

ART. II.—*On the Predisposing Causes of Epidemic Diseases.*

By A. P. MERRILL, M. D., of New York.

IN view of the prevalence of epidemic diseases, and especially of the present prevalence of cholera, the most general and fatal of modern epidemics, it is important to consider what are some of the more prominent of the predisposing, as contradistinguished from the proper exciting, causes of this class of diseases. These causes are too numerous and varied to be named in detail; but if only a few prominent considerations in regard to them can be duly presented, it may lead to some abatement in the ravages of disease.

As far as practicable the proper distinction should, of course, be made between predisposing and exciting causes, which are often strangely confounded, and sometimes spoken of interchangeably. The former may be held to embrace all those deleterious influences which, by disturbing the normal functions of the body, render it more susceptible than in a state of health to the action of the latter. In the fullest manifestation of these bodily functions, with the usual concomitant of mental health and vigour, man is often enabled to resist the influence of exciting causes of disease so as to escape a prevailing epidemic entirely; or, having suffered an attack, he may be able to overcome the peculiar disturbance of normal function caused by the disease, without the agency of medical treatment. But anything which disturbs these normal functions, whether to the extent requiring remedial measures or not, must be considered a predisposing cause of epidemic disease.

Exciting causes, on the contrary, must be regarded as specific influences, the tendency of which is, under all circumstances, to produce specific results. Thus, the exciting cause of cholera, whatever may be its character and origin, is capable of producing no other disease than cholera, and the same is true of smallpox and all other specific diseases. Each must have its specific cause. Periodic fever, which prevails so extensively throughout the world, is doubtless due to the action of a specific cause, without which the disease cannot exist; but the different varieties of this disease as indicated by the nosology in common use, and dependent mainly upon the particular organs and tissues especially disordered, must be produced by the co-operation of some additional agency, which determines whether the fever at any particular time and place shall assume the epidemic form of a gastric, enteric, hepatic, or pneumonic disease. But whatever may be the type and form, it can scarcely be doubted that those persons are most liable to suffer, who have been living under the influence of certain predisposing causes, such as I shall have occasion to refer to in the course of this essay. While exciting causes are known only by their effects, and we have no means of controlling them, the origin and progress of predisposing causes

are mostly discoverable, and may be prevented or avoided. We must therefore look to the power we have over this class of causes as our principal hope and dependence, in guarding ourselves against the prevalence and fatality of epidemic diseases.

Nothing is more common than to attribute the invasion of an epidemic disease to certain agencies as exciting causes, in the shape of decomposition, giving rise to mephitic effluvia and to every variety of offensive exhalation; but although these may of themselves sometimes excite diseased action in the human system, there are many good reasons for believing that such deleterious influences only prepare or predispose those who are exposed to them, to the operation of the specific and exciting cause of any particular epidemic, the source and character of which cause are alike unknown. It is not less true than fortunate, that it seldom happens that more than one kind of epidemic cause prevails largely at one and the same time and place, the tendency of which is to produce a specific disease, but other diseases, and especially those of a febrile character, will always exhibit more or less of the characteristics of the prevailing epidemic. If the epidemic be yellow fever, persons suffering with smallpox will die of black vomit. If cholera, cases of fever will certainly present symptoms of that disease, and become exhausted by scrous evacuations and cramps.

The predisposing causes of epidemic diseases are to be distinguished from the exciting causes by the fact that they operate upon the organism, not to produce a specific disease, but to impair its normal condition, so as to render it less capable of resisting the influence of the true epidemic and exciting cause. No amount of such predisposition caused by unwholesome influences can be supposed capable of originating a specific epidemic disease without the co-operation of the specific cause of such disease. Whenever it is said, therefore, that in certain localities causes of disease exist which may produce cholera, yellow fever, &c., it must be understood that one or another of these diseases may appear and become epidemic in such place, by reason of the prevalence of its exciting cause among a people thus predisposed. To contend that such unwholesome condition may operate as a specific cause of such epidemic, would imply a necessary connection between the reputed causes of disease and the prevailing epidemic, and require us to expect that such epidemic, or several kinds of epidemics, must appear wherever such defective sanitary police is found.

The defective police of cities is sometimes supposed to give rise to the exciting cause of cholera, but in portions of London and Paris such defective police existed to a great extent for centuries, and no doubt favoured the spread of epidemic diseases in those cities more or less every year, without ever producing a single case of cholera, which disease made its appearance only when the proper exciting cause reached those localities from the distant east. Rio Janeiro escaped yellow fever until a recent period, and the disease has not yet made its appearance in Canton, Calcutta,

Constantinople, and many other large eastern cities, notwithstanding, the defective sanitary police of those localities, and the favouring influences of climate. Hence, I infer that these are only predisposing causes of epidemic diseases, and that no specific disease becomes epidemic until the proper exciting cause of such disease appears to co-operate with them. Quite a different example is found in the little city of Natchez, among whose inhabitants squalid poverty found no place, whose streets had never known a beggar, and whose sanitary police was unexceptionable. This gem of a city, situated upon a lofty bluff overlooking the Mississippi River, and enjoying the refreshing breezes daily moving inland from the broad bosom of the Gulf, became subject to frequent visitations of yellow fever, and suffered great mortality whenever the specific cause of that disease extended northward from the West India Islands and entered within the boundaries of the United States. It was not, however, until 1817 that the disease first visited Natchez, when a powerful predisposing cause had been created by an extensive grading of the streets, but here, as elsewhere, the epidemic having once made a lodgment, it continues to occur epidemically and sporadically.

The origin of the cholera pestilence has often been attributed to mephitic exhalations from decaying materials floating upon the river Ganges, and also to certain filthy habits and customs of the Mohammedan pilgrims; but the sacred river of India had borne its millions of dead bodies to the sea, and the pilgrims to the holy shrine at Mecca had practised their revolting superstitions for ages before epidemic cholera was known either in India or Arabia. The decay of human carcasses in the one case, and of animal sacrifices in the other, together with all the conditions which are calculated to impair healthful vigour of body, acted all the while as they do now as predisposing causes of epidemic diseases, but without the concurrent agency of the specific and exciting cause of cholera that disease could not exist and did not. When it made its first appearance in India, and assumed in that country all the characteristics of an epidemic, there must have been good reason to expect that it would extend its ravages to Europe; but it took many years to do this, and while there were no signs of its approach the inhabitants of the worst portions of Paris and London were as secure from its attacks as ever before, notwithstanding the existence of all the reputed causes growing out of a defective sanitary police. And the inhabitants of these and other cities are secure still, excepting only that occasional sporadic cases may occur where the disease has before appeared, unless the specific cause of cholera should happen to reach them in its progress round the world as an epidemic, and then its extent and intensity may depend much upon the existence of predisposing causes, such as operate upon the system to prepare it for attacks of other epidemic diseases as well as this.

These predisposing causes may be arranged under the following heads, having reference to their character and origin; namely, *telluric*, *meteo-*

*logic*, such as appertain to *domiciliation*, to *hereditary taints*, to *dietetic influences*, and to *vicious habits of life*; and these I propose to consider in their order.

*Telluric* influences of an unwholesome character, in the existence of which there is such general belief, have hitherto escaped detection by chemical analysis and by every kind of philosophical inquiry; unless, indeed, it prove true that they are due to the existence of spores from some of the forms of fungous growths, which are said to abound in sickly districts. It is known from long observation that certain forms of disease prevail most in the vicinity of natural marshes, especially when, after having been for a time saturated with water, they have become quite dry. And I am well convinced that these deleterious effects of drying soils are not confined to natural marshes, existing extensively in country localities, but are produced also, and sometimes in greater intensity, by quasi-marshes in cities, artificially created by grading the streets and filling up low grounds, without proper attention to drainage. There appears to be no room for doubt that there are deleterious influences in connection with such localities, whatever may be their character, which operate as causes of various forms of periodic disease, and as predisponents of epidemic diseases.

There is abundant proof of this in New York alone, but the smaller cities of Natchez and Memphis, during my residence in those places, afforded striking illustrations of this doctrine. Yellow fever, cholera, measles, scarlatina, hooping-cough, diarrhoea, dysentery, and other diseases becoming epidemic on different occasions, always prevailed earliest and in their gravest forms in those localities where large deposits of earth had been made, without proper attention to drainage. And it has seemed to make little difference in the result, whether such deposits consisted wholly of fresh-dug earth, or a mixture of common city refuse, and the decomposing materials which abound in what is carted away from the habitations of man, as at once offensive to the senses and injurious to health. In all cities these health-destroying influences prevail more or less; and similar effects are often observed in connection with the cellars of dwellings both in city and country localities, which are a portion of the year kept wet by the oozing of surface water from the ground. In their drying state in summer and autumn, these cellars are as insalubrious as the marshy districts in the open air, affording evidence of the incorrectness of the prevailing opinion, that paludal influences as causes of fever are dependent upon the rays of the sun, excepting only as they facilitate the drying process by the power of solar heat. Sunlight, under all circumstances, appears to be a powerful conservator of health, and the want of it may justly be considered an effective predisponent of disease.

Dry and sandy soils, also, into which the rains readily disappear by absorption, low and barren clay-soils and rocky and precipitous districts, from the surface of which water runs quickly away, the embankments of

canals and railroads, and the beds of inconstant streams, all exercise more or less in dry and hot weather the same deleterious effects as drying marshes, dependent probably upon the fact of their being destitute of vegetable covering. Nowhere else on earth has yellow fever been represented as more malignant in its character than I saw it at the Bay of St. Louis, Mississippi, in 1820, and at Pensacola and other parts of West Florida, in 1822, both being situated on dry, sandy, and barren soils, and the seasons of those epidemic visitations being unusually hot and dry. The epidemic prevalence of the same disease at Natchez and Memphis, as well as the sporadic cases which have occurred upon the lines of certain southern railroads, also afford abundant illustrations of the truth of this theory of morbid causes arising from dry and naked soils. The introduction into the south of that remarkable production, the Bermuda grass, has done much to remedy this state of things, and to improve the public health. Bare soils have not only been covered over, but bayous and gullies have been filled up, and these, together with railroad embankments and levees, have been coated over with a dense sward of vegetable life. The morbid influence of bare and barren localities cannot be due to vegetable decomposition, for vegetation is deficient in quantity, and the want of moisture is unfavourable to fermentation; nor is it dependent upon the previous condition of standing water, as in the case of natural marshes, nor upon the heat and light of the sun, for these are wanting in cellars, but only, so far as is yet known, upon the absence of healthful vegetation, and possibly, the consequent production of certain morbid growths which disorder the normal functions of the body. Periodic diseases are endemic in all such localities, and the cause producing these, whatever it may be, appears to be a predisposing cause of various kinds of epidemic disease. Smallpox, measles, and hooping-cough, which are contagious diseases, and yellow fever, cholera, diphtheria, &c., not contagious, all prevail as epidemics most actively and severely in localities of this kind.

From the earliest period of medical history, these telluric influences have been supposed to exercise their baneful effects upon the health of mankind in all parts of the world, and without its ever having been discovered why it is that, independent of human agency, one locality is more or less healthful than another. No certain clue to the nature and origin of the cause has been discovered, and we only know now what was known and taught by Hippocrates, that marshy districts in their drying state are prolific of fever, and favourable to the spread of epidemic diseases. It may be true and susceptible of proof, that the morbid agencies are due to certain forms of vegetable growth, or to some variety of animalcular life, and that prevention is practicable. Such suggestions have often been made, but we are as yet without any certain knowledge upon the subject, and his will be a high honour who discovers the cause and the remedy.

*Meteorologic influences* have also, in all ages and countries, been con-

sidered prolific agencies of disease. During the prevalence of epidemics of every kind, whether contagious or non-contagious, we hear much of atmospheric influences and infected air, as affording both predisposing and exciting causes of the disease; and a distinguished medical authority long ago attributed these visitations to an epidemic constitution of the atmosphere, without venturing to suggest in what it consists. The common belief among men everywhere has always been, that maladies prevailing epidemically, whatever their character and severity, are justly attributable to noxious aerial agents inhaled into the lungs. But the science of chemistry, in all its boasted perfectability, has not been able to determine in what these morbid causes consist. Experts with the improved microscope have been equally at fault, and epidemic diseases of every variety have spread over large portions of the earth, devastating cities, villages, and country localities, without being attended in any case by any certain evidence that the chemical composition of the atmosphere is at all changed from the normal standard, or that it is charged with substances to produce such results. On the contrary, it has often been remarked that, so far as can be determined, either by the senses or by chemical analysis, the air, while the most fatal epidemics are prevailing, appears to be of unexceptionable purity.

This appears the more remarkable since the proper constituents of atmospheric air are well ascertained and established; and since so great a uniformity is known to be maintained amid all the mutations incident to chemical decomposition and the exhalations and absorptions of animal and vegetable life. It is, indeed, among the wonders of nature that so great a uniformity is maintained, and the diffusion of the heavier and lighter portions provided for by an unerring and invariable law. Still, the researches of geologists afford reasons for believing that before the creation of the higher orders of animal life, the constituent proportions were somewhat different, and such as would not now answer the purposes of man; showing a providential arrangement for the preservation of life and health. The course of nature in regard to this matter is paramount, and all observation shows that, except in confined localities where the law of diffusion is partially checked, no considerable change in the atmospheric constitution can be effected by artificial means. The closest analysis results in determining the relative proportions of oxygen, nitrogen, and carbonic acid to be maintained everywhere, whether epidemic diseases are prevalent or not. And when epidemics do prevail, it cannot be ascertained that new gases or vapors are infused into the atmospheric mass, to account for the change.

In confined localities, where the law of diffusion cannot have free scope, the proper proportions of atmospheric ingredients may indeed be seriously disturbed; but it has been sufficiently proved that such condition does not always act as a predisposing cause of epidemic disease, and it has even been supposed that these deteriorations in the air respired have served to protect the human constitution from the effects of certain morbid influences.

In 1819 I visited the city prison in New Orleans, and found it closely packed with men whose bodies, nearly naked, were reeking with sweat. There was little chance of ventilation through the small and grated openings, and it was with difficulty that any one could enter it from the open air. The odour was repulsive and sickening, and it cannot be doubted that the atmosphere was deprived of its proper proportion of oxygen. The prisoners presented the appearance of great prostration of vital energy, and some of them sickened and died from the effects of the confinement; but not one had the yellow fever, although the disease was prevailing in the city as an epidemic; and the same is reported in regard to other epidemics of that disease since that time, the city prison being the only place of exemption. Men die in such confinement of suffocation, as in the Black Hole of Calcutta; but they do not contract yellow fever or cholera from epidemic influence as readily as in the open air.

But the atmosphere, although itself unchanged and innocuous, may become, it is supposed, the vehicle by which the invisible spores of fungi or microscopic animalcula are conveyed into the human system as they happen to be wafted to and fro by the winds, each variety of spore or animalcule tending to produce, in proportion to its abundance, a specific form of disease, which in this way becomes epidemic. This hypothesis is not without plausibility, but no certain proof of its truth has yet been presented. The cell theory of physiologists, which accounts for every variety of living structure and much of functional movement by the formation, subdivision, and multiplication of cells, seems to afford a better basis for a theory of causation. Every epidemic disease may be supposed to have its own peculiar cell-cause, operating upon the system specifically to produce its peculiar train of symptoms; and to an extent commensurate with the influences favourable to the reproduction of cells, and the predisposition of bodies acted upon. In contagious diseases these morbid cells may be supposed to emanate from the bodies of the sick; and in diseases not contagious to originate elsewhere. But in both cases alike to be conveyed by currents of air, by ships and animals, by travel and commerce; a single cell, under influences favourable to its growth and propagation, being sufficient to produce its proper disease, under these favourable conditions, in proper time.

This cell theory affords us a better opportunity than either the animalcular or sporule theory for explaining certain anomalies in etiology which present many difficulties; such as the escape from disease of persons crowded into badly ventilated prisons and tenements, and those exposed to certain mephitic exhalations, commonly considered exciting causes of epidemic disease. Certain sections of large cities, streets, wharves, sewers, and cesspools, and various kinds of manufacturing establishments, are productive of mephitic gases more or less offensive to the senses, giving abundant occasion for complaint; but it is far from being true that such localities

are *always* more subject than others to attacks of epidemic diseases. On the contrary, it often happens that an epidemic bears lightly upon those who are thus exposed, while other portions of the same city, more highly favoured in their sanitary police, suffer from the prevalence of the most fatal grade of the disease. It is not to be inferred from all this that such mephitic exhalations are harmless of evil to the human constitution, or that they are not predisposing causes of disease in general, but only that they are unfavourable to the action of the present specific and exciting cause—antagonistic, it may be, to the development and multiplication of the one particular cell-cause then prevailing. Every cell wafted within the scope of such influence may perish for want of its proper pabulum, even under the operation of predisposing causes giving rise to much suffering and mortality.

Electricity and magnetism, temperature, moisture, and atmospheric pressure may, in their varying conditions, become predisposing causes of certain epidemic diseases; but there seems to be no good reasons for believing that any of these, either in their excess or deficiency, are exciting causes, and therefore essential to the prevalence of any particular epidemic. The yellow fever has by some been considered an exception, and it cannot be doubted that heat of climate is favourable to its extension and fatality, inasmuch as the disease prevails as an epidemic only in hot seasons and countries; but it is not essential to its existence, for sporadic cases occur in localities wherever the disease has once been epidemic, both in the hot and cold season, and it is often more severe in the latter than the former. Heat of climate, therefore, although favourable to the prevalence of an epidemic of yellow fever, cannot be considered essential to the existence of the disease.

There must be a specific exciting cause of every epidemic disease, without which the disease does not exist; but, whatever may be the character of this cause, there seems to be a necessity, in the present state of etiological knowledge, for much reliance on predisposing causes, or for dependence upon a mysterious agency sometimes denominated, for want of a better term, *epidemic influence*, or else there would not be times and seasons of pestilence, and other times and seasons of exemption. There must be a dynamic power exercised over the germ of the disease, in whatever shape or form it may be, and upon the existence of which its activity depends. The specific cause of cholera, for instance, must owe its origin, increase, and expansion to some favouring condition without which it would not have been produced, or, being produced, it would have lain dormant forever. As the army-worm which eats away the grass and corn, the cotton-worm which devours the foliage of the cotton-plant alone, and the grasshopper and locust which feed upon vegetation almost indiscriminately, only flourish at certain times and seasons when the conditions necessary to their increase happen to exist, so may these reputed causes of epidemic diseases be dependent upon certain conditions peculiarly favourable to each of them,



and without which they can appear only to a very limited extent, producing at most only a few sporadic cases of disease, however active may be the predisposing causes which invite attack.

The fact, now so well established, that influenza, cholera, and yellow fever, when prevailing epidemically, often attack the crews and passengers of ships at sea, and which could not have derived the disease from any place where it was then prevailing, would seem to justify the conclusion that some meteorologic influence must prevail in mid-ocean, and pass from continent to continent without human agency. But of this nothing is known except the results, and there may be equal propriety in attributing the disease to either animalcules, sporules, or morbid cells, and perhaps also to magnetic agency, but it cannot well be assigned in this case to decomposition or telluric exhalations. In the holds of ships at sea, and especially in long voyages, and in the modes of life among mariners and emigrants, there may be abundant sources of predisposing causes, laying the subjects exposed to them more or less liable to the action of the epidemic or exciting cause; but it cannot be supposed that the disease is in any such case the effect of the former, without the proper and specific agency of the latter. Personal contagion in these cases is quite out of the question; and the communication of the disease by means of exhalations from the dejections of those affected by the cholera, is equally improbable.

*Domiciliation.*—Although the idea commonly connected with the word epidemic is what its etymology implies, that it refers to a disease visited upon the people at large, it often happens that particular habitations suffer more than others similarly located, and sometimes that the disease confines its ravages to a single domicile. If it be a contagious disease, it will, of course, be communicated to unprotected persons who are exposed to it, and thus be conveyed to other domiciles; but it will still fail to present all the characteristics of an epidemic, except in the household where it appeared and has principally prevailed. Smallpox, measles, scarlatina, and hooping-cough occur in this way; more commonly cholera and yellow fever, and especially diphtheria, which frequently attacks every member of a family where it originates, without extending to any other in the same neighbourhood.

I have known both yellow fever and cholera to be thus circumscribed. In 1854 the cholera was confined to a single block in Memphis, and not communicated beyond, excepting only to a few individuals who had slept within the infected block, or sphere of epidemic influence. It has been a common event in the South for epidemic diseases prevailing among negroes to be confined to a single plantation, and sometimes even to a single negro cabin. Cholera, yellow fever, pneumonia, dysentery, diphtheria, and other diseases have been thus limited within given bounds; and I have been in professional attendance upon a plantation of more than one hundred souls, one-tenth of whom were white persons, not one of whom escaped an attack

of yellow fever within the space of thirty days. From the octogenarian to the new-born babe, all had the disease, and every fatal case terminated in black vomit. So virulent was the epidemic influence in this case, that several persons who had volunteered their services in nursing the sick died of the disease, and in no instance did any one escape who had slept a single night on the premises. Other plantations in the neighbourhood—those within half a mile—escaped the disease entirely, although there was frequent intercourse between them. No case of yellow fever had ever occurred at this place previously, but since that time it has been frequently visited by the disease, sporadically.

It can scarcely be doubted that these limited epidemics, of which little notice has been taken by authors, are due to the same causes which produce more extended ravages of disease. It is from such beginnings, indeed, that the same diseases, under other and more favourable conditions, expand over large portions of the earth. Could we trace the great epidemics to their origin, we should probably find their starting-point to be some obscure domicile, whence they expand in certain directions according to favouring circumstances, and become fatal in proportion to the activity of the exciting cause and the predisposition prevailing among the people. Admitting the truth of the cell theory as applied to epidemic etiology, we may presume that any agency which can give rise to a single morbid cell may, if continued, cause an unlimited multiplication of its cell-kind, and thus account for the prevalence and expansion of the particular disease which is its specific effect upon the human organism, those individuals and communities suffering most severely which are under the influence of the strongest predisposing causes.

In the investigation of predisposing causes, in both cold and hot climates, during the prevalence of epidemic diseases, I have observed that the decomposition of vegetable and animal substances sometimes abounds and sometimes not. The same inconstancy exists in reference to all sorts of filth, crowded tenements, and defective ventilation. Infirmity and predisposition to disease exist, and epidemics prevail, both with and without these conditions, leaving it at least doubtful as to their uniform agency in facilitating the spread of all epidemic diseases. But, so far as my information extends, drying soils which have been long saturated with water, and especially those which are deficient in living vegetable covering, never fail to act as predisposing causes of epidemic diseases, whether in-doors or out. Cellars partly filled with water, like ponds and pools in the open air, are quite harmless of these effects while the water remains in them; but when it is drawn off, or subsides by evaporation and absorption, and while the earth is undergoing the drying process, then it is that the predisponent influence is the most powerful, and disease most likely to occur.

Cities have most to fear from this condition of cellars, while in country localities the out-door influences of drying soils are most likely to abound;

and nothing is more certain than that both endemic and epidemic diseases prevail most where these conditions exist. No doubt they give rise to specific and exciting causes of certain forms of disease characterized by periodicity; and when we observe that all epidemic diseases give preference to such localities, it is fair to presume that the human system is predisposed by them to be acted upon by the specific cause of any epidemic which may at any time prevail, whether it come in the form of electricity, animalcules, sporules, morbid cells, or other agency not yet suggested. While we are aware of these uniform coincidences, it would be unreasonable to ignore the fact of evil influences merely because we are unable to understand the mode of their operation.

To guard against these limited epidemics connected with domiciliation, the same rules should be observed as in cases of the more general prevalence of the same diseases. For obvious reasons, the preventive measures required are the same as in regard to larger fields of operation. Stagnant water resting upon surfaces which are afterwards to become dry, and especially cellars alternately wet and dry, are to be remedied by thorough drainage, and every such out-door surface is to be covered, when practicable, with growing vegetation. These, according to my observations, are essential measures of prevention, and should not be considered of secondary importance to the avoidance of confined air and the products of fermentation.

It is worthy of remark, in this connection, that long observation justifies the belief in the greater prevalence of epidemic influences near the surface of the ground. Other things being equal, those who sleep in cellars and upon the lower floors are more liable to attacks of the disease in its graver forms than such as have their sleeping apartments in the more elevated rooms of the house. This may be considered a reason not only for going to the upper stories to sleep, but also for the construction of elevated dormitories. It may be found safer during the prevalence of epidemic diseases to mount upward for the enjoyment of nightly repose, than to travel any distance without such elevation.

But in regard to individual security, no preventive measure is more to be regarded than that of a removal from the infected dwelling as soon as the presence of the disease becomes well ascertained. This, indeed, is the only course which insures positive safety. There may be benefit in liming, fumigating, ventilating, scrubbing, whitewashing, painting, and a general cleaning and renovating of the premises, but in a large majority of cases it is evident that these measures fail to afford protection to those exposed to the epidemic ravages, and the disease runs its usual course, as if nothing had been done to arrest its progress. Whatever may have been their efficacy as preventives, of which we cannot well judge, it has never been known that an epidemic was arrested in its course by any such preventive measures. When a fatal epidemic once invades a domicile, there can be no hope of removing it by any means yet discovered; and the same is true,

also, of cities and larger districts of country. While the disease does not appear, there may be hope of escaping it; but when it invades a community, large or small, it will certainly continue to prevail for the usual period of its visitations, in spite of all efforts to dislodge it. Not only so, but the particular domicile, city, or larger area of its prevalence will thereafter be subject to returns of the same disease while it continues to afflict mankind. Hence the occasional occurrence of sporadic cases in all such localities; and hence, too, the common fact of the first appearance of subsequent visitations of the same epidemic disease just where it originally occurred; showing either that predisposing causes are more rife there than elsewhere, or that the exciting cause has never been wholly removed.

*Hereditary and Constitutional Taints.*—Certain temperaments and diatheses are supposed to be transmissible from one generation to another, as well as certain hereditary diseases, such as scrofula and cancer; and the same is true, doubtless, of idiosyncrasies, and predispositions to contagious and epidemic diseases. In these latter cases there is, probably, a hereditary deficiency in cerebral and nervous energy, which is as much a predisposing cause of disease, as the same condition when produced by external agencies, such as we have been considering. The scrofulous, scorbutic, and certain nervous diatheses, with concurring temperaments, which have become hereditary in certain families, undoubtedly have their influence in predisposing the system to the action of the exciting causes of epidemic diseases, explaining the otherwise unaccountable fact, that under the same exposure some who are apparently in perfect health suffer earlier and more violent attacks than others, and that certain whole families suffer greater fatality than others, under the same circumstances.

There may be, in these cases, little or no perceptible sign of existing defects, and yet the predisposition may be found somewhat strong. In fact there are certain idiosyncrasies of constitution which are only developed to our observation when the subject actually suffers from attacks of disease to which they are predisposing causes, just as certain constitutions display an unusual susceptibility to the action of particular medicines, which can be known only by actual experiment. So long as the exciting causes, to the operation of which they are particularly susceptible, do not reach them, whether it be in the shape of epidemic influence, or articles of medicine taken into the system for particular purposes, their peculiar predisposition to be acted upon by them is not discovered, and cannot be known to exist. And this is probably the true explanation of the curious fact, that some individuals and families are so strongly predisposed to certain diseases which are supposed to be capable of affecting the system but once, as to be very perceptibly influenced by their exciting or epidemic causes whenever they happen to be exposed to them, even although they may have gained all the immunity afforded by a severer attack of the disease.

I have often known individuals to be so constitutionally predisposed to

the exciting cause of yellow fever, measles, cholera, &c., that they always experienced decided symptoms of these diseases when prevailing epidemically. In regard to yellow fever, such is my own case. Having suffered a severe attack of the disease in early life, I might have expected the usual exemption from it subsequently, but upon every occasion of exposure to the epidemic influence in numerous instances since, I have never failed to contract the disease in a less violent form; and I have noticed the same thing in other persons. There are persons who are equally susceptible to the epidemic influence of other diseases, experiencing upon every exposure more or less of the distinctive symptoms of the disease. Probably it is more common with cholera than with other epidemic diseases, that persons experience more or less of its characteristic symptoms from every exposure to the epidemic influence, their predisposition subjecting them, indeed, to repeated attacks in the same epidemic visitation; and such persons are liable to suffer from the distinctive symptoms of the disease while residing where cholera has once prevailed as an epidemic, upon every attack of indigestion and diarrhœa, thus giving evidence that some portion of the epidemic cause remains after the epidemic itself has disappeared.

I am not sure there is any remedy for such constitutional and hereditary predisposition to certain diseases, excepting, perhaps, the general one of invigorating regimen with a view to elevate the standard of health. But there is some degree of security against fatal effects in a knowledge of the existence of such predisposition, that timely and efficient measures may be taken in the application of remedies. The susceptibility of the system to the action of the exciting cause of the disease, and to the action of remedies, is only to be learned by observation and experience in each individual case.

*Dietetic influences* are often predisposing causes of epidemic diseases, and especially of those which are prevalent and fatal to emigrants in hot climates, and of those, also, which are seated mainly in the digestive organs. It is well known that yellow fever epidemics in southern latitudes are most fatal among persons of northern birth; and that even the natives of hot climates, ordinarily exempt from the graver forms of this disease, may become almost equally susceptible to it by adopting to some extent northern habits of life. The negro race present the best illustrations of this truth. In Africa they suffer, in general, from only the milder grades of the disease; but those born in this country, and who have been fed from their youth up, on a plentiful supply of fat pork and corn bread by southern planters, are subject to the more violent and fatal grades of yellow and bilious fevers, of which diseases they die in considerable numbers. Few, indeed, are the cases of fever among those people which can be safely left, as in Africa, to the remedial powers of nature. Active and skilful medication must be resorted to if we wish to cure them, and the frightful mor-

tality which has occurred among them since their emancipation proves the want of it.

This greater predisposition to disease, especially those of a febrile character, is to be accounted for, mainly, by reference to diet. The natives of hot climates, and especially African negroes, live principally on vegetable food, which supplies the system with only a moderate amount of hydro-carbon; and on ripe and acescent fruits, which are not only deficient in this quality, but by their juices afford protection against the scorbutic diathesis which prevails so injuriously among northern immigrants. The common error was strikingly exemplified in 1821, when General Jackson took possession of Florida and marched a body of northern troops into Pensacola. These troops were fed on strong meat diet, with no other vegetable food than sour flour and musty beans. In a short time frightful havoc was made among them by scurvy, which seemed to defy all means of cure and prevention, until the happy thought was acted upon to supply the whole command plentifully with sour oranges and sugar, which proved at once, both curative and prophylactic, and the disease disappeared.

Natives of hot climates in general indulge sparingly in alcoholic drinks, giving preference to the milder kinds of wines, and making up for their want of stimulation, in some measure, by the use of capsicum; while immigrants from the north persevere in their habitual use of distilled liquors, and other hydro-carbonaceous materials so unsuited to a southern climate. So disqualifying are these northern dietetic customs to southern climates that the negroes who are returned to their native country have, equally with the white race, to undergo an acclimatizing process, with only a little less danger of fatal effects. In Liberia and Sierra Leone the mortality among coloured immigrants from America has been very considerable, but this mortality does not extend to recaptured Africans in the hands of slave traders, whose habits of life have not been changed by negro slavery in America.

The habitual use of capsicum in large quantities, so common to the natives of hot climates, and especially in Africa and Mexico, in both which countries nature provides this article in its greatest pungency, may afford some protection against fever, as is sometimes contended by those who use it; but, like other unnatural excitants, it has its evil effects. Hypertrophies and scirrhus indurations in the digestive organs, and especially in the stomach and duodenum, are its common effects, the dangerous character of which is none the less because of the tardy development of the diseased condition. This view is justified by several autopsy examinations which I have made of those who have died at the age of fifty to seventy years, hard scirrhus balls being found in connection with the stomach and bowels, and strictures of the pylorus and duodenum from indurated hypertrophy of the mucous and muscular tissues.

When epidemic influence tends to the production of fever in southern

latitudes, those immigrants from northern climates who have conformed for any length of time to the proper diet of southern races of men in regard to moderation in hydro-carbonaceous food, and the substitution of vegetables and fruits, are the most likely to escape the disease, or to suffer, if attacked, only its milder grade. Of course the danger of a fatal issue is proportionally lessened. But it must here be remarked that temperance in drinking, and especially the avoidance of distilled liquors, are of the utmost importance in guarding the system against all epidemic influences. The predisposing causes of epidemic diseases are many and various; but among them all none are more to be dreaded and deprecated than the habitual and excessive use of alcoholic drinks. I know of no exceptional disease, and if men wish to avoid and escape epidemics, it behooves them to abstain from stimulating beverages.

Predisposition to Asiatic cholera is always increased by those indulgences in diet and drink which are unusual, and which tend in any degree to impair the healthy tone and vigor of the digestive organs, and especially which interrupt or disorder the secretions of those organs. Physicians and sanitary boards have displayed ingenuity in constructing dietetic rules when this disease is prevailing as an epidemic, and the discrepancies and contradictions displayed are not only curious, but afford abundant evidence of the futility of attempting to enforce any such protective policy. In regard to this matter the maxim holds true, "What is food for one is poison for another." The only fact to be valued is, the danger of disordering the digestive system by the use of food known to be difficult of digestion, or the use of too large a quantity of digestible food, or by irregular and untimely meals, or any of those imprudences which tend to impair the tone of the stomach and bowels. Precisely the same is true in regard to the predisposing causes of diarrhoea, dysentery, and cholera morbus, except that in those cases the predisposing causes of epidemic cholera may become exciting causes of these and other diseases of the digestive organs, which are only occasional and not epidemic. Undue fatigue, sudden transitions of temperature, and want of proper rest and sleep, may also be added to the other predisposing causes affecting the digestive system, as may, also, with great propriety, all mental emotions acting upon the nervous system to depress it and impair its energy.

*Vicious habits of life* variously predispose to epidemic influences by disordering the healthy functions, and especially those of the brain and nervous system, upon which the exciting cause makes its impression. The physiologists tell us that vegetable and animal food in due proportions is best suited to the nourishment of the body, and to the preservation of health. Common experience confirms this, and teaches, also, that the proper beverages are those only which nature has provided without the assistance of art, namely, water and milk. Whatever is more than these is unnecessary, productive of more or less evil, and may be classed among

the vicious habits of life. The habitual use of opium, tobacco, and other narcotics, including all alcoholic beverages, has an undoubted tendency to cause derangement of nervous function, to vitiate the secretions, and to establish an abnormal condition, operating as a predisposing cause of all epidemic diseases. Long indulgence in such vicious habits prepares the system, like certain hereditary taints, for the operation of morbid causes, and of certain remedial agents, the precise character and extent of which can only be ascertained by observation and experiment, creating, in fact, an artificial idiosyncrasy, which, while such habits are continued, can neither be controlled nor cured.

Nothing is better established than that narcotic influences of every kind gradually wear away the healthy tone and vigor of the nervous system, producing either direct or indirect debility; and that their habitual use also impairs the healthful susceptibility of the brain to those normal influences necessary to the enjoyment of bodily and mental health. It is reasonable, therefore, to expect that persons who have by their vicious habits brought themselves to this condition, will be more predisposed than others to the operation of morbid causes, and all observation proves that such is the fact. To consider the influence of improper clothing, sudden transitions of temperature, sedentary occupations, confined and corrupted atmosphere, irregular and deficient sleep, and many other things which might properly be classed among the vicious habits of life, would be to enter upon the discussion of the whole science of hygiene; the object of which is to teach the great truth, that it is only by a close adherence to the laws of nature and Providence that the human system can be sustained in a state of health, and protected against the baleful influence of causes of disease. By the proper use of every faculty and function, without abusing them by artificial and unnatural means they are best preserved from debility and disorder, and the organs of the body with which they are connected, strengthened, and qualified to resist morbid influences. The laws of life impressed upon the human organism cannot be habitually violated, either by acts of commission or omission with impunity, and the neglect or perversion of a single function has its certain penalty in suffering and disease. There is, indeed, little reason to doubt that the great mortality from epidemic diseases is in great measure due to the influence of unnatural indulgences and excesses, habits of life which are unknown to any but the sufferers, and the deleterious effects of which upon the general health are often scarcely noticed even by themselves; so obscure and insidious are the operations of morbid causes, and so certain are the penalties visited upon those who habitually violate the laws of nature.