CHANCELLOR (C. W.)

Contagious & Epidemic Diseases

CONSIDERED WITH REFERENCE TO

Quarantine and Sanitary Laws.

IS YELLOW FEVER CONTAGIOUS?

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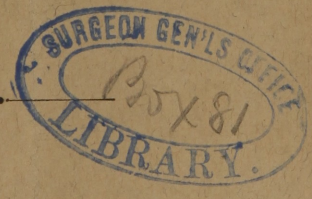
C. W. CHANCELLOR, M. D.

Late Professor of Surgery in the Washington University, Baltimore; Secretary of the State Board of Health of Md.; Member of the American Public Health Association; Editor of the "Sanitary Messenger," &c., &c., &c.



BALTIMORE:
PRINTED BY JOHN COX,
Corner Pratt Street & Spear's Wharf.

1878.

With the respects of

Dr. C. W. Chancellor.

Baltimore, Md.

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PROPOSITIONS.

1. WHAT IS A CONTAGIOUS DISEASE?
2. WHAT IS AN EPIDEMIC DISEASE?
3. IS YELLOW FEVER CONTAGIOUS?

THE

CONTAGIOUSNESS OF YELLOW FEVER.

In collecting, enforcing and adding to the evidence accumulated upon this most important subject, no claim is laid to originality; the facts presented are simply a reproduction of the experience and opinions of wise investigators, given for the most part in their own language. Its value does not consist in vague speculations, based upon limited experience, but in the mass of evidence gathered from the researches and writings of experienced and reliable scientists.

A contagious disease is a disease which is communicated from person to person. An epidemic disease is a disease which at certain periods prevails over the whole, or over a large portion of a community. A sporadic disease is a disease which arises either in a single instance, or of which the cases at one time are few and scattered. The cause of a contagious disease is a specific animal poison. The cause of an epidemic disease is, or rather is supposed to be, a certain condition of the air. A contagious disease prevails by the communication from person to person of that specific animal poison from which the malady derives its existence. An epidemic disease prevails through the influence of the atmosphere. The specific animal poison which gives origin to a contagious disease must have existed in some person, and have been communicated from that person to another, by actual contact, before such a disease can be propagated. The application by contact of its own specific virus is indispensable, as a first step, to the progress of a

contagious disease ; it is essential to every subsequent step. For the extension of an epidemic disease, on the contrary, it is only necessary that a person (provided he be predisposed to receive the malady,) be surrounded by the noxious air from which the epidemic arises. A distinction has, indeed, been made between contagious disease which is communicable by palpable matter, and one which is communicable by invisible effluvia. Whether its application to any part of the body of the individual who receives it, can be distinctly traced or not, it must come in contact with some part of his body. The small-pox is communicable by the application to a healthy person of the matter contained in its pustules, it is also communicable by placing a healthy person within a certain distance of the diseased ; in the former case the application of the morbid matter is palpable ; in the latter case it is not palpable, it is too subtle to be appreciated by the senses, it is conveyed through the medium of the air; but its application is as real, and as really by contact, as when it is applied by the lancet of the innoculator.

In the whole range of politics, nay, even in that of theology itself, there is no subject on which such vague notions have prevailed ; none respecting which men's minds have been so completely and so generally mystified as that of contagion. The subject of contagion certainly opposes to its investigation no particular difficulties ; but by the aid of one enormous assumption, and by neglecting to distinguish between one or two circumstances, which it is essential to discriminate, the extent to which both medical and unprofessional men of the greatest intelligence have allowed their understanding to be abused, is perfectly astonishing. For several centuries the subject of contagion has had the singular property of depriving the physician, the philosopher and the statesman of the power of applying to its investigation the commonest rules of reasoning ; and men have argued on this topic, apparently to their own satisfaction, and to that of others, in a manner which would have covered them with shame, and overwhelmed them with contempt, had they so done with reference to any other subject of human inquiry.

And yet it is a subject on which it is of great importance that the ideas should be clear and the judgment sound. It is intimately connected with the life or death of millions of the human race; it is interwoven with the commercial welfare of nations, and with the interests of this country in particular; and the whole system of quarantine laws should be entirely dependent upon it. To this subject the anxious attention of national legislatures has been directed more than once. In 1824 a committee of the House of Commons thus recorded their opinion on the matter: "The influence which this law (that of quarantine) is supposed to have in the protection of public health, its bearing on some of our strongest prejudices, and its containing the various precautions which have been long deemed our safeguards against the introduction of contagious diseases, from whatever part of the world the danger may be apprehended, renders every recommendation that may affect it a matter at once of general interest and peculiar delicacy. On the one hand care is to be taken that in the attempt to relieve commerce from burthens and inconveniences which press upon it, and to afford it the greatest freedom of which it is susceptible, we do not expose the country to the most formidable risk. On the other hand, that neither ancient prejudices, nor an excess of anxiety to avert possible danger, should induce the continuance of restrictions inessential to their object; and should thus deny to the trade any of those facilities which, consistently with every prudential regard to considerations of protection and safety, it may be permitted to enjoy."

The subject is now about to undergo an investigation by a Committee of the Senate and House of Representatives of the United States, and it is of the utmost importance that those who are to engage in the inquiry should come to it with some real and correct information, and with unprejudiced minds. The data submitted to the American Public Health Association, at its late meeting in Richmond, Va., was not sufficient to justify that body in committing itself to any special theory in connection with the origin and prevention of yellow fever, notwithstanding the manifest prejudice

with which many came to the meeting in favor of declaring yellow fever a contagious disease. In this instance ignorance was not blamable, and prejudice was unavoidable, for the investigation was hastily instituted, and the report of the commission was neither complete nor exhaustive.

CONTAGIOUS DISEASES.

Before proceeding to consider the question of contagion, it may be proper to observe that it is by no means exclusively a medical question; it is really a question of science, to be decided by facts which every one can understand; a question of testimony, to be determined by evidence which every one can appreciate. There are circumstances which render medical men peculiarly unfit to investigate the subject. Few members of a profession are capable of taking anything but a professional view of any professional subject. In medicine the authority of the master has at least as much influence over the mind of the student as it has in any other science. On this subject, in particular, pupils, before they are capable of forming an opinion for themselves, are taught in the schools certain dogmas, which are inculcated upon them with extraordinary earnestness; their minds are trained to take only one view of a subject, and to consider all doubt on the matter as leading to the most terrible consequences. It is, therefore, only now and then that a man arises, endowed with extraordinary power, or placed in circumstances peculiarly favorable to the discovery of the truth, who is found capable of making that mental effort, which it is necessary to exert *in order to unlearn;* to disregard the undue authority of the master; to look into nature as an original and independent observer; to see what is passing around him with his own eyes, and to judge with his own understanding. Among the members of the Spanish Cortes, in 1822, there were nine medical men. The subject of contagion was brought before the consideration of that body. It was a subject in which the Spanish Cortes could not but feel a deep interest, in consequence of the fever which had so recently

depopulated numerous cities of the Peninsula. So overwhelming did the evidence adduced to prove that the fever which had lately raged in Spain was not contagious, appear to the Assembly, that, in opposition to the unanimous opinion of the nine medical men of their own body, as well as that of an immense majority of the physicians of Spain, they rejected altogether, after a solemn debate, and by a majority of sixty-five to forty-eight votes, the project of a code of sanitary laws, which had been for years in careful preparation, successively by a commission of the government, and two committees of the Public Health of the Cortes. Here evidence in support of an undoubted truth, relating to a question which might have been deemed exclusively professional, sufficient to satisfy a majority of sixty-five to forty-eight unprofessional members, was not sufficient to satisfy a single individual out of nine professional men!

It has been stated that a contagious disease is a disease capable of being communicated from person to person. It is produced by an animal poison, and it has no other known cause. This animal poison is the product of a peculiar secretion of the animal economy. The character which is essential to it is the power of producing, when applied to a healthy person, a similar disease.

All the diseases to which the human body is subject are divided into acute and chronic. Contagious diseases, in like manner, are either of an acute or chronic character. Examples of acute contagious diseases are the small-pox and measles; of the chronic the venereal, the itch, and a few others.

That species of contagion by which certain chronic diseases are propagated is so obvious as to require no discussion. The morbid secretion upon which it depends is palpable, the application of it is direct, the effects are visible, and can be observed and marked through every stage, from their commencement to their termination. With the single exception already adverted to, the same is true of that species of contagion upon which acute diseases depend. The small-pox secretes a contagious matter which is contained in its pus-

tules; the measles secretes a contagious matter which is contained in its vesicles. Apply a portion of the fluid contained in the pustules of the one, and the vesicles of the other, to a healthy person; it will excite the same train of symptoms as existed in the individual in whom the contagious matter was secreted. Moreover, persons who approach within a short distance of the affected, and who do not come into actual contact with them, are often attacked by these maladies; but this is never the case with chronic contagious diseases, in all of which the contact must be direct. It has been already shown, however, that even in the former the contact is no less real, though it is not visible, and that the contagious matter, in a form too subtle to be appreciated by the senses, is conveyed from one body to another. The origin of contagious matter, like the origin of every natural production, is concealed from the scrutiny of man. We know nothing of it; but of the nature of the diseases it produces, this much, at least, is certain, that they depend upon a peculiar animal poison, and that they are propagated by the communication of that poison from person to person.

It would have been reasonable to suppose *a priori* that diseases arising from causes thus specific, would observe peculiar laws. They are found to do so, and a knowledge of these laws is essential to the understanding of this subject.

1. Contagious diseases produce certain phenomena; that is, a combination of certain symptoms. These symptoms are determinate and uniform; they are always the same; they never vary, except in degree. In every individual, under every variety of age, sex, condition and mode of living, in every country, in every season of the year, and in all possible states of the atmosphere, these symptoms are precisely the same. The operation of any one, or of any combination of these agents, so powerful in modifying disease in general, is only to render the symptoms of a contagious disease more or less mild or malignant. The symptoms themselves are uniformly the same. The small-pox is never without its pustules; the measles is never without its vesicles; the virus of small-pox never produces the symptoms of measles;

that of measles never produces the symptoms of small-pox. Each disease preserves, under every variety of circumstance, the same specific character.

2. The phenomena produced by contagious diseases are not only determinate in themselves, but they are uniform in their accession, in their progress, and in their termination. Beyond certain limits, which are narrow and fixed, they never vary in either of these respects. The small-pox produces its appropriate symptoms in a certain time after the contagious matter has been received. First, certain symptoms arise; these are succeeded by others; this succession takes place in a certain order; the symptoms come to their height in a certain period; they decline in a certain manner; they terminate in a certain time The period also when the disease has run its course, and ceases to be contagious, that is, ceases to exist, is determinate. All these things are regular as the course of the planets. In small-pox the law of the disease is that no contagion takes place until the eruption appears; and that it remains as long as there is any scab on the skin. The period which elapses between the reception of the contagious matter and the first appearance of the disease in small-pox from innoculation is 8 or 9 days. Thus, of 810 inoculated cases, in 519 fever commenced before the ninth, in 219 on the ninth day. The exceptions are extremely rare in which it either anticipates or exceeds this period. In the casual, or what is called the natural small-pox, the latent period is somewhat longer than in the innoculated; but the utmost range is only from ten to sixteen days. The latent period of the contagion of measles is from ten to fourteen days. The other phenomena of these diseases succeed each other with a like regularity.

3. The morbid matter producing a contagious disease being once secreted, that disease can be propagated at any time, and among any number of persons. So long as it retains its energy this specific virus never ceases to produce its specific effects; these effects can be produced by no other cause. From this law it follows that no disease which is not contagious at its commencement can become contagious in

its progress. The spontaneous generation of a contagious disease is as great an absurdity as the spontaneous generation of an animal. Nor, on the other hand, can a disease which is contagious in its commencement cease to be contagious in its progress. The notion that a fever may arise from cold, from wet, from a peculiar constitution of the atmosphere, or from any of the common causes of fever, and become contagious in its progress, originated in an ignorance of the laws of the animal economy, and has been perpetuated in consequence of inattention to those laws. No man of sense can consider what a contagious disease really is, and what the ascertained laws of the animal economy are, without perceiving that this notion of the generation of a contagion must be false. To suppose, indeed, that a disease non-contagious in its commencement may become contagious in its progress, or the converse, is to imagine in the animal economy precisely the same absurdity as it would be in the vegetable were an acorn, by a change of soil or climate, to cease to produce an oak and generate a bramble.

4. Acute contagious diseases, as a general rule, are capable of affecting the same person once only; chronic contagious diseases are capable of affecting the same person more than once. On what this peculiarity depends we do not know; it is an ultimate fact, but the fact itself is certain. Cases, indeed, are on record of the occurrance of acute contagions, as small-pox and measles, more than once in the same individual; allowing the perfect accuracy of the observations on which these statements are made, it must still be conceded that it is an event so seldom witnessed that it can be ranked only with the most singular of the exceptions which are known to exist to any general rule.

5. Strictly connected with this law, and as a consequence of it, there follows one negative character of an acute contagious disease, namely—when it has once gone through its course there can be no relapse. It is impossible, either in that weakened state of the body which immediately succeeds an acute disease, or in any other condition of the constitution, whether by exposure to the common causes of fever, or

by an application of the specific virus in any degree of intensity, to re-excite the original train of symptoms.

It might reasonably have been thought impossible that diseases so uniform, so specific, could be confounded with any other maladies. Yet there is an important class of diseases with which they have been generally confounded, and with which they not only have nothing in common, but to which they afford a perfect contrast, namely—

EPIDEMIC DISEASES.

The term epidemic, considered etymologically, merely signifies *generally prevailing;* but in medicine it is universally appropriated to designate a certain class of fevers. These fevers are highly malignant; they occur frequently; they spread extensively; they prove more mortal than all other diseases together. Supposing mankind to consist of one thousand millions; it is computed that thirty millions die annually from all diseases, and that of this number fifteen millions, that is one-half, die of epidemic maladies. These diseases, therefore, possess an extraordinary interest and importance. Epidemic diseases appear to derive their origin from one cause, namely—the state of the air. A certain condition of the air is supposed to produce epidemic diseases, because the hypothesis affords the best solution of all the phenomena which they exhibit. What that constitution of the atmosphere is which gives rise, in any case, to an epidemic disease, we do not know; therefore we cannot know what the peculiar constitution of the atmosphere is which gives rise to peculiar epidemics. This is the all-important question. It is reasonable to believe that there are certain qualities of the atmosphere which have a considerable influence in the generation of these diseases, namely—its heat, cold, moisture, dryness, and electrical state; but what degrees and combinations of these qualities are connected with the production of epidemic diseases, we do not know. We have derived from experience the certain knowledge of one fact only, namely—that these maladies are generated most

frequently, and in the most malignant form, by a moist and warm atmosphere. It has, morever, been supposed that certain changes may take place in the constitution of the air which are not perceptible by our senses, and that these changes may have the most important influence on human health and life. These occult properties remain to be investigated.

In assigning certain conditions of the air as the cause of epidemic diseases, we are able to advance one step. The air, it is certain, is often charged with noxious exhalations arising from the putrefaction of animal and vegetable matter. These exhalations are generated in certain localities, notably where stagnant water contains dead vegetable matter; and their production is generally promoted by heat. Their precise nature is not known, for they have never been obtained in a separate state; but it is certain they are suspended in the air; that, naturally, they do not extend far beyond the place where they are generated; that by currents of wind they are capable of being conveyed to a great distance; that they exert a powerful agency in producing some of the most malignant fevers; and that a long continued exposure to them tends to shorten the duration of human life.

Epidemic diseases observe certain laws, and these laws, it will be seen, are the complete contrast of those which regulate contagious diseases.

1. The phenomena of epidemic diseases are not determinate and uniform; they are diversified in the highest degree; not only in different countries and different seasons, but in the same country and in the same season. These symptoms observe no regular concourse; they do not succeed each other in any determinate order; there is no discernible connection between the application of their cause and the appearance of its effects; their duration is variable. The phenomena of contagious diseases, on the contrary, as has been shown, is determinate; the order of their succession is regular; the period which elapses between the application of their cause and the appearance of its effects is fixed; their duration is uniform.

2. Though there is the greatest possible diversity in the phenomena of epidemic diseases, yet in all countries the periods at which they commence, decline and cease are somewhat determinate and exact. These periods correspond with certain states of the season. They differ in different countries according to their geographical position, and they may be anticipated or postponed by circumstances, but in general they are remarkably uniform. In Asia Minor, Egypt and Syria they commence in March or April, and cease in June or July; in most parts of Europe and in North America they begin in July or August, and end in November or December. All the epidemics of yellow fever in the United States, of which we have any certain record, have appeared in June, July or August, and committed their greatest ravages in the months of August, September and October.

3. Epidemic diseases commence, spread and cease in a manner perfectly peculiar. They arise, for example, in some particular quarter of a town, or in some district. They do not proceed to attack other places in succession, according to their proximity to the quarter first affected, but they break out at once in the most distant and the most opposite directions. They prevail, suppose, in a certain district; suddenly they diminish or cease there, and appear in another quarter, it may be, the most remote from the first; then they may again return to the place first attacked, or they may suddenly appear in a spot near to it, or in one in an opposite direction. People are attacked, not in proportion as the inhabitants of the affected mix with those of the unaffected places, but in proportion as the inhabitants of the unaffected expose themselves to the *air* of the affec ed places. The visits of the sick to unaffected places is followed by no increase of the disease, unless a favorable condition of the atmosphere exists in the place; the visits of the inhabitants of an unaffected to an affected place is attended with a certain increase of sickness. The liability of persons to the epidemic of yellow fever on their arrival in the infected district is proverbial. On their removal from a noxious to a pure air the sick often rapidly recover; but they do not com-

municate the disease to the inhabitants of a *pure atmosphere*. The manner in which epidemic diseases terminate is most peculiar and characteristic. It is precisely at the period when the greatest number of persons are affected, and when the greatest mortality prevails that these maladies rapidly decline and suddenly cease. There is scarcely an exception to this law in the history of epidemic diseases. It perfectly accords with the nature of the cause upon which epidemics are here supposed to depend; it is totally inexplicable upon the hypothesis that they are produced by contagion. To suppose that a disease which is propagated by contagion can rapidly decline, and even suddenly cease, at the very period when the greatest number of persons are affected, and when the greatest mortality prevails, that is, when the contagious matter is proved to be in its most active and malignant state, is utterly absurd. So true is this, that the most intelligent and candid contagionists acknowledge, in so many terms, that this important fact is perfectly inexplicable upon their system. "It is a very common fact," says one of the most distinguished and able advocates of the common doctrine of contagion, "*and perhaps wholly unaccountable upon any theory of the propagation of contagion*, that pestilential diseases, after running an indefinite course, notwithstanding all the measures adopted to restrain their progress, frequently cease spontaneously, at a time when the walls of the houses, furniture, &c., must still be supposed to be highly impregnated with the contagion." The fact is indeed certain; it is most distinctive of these two classes of diseases; it is alone sufficient to prove that they are essentially different.

Were the common term epidemic confined to its strict etymological signification—*generally prevailing*—it would be correct to say of the small pox, for example, when generally prevailing, that it was epidemic. But this term should be appropriated only to the designation of a class of diseases observant of the laws which have been stated. To call any disease epidemic, therefore, merely because it is generally prevailing, unless it be also obedient to all the other

laws which characterize epidemic diseases, must lead (and the history of this subject affords abundant proof that it has led) to the most pernicious confusion of ideas.

It has been shown that fever is capable of being produced by two causes: by a specific contagion, and by a peculiar constitution of the air, which for the sake of distinguishing it from its other states, and of expressing the fact that it is the cause of epidemic diseases, may be termed its epidemic constitution; it is commonly called a pestilential constitution; but fever is capable of being produced by another, and a totally different condition of the air, namely, by the corruption of it. This corruption may take place in various ways, and exist in various degrees of intensity, and its effects will vary accordingly from the headache produced by a crowded theatre to the mortal fever occasioned by such a corruption of it as occurred in the black hole of Calcutta. There is evident difference between an epidemic constitution of the air, and a corruption of it. We know nothing whatever of the change of properties of the air which renders it capable of producing pestilential fever; investigation should be specially directed to this point. The effects of an epidemic constitution of the air extend over a whole country, or over a large portion of it, while the effects of a simple corruption of the air are confined to that particular spot in which the deterioration takes place.

Corruption of the air may be produced by three causes: 1st By the confinement of the *healthy* exhalations of the body, as in crowded and ill-ventilated apartments. 2d. By the confinement of the *morbid* exhalations of the human body, as in hospitals where people laboring under diseases are crowded together, and the air is filled with the poisonous effluvia of sores, mortifications, dysenteric and other fœted excrements. 3d. By exhalations arising from the putrefaction of animal and vegetable matter.

Forestus mentions a malignant fever which raged at Egmont in North Holland, occasioned by the putrefaction of a whale which had been left on the shore. Senac gives an account of a malignant fever which was excited by the ac-

cumulation of the offal of a city without the walls. It was received into a ditch filled with water; while covered by the water no bad consequences resulted; but when the quantity increased so that it rose above the surface, a dreadful fever spread through the city and its neighborhood, so that where four hundred used to die yearly, the deaths were increased to two thousand. The malignant fevers which prevail in low marshy situations, particularly in warm weather, are examples of the effect of the putrefaction of vegetable matter in producing these diseases. Decaying vegetable matter produces congestive malaria, and decaying animal matter produces the type of miasma which causes typhoid or typhus fever; the atmosphere vitiated by a conjunction of these two poisons may serve as a medium for the spread of yellow fever where the germ of the disease exists, either by importation or by hibernation. Nothing is surer than that typhoid fever is produced by animal affluvia, and if at the same time a vegetable malaria, such as will produce a high grade of remittent bilious fever, is prevalent, a typho-malarial disease, akin to yellow fever, will be produced.

The fevers produced by an atmosphere thus corrupted, have generally been stated to be produced by contagion. Most authors who have observed and recorded facts similar to those which have been mentioned, have represented them, not as proving the power of a corrupted atmosphere to excite malignant fever, but as establishing its power to generate contagious fever. But it is obvious that they do not afford the slightest evidence of the existence of a contagious influence; that the supposition of contagion is entirely gratuitous; that the exact and only point they prove is the power of a corrupted air to produce malignant fever; that other evidence is necessary to prove that the fever so produced is contagious, namely, evidence that when once generated it reproduces itself by contact of the sick with the healthy in a pure atmosphere, and that it observes all the other laws of a contagious disease. The single error of thus confounding the influence of a corrupted atmosphere with the generation and communication of a specific animal poison, has produced

the most extraordinary and universal confusion of ideas on the subject, and the removal of this source of misconception is all that is now needful to render it perfectly luminous. We hope and believe, it will be felt to be so by every intelligent and unprejudiced mind.

There is one fever, for the especial purpose of elucidating the nature of which, we have entered into this discussion, namely,

THE YELLOW FEVER.

The point to be ascertained is, whether or not this fever is contagious; and in order to arrive at the truth, it is only necessary to examine whether it conforms to the laws of contagious or epidemic diseases. Let us then attend to the history of this fever with a special reference to this matter. We will take the fever of Barcelona, Spain, in 1821, as a prototype of the fever which prevailed in the lower Mississippi Valley last autumn. Of the fever of Barcelona in 1821, Dr. Maclean has given so complete and masterly an account, that in order to clearly exhibit its nature, (and it may stand as a paradigm of yellow fever,) it is only necessary to select from the facts with which he has supplied us.

1. In the first place it appears that this disease was singularly diversified in the forms it assumed; that the combination, the succession and the degree of its symptoms were so different in different cases that it was difficult to assign to it any fixed and invariable progress, and that it was exceedingly irregular in the slowness or the quickness of its course. In all these respects it conformed to the first law of epidemic diseases, and was in contrast with that of a contagious disease.

2. This fever commenced in August, that is, precisely at the period of the year in which epidemics have always been known to manifest themselves in Spain in similar latitudes. Thus in the epidemic which prevailed in Andalusia, in 1804, out of the twenty-three towns which it attacked that year, it commenced in the month of August in ten, and in September in eight. The fever of Barcelona continued to in-

crease till the middle of October; the greatest mortality took place on the 19th of that month. This is also in strict conformity to the regular course of epidemics. In the epidemic of 1804, in sixteen tows in Spain, the greatest mortality took place in the month of October; in Cadiz, in Alicante, and at Gibraltar, by a singular coincidence, it took place on the same day, namely, the 9th of that month. From the 19th of October the fever of Barcelona gradually declined, and subsequently it continued to diminish, in a regular and progressive manner, until its total disappearance. Thus the fever conformed to the second law of epidemic diseases.

3. It appears, that in Barcelona, from the neglect of the public police for many years, the sewers, drains, canals and other channels for carrying away the impurities of the city, had been choked up, and become foul to such a degree, that towards the end of June it was impossible to pass by the sea-wall, where they were discharged into the harbor, without being incommoded by the stench of accumulated and putrifying animal and vegetable substances. A committee which was charged with the office of cleansing the port, discovered that the water course was obstructed at its mouth by a bank of sand, which prevented its discharge, and, consequently, that a large quantity of stinking water was collected, the product of various manufactories, slaughter-houses, wash-houses and other establishments situated on its banks, exhaling an insufferable stench. The foul water which stagnated around this sand bank was one foot higher than the level of the sea. Now in the houses of Barcelona which faced the port, in the streets de los Encantes, de la Merced, Mencado and others adjoining the focus of infection, the mortality was horrible and nearly general; whilst in the streets of Santa Anna, Tallers, San Padro, which are higher, and in others which are exposed to the north, and which are most distant from the focus of infection, there were very few sick. At a certain elevation and at a certain distance from the southeast wind, which was the conductor of the noxious exhalations, as is proved by the course of the

epidemic, not an individual sickened who had not been exposed to the causes affecting the lower part of the city. Indeed the higher parts of Barcelona enjoyed a total exemption from the disease. These facts prove that the disease was a true epidemic; they are inexplicable on the supposition that it was propagated by contagion.

4. Certain facts connected with the origin, progress and termination of this disease, afford irresistible evidence that it was an epidemic fever, and could not possibly be propagated by contagion. Thus it was common to see four, six, or even eight individuals of the same family simultaneously affected; that is in the same day, the same hour, the same instant. This might have arisen from an exposure to a pestilential air, it could not have arisen from contagion. It broke out in numerous points at once; it committed the most fearful ravages in certain spots, while places in the closest proximity were entirely exempt from its attack. In a narrow street in Barcelona called Calle de la Daguizea, one hundred and thirty persons died; in a place within ten yards of it not one perished. In Barcelonetta there were two families which resided close to each other—they both lived about the middle of the south side of Calla Santa Barbara—the houses were of the same size, plan and structure. The easternmost family consisted of six persons, they kept a grocer's shop and were in constant communication with the public—here not one was sick. The westernmost family consisted of ten members, they kept a wine and liquor shop, and were also in constant communication with the public—here every one sickened and nine died. The grocer whose family did not suffer at all, was sheltered from the southeast wind; the spirit merchant's family, every member of which suffered, was directly exposed to it.

These facts are in perfect harmony with the usual cause of fever in this country. Of the fever in Gibraltar, in 1813, Mr. Gardener, Surgeon to the Naval Hospital, observes that the disease did not spread from any focus, but broke out in fifty different places at once. "The rise and progress of our epidemics," says Mr. Amiel, "have never been traced in a

satisfactory manner from a single point of contagion to a gradual number of individuals or families; and instead of creeping slowly from one district to another, cases have made their appearance unconnected and scattered at different points; and in some instances it has spread with the rapidity of the electric fluid, attacking persons who had never approached the sick or any assignable cause of contagion."

Like other epidemics, it was when the fever of Barcelona had acquired its greatest degree of extension, and produced its greatest mortality that it began notably to decline. That day, as has been stated, was on the 19th of October; on that day there died two hundred and forty-six persons, on the 2d of November there died only ninety-eight; subsequently it diminished in a regular and progressive manner until its total disappearance.

When those who had contracted the fever in Barcelona removed into the country, whether they died or recovered, not a single case occurred of the communication of the malady, even to their nearest relative, *if the latter had not been in the city.* Great numbers of persons passed the whole day in the capital who retired at night to their families, either in country houses or in the nearest villages; in no case did they communicate the disease to any individual.

The danger, so far from being in the direct ratio of intercourse with the sick, was in many instances in the inverse ratio. Whenever the hospitals were placed in healthy situations, the attendants on the sick, in these establishments, enjoyed even a greater exemption from disease than the inhabitants of the town generally. The average proportion of persons who were sized, estimated upon the whole community, was about one in seven. In the General Hospital, the proportion of those who sickened among the attendants was also one in seven; in the Lazaretto of the Vice Queen of Peru, it was one in eight; in the Hospital of the Seminoria, it did not exceed one in thirty; in the Lazaretto of Nazareth, which was the receptacle of the worst cases, there were thirty attendants upon the sick; of these not one was seized.

Surely this is evidence which no mind can resist that the disease was not contagious.

Several families isolated themselves in their houses, and employed the most exact precautions for avoiding communication with the sick; but they did not by any means preserve themselves from the malady. Those who shut themselves up in good air, and who possessed the means of surrounding themselves with the conveniences and comforts of life, were uniformly exempt from the disease; those who shut themselves up in the pestilential atmosphere, and who had not the means of rendering their condition comfortable, were sooner affected than those who mingled in indiscriminate intercourse. These facts afford the most irresistible evidence that this fever is a true epidemic. It conformed in every respect to the laws of epidemic diseases; it is without a single character of a contagious disease. So complete is this evidence that it produced the fullest conviction in fifteen physicians who assembled from all parts of Spain and of Europe to investigate the disease, and it produced a practical conviction in the Spanish Cortes, contrary to all their ancient and deep-rooted prejudices, notwithstanding the fact that they had so recently witnessed the appalling extension and the horrible mortality of the disease. In the United States, Dr. Rush, who had been a warm advocate for the doctrine of the contagious nature of yellow fever, on a more patient and strict examination of its phenomena and history, became convinced that he was in error, and with a magnanimity which has but few parallels in the medical profession, proclaimed to the world that he had thought and written on this very important subject in a manner calculated to mislead. "In the fouth volume," (Medical Enquiries and Observations,) says this celebrated physician, "the reader will find a retraction of the author's former opinion of the yellow fever spreading by contagion. He begs forgiveness of the friends of science and humanity, if the publication of that opinion has had any influence in increasing the misery and mortality attendant upon that disease. Indeed, such is the pain he feels in recollecting that he ever entertained or prop-

agated it, that it will long and perhaps always deprive him of the pleasure he might otherwise have derived from a review of his attempts to fulfil the public duties of his station." With such evidence before us, it is impossible to resist the conclusion that the yellow fever is an epidemic and not a contagious disease.