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In 1866

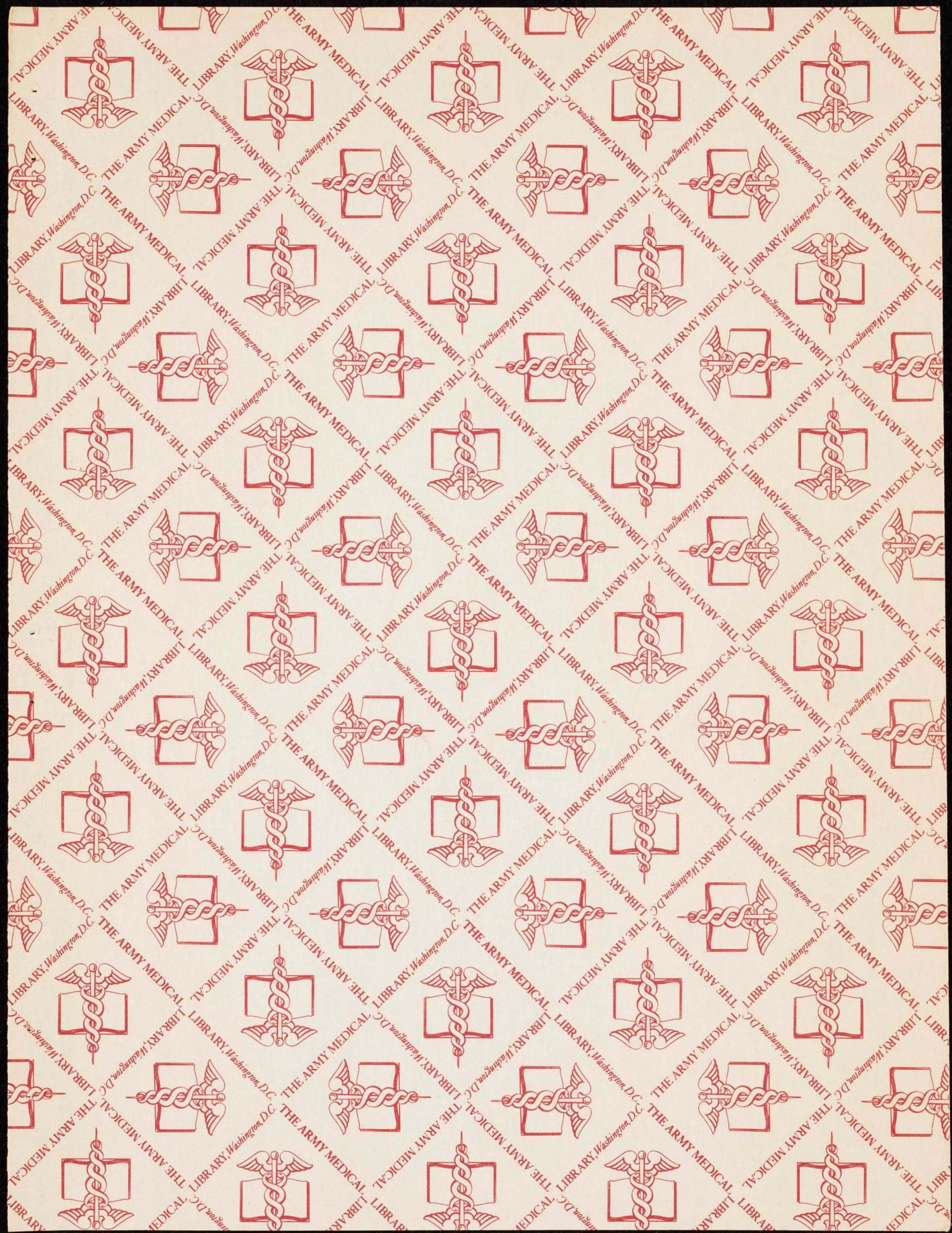
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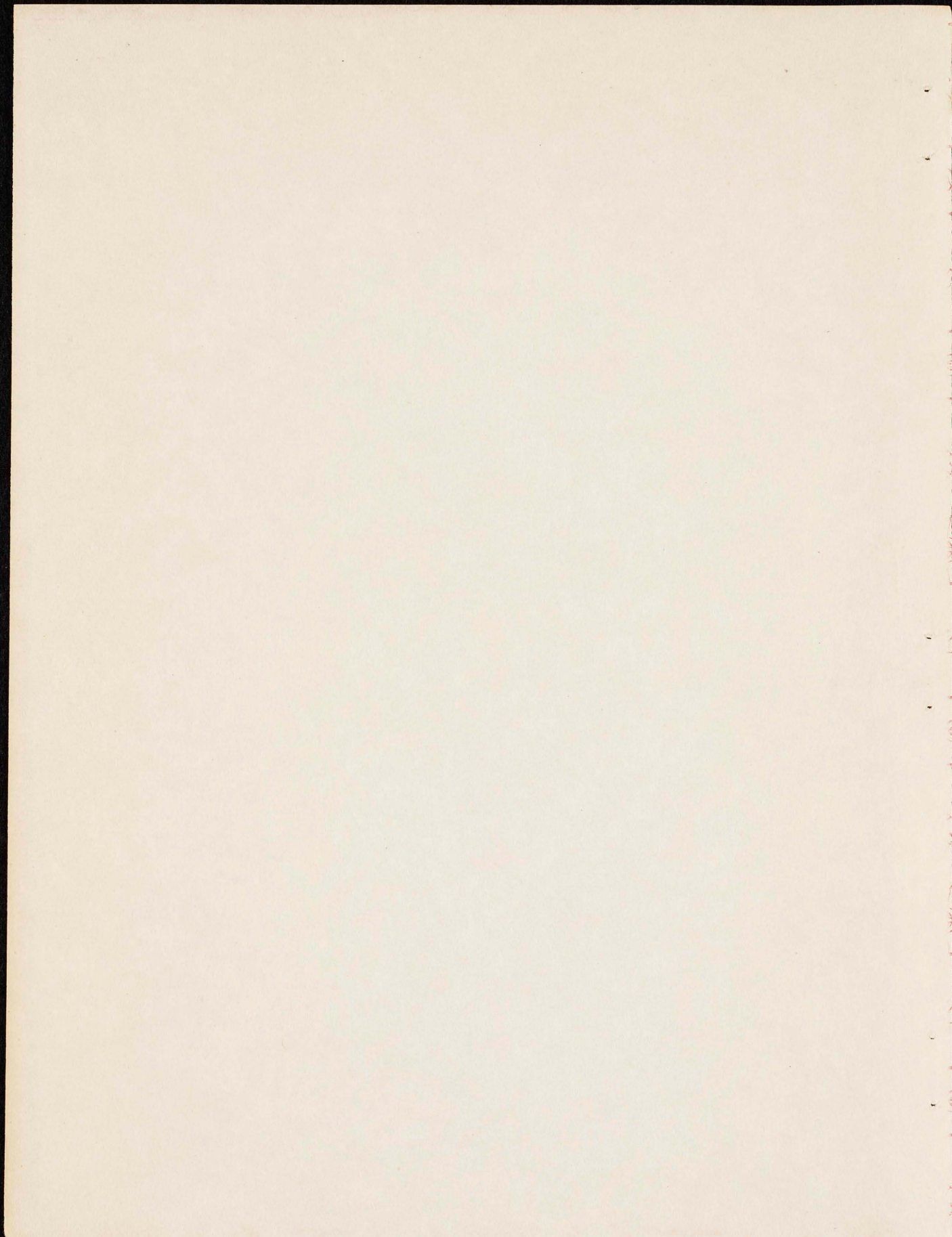
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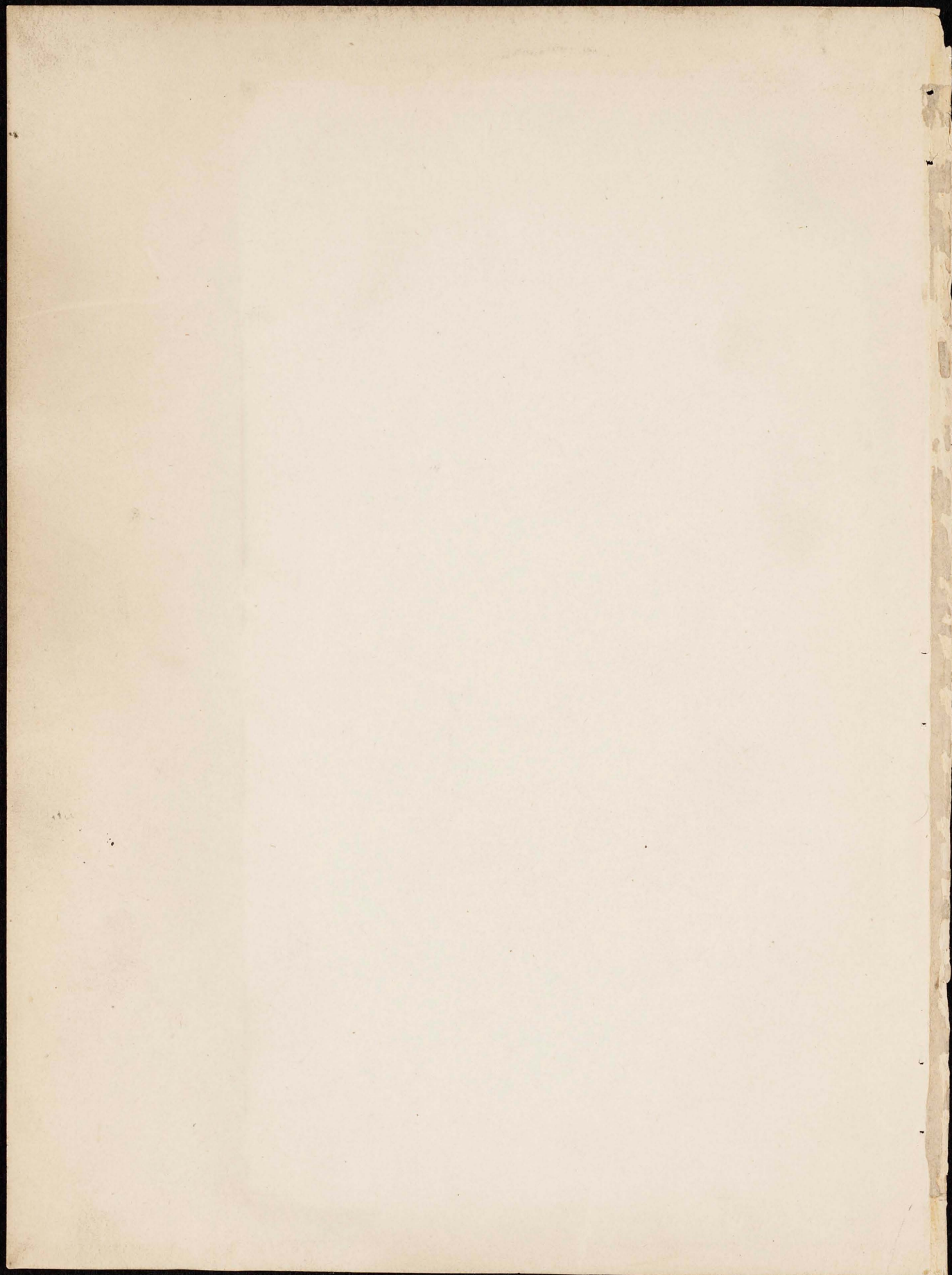
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CHOLERA AND DISINFECTION.

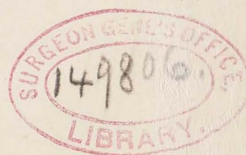
ASIATIC CHOLERA IN BRISTOL

IN 1866.

BY

WILLIAM BUDD, M.D., F.R.S.

"OBSTA PRINCIPIIS."



BRISTOL :
THOMAS KERSLAKE & CO., 18, QUEEN'S ROAD.

1871.

Annex
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P R E F A C E.

THE following account of Asiatic Cholera as it occurred in Bristol in the course of the great European Epidemic of 1866, was first published in the *British Medical Journal* for April 13, 1867. Under present circumstances I make no apology for giving this account to the public in a separate form.

Once more, it is but too plain, we are seriously threatened by the great Indian Pestilence. Not only is Cholera making great ravages in continental towns with which we are in frequent intercourse, and from which we have often derived the infection before, but ships bearing men actually stricken with it are constantly reaching our shores. Even as I write it is said that the disease, appearing under some unfamiliar guise and thus escaping quarantine, has broken through our first line of defence. At Hartlepool on the 8th of this month,—so the statement runs,—a Hamburg steamer arrived having on board a sick sailor recently from Altona. The real nature of this man's malady not being at first apparent, he was brought on shore and placed in the general hospital, where he soon afterwards died of cholera in its most malignant form. The national danger, therefore, is not only great but imminent.

I believe I am only expressing the general opinion of the profession in England when I say, that we know enough of cholera to justify the assertion that whether we are to escape with merely a slight visitation, or, on the contrary, to endure for the fifth time the agonies of a great national epidemic, may in a great degree, if not entirely, depend on the nature and efficacy of the measures we adopt during the next few weeks. What these measures should be is a question which possesses for the whole nation at this moment the highest importance.

Now, looked at from this point of view, the experience of Bristol in 1866 has this very special claim to attention, that it presents what, if I am not misinformed, is still the only example of a great city, eminently disposed (as the

recent ravages of scarlet fever here have painfully shown), by the character and crowded state of its population, to the propagation of contagious disease, succeeding in protecting itself against cholera by measures specially designed for that object.

In whatever way the facts may be interpreted, this much, at least, is certain.

In all former epidemics of cholera Bristol had a large mortality from it, but in the epidemic of 1866, while nearly the whole of Europe and a great number of our own cities (the metropolis included) were suffering severely, in Bristol, cholera, although implanted over and over again, in the lowest parts of the city entirely failed to spread.

As a matter of scientific curiosity only, the conditions of such an exceptional and happy immunity deserve to be minutely studied.

But, practically, the case at the present time is of far greater moment.

For, if Bristol really was saved from cholera in 1866 by the preventive measures then taken, is it not possible that the kingdom may now be saved in the same way?

I speak still in the interrogative mood because, however strong the evidence may seem, one is almost afraid to believe in so great a triumph as this until it is assured by still more extended experience. In exact proportion to the importance and magnitude of any given conclusion, the true philosopher, strong though his own conviction may be, is exacting of proof.

The exemption we enjoyed from the sad fate of so many sister cities was, I believe, due to two principal causes.

First, to the unexampled vigour with which the whole system of prevention was carried out by our health officer, Mr. Davies; and, Secondly, to the adoption, in a systematic way over the whole city, of what I may venture to call the great principle of "Disinfection by anticipation,"—a principle destined, if I mistake not, to play no small part in future preventive medicine.

In the Preface to the second edition of a pamphlet on the mode of Spreading and on the Prevention of Asiatic Cholera, which I published in 1865, this principle is referred to in the following terms:—

"I am anxious to take the opportunity, which the publication of a Second Edition of this little pamphlet affords me, of saying an earnest word on the extreme importance to all places threatened by cholera of establishing depôts where disinfectants may be had gratis or at cost price.

"IN SUCH TIMES AS THESE NO HOUSE SHOULD BE WITHOUT ITS SUPPLY OF THESE PRECIOUS SAFEGUARDS.

"Two well known facts will show at once what great issues may hang upon this.

"The first is, that of the most malignant attacks of cholera, a large proportion occur suddenly *in the dead of night*, when disinfectants if not at hand, cannot readily be got; and Second, That the discharges *from a single case* may, under conditions of no uncommon occurrence, become the means of spreading the disease through a large community.

"If from this time, the practice were made general of throwing chloride of lime or some other disinfectant into privies and waterclosets, every night and morning at least, in all places threatened by cholera, the public safety would be immeasurably increased. In this way the care of the many might be made to counteract the negligence of the few. For the result of this practice would be that the sewers would be always charged with the antidote, and any choleraic poison that might chance to find its way into them would be at once bereft of its deadly power. In the way of a preventive measure nothing could be named which promises so much as this. There are some who even go so far as to believe that Cholera, although it might prevail with local severity, here and there, could scarcely become epidemic in the face of this precaution, provided the water supply were at the same time good. In comparison with the object to be obtained the expense would be slight, and would probably be more than repaid, by the improvement which would otherwise accrue in the public health.

"Of the part which the public authorities, the managers of great public charities, and the great employers of labour, might take in promoting this salutary measure I need not speak. A word to the wise is enough.

"The paramount duty which devolves upon all Boards of Health of keeping the sewers of a district, in which cholera prevails, thoroughly and constantly disinfected is well understood here, and under the guidance of our able Health Officer will, I have no doubt, be fully acted upon should cholera come among us."

The anticipation in which I ventured to indulge in the last sentence of this quotation was, as will be seen in the following pages, fulfilled to the letter.

For myself, I believe it is impossible to exaggerate the importance of the principle here acted upon.

If indeed the recent and now generally adopted doctrines as to the mode of spreading and the prevention of cholera have any truth in them, the case amounts to this,—that where this principle is enforced it must be almost

impossible for the disease to spread widely, and that where not enforced there is no certain security that it may not commit wide-spread havoc. The more indeed I examine the evidence, the more convinced I am that it is from not having adopted this principle, that, in spite of the lavish use of disinfectants in case of actual disease, so many great communities have continued to suffer terribly from this ignoble and deadly pest.

The suggestion that the expense incurred by the practice would probably be more than repaid by the improvement that would otherwise accrue in the public health, was realised here in a degree that surpassed all expectation.

This, in fact, was the result: In a season of pestilence, and at a time when the London death rate exceeded—if I remember rightly—its weekly average by nearly a thousand, the mortality of Bristol fell to the unprecedentedly low figure of twelve* in a thousand, and the parish of Clifton, with more than twenty thousand inhabitants, passed an entire week without a single death! A lesson, this, which other municipalities might do well to ponder.

In conclusion I need scarcely add that I do not put forward this record of our experience, in Bristol, with any view of disparaging, but rather in furtherance of, the instructions for the prevention of cholera, which have already been issued by Government. These instructions are, as far as they go, extremely well conceived. If the execution of them be at all equal to the design, they will do much to keep cholera from us.

All that is wanting to render them complete is to enforce the principle of disinfection by anticipation. At present the chief danger of invasion by cholera lies in our seaports. If from this time the sewers of such of these as are in communication with infected places were constantly saturated with disinfectants, as the sewers of Bristol were in 1866, our security would be greatly increased. In this belt of protective agents the seeds of the pestilence would find a barrier not easy to pass. It would be as a coat of mail against which the arrows of the foe would strike harmless. Mistakes might (as indeed they certainly would) be made; cholera might still escape recognition and quarantine alike; but the risk of evil consequences would be immeasurably reduced.

It should always be remembered too, that the case is one in which the safety not only of the seaport towns themselves, but that of the whole kingdom is at stake.

* The official number returned was fourteen in a thousand, but as this ratio was founded on an assumption that the population of Bristol was some fifteen or twenty thousand less than the recent Census has shown it to be, twelve in a thousand is nearer the truth.

A few hundred, or even a few thousand, pounds spent in the purchase of the needful chemicals would be a trivial outlay if it helped, in any degree, to secure so great an object. The total sum spent by the authorities in the operations described in the following pages did not exceed six hundred pounds. This was a small rate of insurance for a city of nearly 180,000 inhabitants to pay against such a terrible scourge. Putting the question of cholera altogether aside, and looking merely to what must have been saved by the improvement which followed in the public health, Bristol never made a better investment, even in a money point of view.

Had the town been swept, as so many great towns were, by a cholera epidemic, six hundred, or even six thousand pounds, would have gone but little way towards the resulting expenditure.

It will, no doubt, surprise many that among the items charged to the city a cholera hospital does not figure.

One of the most striking features of this striking history is the fact that with the exception of some half dozen or so, all the sufferers were treated in their own (too often) crowded and squalid homes. Such, indeed, was the confidence which our health officer felt in himself, and in the system of disinfection he was authorised to institute, that he did not think it necessary to ask for this means of isolation.

Whether or not the precedent is one to be always followed I leave others to judge, but, in our case, this confidence was fully justified by the event.

CLIFTON,

September, 1871.

CHOLERA AND DISINFECTION.

ASIATIC CHOLERA IN BRISTOL IN 1866.

THE course which events have taken in the year which is about to close,* has furnished evidence as to the prevention of cholera of the most decisive kind and of the highest practical importance.

After having diffused itself widely over Europe, the pestilence has once more obtained a footing in England, and has visited Bristol, among other cities, for the fourth time. Immediately on its arrival here, the plan of disinfecting the choleraic discharges, which I was the first to propose and employ, and of whose efficacy the epidemics of 1849 and 1854 had already given me many practical proofs, was put in active force against it, and has been continued to the end.

The success which has followed has been great beyond expectation, even in the minds of those who were most sanguine of the result. Many, in fact, who were firm in the belief that cholera is propagated by these discharges, and that the true way to prevent its spread is to disinfect them on their issue from the body, had grave misgivings as to whether this knowledge could ever be turned to successful account amid the confusion, the turmoil, and the thousand and one other impediments to be encountered in a great city.

These misgivings, the experience of more than one continental city which, in the preceding year, had tried disinfectants largely with no great mitigation of the scourge, seemed, indeed, fully to justify.

I myself had, as indeed I have elsewhere shown,† a deep sense of the practical difficulties in the way of the plan; but long thought on the subject had led me to the settled conclusion that, with clear insight and a strong will, these difficulties might all be overcome. It always appeared to me, in fact, among a civilized people like ours, to be a question merely of money and

* This paper was written in the last months of 1866.

† See "Memoranda on Asiatic Cholera, its Mode of Spreading and its Prevention." Wright and Co., Bristol, 1866.

of men; and that, if the right man could be got, and the money were forthcoming, the right thing could be done.

A comparison of the numbers swept off by cholera and diarrhœa in Bristol (including Bedminster and Clifton, which, with Bristol, are practically but one town) in the four successive outbreaks of 1832, 1849, 1854, and 1866, will be the best introduction to what is to follow. These numbers are respectively: 1832, 626;* 1849, 1979; 1854, 430; 1866, 29. From these figures, it will be seen that the deaths which, from something below a thousand in 1832, had risen to nearly 2,000 in 1849, fell to 430 in 1854. This great drop, in exact accordance as it was with the corresponding abatement of the mortality from the pest in other cities, was at the time, and no doubt rightly, ascribed to the sanitary improvement which had taken place in the city in the interval between the two epidemics, and especially to the construction of a better system of sewers and the introduction of a pure supply of water.

But the fall from 1854 to 1866 is much more remarkable. For, while the deaths in 1854 amounted to about one-fifth of those in 1849, the deaths of 1866 were one-fifteenth only of those of the former year. Part of this result might, no doubt, be reasonably ascribed to progressive sanitary improvement (a question to which I shall return in another page); but the very abruptness of the contrast between the mortality of the two years naturally suggests to the mind the intervention of some new controlling condition.

As a matter of fact, such a condition did exist in the shape of the vigorous employment of the disinfecting plan. An analysis of the facts will leave no doubt, I think, in any reasonable mind, of the reality, while it alone can give an exact measure of the extent, of the operation of this plan in preventing the spread of the disease.

The first case of cholera in Bristol in 1866 occurred on April 23rd, at the Princes-Street Bridge toll-gate, in the person of a young sailor, who, about sixty hours before, had left Rotterdam, where the disease was then rife. The attack was a very malignant one, and terminated fatally in about eighteen hours from the date of the first symptoms. By good fortune the patient, immediately on his arrival in Bristol, fell under the care of Mr. Davies, our admirable health officer, by whom all the necessary precautions were taken. The rice-water discharges were disinfected on their issue from the body; the privy was drenched with the proper chemicals; the bed on which the sick man lay was destroyed; and the corpse, wrapped in the sheets and other coverlets on which death had taken place, was speedily fastened down in the coffin, imbedded, so to speak, in MacDougall's powder.

In the next Weekly Report of the Registrar-General, a notice of the case appeared, in the form of a letter from Mr. Davies, which I here transcribe:

* The total number of cases officially reported to the Board of Health in 1832, were 1612; of deaths, 626. These numbers are believed by Dr. Symonds, who was Secretary to the Board, and to whom we owe a very interesting account of this epidemic, to be far below the truth. (*Trans. Prov. Assoc.*, vol. ii.) From calculations founded on the excess above the annual average which the mortality in Bristol reached in that year, he considers that the deaths from cholera fell, in reality, little short of one thousand.

" 2, Queen Square, Bristol,

" April 24.

" Sir,—At five o'clock yesterday, I was asked to visit Henry Thomas, mariner, at Princes-Street toll-gate, in this city. I found him suffering from all the symptoms of Asiatic cholera. He died about five A.M. this morning. He left Java in December, and arrived at Rotterdam on April 14th; left Rotterdam last Sunday morning (April 22nd), and reached London on Monday, April 23rd, at 8 A.M. He left immediately by train for Bristol; was taken ill in the train about 11 A.M.; was ill only eighteen hours. He had rice-water evacuations, most violent cramp of almost every muscle, cold perspirations, sunken eyes, &c. I saw a great deal of cholera in 1849, and I could not distinguish this from a genuine case. I have signed the certificate of death 'cholera.' As the case is isolated, I did not insert the word 'Asiatic;' but I believe it was a case of that disease. My friend, Dr. William Budd, visited the corpse with me this morning, and he is firmly of opinion it was Asiatic cholera brought from Rotterdam.

" Your obedient servant,

" DAVID DAVIES, M.R.C.S.

" The Registrar General."

" The people of that city" (*i.e.* Bristol), writes the Registrar-General, in a note appended to this communication, "are, no doubt, alive to the importance of destroying every vestige of the rice-water evacuations in such cases."

It will be seen, from the details already given, that the confidence here expressed by this eminent public officer was not misplaced. The precaution in question had been fulfilled to the letter.

Knowing, myself, the thoroughness with which, from the first, disinfection had been carried out; sure of the doctrine on which its principle is founded; and strong in the confidence of former success—I ventured to predict that the case would remain without issue. And so the event proved. No other case of cholera occurred in Bristol until the 21st of July following, and that was in a distant part of the city, in a man who had held no communication whatever with Princes-Street Gate.

From that time to the 12th of November following, the disease made its appearance in twenty-four other distinct localities; making, in all, twenty-six infected spots. In five of these instances, as in the case from Rotterdam (making six altogether), the disease was distinctly traced to importation from without; in five others importation was probable, but could not be actually proved; in two, the disease was derived from a previously infected spot in Bristol itself; in the remaining instances, to the number of thirteen, the source of the infection could neither be made out nor guessed.

This last is a difficulty which need not trouble us. During the whole of the period included in this outbreak, Bristol was in daily, rapid and incessant

intercourse with the great cholera field in South Wales, with London, Liverpool, and other largely infected places. It is well known to the student of cholera epidemics that, in cities thus circumstanced—and the remark, indeed, is equally true of other epidemic disorders—this pest continually crops up in this sporadic fashion, without offering any tangible clue to its origin. But, without forming any theory as to the source of these thirteen instances, it is sufficient here to know that each was, in its turn, a new centre of infection, whereby to test the efficacy of the preventive measures.

Touching the twenty-six cases of cholera which, in one way or another, had thus become planted in Bristol, two observations may at once be made. The first is, that the disease was more than commonly malignant—as many as twenty-two of the twenty-six cases having ended fatally; and the second, that a large proportion of them occurred in places crowded by the very poorest class, and amidst sanitary defects of the most flagrant kind. No fewer than six, in fact, occurred in St. Philip's—a parish which paid a large tribute to cholera in every former outbreak; which has long had an evil notoriety as a very hot-bed of contagious disorders; and which at this hour* is maintaining its old reputation by the rapid development within it of a kindred scourge.

The first of these two conditions—*i.e.*, the great malignity of the individual cases—must not be lost sight of. For here, as a rule,[†] no doubt, as in other acute diseases of the contagious class, the more malignant the case, the larger the stock of new poison bred and cast off for the infection of others. The second—that relating to the social state of the community attacked—speaks for itself. Both—the one by furnishing a more abundant seed, the other by providing a fitting soil for its development—conspire to a common end in promoting the spread of the disorder.

The point which most interests us is, however, the mode of distribution of these cases over the inhabited area. This will be best seen by reference to the accompanying Map B, which, at my request, my friend Mr. Davies has filled up for me, in illustration of the outbreak. The twenty-six red dots to be seen on the map mark the site of the twenty-six cases of cholera already referred to. The first thing that strikes attention in regard to them is their wide-spread and very scattered distribution. In the lower levels, at least, there is scarcely any district that has not its red plague-spot. To use the words of Mr. Davies, the city has been tried by the enemy at almost every point.

In fourteen of the number, the red dots stand alone. These fourteen were, all, cases in which disinfection was actively put in force from the first, and which remained absolutely barren and without issue. In twelve cases, the red dots are accompanied by one, two, or three, and in one instance by as many

* November 1866.

[†] I use the words "as a rule," because in some of the most malignant cases of cholera the discharges are comparatively small. But, in spite of these cases, which, according to my own observation, are much fewer than are supposed, I have no doubt that the rule holds good.

as four, green ones. The green are the offspring of the red. They belong to cases in which, for the most part, from some cause or other, some delay—in one or two, indeed, considerable delay—occurred in the application of the disinfecting plan, and in which the first case was followed by one or more cases of cholera or choleraic diarrhoea in the same house. In three instances, but in three only, the disease was conveyed to an adjoining house; in two others, to a house in the neighbourhood.

I need hardly say how much these last cases add to the weight of the evidence. For, had all remained sterile, it might have been plausibly argued, that our exemption from an epidemic in Bristol was not due to the measures taken to prevent it, but to some peculiarity in the cases, or to the excellence of our sanitary condition. So far from this was the truth, that the moment any failure occurred in the prompt application of these measures, the distemper showed its old tendency to spread.

Of the second group of cases, marked by the green dots, eight ended fatally—making twenty-nine deaths in the whole.

The green and red dots together, to the number of forty-nine, mark the sum total of cases of cholera which have occurred in this town in the present year.

The one important feature for us, in the map before us, is its great dissimilarity to other published maps of cholera outbreaks. It is well known to those who are versed in the literature of this subject, that great numbers of cholera maps exist, constructed on this same plan. I myself possess a goodly collection; and in their one essential character, to be presently named, they all differ entirely from this one. Indeed, as far as I know, there is no extant map of cholera which at all resembles it. Many city outbreaks there have been, no doubt, with even fewer cases in proportion to the population; but I cannot at present call to mind one in which there have been at once so many distinct and wide-scattered centres of infection, and so little local infection following upon them.

As there is nothing like contrast to put results of this kind in their true light, I have appended to this map a map of a former outbreak of cholera in Bristol—that of 1832. Unfortunately, there are no maps of the outbreaks of 1849 and 1854; but had such maps been made, they would have presented, with the variation in point of numbers specified in a former page, exactly the same general features as this one.

The 1832 map exhibits in a striking degree the peculiar feature to which, in the memorandum I addressed in 1863 to the Calcutta Cholera Commission, I drew attention as characteristic of them all.* The red dots, instead of being scattered in an isolated way, and with wide intervals between, over the inhabited area, as in Map B, occur here in dense clusters, representing so many cholera-fields, in each of which they lie “thick as leaves in Vallambrosa.”†

* *Vide* Memoranda on Cholera.

† This map was copied for me by Mr. Lavars, of this city, from a map which illustrates a Government “Report on the Sanitary Condition of Bristol and other Large Towns,” by the late Sir H. De la Beche. The red dots only give the site of cholera in Bristol and Clifton. For a complete view of the epidemic, some fifty or a hundred more, distributed in the same clustered manner, would have to be added for Bedminster.

2-12- This, as I have elsewhere shown, so far from being an accident, has its root in the very essence of the disorder. It springs from the fact—common to this and a large group of other contagious diseases—that the contagious germs, from being cast off in a liquid vehicle, necessarily, in the first instance, impregnate the soil around the infected man, and propagate the disease by infecting the ground.

The contrast between these two maps is striking enough as it stands; but the contrast between the *facts* in the two cases was even greater than here appears. For the forty-nine dots, green and red in Map B, represent the sum total of cases; whereas the three hundred and sixty-six dots in Map A represent infected houses only, and stand for at least double, if not three times their number of infected people.

Each map may be best read by the light of the other. In general terms, B may be described as a map of cholera with the seed destroyed, and, as a consequence, robbed of its offspring; A, as a map of cholera with the seed cast loose and allowed to fructify. Of the two, it is difficult to say whether the one, as illustrating the natural law of propagation, or the other, as illustrating the frustration of this law by human interference, be the more interesting. It is impossible not to be struck with the force and beautiful simplicity of the evidence, as thus presented. Pick up the first man who passes in the street, and, with one or two explanatory hints, he shall read the phenomena as readily as the physician who has followed all the steps of the induction by which their true interpretation has been reached.

I do not disguise from myself, indeed, that a very specific objection may be plausibly laid, *in limine*, against the view here taken of these results.

Appended to this paper is a document with which Mr. Davies has kindly furnished me, and in which that gentleman has given, in a tabular form, the principal conditions amid which the individual cases occurred. On looking down the column headed "Water Supply," it will be seen that the great majority of the sufferers—three-fourths of the whole, to speak more precisely—drew their drinking-water from the Company's pipes, or, in other words, were supplied with water free from the possibility of sewage-contamination.* Those who hold that drinking-water is the only or even the chief medium for the dissemination of the cholera poison, may, therefore, fairly argue that we owe our exemption from an epidemic visitation in Bristol, not to the use of disinfectants at all, but to the purity of this important element.

It must not be forgotten, indeed, that in seven of the cases, the drinking-water used was well-water; and that, in three of the seven, it formed the supply of crowded courts. But as, in all seven, Mr. Davies very properly shut off this water as soon as he had cognisance of the facts, these cases were from that time put, in this matter, on the same footing with the rest.

* I took, on public grounds, an active part in the formation of the Bristol Water Works Company, and was a member of the first Board of Directors. Two conditions were made by me a *sine qua non* of my joining the Board: 1. That the water should be drawn from sources beyond the possible reach of sewage contamination: 2. That it should be distributed under the constant pressure system.

That the cholera-germ is often transmitted through drinking-water, the late Dr. Snow, by his admirable researches, long ago proved. That, thus distributed, it may now and then give rise to a wide-spread infection, is equally sure. I could myself add, from my own observation, more than one to the many decisive examples of the fact already recorded.

To secure pure water, and thus to cut off one important channel of communication, is, therefore, clearly, enough, a very important safeguard. But that this safeguard is of itself, and single-handed, sufficient to prevent a severe visitation, is entirely opposed to facts. Even as I write, the particulars of an outbreak illustrating this remark have come into my hands, which, in view of the present tendency of opinion in influential quarters, it may not be amiss to quote.

In the months of September and October last, Asiatic cholera attacked forty-three, and slew thirty, out of two hundred and eighty-two *male* patients in the Devon County Lunatic Asylum. At the same time, the *female* patients, who, I believe, exceeded the males in number, were unusually free from diarrhoea, and there was not a single case of cholera among them. Now, the drinking-water was not only proved by analysis to be exceptionally pure, but both males and females—*i. e.*, those who were more than decimated by cholera, and those who escaped it altogether—were supplied from the same well. So that, in other words, under circumstances in which communication by drinking-water was out of the question, more lives were lost in this little community of 282 persons than in the whole 160,000 which make up the population of Bristol.

Evidence of the same crucial and decisive order abounds to show that, when the other known conditions for its spread are present, cholera may do its very worst where the drinking-water can play no possible part in its dissemination.

It will not be overlooked by those who scan Mr. Davies' table closely, that, in the very instances in which the greatest number of cases occurred in one house, and in the only two in which it spread to adjoining houses, the water drunk was Company's water.

But, if experience does not authorise us in explaining away the entire failure of cholera to establish itself as an epidemic here by the exclusion, in the greater number of cases, of this one mode of propagation, still less can this failure be set down to general sanitary improvement. It is, indeed, probable, as I have already hinted in a former page, that, had no specific measures been taken, the mortality from cholera would have been less in 1866 than it was in 1854. I use the word "probable," because the experience of Exeter shows that this is by no means sure. The case of that city is as striking as it is instructive. In 1832, there were nearly 1,000 cases of cholera in Exeter, and 346 deaths; in 1849, there were only 44 cases; and in 1854, only 4. This quite extraordinary diminution was ascribed at the time, and no doubt in some degree rightly so, to the improvements which had been made in the sewerage of the town, and to the introduction of a pure supply of water. The improvement thus begun has gone on without ceasing from that time to this.

Why did the males die more than the females?

Q. B.

N.B. In the two points just referred to, Exeter can probably compare favourably with any city in the kingdom. So great, indeed, but a short time ago, was the reliance placed on its preeminence in respect of these two conditions, that a distinguished citizen of that town, who had himself taken a leading part in its municipal government, expressed to me in the early part of 1866 a confident opinion that cholera could not possibly become epidemic there. And yet, instead of there being, as in 1854, only four cases altogether, more than one hundred persons are said to have been swept away by the pest. No doubt cholera has revealed, as it is its wont to do, some sad blots in the sanitary state of the town; but I suspect we can more than match them in the city in which I write.

If there be any one who supposes that destitution, crowding, squalor, filth of all kinds, and the thousand other conditions which favour the spread of contagious diseases, no longer abound in Bristol, a morning's walk with the Poor-law medical officers, in the course of their duties, will suffice to disabuse him. At this very moment, indeed, evidence having the most special relation to the propagation of contagious intestinal disease, has developed itself on a large scale in one quarter of the city, as if to show by a signal example what our sanitary liabilities in this way really are, when specific precautions are not taken.

Few things are more sure in the natural history of cholera than this: that the conditions amid which it most thrives are identical with those which promote the spread of typhoid fever. Now, while I write these lines,* the parish of St. Philip's, in that very part of its area where the cholera cases fell thickest in the course of this summer, is the site of an outbreak of this kind of fever which, for severity, has seldom been equalled here. Since the beginning of September, Mr. Woolmer, one of the Clifton Union medical officers, has had within a small compass nearly sixty cases under his care—more than the total number of cases of cholera in the whole city. Other practitioners have had their share; and the fever would, no doubt, have gone further, had not the disinfecting plan been at length brought to bear vigorously upon it.

In order to form a just estimate of the risk we should have run of a severe outbreak of cholera in Bristol, had things been left to their natural course, two other facts must be taken into account.

The first is that, in spite of its peculiarities, there has been something in the past season peculiarly favourable to the spread of the pestilence. The wide area over which cholera has prevailed in an epidemic form in Europe—from Naples on the one hand to Edinburgh on the other—is alone sufficient evidence of this. But it becomes still more striking when we descend to details. While the events which are the subject of this narrative have been pending, Asiatic cholera has carried off more than 100,000 persons in Austria, and more than 40,000 in Belgium and Holland. In the town of Swansea, to come nearer home, more than 400 have fallen victims to it. In the small town of Glastonbury, more than 30 have perished. In the village of Zeal, Devon, 15 died

* November 1866.

out of 170 inhabitants ; while at Methyl Hill, in Scotland, 76 were swept away in a population of less than 400.

The second fact to which I refer is, that in the months of July and August—the very months in which Bristol was most threatened—diarrhoea of a severe kind was very prevalent, and especially so in the districts attacked by the scourge. As two most precise bits of evidence in proof of this, I may mention that some women, employed in a sanitary mission of which I shall presently speak, distributed eighteen pounds' worth of an astringent mixture to persons suffering from diarrhoea ; and Dr. Tibbitts, one of the medical officers employed by the Corporation of the town, dispensed one hundred and thirty-six gallons of a similar preparation for the same need.

This state of the public health, in its relation to cholera, is important in two ways ; first, as constituting, in itself, one of the strongest of all known predispositions to an attack ; and, secondly, as revealing by certain evidence the wide-spread existence of the sanitary conditions on whose presence the diffusion of cholera depends.

Whatever the light by which we view the events, we are thus unavoidably led to the belief that this city owes its exemption from an epidemic of cholera in the summer of this year, to the specific measures taken to prevent the spread of the malady. Had the principle on which these measures are founded been purely empirical, the facts would have left us no reasonable alternative. But, as we know, the case is far otherwise. By an induction which, for commanding clearness and logical severity, is rare indeed in physic, we have arrived at the conclusion that Asiatic cholera is propagated (exclusively, as I believe) by the rice-water discharges. To destroy these discharges is, therefore, to destroy the seed by which the disease is sown, and, by the very act, to prevent the possibility of a future crop. In Bristol, the seed has been destroyed, and the crop has failed. What was expected has exactly come to pass. The accordance between theory and fact is not general merely, but very nearly perfect.

The measures by which this great result has been attained were, in the highest degree, simple. First among them, I need scarcely say, was the disinfection of the rice-water discharges on their issue from the body, and of every article or thing that might, by any possibility, become soiled by them.

Although, with the exception of six or seven, all the sufferers were treated at their own homes, I have reason to believe that this was pretty effectually done from the moment when, in each case, the true nature of the disease was recognised.

Could this precaution have been secured from the first, and in every attack, it had no doubt sufficed of itself, as it did suffice, for instance, at Horfield,* and in many another case I could cite. But, although not difficult in an organised establishment, or in a well-ordered home, it is plain that the observance of such a precaution as this can never be insured, with the certainty needful for the object in view, among the ignorant and destitute poor of a large city.

In such a community, cases are sure to arise in which the first period of

* November 1854.

*the measures were taken
with perfect success and
prevented the disease from
spreading*
R.B.

cholera is allowed to pass away without preventive measures at all; and others—of the milder sort—in which the specific nature of the disease is not even suspected from first to last. As it is not less certain that the germs which are the resulting offspring may become the source of a wide-spread infection, the consequences are not difficult to foresee.

There is another characteristic which lends to these conditions a quite peculiar urgency. In typhoid fever, and in most other contagious fevers, the infection is, for the most part, slow to develop itself, and some breathing time is allowed in which the physician can still intervene with power to prevent their spread. No so here. In Asiatic cholera, from the peculiar shortness of the period of incubation, new crops spring up in such rapid succession, that the practitioner often finds himself overwhelmed and distracted by the burden of a great epidemic before he knows where he stands. Hence while, on the one hand, a single omission in the adoption of the proper measures may, under certain conditions, cause the best plans to miscarry, on the other, omissions are well nigh sure to occur. To cope successfully with so fatal a dilemma, there is, clearly, but one possible way; and that is, TO BE BEFOREHAND WITH THE POISON.

Acting on this principle, the Bristol Board of Guardians, on August 4th, immediately after the occurrence of the second group of cases, issued a placard of which the following sentence contained the pith: "Disinfect your closets and privies every night and morning as long as cholera prevails in England, and you will do more to keep the disease away from your home, and from your city, than can possibly be done by any other means." In order to supply the needful chemicals, depôts of disinfectants, to be had gratis, were, at the same time, established in different parts of the town.

Shortly afterwards, Mrs. Norris, the distinguished wife of the Rev. Canon Norris, having learnt by long experience how careless the working classes often are, even in matters affecting their most vital interests, hired an intelligent woman, whose duty it should be, under the direction of Mr. Davies, to visit the poor, and to see that the daily disinfection here enjoined was actually carried out. The idea, which had originated with this excellent lady, was at once enlarged upon; and, before long, twenty-eight women, paid by a special subscription, and each with her allotted district, were employed in insuring the execution of this important measure. The whole of this organisation remained in force until cholera had ceased to be epidemic in the South of England.

The great employers of labour had already been urged, both publicly and privately, *to disinfect the latrines in their several works at least once daily.** The

* In the pamphlet on the mode of spreading and on the prevention of cholera (1865) before referred to, this prevention is made the subject of the following remarks:—

"The occurrence of the disease in great public establishments, where the taint of a common latrine imparted by a single casual case, may communicate the disease at once to large numbers of persons, is another special danger.

"This is a contingency which has, by no means, been taken sufficiently into account in studying the course of events in city outbreaks.

"A very striking illustration of it appears to have occurred in the last great cholera epidemic at Munich.

"It seems to have been ascertained that the germ of the disease was brought to Munich by Italians, who had come there in charge of goods for exhibition in the Munich Crystal Palace.

"Many of these Italians, coming from places where cholera was reigning, were seized with choleraic diarrhoea, or in other words, with cholera in a light form, and the latrines of the Crystal Palace were tainted by them.

"The overlookers of the Palace, resorting to these latrines, received the infection in great numbers, and, as scarcely more than little lots of two or three lived in the same street, Cholera broke out in a short time, almost simultaneously, in nearly every part of the city."—[Pettenkofer's Verbreitungsart der Cholera," p. 68 and Seq.]

h. B.

same measure had also been recommended to all institutions where large numbers of persons are employed, maintained, or kept.

The Board of Health meanwhile kept up from the beginning of May a constant disinfection of the main sewers in all the lower levels, and of all threatened districts in other parts.

In these various ways, a chemical bed was, if I may so speak, prepared for the poison, by whose action the population were insured against harm from any specific germs that, by accident or otherwise, might find their way into the drains or sewers of the town. The sulphate of iron in the drain thus lying in wait for the poison may be likened to the wire-gauze in the Davy lamp, always at hand to prevent the explosion of the fatal fire-damp.

I believe it is difficult to exaggerate the importance of the various measures here enumerated. It is probably from the omission of these very precautions, that, in spite of the almost universal adoption of disinfection, cholera has raged in many places on the continent to such an extent as even to shake the belief of many in the theory on which this mode of prevention is founded, or to raise the doubt whether, supposing this theory to be partly true, it may, after all, be more than a fragment of the truth. Carry out these precautions in their entirety, and I believe it to be next to impossible for Asiatic cholera to become epidemic anywhere; neglect them, and I believe as firmly that, although much may still be done to keep the pestilence in check, we can never be sure of averting a severe visitation.

In general terms, this precautionary code may be described as a great system of insurance by which every man is enabled to insure against his neighbour, and the municipality against all. It is a system which might be extended with the best results to the prevention of many another epidemic disorder.

The measures taken when cholera actually broke out in a house may be best described by saying that what most characterised them was their thoroughness. Many things were no doubt done which, scientifically speaking, might be deemed superfluous. With such grave alternatives at stake, it was, however, wisely considered better to err by excess of precaution, than to run the risk of possible failure by default.

1. As already mentioned, the characteristic *ejecta*, and everything that might become tainted with them, were systematically disinfected.

2. Not only the privy of the infected house, but the privies of all the houses in its immediate neighbourhood, were constantly dosed with the proper chemicals.

The drains and sewers connected with these cloacæ were dealt with in the same way.

4. Wherever there was a pump, the handle was removed or chained up.

5. After the termination of the particular case or cases, the beds occupied by the sick were destroyed, and, where feasible, the inmates were removed, and the house thoroughly cleansed, whitewashed and fumigated.

6. In the case of death, the body was speedily buried, with the proper precautions; and, in the case of recovery, the convalescent was kept for some

time under medical surveillance, and guarded by the same precautions as if the disease still existed.

The chemical agents used in these various operations, public and private, were principally sulphate of iron, carbolic acid, and MacDougall's and Calvert's powders. The first of these was much employed in the larger operations; for which, as indeed for disinfection generally, it is admirably suited, by its cheapness, by the absence of corrosive power, and by many other qualities. Often, in order to secure a more abiding disinfection, this agent was placed in bulk in the convenient form of a coarse powder, in the drain or sewer—a mode of employment which deserves to be widely imitated. In the infected houses, the disinfecting powders were found very convenient for many purposes. In almost every case, a thick layer of one or the other of these was placed under the breech of the patient. Dispersed by a common dredger, such as cooks use for dredging flour, they were found to be the readiest means of sweetening the foul air of a filthy and crowded house.

Chloride of lime and Condry's fluid, in water, were sometimes used for the disinfection of tainted linen, and chlorine, in the gaseous form, for fumigations; but, in almost every case, all tainted linen was destroyed.

But above all important was the admirable intelligence and vigour with which the whole of this preventive scheme was carried out. Bristol had been singularly fortunate in the choice of her medical officer. Vigilant, earnest energetic, faithful in the highest sense of that word, not afraid to exceed his powers when to stay within them might give an opportunity to the foe—the pestilence itself, in fact, not more regardless of red tape than he—Mr. Davies was exactly the man for the work. Whenever intelligence reached him of a new case, whether by day or night, scarcely an hour was allowed to pass before this conscientious officer was on the spot with his staff; and he never left it before the right thing was thoroughly done. Deeply penetrated with the idea that, to prevent a pestilence, as to prevent fire, you must extinguish the first spark, he rightly judged that every hour was of importance to success. To smite early, and to smite hard, was clearly the only way to do battle with such a hydra as this. It is but fair to say, that in all this he was, as time wore on, admirably seconded by the several boards of guardians which bear rule in the city, and by the medical gentlemen who acted under him. The figures recording the success which crowned these efforts have already been given. It is only by contrast, however, that it is possible to have a just measure of it. While Bristol was being repeatedly attacked by cholera, the metropolis also was invaded by it.

The following passage, which I extract from the Registrar-General's Report for the week ending July 30th, gives a graphic picture, by no unfriendly hand, of what happened there. From the opening sentence it will be seen that the hint which this eminent person had addressed to Bristol earlier in the year, was, in reality, much more needed nearer home.

"Whoever will take the trouble to go among the people now suffering in crowded dwellings will see the danger of the water-butt: poor women are washing the dirty linen of patients with water drawn from those vessels which

are often found close to the water-closets ! It would be a source of additional safety to London if the tanks and butts were all abolished, and the pipes were filled on the system of constant supply. The time has come for this reform.

"The mortality is overwhelming in some of the districts. In Poplar, alone, 145, in Bow 188 people, died last week, including Dr. Ancell, the meritorious health officer, and Mr. Ceely, clerk to the Board of Works, whose name figures in the placards. The people are falling ill every hour. You see them of all ages—children and adults—lying about their beds like people under the influence of some deadly poison ; some acutely suffering, nearly all conscious of their fate, and of all that is going on around them. Here the doctor is drawn by the husband to see the wife now attacked ; there the husband lies in spasms ; here is an old woman seated dead with eyes wide open ; there lies a fine four year old child, his curly head drooping in death, but the mother says the pulse is strong, and he takes what she gives him. An older brother, just recovered, is running about. Several wards of the London Hospital are full of patients, many of them very young children, in all stages of the disease—some dying, some well again and playing. The medical men have no rest, and with the health officers, are nobly doing their duty—brave men, ready to lay down their lives for their patients. The people themselves are most patient, most willing to help each other, the women always in front, and none shrinking from danger. There is no desertion of children, husbands, wives, fathers or mothers from fear.

"In the midst of this scene the authorities have been to some extent paralysed. The nuisance inspectors are not sufficiently numerous, neither are the medical officers. The administrative work has not been organised with sufficient promptitude nor carried out with sufficient energy."

In the plague-stricken district thus described, nearly 1,500 persons in a single week fell victims to the malady.* From this great centre of infection the pestilence gradually extended to other districts, and before the epidemic ceased it had carried off, taking the cases of cholera and those registered as diarrhœa together, more than 8,000 persons.†

But even such a retrospect as this, painful as it is in many respects, may, the same writer shows, be looked upon with satisfaction when compared with what happened in London in former epidemics, and still more when compared with what has happened on the continent now.

In a general survey of the results in 1866, he says : "Holland and Belgium have published returns down to a recent date, for which the Registrar-General

* The Registrar-General has called attention to some very striking circumstances, which seem to render it probable that polluted drinking water played an important part in this great tragedy ; but whether by the actual distribution of the specific germ, or by its action as a predisposing cause, or in both ways, more complete data are required to determine. In whatever way this element may have intervened, it is clear, however, from the details given in the passage quoted above, that the other known modes of communication must have contributed largely to the fatal result.

† The exact numbers, as given by the Registrar-General, are—

Cholera.....	5,540
Diarrhœa.....	2,613—8,153

We may, no doubt, safely conclude that the majority of the cases in the second column, although registered under the head of diarrhœa, were, in reality, due to the specific cause.

is indebted to M. de Baumhauer and M. Heuschling, and the facts prove that the epidemic is as fatal as it ever was under unfavourable sanitary conditions. Thus, in 22 cities and towns of Belgium and Holland containing less than half the population of London, or 1,460,808 people, the deaths from cholera alone in the present year were 20,643. So the deaths were 141 in 10,000; and if the same proportion of inhabitants had perished in London, the deaths, instead of 5,000 (the writer omits, here, the 2,613 deaths from diarrhœa), would have exceeded 42,000. In Brussels the deaths were in the proportion of 164, Utrecht 271, Amsterdam 42, in 10,000 inhabitants.

"By the bulletin published monthly by the Prefect of the Seine, it appears that the deaths from cholera in Paris were 6,653 in 1865—that is, in the proportion of 39 to 10,000 inhabitants; while by the second outbreak in the present year 1,812 persons had died by the end of July, the date of the last return, when the epidemic was increasing rapidly.

"In London, cholera has not only been less fatal than it was in previous epidemics, but its fatality has been reduced almost to insignificance in several of the districts by the mere force of hygienic science, before which the destroyer has retreated step by step; never, however, losing an opportunity of asserting its full power wherever negligence or ignorance presented an opening, either in England or in the cities of the continent of Europe.

"Cholera obeys certain laws; and the knowledge of those laws renders its subjugation in Europe practicable, provided all the people, as well as the Governments, will co-operate in the work. This it may be hoped will be done, and it only remains for the metropolis of this empire to hold its own and to keep the lead."

If, following the example of the Registrar-General, we now make the same comparison between the mortality from cholera in London and Bristol, which that gentleman has instituted between the mortality of London and that of the cities of Holland and Belgium, we shall find that, in round numbers, the mortality of Bristol (taking this as 29, or say 30 in 160,000) is to that of London as 1 in 14. So that, if the same proportion of inhabitants had perished in Bristol as in London, the deaths instead of 29 or 30 would have been 431.*

Perhaps no fact could be cited which singly offers so strong a pledge of the real efficacy of our preventive measures, as that Bristol,* in respect to cholera in 1866, stands as 14 to 1 in advance of a city which may be described as taking the lead, in the same matter, of the cities of Europe at large.

It is said to be the besetting sin of men, generally, to magnify their own deeds. I believe there is a superstition abroad that to do so is, in an especial degree, a weakness of the provincial mind. But if the interpretation of the events here related be the true one—and as all the facts bearing upon it have been conscientiously given, this is a point on which each may judge for himself—I think I am not assuming too much in believing that they will long be memorable in the history of cholera.

* As the population of Bristol was, in reality, much nearer 180,000, than 160,000, the case is greatly understated in the text.

That in small communities, in single well ordered houses, and in organised public establishments, the pestilence may be stamped out with ease and certainty by the disinfecting plan, was already abundantly proved. But as far as any results hitherto published go, it would appear that Bristol has been the first to show that the same thing may be done *with success very nearly as entire* in a city counting more than 160,000 inhabitants, and including a large seaport—a city filled with crowded courts—and having, besides, a large Irish element in its population.

The facts are important, not only as establishing this, but as showing on what conditions, and (as I believe) on what conditions alone, such an incomparable result may be attained.

How far, in all this, Bristol may be rivalled by Glasgow and Manchester, we shall probably soon know ; but should the results prove that their success has equalled ours, it will, I fancy, be found also that it has been obtained under the same system as that which we have adopted here. Birkenhead and Edinburgh are apparently not far behind ; and, if no other cities can be placed in the same high rank with those already named—unless, indeed, Plymouth should be included in it—a good many have succeeded in keeping cholera so far in check by the disinfecting plan as to establish the efficacy of this plan upon a wide and impregnable basis.

The gain to humanity is a thing of which every man can judge for himself. But the gain to science also must not be lost sight of. In its relation to this, the results are most opportune. Already, indeed, a note has been sounded—a note which, I doubt not, will find an echo in many quarters—whose tendency will be to shake the faith of the profession in all the great conclusions respecting the spread and prevention of cholera on which it has lately been acting.* The results obtained here and elsewhere, in the late epidemic, are of great value, not in themselves only, but as evidence in favour of these conclusions. They serve, in fact, to close up the demonstration. This may be regarded now as sufficiently complete.

If, on the one hand, it can be shown that Asiatic cholera is actually propagated by the rice-water discharges ; and if, on the other, it can be equally shown that its propagation may, under conditions the most diverse, always be prevented by destroying these discharges on their issue from the body,—the inability to trace, or even to guess at, the source of the specific germ in every instance of cholera that may chance to spring up, is a difficulty that need trouble us as little as our inability to do the same in every case of small-pox or cattle-plague, or, I may add, in every specimen of mildew. The final removal of the difficulties which such instances seem to suggest to some may safely be left to time and to the accumulation of such facts as those which I have here placed on record. Whatever may be the value of these particular facts, I have felt it my duty to make them public, for the guidance of those who may still need guidance, and for the encouragement of those who do not.

* See in a recent number of the JOURNAL, a paper by Professor Christison, entitled "Cholera in Prison."

A Table of the Cholera Cases in Bristol in 1866.

No. and Date.	Locality.	No. of Deaths.	No. of Attacks	No. of Houses.	Water-supply.	Supposed source of infection.	Remarks.
1. April 23	Princes Street Turnpike	1	1	1	Co.'s	Rotterdam	Fatal in about 18 hours
2. July 21	Unity Street	1	1	1	Co.'s	Not known	Had suffered from chronic diarrhoea for some time.
3. July 29	Rivers Court	2	4	2	Co.'s	Volunteer's review near Bath	Not reported early. Four days delay. Form of disease, choleraic diarrhoea
4. Aug. 4	Passage Street, St. Philip	1	3	1	Co.'s	A daughter came here with diarrhoea from London	Not reported early. Three days' delay
5. Aug. 4	Narrow Plain	4	5	2	Co.'s	Not known	Worked at the Shot House
6. Aug. 5	Redcliff Road Lane	1	1	1	Co.'s	Not known	
7. Aug. 6	Water Street	0	1	1	Co.'s	Not known	
8. Aug. 16	Old Market	1	1	1	Co.'s	Briton Ferry. Ill before arrival	A very severe case. Taken ill soon after leaving Briton Ferry
9. Aug. 19	Windmill Hill	2	2	1	Well	Not known	Some Welsh workmen came here, and diarrhoea became prevalent afterwards. Pump water. Ground not paved.
10. Aug. 21	Pithay	1	1	1	Co.'s	"	
11. Aug. 28	Parson Street, Bedminster	1	4	2	Well	Ashton Iron Works	
12. Aug. 28	Trinity Street, Old Market	1	1	1	Co.'s	London	Had just returned from the funeral of his daughter dead of cholera in London.
13. Aug. 28	Kingsdown Parade	0	1	1	Co.'s	Manchester or Liverpool	Had just returned from these places
14. Sept. 6	Jubilee Street	1	2	1	Co.'s	Not known	Husband recovered. Had been working in Avon Street, Bath
15. Sept. 6	Cumberland Basin	1	1	1	Co.'s	Port Talbot, Wales	The husband had been working on board
16. Sept. 7	Bridewell	2	3	1	Co.'s and Well	A tramp	
17. Sept. 10	Freestone Road	0	3	1	Co.'s	The Liverpool boat, <i>Athlete</i>	
18. Sept. 12	Horse Fair	0	2	1	Well	From the case in Water Street	A woman from one house frequented the other
19. Sept. 15	Model Lodging Houses, Narrow Lewins Mead	1	1	1	Co.'s	Not ascertained	The master is a commercial traveller, and had returned from several towns affected with cholera
20. Sept. 15	Richmond Hill, Montpelier	1	1	1	Co.'s	The master from Exeter, etc.	
21. Sept. 15	Avon Place, Temple Backs	1	1	1	Co.'s	Not known	
22. Sept. 16	Princes Street, Queen Square	1	1	1	Co.'s	"	Had been visiting the house in Parson street
23. Sept. 23	Ship <i>Attila</i> , Cumberland Basin	1	1	1	"	"	
24. Sept. 24	Above Bedminster Turnpike	1	2	1	Well	The case in Parson Street	
25. Sept. 18	Park Hill	1	1	1	Well	Manchester or Liverpool	A man had returned into this Court from Wales with diarrhoea three weeks before, and recovered; another man
26. Nov. 12	Warren's Court, Frog Lane	2	4	2	Well	Welsh Iron Works	
		29	49	30			

had choleraic diarrhoea, probably contracted from the first mentioned; then these two children fell in one day. There were two privies open and common to the court, where all the people relieved themselves. The two first cases were not recognised as specific until the children died. This is the common history of cholera—unrecognised diarrhoea of a specific character, then cholera and death.—D. DAVIES.

A. MAP OF BRISTOL ILLUSTRATING THE DISTRIBUTION OF CHOLERA CASES IN 1832.



1871

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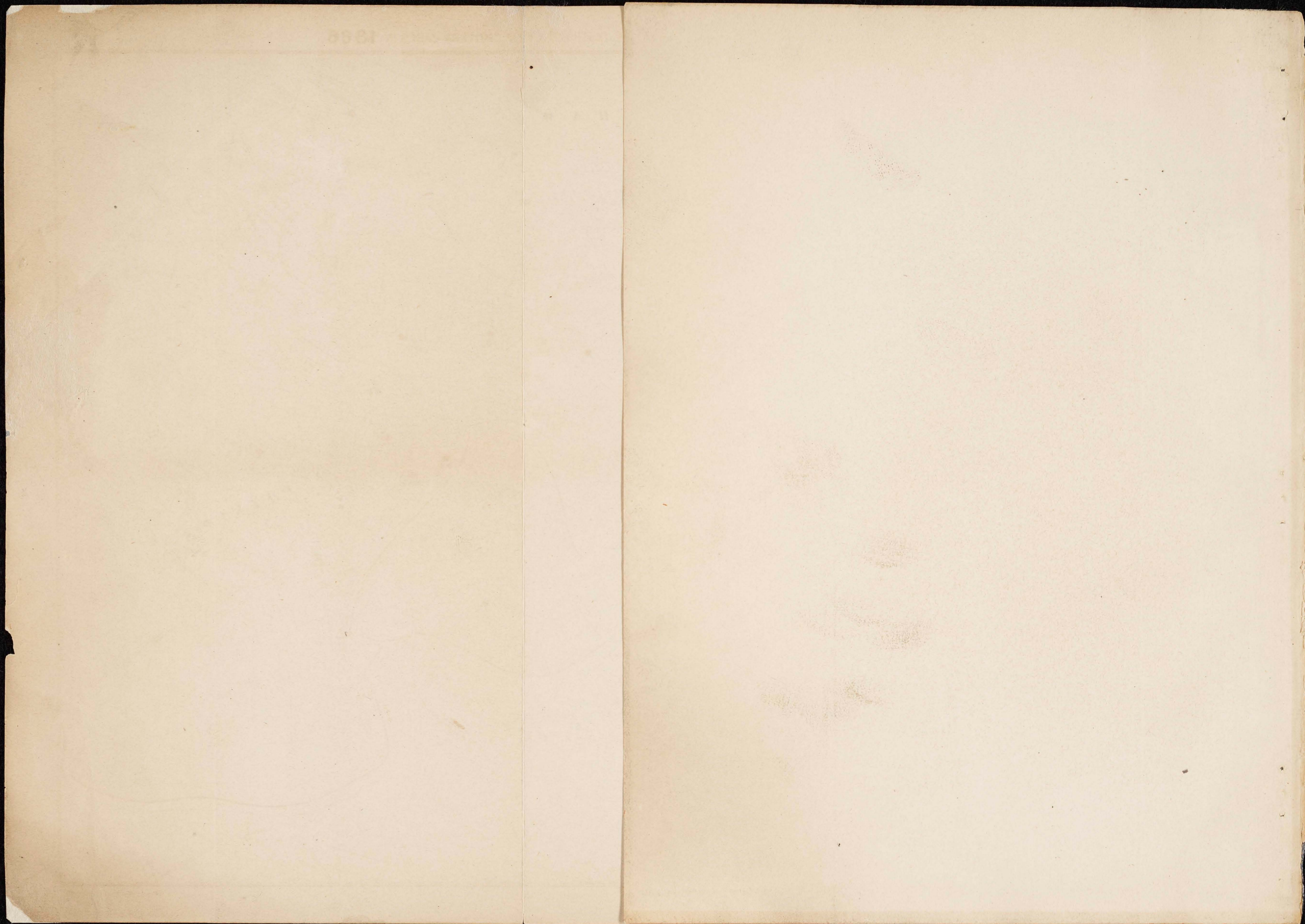
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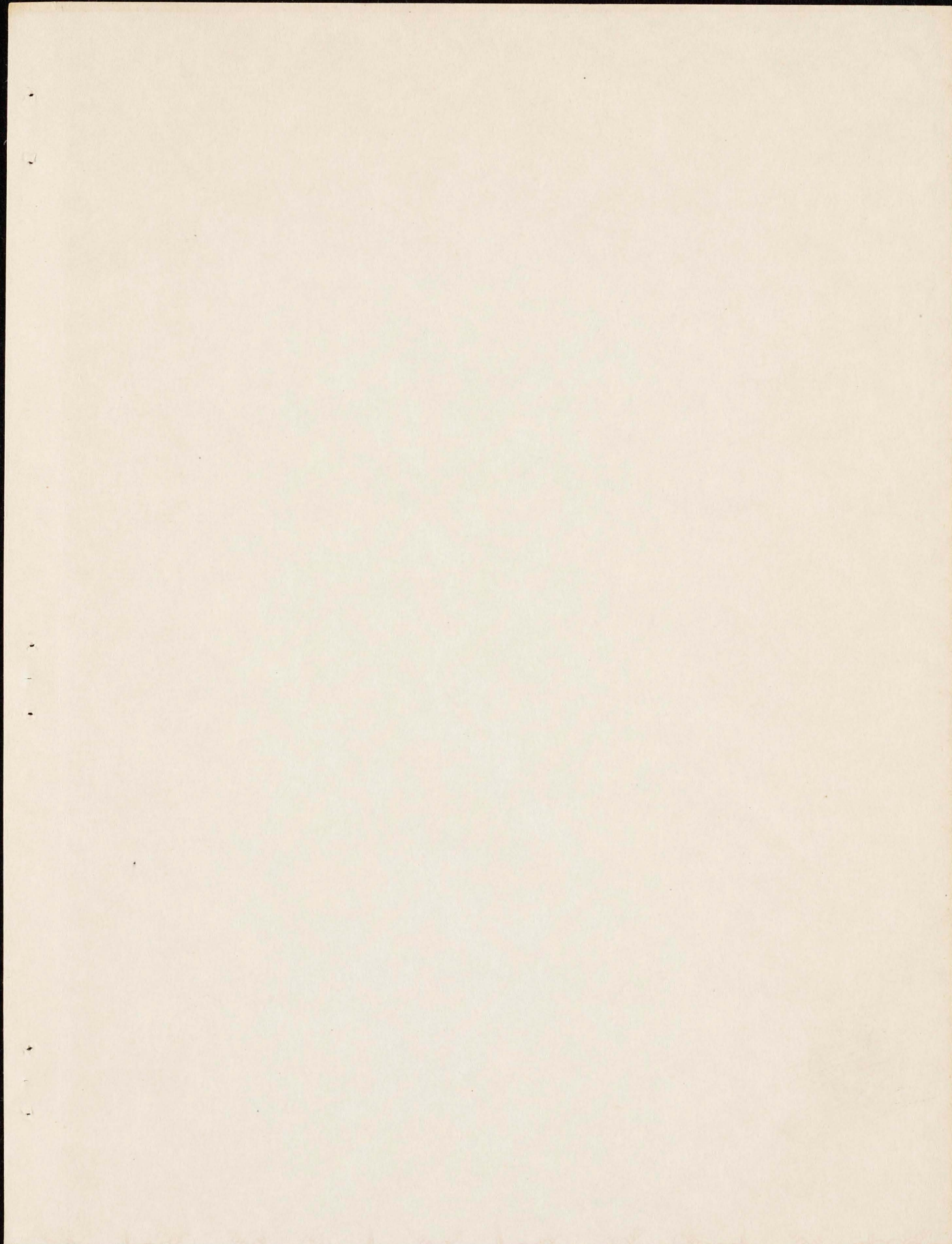
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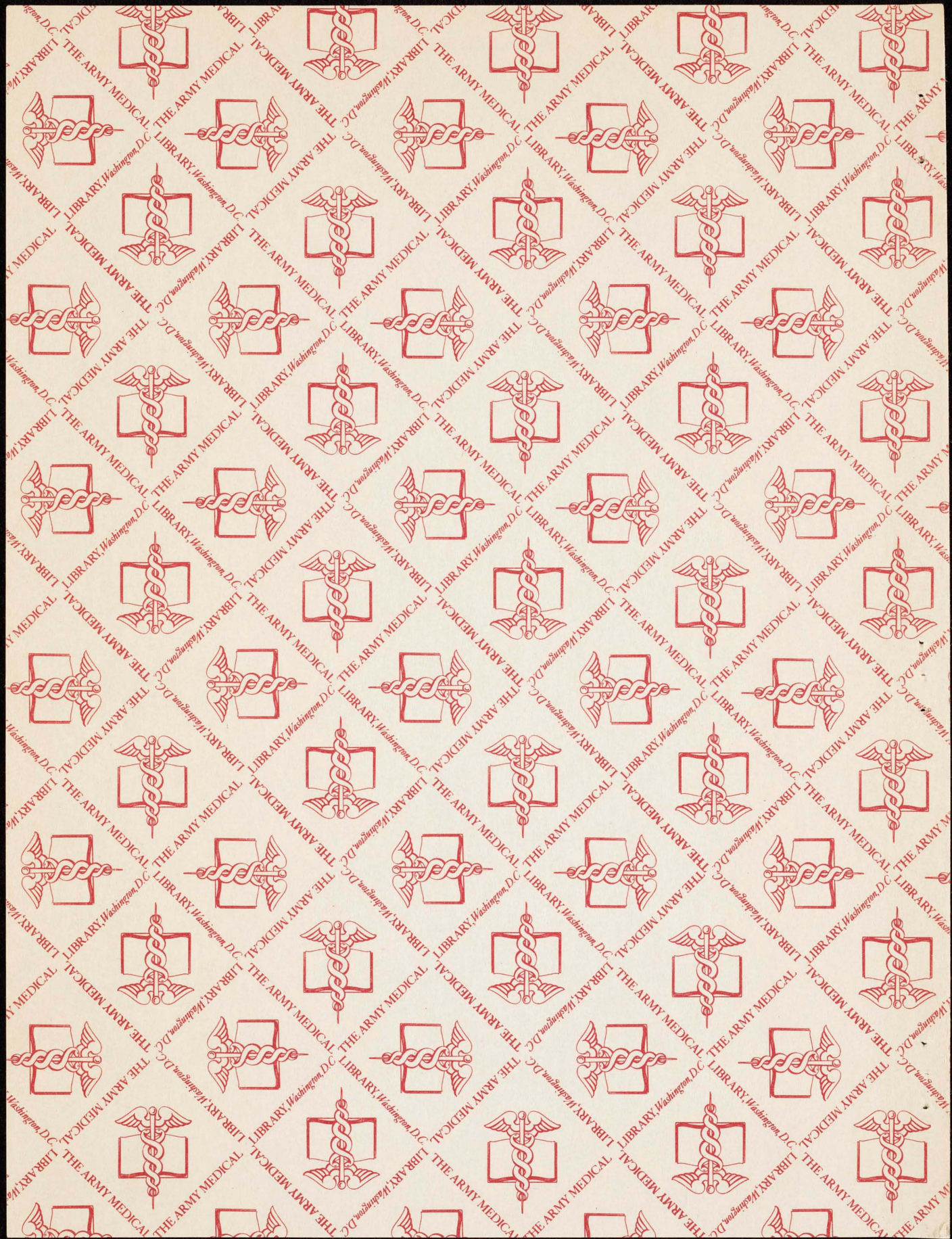


B. MAP OF BRISTOL ILLUSTRATING THE DISTRIBUTION OF CHOLERA CASES IN 1866.









Budd, William, *Asiatic cholera in Bristol in 1866...*
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