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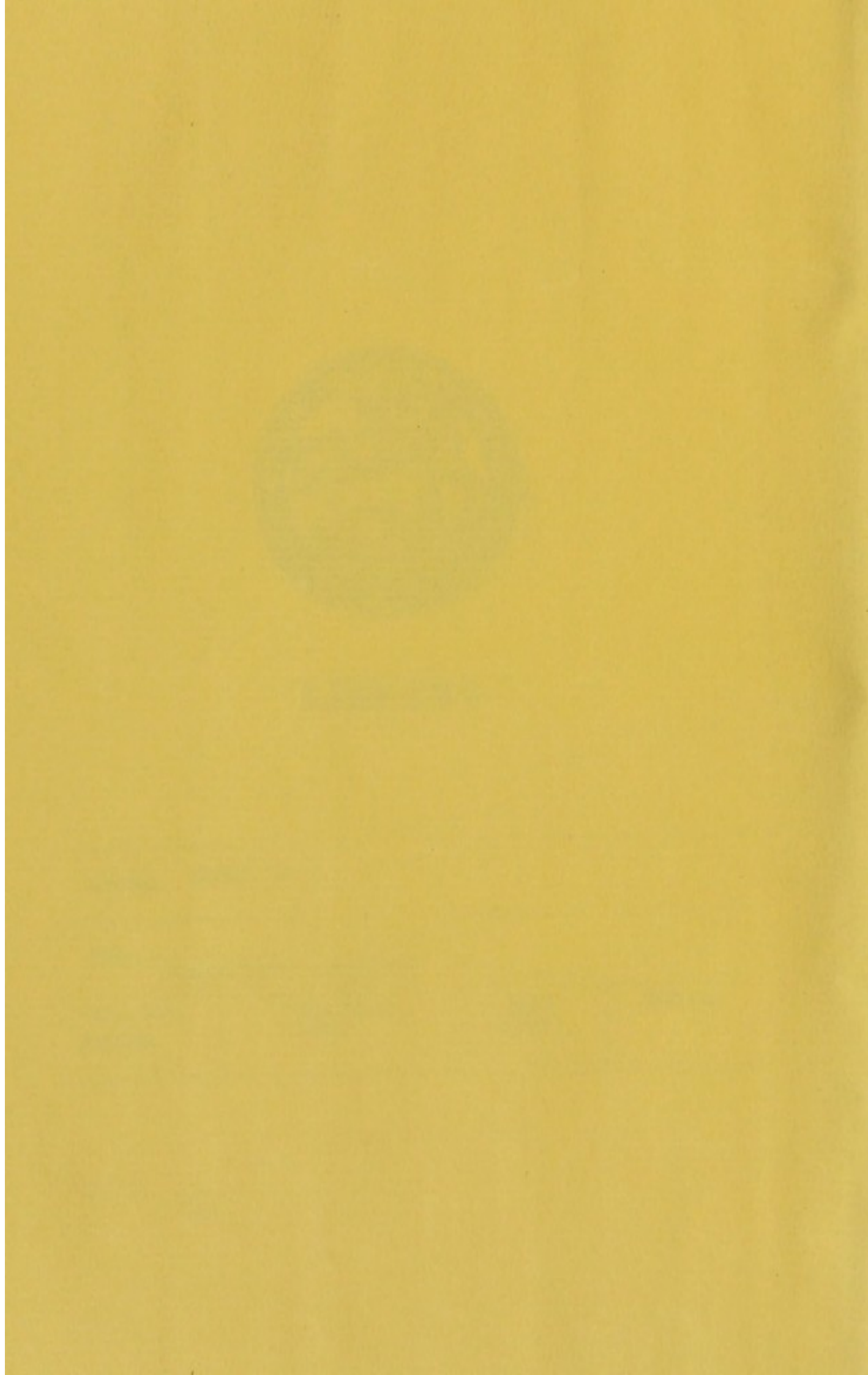
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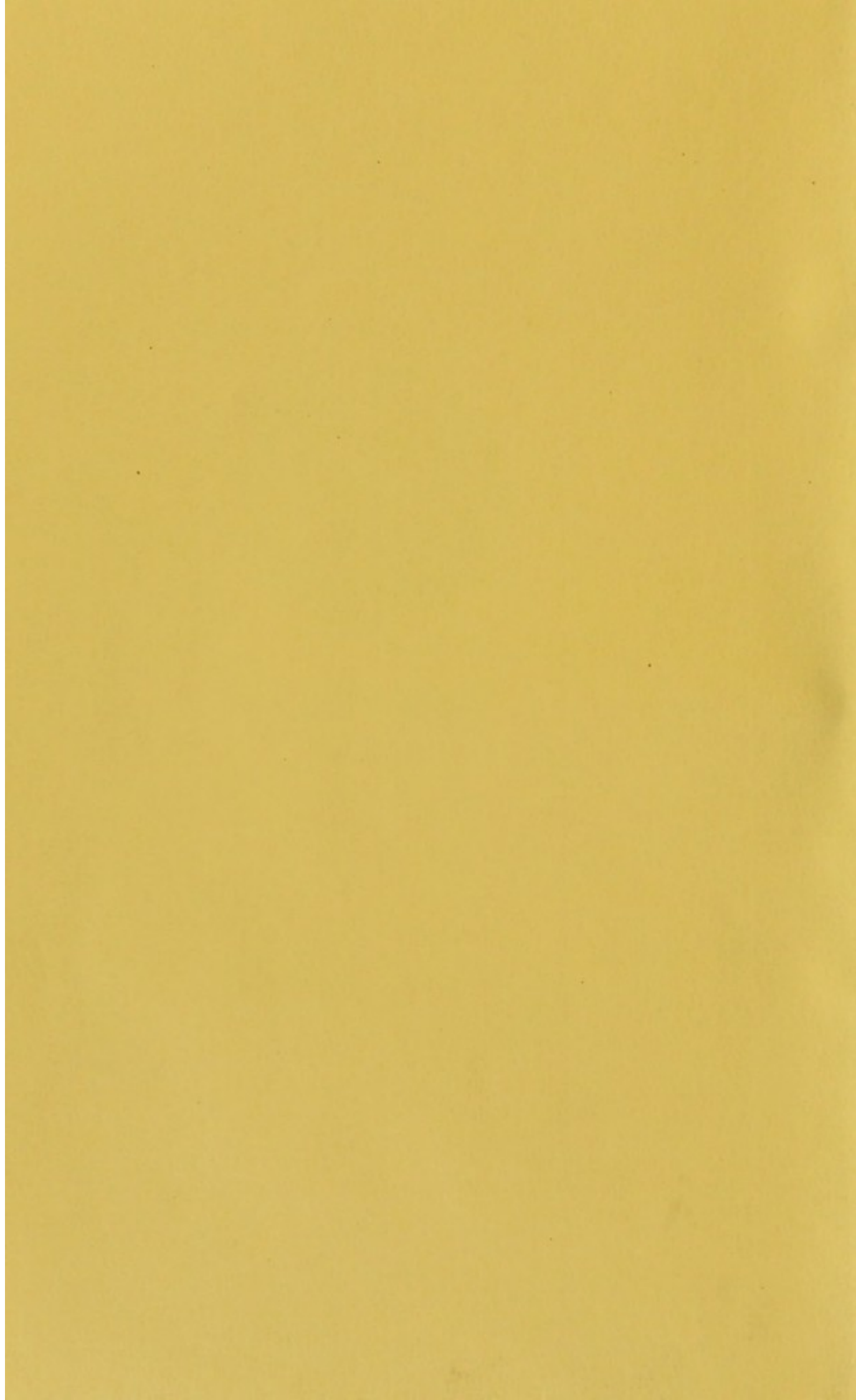
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MALIGNANT CHOLERA:

ITS MODE OF PROPAGATION,

AND

ITS PREVENTION.

BY

WILLIAM BUDD, M.D.

PHYSICIAN TO THE BRISTOL INFIRMARY.



LONDON:

JOHN CHURCHILL, PRINCES STREET, SOHO.

MDCCCXLIX.

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MARTIN'S

THE MODE OF PROPAGATION

OF THE NEW SYSTEM

BY WILLIAM BUDD, M.D.

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LONDON:

JOHN CHURCHILL, PRINTER, ST. PAUL'S CHURCH-YARD.

MDCCCXXXV.



MALIGNANT CHOLERA:

ITS CAUSE, MODE OF PROPAGATION, AND PREVENTION.

IN the *Medical Gazette* of last Friday, an announcement was made by Mr. Brittan of the very important discovery, that peculiar microscopic objects exist constantly in the characteristic "rice-water" discharges of persons affected with Malignant Cholera, and in the atmosphere of infected places.

I do not wish to anticipate anything Mr. Brittan may have farther to say on the subject, or to claim the slightest credit for anything that he or others have already published; but at a time when cholera is destroying hundreds of our fellow-creatures daily, and filling the land with mourning, it is the duty of every one who believes himself to be in possession of any observations which throw the smallest light on the cause of, and the means of controlling, such an awful visitation, to give them, *without delay*, all the publicity possible. I therefore venture to submit to the medical profession, and the public, the following remarks.

The peculiar objects in question were first seen by two or three members of a committee appointed by the Bristol

Medico-Chirurgical Society for the microscopic observation of subjects connected with cholera. The first drawings of them, together with the great variety of other objects, generally to be met with in the "rice-water" discharges, were made by Mr. J. G. Swayne and Mr. F. Brittan, in the second week of June last. These drawings, together with specimens of "rice-water," were exhibited at the next meeting of the committee. At that meeting there were present Mr. J. G. Swayne, Mr. F. Brittan, Dr. Bernard, Mr. Neeld, Mr. A. Prichard, and myself. Numerous other drawings of the same kind, by Mr. J. G. Swayne and Mr. Brittan, were laid, shortly afterwards, before the Bristol Medico-Chirurgical Society.

The laborious observations subsequently made by Mr. Brittan and Mr. Swayne, and laid, from time to time, without reservation, before the Bristol Medico-Chirurgical Society—though not enforced by any arguments to that effect—certainly did much to show that some very important relation existed between these bodies and malignant cholera. The presumption thus raised was much strengthened by the very important discovery, subsequently made by Mr. Brittan, and reserved for separate publication, of the constant presence of objects of the same kind in the air of infected places.

Shortly afterwards, and being at the time aware of this discovery, I detected the same organisms in great numbers in almost every specimen of drinking-water which I was enabled to obtain from Cholera-districts. First, in the drinking-water from Wellington Court, Red-cross Street, where cholera first broke out (with any violence) in Bristol; subsequently, in the water of the Float, and in the drinking-water from King Street, in the same city; since then, again, in London, in water from Lovegrove Street, and from the Surrey Canal;

and lastly, in drinking-water from the Stapleton work-house;—being all places where, at the time the water was obtained, cholera was making dreadful havoc.

This led me to examine a great number of specimens of water from healthy quarters; and although I often found in it a good deal of matter of various kinds, organic and other, in no single instance did I see anything resembling the peculiar bodies in question.

[These considerations, and others, that will appear in the sequel, have led me to the conclusions embodied in the following propositions:—

1. The cause of Malignant Cholera is a living organism
A of distinct species.
2. This organism—in shapes hereafter to be described,
A —is taken by the act of swallowing into the intestinal canal, and there becomes infinitely multiplied by the self-propagation, which is characteristic of living beings.
3. The presence and propagation of these organisms in
A the intestinal canal, and the action they there exert, are the cause of the peculiar flux which is characteristic of malignant cholera; and which, taken with its consequences, immediate and remote, constitutes the disease.
4. The new organisms are developed only in the human
A intestine.
5. These organisms are disseminated through society,
A (1.) in the air, in the form of impalpable particles;
(2.) in contact with articles of food; and (3.) and principally, in the drinking-water of infected places.

[The evidence on which the first proposition is founded is a matter of direct observation, and is derived from microscopic examination of the characteristic “rice-water” discharges of persons affected with cholera.]

The existence of peculiar objects in these discharges, totally different in nature from any common morbid product cast off by the human body, and having all the characteristics of living organisms, may be readily ascertained by any one who will take the pains to examine, under the microscope, a series of well-marked specimens of this kind. These organisms abound most in what passes from the bowels, but are also met with in great numbers in the matters vomited; especially in cases in which spontaneous vomiting is a prominent symptom.

In the matters vomited, they are, however, according to my observation, not only much fewer, but also, as a general rule, much smaller, than in the fluid which passes downwards.

The best specimens of "rice-water" to select for the study of these beings, are those which are of a dirty white.

In these specimens they are generally much more abundant, of a much larger size, and, indeed, in all respects in a higher state of maturation, than in the purely white specimens.

Single individuals are occasionally met with in samples of this dirty colour, so large as to occupy nearly a fourth of the field of the eighth of an inch object-glass. These larger organisms are filled with a vast number of granules, which appear of a yellowish brown by transmitted light. It is, in fact, to the presence of a large number of such organisms, so coloured, that the dirty colour of these discharges is due.

Individuals of this large size are, as far as I have seen, only met with, in great abundance, in very malignant cases; and I have, consequently, been led to look upon the occurrence of discharges having this dirty white colour as of extremely bad augury.

A glance through the microscope at a single well-

marked specimen of this sort, is enough to convince the most sceptical of the reality of all that has been above asserted of the nature of these peculiar objects.

FIG. 1.

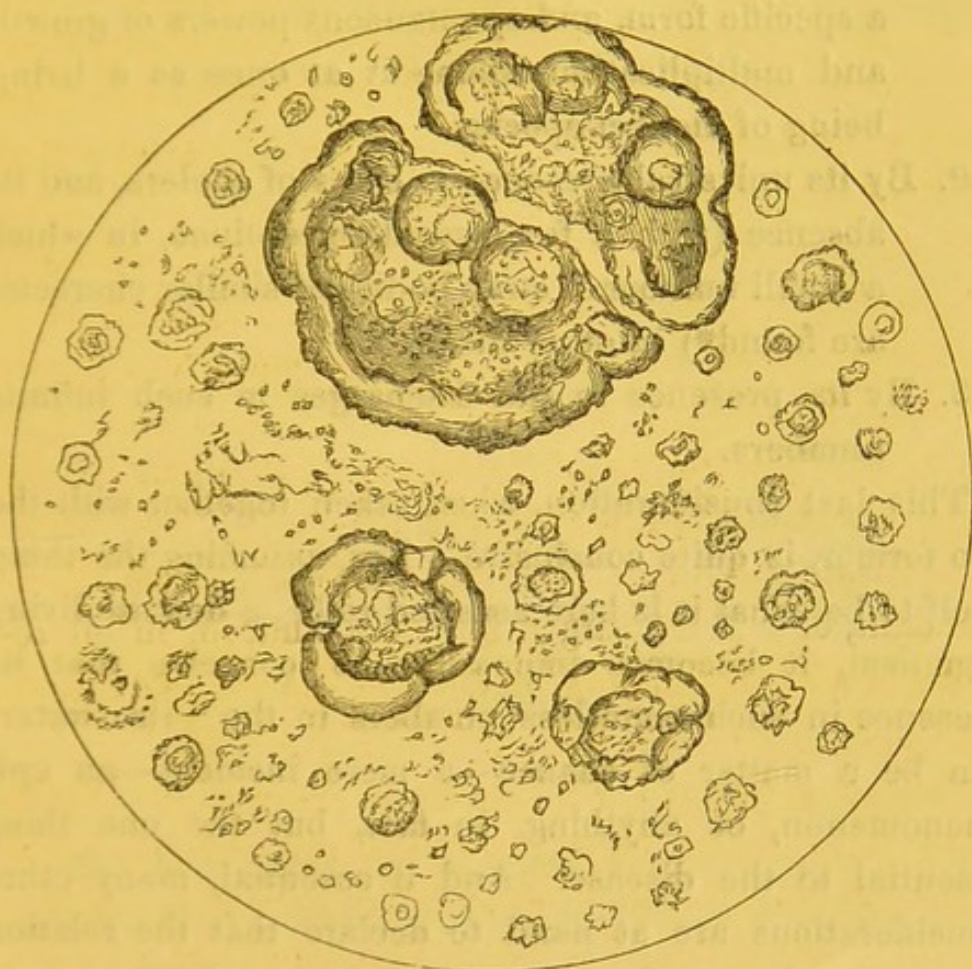


Fig. 1 is an accurate representation of them, in various phases of development, and will give a far better idea of their character than any verbal description could convey.

The large specimen, represented in the upper part of the figure, is one of great interest, from the complex organization it displays, the light it throws on the mode of propagation of these beings, and the striking resemblance it bears to other well-known living types.

That the organism here figured is essentially related to

malignant cholera may be clearly established by the following considerations:—

1. By the characteristics of the thing itself, which, by showing it to be possessed of a complex organization, having a definite mode of development, a specific form, and spontaneous powers of growth and multiplication, stamp it at once as a living being of distinct species.
2. By its universal presence in cases of cholera, and its absence (with a few casual exceptions, in which a small number of stray bodies of similar character are found*) in other diseases.
3. By its presence in the discharges in such infinite numbers.

This last consideration, when taken together with the two former, is quite conclusive. For, assuming the thing itself to be, what it is here asserted to be, a definite living organism, it becomes impossible to conceive that its presence in such countless numbers in the "rice-water" can be a matter of chance—a mere incident—an epiphenomenon, or anything, in fact, but the one thing essential to the disease. And if essential, many other considerations are at hand to declare that the relation thus proved to exist can only be one of Cause and Effect.

Some estimate may be formed of the weight which attaches to the fact on which we are now dwelling, when it is stated, that as many as from 500 to 1000 of these organisms may often be counted (speaking approximately, of course) within the field of an object-glass of an eighth-of-an-inch focus; besides myriads of what, from analogy, are probably spores, each capable of reproducing the perfect being.

* Note 1 in Appendix.

These considerations seem to me to be perfectly conclusive. Two other facts, however, yet remain to be mentioned, which, although they may not be needed for conviction, set the seal to the proof.

These are, the discovery before mentioned, of the cholera organism, first, in the atmosphere and, subsequently, in the drinking-water, of infected places.

FIG. 2.

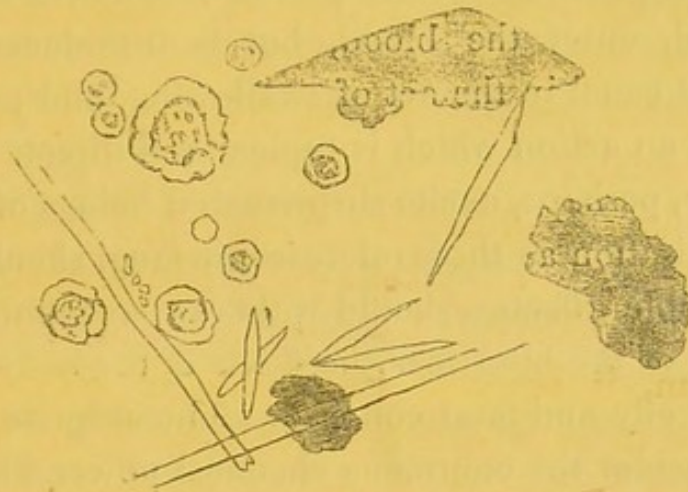


Fig. 2 contains an accurate representation of these bodies from a drawing made by myself from a specimen of drinking-water.*

Assuming, then, from the facts which have been detailed, that these organisms really have the relation to malignant cholera which is here assigned to them, the next question that arises is, what is their peculiar nature?

This is a question which I am not, as yet, prepared to answer in more than general terms. From what I can at present judge, I am inclined to consider these bodies as most nearly related to the simpler orders of fungi. In

* See Note 2 in Appendix.

their general form, in their exceeding prolificness, in their mode of development, in the brownish colour of the maturer specimens, in their angular fracture, and in the shapes taken by their broken remains—the resemblance of these beings to the lower orders of this great family is very striking. More than this I will not venture upon at present.*

The second and third propositions follow so plainly as corollaries from the first, that they require no independent proof. I had, indeed, long been convinced by other considerations, that the cholera-poison does not, as is generally supposed, enter the blood, but is introduced into the intestinal canal in the act of swallowing, and produces its effect by an action which is topical and direct.

It may, perhaps, excite surprise that beings of so simple an organisation as these microscopic fungi should produce such terrible effects—should withdraw so rapidly through the coats of the intestines the fluids of the body, and thus cause speedy and fatal collapse. The surprise will cease if we consider the enormous chemical power which plants possess to supply themselves with the materials of their

* I for some time inclined to the opinion, that these beings were more nearly allied to the simpler forms of *Algæ* than to any other species. Their resemblance to certain states of the *Protococcus Nivalis* and other kindred forms is, indeed, very close. A more extended examination of these simple types, to which I was in part led by a hint from my friend Dr. Bernard, convinced me, however, on the grounds stated in the text, that these beings are true fungi. For the rest, it is well known to naturalists that these two families run into one another by insensible gradations.

I have not, as yet, succeeded in throwing any additional light on the nature of these bodies by the action of chemical re-agents, although I have made a good many experiments with that view. Iodine and sulphuric acid do not strike a blue colour in any part of their structure, or, indeed, produce any other change in them of a sufficiently marked character to allow of any deductions being drawn from it.

growth. The green leaf, under the influence of light, decomposes the carbonic acid in the atmosphere, so as to fix the carbon in its own tissues, with a force far exceeding that of our most powerful voltaic batteries. The various tribes of fungi exert, *in the dark*, perhaps quite as great a force in withdrawing the materials for their growth and propagation from the organic substances on which they feed. The rapidity, indeed, with which they grow and multiply is the measure of the force which they thus exert.

The truth affirmed in the fourth proposition—that the human intestine, namely, is the sole breeding-place of the poison, must be looked upon as the crowning truth of all, on account of the momentous practical consequences to which it directly leads.

[Fortunately,] the evidence on which it rests consists almost entirely in matters of fact, which may be brought home to the sense, and of which every one may judge for himself.

In the first place, it is evident enough that the cholera fungus—as I will provisionally call it—*does* breed in the human intestine, and that with a fertility exceeding all calculation.

This is a matter of plain observation. It is impossible, in fact, that the countless myriads of these fungi which are found in the “rice water,” could have entered the intestine as such. No other medium external to the human body contains them in sufficient numbers to account for their enormous abundance here. Nor can this abundance be explained in any other way than through the infinite multiplication of the few germs which, once swallowed, have here found the conditions necessary for their growth and propagation.

To this may be added the very important consideration, that these beings are found in the “rice water” of a

larger size, and in a higher state of maturation, than they usually exhibit, except with marks of decay, in any other medium.

It is evident enough, therefore, that wherever else these fungi are generated—supposing this question to be really open—here, emphatically, is their native home; the great hot-bed in which they are bred.

This view further accords exactly with the fact, that whenever the disease is introduced into a new community, it takes time to develop itself. First, a few dropping cases occur with more or less irregularity, and these gradually multiply; but it is generally some months yet before the disease bursts out in its full virulence. Plainly, this is not a pestilence caused by a miasm diffused widely through the air, and producing its full effect at once, but one that grows as it goes, and spreads by the gradual increase of the peculiar agent which is the instrument of its deadly work.

The same view accords perfectly with what has long been known of the effect of human agency in propagating the disease:—of the migratory character of the disease—of “its continued extension in all directions from the place in which it originated, with a rapidity, not uniform, and never greater than that of human intercourse”—of “its having, in many instances, appeared to follow the principal lines in which this intercourse takes place”—and of “its having frequently shown itself in a port, or town, soon after the arrival there of a vessel, or caravan, from one previously infected.”

All that seems necessary, therefore, to complete the proof—if, indeed, anything more be necessary—is to show, 1, That these fungi are not bred (in these climates, at least) in any other place; and 2, That those bred in the human intestinal canal are sufficient to account for the

propagation of the disease. On both points, as I believe, the evidence is, at once, clear and decisive. allied

In regard to the first, it might be enough (after what has already been shown) to bring forward the fact, that these beings have never been discovered elsewhere with characters indicating a process of development, or propagation. In water, which there is reason to believe is the principal medium for their diffusion, they exhibit signs of commencing disintegration and decay within no long time of their separation from the body. allied

But other considerations are not wanting to the argument, and considerations, too, of a still more conclusive kind. These are, in part, derived from the fact already proved, that the human intestine is, at least, the chief, if not the only, breeding place of these beings. Their ascertained development in such a peculiar *habitat* as this, is the best proof that the conditions required for this development must be of an extremely special order. But *how* special can only be appreciated when we add to this the other fact, that it is only in the intestinal canal of *Man* that these beings propagate.

The entire exemption of the lower animals from a plague so deadly to man, is, indeed, a fact which has arrested attention, as it well might, at all times, and in all places, and has ever been justly regarded as one of the most remarkable in its history. And yet this cannot be because these animals do not receive the poison into their bodies. The dog, the cat, and the horse, which attend upon us, which breathe the air we breathe, and drink the water we drink, must swallow these fungi in great numbers, as well as ourselves; and yet the dog, the cat, and the horse — aye, and as far as we know, all other animals — escape harmless.

If, then, this fungus does not find what is necessary for

its development in situations which, as far as general conditions are concerned, resemble its native home so closely, it is little likely that it should do so in any of the elements of the dead natures which surround us. Unless, indeed, we suppose, which is most improbable, that the exemption of these animals from cholera is due to the fact, not that the cholera-organisms do not breed in their bodies, but that, breeding there, they are of none effect.

I say, most improbable, because, while it is contrary to all analogy that the last supposition should be true, it is consistent with all analogy that the first should be perfectly true.

As an illustration of this, I might adduce the exclusive propagation of the potato blight (which is also a fungus) in the tissues of the potato-plant; and, if there were need, a thousand other instances of the same sort.

If these considerations should not be deemed sufficient to establish the point, I have one more in reserve, which includes the rest, and is worth them all. I allude to the fact, of which evidence will be presently given, that, in this climate at least, the cholera fungus not only does not breed anywhere but in the human intestine, but that, unless in the dried state, its germs cannot even long survive their removal from this, their appointed home.

As regards the only remaining question, — whether, namely, the germs which are here bred are sufficient to account for the propagation of the disease, nothing need be added to what has been already said.

It has already been stated, that within the field of the eighth of an inch object-glass, from 500 to 1000 of these fungi may sometimes be seen; besides spores in countless numbers. When we reflect that the little flake of matter included in this field is not bigger than a pin's head, and

that every single discharge from the bowels of a person sick of cholera contains myriads of such flakes, we are led to the unavoidable inference that in every such discharge there are germs enough, did they all take effect, to infect the population of a kingdom. Fortunately, as I shall presently show, most of these germs, when once out of the human body, soon begin to decay, and thus it happens, that where one reaches its destination, ten thousand perish by the way. And it is well for us that it is so. Were it otherwise, indeed—awful as the consideration must seem, and well calculated to fill us with a sense of our dependence—the annihilation of the human race must have been the inevitable consequence of the fertility of this microscopic parasite.

I have been thus particular in working out this chain of demonstration, because of the immeasurable importance of the result to which it leads. For, once show this result to be true, and there follows from it, by direct logical inference, this most momentous conclusion,—that if, from the first invasion of the disease into this country, the poison contained in the discharges of infected persons had been destroyed, (and the destruction of it may doubtless be accomplished by simple means,) **MALIGNANT CHOLERA HAD NEVER BEEN EPIDEMIC IN ENGLAND.**

And it follows, yet more, that by acting upon this knowledge now, although we may not be able at once to “stay the plague,” we may yet much abridge its sojourn among us.

A conclusion so momentous as this, whether we measure it by the regrets with which it fills the breast for the past, or by the hopes it raises for the future, might well give rise to misgivings as to the trust-worthiness of the chain of evidence on which it hangs. But look at this

chain in whatever way I can—twist it or turn it as I may—I can see no break or flaw, but, on the contrary, every link perfect.

Entertaining, therefore, the conviction that the conclusion is just, I could not acquit my conscience without, at once, making public the grounds on which it is founded.

Having now treated of the nature of the poison, and of its source, we may next consider the mode of its dissemination.

According to the fifth and last proposition, the germs of the cholera-fungus are diffused in three ways:—1, through the air; 2, in contact with articles of food; and 3, and chiefly, in the drinking-water of infected places.

The evidence on which the last averment rests,—that water, namely, is the chief vehicle of the poison,—is clear and paramount. It may be seen on all sides, and in a thousand circumstances:—

1. In the fact, that it is into water (through the sewers) that the poison commonly passes in the first instance, and always in the greatest quantity; and that in water, therefore, it must always most abound.

2. In the well-known tendency of cholera to follow the course of streams.

3. In its known partiality for low levels.

4. In the striking immunity (on the whole) of persons who only *visit* infected places, and who do not eat and drink there.

5. In the singular concentration of the disease, in many instances, in courts and other limited localities, while the inhabitants of the immediate neighbourhood remain perfectly healthy.

6. In the successive outbreak of cholera, in its most violent form, in different parts of the same town, separated from one another by large healthy districts, but between which, communication by water (through sewers) may be shown to be ready and direct.

7. In the frightful fatality of the disease in particular parts of infected towns, in which the drinking-water of the inhabitants has been *known* to be contaminated by the contents of sewers.

8. In the fatality of the disease in vessels in the rivers of infected towns; and especially in such vessels as draw their drinking-water *from those parts of these rivers near which the sewers of infected quarters open.*

The facts stated under most of these heads speak for themselves, and require no comment. That mentioned in the fifth is one of very great importance to the argument, because its occurrence can only be explained on the view I am here enforcing. A single illustration will suffice to make this plain :—

The first violent outbreak of cholera in Bristol occurred, early in June, in a series of small courts, all communicating with one another, in the neighbourhood of Redcross-street. In little more than a week the disease killed, in this one locality, out of a small population, more than fifty persons; and yet, all the while, the inhabitants of Redcross-street itself, a few steps from the spot, remained perfectly exempt. Now it is impossible to conceive that a thing so deadly here, and so harmless a few steps off, could have done its work through the medium of an element so shifting as the air. But once suppose the poison to have been introduced into the bodies of the persons who took the disease, in the water they drank—water, be it remembered, which I have shown to

have been actually infected*—and what was before a mystery is now clear as day.

The fact stated under the sixth head (if any of the doctrines put forward in these pages be true) is equally conclusive.

Of this fact a thousand illustrations might be adduced, if they were needed, and if time allowed.

For many such, I need not go farther than to the history of the epidemic which for some months past has so heavily afflicted this city.

From the first outbreak of the disease at Keynsham, on the bank of a stream which feeds the Avon, about eleven miles above Bristol, to its subsequent appearance at Hanham, on the Avon itself, and then at Cruwys Hole, and at the Bristol Cotton Works a little lower down the river; from its transference thence to Redcross-street, and its spread there in the way already described, to its next frightful outbreak in the Rackhay, at a time when the Float—whose water was shown to have flowed up into the sewers of this locality—must have been teeming with cholera fungi, derived from the sewers of the cholera hospital,—we see evident and unmistakeable illustrations of the diffusion of cholera by water.†

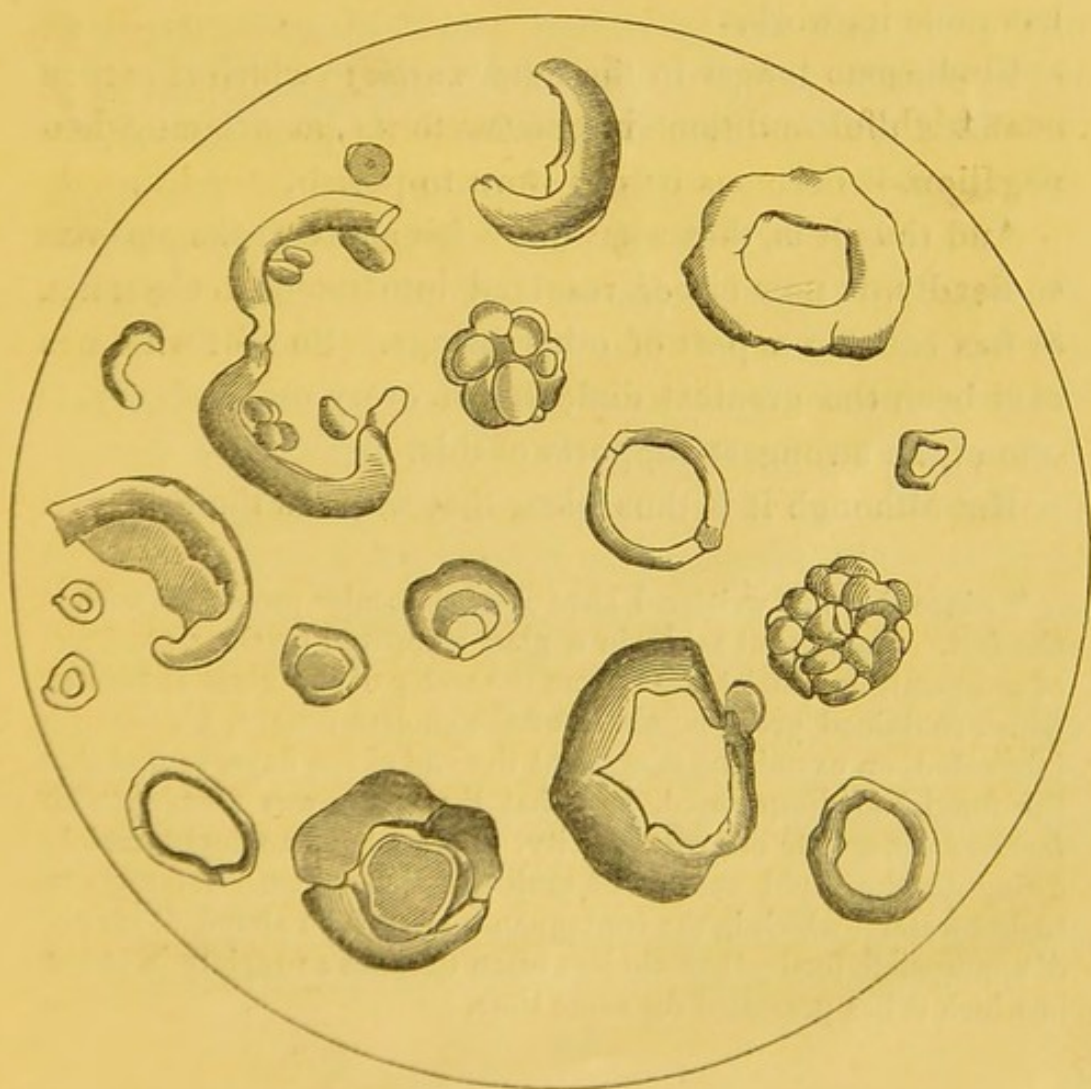
* See page 4.

† Dr. Snow, whose ingenious pamphlet on Cholera fell into my hands while these materials were preparing for publication, has been led, by the consideration of particular instances of some of the facts above alluded to, to the same conclusion as to the part which water plays in the diffusion of the disease. Of being the first to develope and to publish this very important conclusion he must, therefore, have the whole merit. To no part of this merit do I lay the slightest claim. In Dr. Snow's illustration of the entire subject of the propagation and prevention of cholera there is, besides, much that is so apt, and in such entire accordance with the truth, that the detection of the actual cause of the disease, and the determination of its nature, were all that was wanting to convert his views into a real discovery.

But although water is the chief medium through which the disease extends itself, it is not a medium in which cholera can propagate itself indefinitely in any one place.

I have ascertained, by many observations, that the cholera-fungi do not remain very long in this element before they begin to show evident signs of maceration and decay. This is an event, indeed, which befalls all organisms of this class when they are placed in liquids in which they do not find the conditions necessary for their growth and propagation. The forms taken by the decaying remains of the cholera-fungus are represented in the annexed wood-cut.

FIG. 3.



It is more than probable, too, that these fungi—sharing in this, also, the common fate of their tribe—become the prey of beings of a higher order.*

And herein lies the secret of that fact which has always been looked upon as one of the great mysteries of the disease ;—a fact which has been an enigma to all previous inquirers, and a stumbling-block in the way of all previous theories—I mean the *rapid subsidence* of cholera in a place where but a few weeks before it was raging like a plague.

Knowing what we now do, it is not only easy to explain this fact, but to see that it must be so.

When, indeed, the cholera-fungus has once passed through all the human bodies to which it can gain access, in a poisonous dose, in the several ways pointed out, it has done its work.

Finding no longer in the other *media* to which it is then confined the conditions necessary to its growth and propagation, it becomes its own turn to perish.

And thus it is, that what but a few short weeks ago was so deadly, is now either resolved into its first elements, or has become a part of other beings. So that what has ever been the greatest difficulty of every other theory, is one of the strongest supports of this.

But although it is thus clear that water is the principal

* Since this was written I have obtained ocular proof that such is the fact. Having set aside, in a glass-stoppered bottle, a specimen of sediment, in a moist state, from the water of the Float at Bristol, which contained great numbers of the cholera-fungus, I was much interested, on examining it again at the end of ten days, to find that the fungi had disappeared, and that the water was teeming with *infusoria*, in a state of great activity. It is, I have no doubt, mainly owing to the rapid and great multiplication of such infusoria in turbid water—which is the consequence of such an abundant supply of appropriate food—that cholera often declines so rapidly in towns in which it has prevailed for some time.

medium through which cholera diffuses itself, it is no less clear that water is not the only one.

If we must look to this element to explain the chief diffusion of the disease, we must look to the *air* to explain its occasional transport over wide tracts without the intervention of man; its introduction into new countries in spite of quarantine and every other human precaution; and probably to explain, also, in many instances, the single and casual case.* It is doubtless, also, to poison dried in the air, and thus preserved with its powers unimpaired, that must be ascribed the occasional rekindling of the disease, without any fresh importation of this poison, in places which cholera has once visited. But for all the poison that thus takes effect through the air, a new stock is immediately returned to the water with increase a thousandfold. And thus it is that every case so originating, tends to infect the whole district which lies below it, in the line of water-shed.

Such is the way in which these two great elements play—so to speak—into one another's hands.

It is possible, also, that the part which the one or the other of these elements takes in the diffusion of the disease may vary much with season and climate. And it is not difficult to imagine that, in the high temperature and long continued droughts of India, we may one day find the reason why cholera is perennial there, while in the cold and damp climates of the north its visits are occasional only.

But whether this be so or not, what we already know of the nature and history of the cholera-poison is not only sufficient to enable us to account for all the chief pheno-

* Dr. Snow's illustrations of all this are as perfect and apposite as if he had been aware of the existence of the cholera-fungus.

mena which mark the course and spread of the disease, but actually to show that these phenomena must necessarily happen as the direct consequence of such conditions.

Take the human body for the source of the fungus, and air and water for its chief vehicles: consider its great minuteness on the one hand, and its infinite multiplicity on the other; its exceeding fertility within the human body, and its proneness to decay (except in the dried state) without; and with these elements you explain all. You explain alike the gradual diffusion of the disease, its epidemic prevalence, and its final cessation; its intense concentration in some localities, and its occurrence in scattered and isolated cases in others; its propagation in many instances with proofs of direct communication too plain to admit of dispute or evasion, and its propagation in a thousand others in ways impossible to trace.

Testimony such as this, so manifold and so various, so inconsistent in appearance, and yet so consistent in fact, coming from so many and such opposite quarters, but all telling the same tale, can only belong to the truth.

And such is, as I firmly believe, the character of the doctrine put forward in these pages as to the nature of the cause of cholera, and the mode of its propagation.*

One task only remains, therefore—but it is the most important of all—to show, namely, in what way this doctrine may be brought to bear on the mitigation of the horrible pestilence which is still raging around us.

The means by which this mitigation may be accomplished are simple and obvious.

The objects they include are these two:—

* See Note 3 in the Appendix.

1. To destroy, from this time forward, all the poison which continues to be generated in the bodies of infected persons ; and 2. To prevent, as far as possible, the poison which has already escaped us from taking effect.

The first of these objects may be attained by means of the simplest kind. All that is required, in fact, is to receive, henceforth, the discharges from the sick into some chemical fluid known to be fatal to beings of the fungus-tribe. And among chemical agents, a thousand are known, which accomplish the destruction of these beings with unerring certainty.

Nothing more is necessary, therefore, than to choose from among these agents the cheapest and the most convenient. This is a matter of detail which might be easily settled, but which I will not undertake at once to decide ; contenting myself merely with suggesting that, on both grounds, the solution of chloride of zinc possesses strong recommendations, if it should be found, as I believe it would be, effectual for the end in view.

Had this simple precaution of destroying the germs of the disease, by this or some other means, been taken from the first, cholera would never have been epidemic in England. By adopting the same precaution for the future, it may be prevented from ever becoming epidemic again. By adopting it now, the disease may be soon made to cease from the land. Let the towns which have hitherto been fortunate enough to escape the scourge look well to this, for in this they may find their continued safety.

The only difficulty, in fact, in the way of such a consummation is in getting a measure of this kind universally acted upon. The experience of vaccination has unfortunately shown that, whether from ignorance or perverseness, the lower classes of this country will often reject the

only means by which they can be preserved from the greatest perils. Notwithstanding this, however, the practice of vaccination has become sufficiently general to lead to the great abatement of small-pox among us. In all their main conditions, the two cases are perfectly parallel. But in the present case, there are many circumstances which will enable the voice of authority to act with far greater effect in enforcing the dictates of science.

Although everything might not be done, yet a vast deal might be done, to ensure the universal adoption of this measure by a well-organised system of medical police, quickened and directed by a vigorous head.

It is, besides, no small guarantee for the execution of so simple a thing as this, that the penalties of its neglect can be shown to be so tremendous.

The second object—that of preventing the poison which has already been cast loose from taking effect—is, I fear, more difficult to accomplish. Nevertheless, for this, too, a great deal may be done.

As water is the principal channel through which this poison finds its way into the human body, so is the procuring pure water for drink the first and most effectual means of preventing its action.

From this day forward, let the people of infected districts be supplied with water from healthy quarters, or from sources beyond the reach of contamination; or, if this be not feasible, let steps be taken to rid the water they are compelled to drink of the deadly poison it holds. This, probably, might be done by very simple means. It is more than probable, even, that the act of boiling would suffice. But if boiling the water should not succeed, it might be distilled rather than fail. Such a process as this could, of course, not be employed to purify the drinking-water of a large community, but

many a family now living in fear and trembling in a tainted district would be too happy to purchase the slightest addition to its means of safety at so small a cost.

To no part of the community is the need of an immediate supply of pure water more urgent than to the immense floating population of the port of London. At present the crews of vessels in the most tainted parts of the Thames draw up from it, in buckets, their daily supply of water, which they commonly drink without any other purification than that which it undergoes by a few hours' standing. The effect of this—of which many illustrations will doubtless appear in the records of the Seamen's Hospital—may readily be conceived, when I state that when I last examined the water of the Surrey canal, in which many of these vessels are moored, the sediment it threw down was literally teeming with the cholera-fungus.

The importance of preventing the disease in sailors will be more apparent when we reflect on the unquestionable fact that ships are great instruments for its diffusion.

Besides these, there are other things to be done, which, although of minor importance, should not be neglected. Such are the whitewashing of all houses in which the disease has occurred, and the destruction or purification of tainted articles.

Such is a brief summary of the most urgent measures to be adopted in the present emergency.* The complete extermination of cholera would, no doubt, be too much to expect from them. But by carrying out these measures with a vigorous hand, and by uniting them into

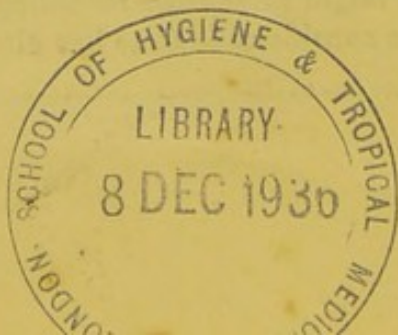
* It is plain from what has been stated above, that great danger of rekindling the disease might arise from meddling with the sewers of infected places, until a considerable time has elapsed after its entire disappearance.

one great plan of action, we may yet hope, by God's blessing, to keep this deadly foe at bay, and thus to prevent many a happy home from being made a house of mourning.

I cannot conclude these observations on cholera, and its mode of propagation, without remarking how important it is—even in regard to their own interests—for the Rich to attend to the physical wants of the Poor. To do this is one of our first and plainest duties. The duty itself we may evade, but we cannot evade the sure penalties of its neglect. By reason of our common humanity, we are all more nearly related here than we are apt to think. The members of the great human family are, in fact, bound together by a thousand secret ties, of whose existence the world in general little dreams. And he that was never yet connected with his poorer neighbour by deeds of Charity or Love, may one day find, when it is too late, that he is connected with him by a bond which may bring them both, at once, to a common grave.

September 25, 1849.

Postscript.—The substance of these pages has been in type since Wednesday, the 19th inst. Its publication has been delayed at the solicitation of some of Mr. Brittan's particular friends, (at the cost, it is feared, of what must appear a great breach of duty on my part towards the public,) in order to give Mr. Brittan priority of publication.



APPENDIX.

NOTE 1.—(Page 8.)

EXCLUDING cases of the prevalent diarrhoea, in which some of these bodies are generally to be seen, I will venture to affirm, that they never occur in any other disease in any considerable number. Their presence in large numbers would, in fact, of necessity, give rise to sensible characters in the intestinal discharges, of such a specific nature as would at once reveal the existence of these organisms to the practised eye.

There is a particular source of fallacy besetting investigations of this sort so likely to mislead the inexperienced, if they are not warned against it, that it ought to be pointed out: I allude to the singularly deceptive appearances sometimes put on by globules of oil. In the discharges of the infant, especially, these globules often become coated with a thin film of albumen, in the way first described by Ascherson, and thus assume the appearance of cells. Some of these pseudo-cells resemble so closely the simpler forms of the cholera organism, that it is sometimes necessary to look more than once, and well, too, in order to distinguish between them. Any difficulty of this kind may, however, at once be cleared up, by digesting the specimen for a short time in hot ether. By this process, the oil-globules are at once dissolved, while the true cholera organism remains unaltered.

There is another apparent exception to the proposition to which this note refers, which would seem at first sight to be more serious. Choleric discharges are said now and then to occur, in which none of these peculiar organisms (i. e. in their fully-developed state) are to be discovered. I have never met with any instances of the kind myself, but my friend, Mr. J. G. Swayne, informs me that he has seen two examples of it. In both cases, I believe, these objects were found in their usual numbers, in subsequent examinations of other specimens of "rice-water" from the same subject. And the same,

no doubt, is the case in all instances of this sort. Indeed it may be safely asserted, that it is just as possible for the itch to occur without the *Acarus Scabiei*, as for malignant cholera to occur without these bodies.

NOTE 2.—(Page 9.)

It is proper to inform persons who may wish to verify these observations, that the task is one which will require no small labour and patience. As the individuals to be found in so large a medium are of necessity comparatively few, and widely scattered, many precautions and much time are needed for their detection. The plan I have adopted myself has been, to pour the specimen to be made the subject of examination into a tall cylindrical glass, to set it aside for twenty-four hours (carefully covered), and then to examine the sediment, which, at the end of that time, may always be found at the bottom of the vessel. Many portions of this sediment may perhaps have to be looked at, and that with great care, before anything characteristic is met with. By the exercise of a little patience, however, one or more clusters of these bodies are generally to be found, with their characters so well marked as to admit of no doubt as to their nature. I have examined some samples of water, so rich in them, that by any one who had not been previously informed of their source, these samples (viewed through the microscope) would infallibly have been taken for specimens of "rice-water" itself.

NOTE 3.—(Page 22.)

The establishment of this doctrine for Cholera opens a wide field of discovery in other diseases. It leads at once to the persuasion that dysentery is a disease of the same class, is propagated in the same way, and may, probably, be prevented by similar means. It suggests also the suspicion that whooping-cough and influenza are diseases of the same order; produced, that is, by the growth and propagation of microscopic beings at the expense of the materials of the human body, but drawing these materials from the lining membrane of the air-tubes, and transmitting their germs through the air.

