, roods, or inches, he entertains the same dread. Meadows he pronounces unhealthy, because the ground is not sufficiently dry. In fact, it would be scarcely extravagant to say that he seems to regard water, in every form and condition in which it can exist on the surface of the earth, as a nuisance during warm weather.

All this, I say, is extravagant and erroneous. Meadows, if properly drained and cultivated, are not unhealthy; but if defectively prepared and unskillfully managed, they are so, in common with every other portion of fertile soil suffered to lie in a similar condition. All experience testifies to the truth of this. Nor, if well constructed and carefully superintended, are either fountains, basins, lakes, or other ornamental forms of water sources of malaria. It is the abuse of them only that renders them so; and the abuse of the greatest good is productive of mischief. I could refer to hundreds of instances in which such water improvements have been for many years, some of them for ages, familiarly approached and regularly frequented, both by night and day, without having produced, by malaria, a single case of disease. As relates to the formation of that poison, Dr. McCulloch and his countryman, Dr. Ferguson, are the

antipodes of each other. The one flies for safety from *moisture*, and the other from *dryness*; and science sanctions the conduct of neither. Let ornamental bodies of water be surrounded by well-cultivated grass-ground, and have their margins paved, gravelled, or pebbled, and lined with shrubbery and trees with branchy trunks, and they will produce no poison to injure those who may stray around them, admire their beauties, and enjoy their freshness, either by sunlight or moonlight. Let the borders of lakes, ponds, and pools be muddy, and strewed with vegetable matter running to dissolution, and they will soon become active laboratories of malaria; not otherwise. Were it true that this poison is formed, in warm weather, wherever there is moisture, and that so minute a portion of it as Dr. McCulloch pronounces sufficient, could produce disease, health would be a stranger to the human family. In summer and autumn, disease would be acute; and chronic affections, in the form of our author's "ill health," would be a source of misery during the other portions of the year. If the doctor will examine the matter a little more accurately, he will find, that in nine cases out of ten, if not in nineteen out of twenty, this "ill health" or "indisposition," which prevails so extensively, and which he ascribes in every instance to the influence of malaria, is the product of indiscretion in diet and drink, or of excess or irregularity in the indulgence of the passions. In other words, it is the issue of some sort of intemperance, which is one of the most productive sources of bad health.

Our author's representation of this entire subject is eminently extravagant, and calculated to mislead. Who that has travelled through the western portion of the Union, especially the states of Ohio, Kentucky, and Tennessee, has not seen in innumerable instances, large families in blooming health, with a pond to water their cattle during summer, and also for their geese to sport in, within a hundred paces of their dwellings, and often much less? I confess, that when I first saw those sink-holes, (for such many of them are,) I considered them fertile sources of malaria. But my own observations, and the experience of others, the only correct instructors in such matters, soon convinced me of my error. And a brief examination unfolded to me the cause. The ponds have but very little alluvion around their edges, and contain no dissolving vegetable matter; or if they do, the water in contact with it is too abundant to favour the production of miasm, or it absorbs it when formed. Be this solution right or wrong, the fact is certain: the ponds are innocent.

The "Essay" pronounces "woods" unhealthy. I have already mentioned, and now repeat, that in the United States they are not so. Our forests, when free from fens and marshes, are healthy. The "pine woods" of the south and west, as stated in another place, furnish secure asylums from malaria. This is probably owing to several causes. The surface of the ground is covered by very little vegetable matter; that which lies on it is chiefly resinous, and therefore not well suited to be dissolved and to produce miasm; and the soil being sandy imbibes and carries down the water that falls on it, together with any poison it may contain. In our common forests, it is only when the large timber and the under-bush are removed, and the soil torn up by the plough, that malaria begins its reign. In a state of nature, those places are free from disease. Hence the vigorous health of our hunters, trappers, and other forest rovers, notwithstanding their exposures, privations, and hardships.

It is well known that, in many large districts, Italy is very sickly. But it is not, as a country, the terrific pest-house that Dr. McCulloch represents it. Nor is Sicily. Nor are the maritime and fluvial regions of the continent of Europe

generally. If they were, they would become deserts. So would all the islands of the Mediterranean, were they such haunts of malaria as our author pronounces them. The inhabitants of those places, moreover, would have neither the robust bodies nor the vigorous minds which they are known to possess. In his account of many of the districts referred to, the doctor seems more of a poet than a historian. He addresses himself to the imagination rather than the judgment. I doubt not but he honestly believes what he states; but he is too credulous. He does not seem to understand the value of doubting, and has not therefore learnt the art. Hence he believes too much of what he hears and reads, especially if it harmonizes with his previous views.

One instance of his credulity is astonishing. Holland is separated from England by the German Ocean, which is from a hundred to a hundred and fifty miles wide. Yet the doctor asserts gravely, that in the spring the east wind conveys malaria from the former country to the latter, and produces intermittents!! This neither needs comment, nor deserves opposition. Its own extravagance refutes it, and renders it innocent. No body will credit it. Malaria borne by the wind one hundred miles, along the surface of an agitated sea!! As soon shall it be brought from the seacoast of the moon! Have the crews of vessels cruising in the midst of the German Ocean ever been sickened by the east wind in either spring, summer, or autumn? No, never. On the contrary, sickly vessels have often sailed from British ports, and become healthy by cruising in that body of water. They are even sent there occasionally for that purpose. But I need scarcely add, that the case would be otherwise were they assailed by malaria from the coast of Holland. Nor are the Hollanders themselves always labouring under intermittents when the poison of that disease is said to be carried from them to the English. Our author's plea, that the *moisture* of the east wind qualifies it thus to convey malaria, cannot avail him. From having swept across an extensive tract of interior country, that wind is *dry* when it leaves the coast of Holland and becomes moist in its passage over the ocean. But the doctor acknowledges that a dry wind is an unfit vehicle for the poison, because it has not the requisite affinity for it. The east wind, therefore, must leave Holland without it, and there are neither lakes, fens, nor marshes by the way, from which it can collect it.

Our author is mistaken in all his views as to the distance to which malaria can be carried from its source and produce disease, else that poison is not the same in Europe and the United States. I repeat what is stated in my dissertation, that the space it travels over land in this country is short; and that over water much shorter. If the doctor will take the trouble to visit and carefully examine the places where he contends that miasm produces fever a "league" or even a "mile" from its source, he will find intermediate repositories of dis-solving vegetable matter from which it arises.

Dr. McCulloch does not appear to have correct views of the general philosophy of the diseases produced by the malaria of the Nile. Plague is incontestibly one of them, although he does not think so. That terror and scourge of the old world, is nothing but a modification of the yellow fever of the new; and neither disease is contagious.* Nor can the miasm of either adhere to

* This opinion the author has maintained since an early period in his medical studies. He asserted it in the year 1801, in an oration delivered before the Philadelphia Medical Society, and published by that body. For aught he then knew, or yet knows to the contrary, he at that time stood alone in the belief, which was pronounced exceedingly wild and visionary. All that he has since learnt respecting it has only served to convince him that it is true. Nor is he now solitary in the opinion. He is supported in it by several distinguished physicians with whom it is honourable to concur. He feels persuaded that time will render the belief universal.

clothes, merchandize, or any other solid substance, and be separated from them again, and still retain its virulence. It cannot, therefore, be conveyed in ships or caravans, from one country to another, and there communicate disease. A belief that bilious malaria can thus attach itself, and still maintain its febrific power, from year to year, constitutes another of the errors of our author. The notion is not sustained by a single fact, and is therefore entitled to no credit.

The opinion that plague and yellow fever are but different forms of the same disease, rests on evidence which must command ultimately universal assent. Some of it is to the following effect. In all leading and essential points the two complaints are precisely alike. They prevail in similar situations, during the same season of the year, and under the same degrees of atmospherical heat. In their rise, progress, decline, and termination they are identical. They spread only in an atmosphere replete with malaria, produced by the dissolution of organic matter. In other words, they are necessarily associated with a want of cleanliness. They attack most readily, and most certainly destroy the same descriptions of persons. When cases of either of them are removed beyond the sphere of a miasmatic atmosphere, they never communicate disease to the attendants of the sick. Palpably, therefore, I repeat, they are not contagious, nor can the poison that produces them subsist from one year to another. It is, in every case, a fresh production of the place and period of its prevalence. There exists between them sundry other points of resemblance, which I forbear to mention.

Shall I be told that these two diseases differ so widely in their fundamental symptoms, that they cannot be the same? That plague is characterized essentially by buboes and carbuncles, and yellow fever by black vomit and a jaundiced skin? I reply that this objection has no weight. Neither are buboes and carbuncles essential to plague, nor a yellowness of the skin or black vomit to yellow fever. In the most malignant and suddenly fatal cases of plague, the former symptoms do not appear, nor do the latter in the worst cases of yellow fever. To every one competently informed on the subject, this fact is familiar. Of the slightest forms of the two complaints the same is true. They are not marked, in the one case, by buboes or carbuncles, nor in the other, by black vomit or a yellow skin. Those symptoms, therefore, are not fundamental. The diseases can exist without them. It is only under certain grades of violence that they are marked by them. Nor is this all. In some cases of plague, a dark discharge from the stomach and a yellowness of the skin have been observed. And that glandular swellings and carbuncular sores exist occasionally in yellow fever, is well known to American physicians conversant with the complaint. In what are *truly* their fundamental symptoms, the two diseases *are* alike. Their *seat* and *pathology* are the same, as appears from accurate *post mortem* inspection. The abdominal viscera constitute the former; and the latter consists in a deep congestion of some of those organs, the result of irritation by the miasm of the complaints. Their symptoms, therefore, really fundamental, are the usual manifestations of great chylopoietic derangement. I mean derangement of the chylopoietic system. Hence I feel justified in asserting, that in every thing essential the diseases are identical.

Dr. McCulloch is inclined to believe, that in ancient times, when Rome contained her millions, and the surrounding country was densely populated, that part of Italy was as sickly as it is at present. This hypothesis is highly improbable, not to pronounce it necessarily unfounded. The existence of a power which governed the world was incompatible with such a state of things. Pes-

tilence alone would have been fatal to it. The crowded population which once covered the Pontine Marshes, the Campagna di Roma, and other portions of the surrounding country, could no more exist there now, than it could in the mangrove swamps of the Congo, or among the lagoons and jungles of the Ganges. The soil of that district of Italy must have been much more thoroughly cultivated in ancient times than it is at present, else it could not have afforded subsistence to its numerous inhabitants. Virgil, moreover, testifies, in his *Georgics*, that in his day Italian agriculture was in high condition: and that was a preventive of the formation of malaria. Compared to its present state, therefore, Italy must have been healthy.

Our author attributes much of the sickliness of modern Italy, and of other maritime and fluvial districts, to the constant augmentation of alluvion along the banks, and at the mouths of rivers and smaller streams. This is certainly at the present time a source of disease; but not necessarily of so much as the doctor ascribes to it. It is doubtful whether it is *necessarily* the source of any. Indolence and neglect are indirectly the cause of the mischief. Let an enlightened cultivation of the soil keep pace with the progress of alluvial deposition, and the evil will be greatly diminished, if not entirely prevented. Land rescued from the water by art differs but little, in many instances, from alluvion. Virtually it does not differ at all. Yet it is well known that by proper means skillfully applied, that can be prevented from producing sickness. Meadows thus formed and managed produce no disease; and even Venice was once a place of health. As mankind advance in knowledge and wisdom, and attain the requisite government of themselves, as individuals and in communities, they will learn to apply to their own benefit the good gifts of nature. The rich alluvion that rivers are daily forming, is one of these. Instead, therefore, of suffering it to depopulate countries by the production of malaria, industry and enterprise will convert it, by suitable modes and degrees of agriculture, into healthful abodes and fertile fields for the accommodation and maintenance of the human race, under their steady increase in number. Even in our own country, the alluvial tracts that were formed centuries ago, and are still covered annually, some of them perpetually, by the waters of the Mississippi, will support hereafter the population of an empire.

As to the apprehension expressed in the "Essay," that Rome will be depopulated and reduced to the desolation of Babylon, by malaria, I consider it unfounded. Or, should it be realized, man will be in fault. I should rather, perhaps say, that the Papal government will be in fault. Let that tyranny be overthrown, or so mitigated that the Italians may feel that they are labouring for themselves, and not for inexorable and rapacious task masters, and their beautiful country will soon put on a new aspect, and rise, in all respects, to a new condition. Her fields will become as fresh and pure in verdure, as her skies are in azure. Her inhabitants will be no longer enervated by sloth and broken in body and spirit by poverty, nor her balmy breezes tainted with poison; and the healthfulness of ancient times will revisit her. The country being thus improved, add to each town and city a wise and energetic police, and the work will be complete. Of every other place where sickness is increasing from the same cause, the same may be said. Agriculture skilfully pursued, and cleanliness strictly maintained, are competent to arrest the mischief and restore health.

Dr. M'Culloch asserts that close, narrow, small, crowded, and of course dirty streets and houses, where the poor reside, are better calculated to resist the progress and prevent the bad effects of malaria, than wide streets, lined with

the large and airy dwellings of the rich. He points to Rome in verification of the fact, and then attempts to assign the cause of it. He seems to think that the febrific poison is, in some way, neutralized in such places. I shall only reply, that things are otherwise in the United States, and that I cannot perceive any correctness or feel any force in our author's reasoning. When any form of bilious disease prevails in the large cities of this country, the poor are the earliest and the principal sufferers; and the narrower and filthier their streets, and the smaller and more crowded their houses, the more certainly are they attacked, and the more formidable are their complaints. To this I have never witnessed an exception; nor do I remember to have read of one, until I opened the "Essay." I know that, at times, some forms of epidemics attack certain classes of the community, in preference to others. But both observation and reading have taught me to believe, that bilious complaints always visit first and most fatally the abodes of poverty.

In Dr. M'Culloch's preventive measures there is nothing new; nor, in prescribing them, does he appear to have been always under the direction of sound physiological principles. Some of them are not only useless but injurious. The doctor recommends the kindling of fires, as a means of *dissipating* or *destroying* malaria, and thus protecting those who would be otherwise exposed to it from its deleterious effects. He alleges that the smoke and heat cooperate in their prophylactic agency.

That fires may be rendered useful cannot be doubted; but not on our author's principle: not by acting on the malaria so much as on the human system. By preserving the proper temperature around the surface of the body they maintain the vigour and secretions of the skin, sustain centrifugal action, which is that of health, and thus enable the powers of life to resist the assault of the miasm. They counteract, moreover, the influence of atmospherical moisture, which might otherwise prove an exciting cause of disease. But they do not, and cannot so dissipate or destroy malaria as to prevent it from coming in contact with those who are around them. Their necessary effect is to create a conflux of air from every point towards themselves. The air, thus flowing from the circumference of the circle to the fire in its centre, and bringing malaria along with it, must inevitably precipitate the poison on those who are in the vicinity of the fire, before it can be materially affected by the heat. On this ground it might even be suspected to do harm rather than good. That they might act on Dr. M'Culloch's principle, the fires should be so arranged as to form the circumference of the circle, and those to be protected from miasm by them occupy the centre. Then, indeed, the enemy might be scorched in the fiery ordeal, before reaching its object. But are matters ever so managed? No, never. Nor does our author so direct them. Fires kindled in the streets, and elsewhere, on an extensive scale, with a view to dissipate or destroy the malaria of the great plague of London, are said to have done mischief. Be this as it may, I have certainly seen fires kindled through the streets of a city, to protect the inhabitants from the poison of yellow fever, and strongly odorous matters consumed in them without doing any good. Indeed to think of purifying, by all the fires that can be kindled and kept burning, the entire atmosphere of a city or tract of country from the malaria constantly pouring into it from innumerable sources, is visionary. The cause is too limited and feeble for the effect contemplated. When those who are exposed to bilious miasm, therefore, so employ fires as to keep their persons comfortable, and their dwellings, especially their bed-chambers, dry, they have nothing further to expect from them. As respects certain other protecting agents, the doctor expresses himself as follows.

"The other class of preventive remedies comprises modes of exciting the animal powers by food, spirituous liquors, and so on, or of diminishing the sensibility by narcoties, such as tobacco and opium. Of the utility of these expedients, the experience is ample."

If by "exciting the animal powers by food," our author means maintaining health in perfect vigour and firmness, by aliment found by experience to be salutary, I concur with him; not otherwise. All excitement beyond this, whether by food, condiments, or drink, tends to exhaust and debilitate the "animal powers," and is pernicious. In other words, it weakens the conservative energies of the system, in common with every sort of excess. Of "spirituous liquors" as a means of prevention, I have expressed my opinion in my dissertation, and am not inclined to retract or alter it. In the *abstract* they are injurious. Other things being alike, persons who have never used them are more likely to escape bilious fever than those who have; and should they be attacked by it, their suffering will be lighter, and their recovery more probable. But, as I have elsewhere stated, it is hazardous for those who have been long accustomed to the moderate use of spirituous drinks to abandon them suddenly, because they are exposed to bilious malaria. To take them in larger quantities as a prophylactic measure, is worse. Health is best secured by making no change. Of wine the same is true. Abstractedly considered, its use is no means of safety. To wash the skin with it and distilled liquors, would be much more beneficial than to drink them. Officers are more healthy than privates, not because, as our author alleges, they *drink more wine*, but because they are more regular in their general habits, and also less exposed. They are, likewise, more cleanly, and more suitably clothed. In plain language, they take better care of themselves, know better how to do it, and are better provided for the purpose. Those, however, who have been accustomed to the temperate use of wine, and have enjoyed good health under it, ought not to relinquish it on account of the occurrence of a bilious epidemic. As to "tobacco and opium," I do not believe that they ever acted as a safeguard against bilious malaria in a single instance, or that they ever will. In that respect, neither science nor experience attests their usefulness. Opium-eaters are said to be as liable to plague as other persons; and as respects yellow fever, I know this to be the case with the votaries of tobacco. They suffer from that complaint no less certainly than the rest of the community. Nor does the Frenchman's snuff, or the offensive smoke of the Hollander's pipe, protect either of them from the bilious diseases of his country. Confidence in such nostrums is discreditably to physicians, and injurious to those who rely on them for safety. Of the practice of applying a handkerchief or the corner of a cloak to the mouth and nose, and covering the head by a veil or *canopeum* of gauze, as a means of protection in a malarious atmosphere, our author speaks *doubtfully*, but is evidently inclined to consider it useful. Here, again, I am compelled to differ from him, and to pronounce such expedients no better than quackery. They are to be classed with the employment for the same purpose, of volatile salts, the "commander's balsam," the "vinegar of four thieves," bags of camphor and saffron tied to the scrobiculus cordis, coughing and spitting while in sick rooms, and washing the hands, face, and mouth immediately on coming out of them, with all other charms and amulets which superstition confides in, reason laughs at, and experience rejects. I have seen them all tried to no purpose; individuals without them escaping as well as those employing them; perhaps better. *Timidity* is the usual accompaniment of their adoption—possibly it is in no small degree the cause—and that, by debilitating the system, invites disease. Next to a re-

moval beyond the reach of malaria, fearlessness, temperance, regularity, and prudence are the best safe-guards.

For a practical man, Dr. McCulloch has too strong a predilection for things bordering on the marvellous. I mean that he speculates too much on certain future and very remote and doubtful contingencies, (not to apply to them a less respectful term,) which the human mind can scarcely grasp. One of these is the reduction of the surface of the earth to a level, by the disintegration of all mountains and hills, and their being washed by rains and dissolving snows into the seas, valleys and low-lands generally! When this event shall have occurred, the amount of alluvion is to be terrific, that of malaria in proportion, and the prevalence of sickness in proportion to each. In direct terms, man and all other animals inhabiting mountains, hills, and plains, are to be extinct; the earth to be a huge quagmire, and peopled only by crocodiles, alligators, frogs, and turtles, and such other foul and misshaped beings as subsist in water and delight in mud!!

Another of these wonderful doings is to be the draining of Lake Erie, and, of course, in time, of all the other lakes connected with it, by the travelling of the Falls of Niagara up stream, cutting a channel for themselves through all obstructing matter, until they shall have reached the extreme point of the Lake of the Woods, or whatever other lake of the entire chain is most remote!! Then there is to be terrible havoc on our northwest borders, by the malaria issuing from the basins of the lakes, thus deserted by their waters, and converted into sinks of festering alluvion! Compared to this new manufactory of poison, the marshes of Italy, France, and Holland will be but so many MontPELLIERS! Lake Superior alone will exceed them all in magnitude and mischief, as far as the *Palaiotherium incognitum*, whose bones have been recently discovered, surpassed in size the elk or the buffalo which he swallowed at a mouthful! How far this atmosphere of lake-poison is to be carried by the wind, our author has not informed us. But, according to some of his other computations, the distance must be prodigious: in one direction at least to the Gulf of Mexico; in another to the Rocky Mountains; in a third to Hudson's Bay, if not to the North Pole; and in a fourth, to England, Russia, "or the Lord knows where!" Nor has he told us whether the levelling of the earth, or the draining of the lakes is to occur first; or whether they are to be contemporary events. Respecting the precise epoch of the catastrophies, whether before or after the millennium, he has left us equally in the dark. He has not even given us to understand, which could perform its journey in the shortest time, a sloth to the moon, the mountains to the sea, or the Falls of Niagara to the furthest end of the Lake of the Woods! Nor has he favoured us with his opinion, whether, by the time of these wonderful occurrences, man may not, to be prepared to meet them, have made such wonderful advances in knowledge as to be able, by some preparation of "tobacco or opium," to render himself poison-proof! On all these momentous topics he has left us to the indulgence of our dreams and fancies, because perhaps he has the charity to consider them as good as his own.

Seriously, such speculations in such a book as the "Essay" by Dr. McCulloch, are grievously out of place.* They tend to give a temporary reality to visions

* It is not unknown to me, that, in the opinion of many, there is a seeming probability in the speculations of our author, respecting the washing down of mountains and hills, and the draining of Lake Erie by the Falls of Niagara. From the highlands, say those individuals, a certain amount of matter is daily conveyed, by currents of water, into the low. Hence, in the lapse of time, including perhaps many myriads of centuries, the former must be reduced to a level with the latter. Again,

of the kind, and thus to divert the attention of readers from substance to shadow. Should a second edition of the work be called for, as I doubt not will be the case, they ought to be withheld from it, in common with several other like disquisitions, in which the author has indulged himself. They resemble too much the empty notions of Captain Basil Hall, about the filling up of the basin of the Gulf of Mexico, and its conversion into dry land, by the alluvial depositions from the waters of the Mississippi. In the pages of a publication treating of grave and important matters, they are as incongruous as a pun in a funeral sermon.

Am I asked what there is in Dr. M'Culloch's "Essay," worthy of praise, seeing I have found so much in it to censure? I answer that there is an abundance in it to be praised; much more than I have either space or leisure to specify. Let the reader examine it for himself, and he will not only find this true, but will be amply rewarded for the time spent and the trouble incurred in performing the task. Added to the many important truths which the work itself contains, it will do much good by inducing physicians to bestow more attention on the subject of malaria than they have heretofore done. On the same ground, the present project of the Medical and Surgical Faculty of Maryland will be eminently useful. It will do much towards procuring for the poison in question a thorough investigation. Were the legislatures of the several states to institute inquiries respecting the malaria of bilious fever in all its relations, and invite physicians to communicate the result of their observations in reply, the issue would be in time an invaluable accumulation of knowledge on a matter of infinite moment to the public welfare, accompanied by an amelioration of the condition of our country which no human foresight can compute. Nor would the benefit of the measure be limited to our own country; the civilized world would partake of it.

To conclude; although the perusal of Dr. M'Culloch's work has both gratified and instructed me, it has not induced me to alter a single view, or surrender a single principle previously laid down in the body of my dissertation. On the contrary, by the able support it has given to many of them, it has strengthened my confidence in their correctness, and rendered my adherence to them the more firm. In its original condition and dress, therefore, that production and its appendix are respectfully submitted to the judgment of the Faculty.

say our calculators, the Falls of Niagara have already travelled up stream eight or nine miles, and are now every moment washing particles from the edge and front of the precipice, over which the water tumbles. Within a period of time, therefore, short of infinite duration, they must arrive at the mouth of Lake Erie, make a breach in its bank, and liberate its waters. All this, while viewed as a mere abstraction, looks well enough. So does the enigma of the infinite divisibility of matter. But let an attempt be made to regard either proposition, as a practical truth, and it becomes an absurdity—certainly it turns to a thing incomprehensible. The calculator who endeavours to fathom it is immediately lost in the abyss of infinitesimals. Besides, admit the infinite divisibility of matter or space, according to the common interpretation of the term, and it may be contended with great plausibility, if not reduced to a demonstrated truth, that the moon may be compressed into a lady's tumbler, and that the sun is no farther from the earth than Washington is from Baltimore. But this is mere badinage. For boys to amuse themselves and sharpen their wits by attempting the solution of philosophical conundrums may be allowable; but when men are writing books to instruct the world on sober and important subjects, it is unbecoming in them to concern with toys or puzzles.

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