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"A good wit will make use of anything,
I will turn diseases to commodity" - Shakespeare

Robert Harris

Essay
on the means to be adopted to prevent the spread of epidemic disease.
When we consider that of the many causes which shorten human life the class of epidemic diseases holds one of the foremost places, and when we review their fearful visitations, which mourn down the populations of the ancient world, and still continue to be the great scourge of modern communities, we cannot but admit the importance of those means which are in any, even the least, degree calculated to diminish the extent of their operations.

In my inquiry into the subject of this essay I shall adopt the following arrangement—viz. 1st. A definition of the terms, and a description of the theories of Contagion and Infection—\(\forall \), in order to arrive at the best means of checking the spread of Epidemic Diseases. It would seem to be the most reasonable course first to make some
remarks upon the means by which
these diseases are supposed to spread.

2. I will adduce proofs that some
of the diseases most universally
recognized as epidemic do spread by

Contagion and Infection, and 3. I
will consider the means to be ad-
opted to prevent the successful action
of these agencies.

And first of the subject of Infection
and Contagion: The difference
between these two has been held to be
as follows viz - that the former
implies the means by which the
diseases is transmitted to the healthy
without the intervention of
any immediate contact between the
parties, i.e. through the medium of
the atmosphere; and that the latter
can be said to have been in operation
only when immediate contact has taken
place, i.e. by touching the sick, or
some article of his apparel, etc.
Contagion, however, is really but a mode of infection, because in either case the infected party does essentially come into contact with the exhalations or excretions of the diseased—whether these be suspended in the air, as in infection, or adherent to the cast off apparel, or skin, as in Contagion. Having made these few remarks on this subject I will

infinitive apply the terms Contagion and Infection in very much the same signification.

The following are the chief points connected with the theories which have been held at different times by different men regarding the essential and intimate nature of the matter of Contagion and Infection.

I. The old doctrine of Semmns

that animalcular organisms play an important part in affecting the spread of epidemic maladies
has been revived and ably sup-
ported by Holland, Renle, etc.

The chief facts which appear to
under this view probable are "1.
Epidemic diseases resemble the effect
of the flight: insects by appearing
and disappearing without evident
cause in uncertain places at
uncertain periods. 2. Unusual
swarms of insects and various
epidemic visitations have been
frequently remarked as occurring
together, although it must be
confessed that no uniformity has
been found in either the character
of the insects or the visitations."
Also the fact that many cases
are now known in which para-
ditic organisms—animal vegeta-
tive—the cause of disease, as in itch,
syphilis, etc. has been supposed
to lend countenance to this view.

But the total absence of any
Proofs of this hypothesis, the occurrence of many epidemics in places and seasons most unfavorable to the development or support of animal life, the possession by some diseases at one time of evidence not another of epidemic character, and also the fact that many epidemic diseases have a decided tendency to confer an immunity from their own recurrence in the same individuals (which of course could not be the case if the causes of the spread were animalcular), are sufficient to throw discredit on this doctrine.

II. The presence of an undue amount of ozone, the atmosphere, and certain obscure electro-magnetic states of the atmosphere are said to constitute an efficient cause of the existence and spread of certain epidemic disturbances. This may have some prob-
ability units side, but is destitute of proof.

III. The fermentation theory of Liebig. This theory is founded upon the assumption that contagious matter is of the nature of an animal poison. It is well known that if a solution of sugar, containing also a portion of a substance called "ferment", as yeast, or almost any decomposing, organized matter, be placed in certain circumstances as regards temperature, etc., the process called alcoholic fermentation will result. The above-named substances, "ferments," are supposed by Liebig to effect a change in the molecular constitution of the substances with which they come in contact, which in all processes of decay and putrefaction assume new arrangements. This seems to be all that takes place in the simple
Case above-stated; but if we suppose more complex matters undergoing the process of fermentation then the products will differ somewhat—let us take for an example yeast work—wherein beer is obtained. Here we have the presence of gluten, as well as of other matters, which, however, may be omitted at present. The essential difference between the two products is that in the latter case the yeast will have increased at the expense of the gluten to a very great extent, while in the former it will have entirely disappeared. Here, then, is the point of analogy between the action of containing poisons and fermentation—viz. that these poisons are of the nature of ferment and that when admitted into the fluids of the animal body they produce changes analogous to fermentation—and these changes result, as in fermentation itself, in the reproduction of the increase.
of the original Contagious poison in the words of Liub. "A substance in the act of decomposition, added to a warm fluid in which its constituents are contained, can reproduce itself in that fluid, exactly in the same manner as bread yeast is produced when yeast is added to liquids containing gluten."

If the blood be in the state analogous to the fluid first described above, i.e. an entity of some element to which impure the poison of disease can reproduce itself (in the above case gluten), then that disease is not Contagious; but if on the other hand, it shall contain any substance analogous to gluten in alcoholic fermentation, then shall the poison be multiplied and the disease shall prove Contagious.

This theory is greatly recommended to our attention when we learn that it explains many of the observed facts of Contagious diseases — as that some
persons appear to enjoy an immunity from their attacks; that most people are not attacked by them more than once in a lifetime, or at least not till a considerable period after the first time; and that they have, tolerably definite period of incubation, and run, for the most part, a determinate course. The first of these facts may be explained on the ground that the analogue of the gluten may never have existed in the blood of the persons thus alluded to, or may have been removed by some peculiar manner of life; the secondly, supposing that this ingredient may have been exhausted by a previous attack of the disease, and may never or not for some time have been reproduced; and the third by the general analogy which it bears to the fermentative process.

If this ingredient happen to be essential to life, then the disease is rapidly fatal, if not essential then rarely fatal, e. g.,
Mr. Lyon adopts this view with some modifications, and even goes so far as to say
than Libby in indicating what he considers
may be in some cases the ingredient
in question: he writes "In infancy,
in early age, and till puberty, there are
Certain waste materials which never
afterwards occur"—thus he derives from
the waste of the Hymen gland of the Cervix
and from certain changes conneted
with the Sexual System—and gives the
following reasons as affording Countenance
to his belief that these effete matters may be
identical with
"the surfaces and organs most prone to
affection in the diseases under consideration,
are those which are eliminative and decom-
atint: those whose normal products can
hardly be retained for any time within the
body, much less out of it, without under-
going aforesaid decomposition, which effi-
ciently stamps them with an incremen-
titious character. Bowels, skin, Kidney,
touils, are the favourite resorts of the several fever poisons, just as they are the surfaces by which naturally the organic waste of the several tissues is eliminated.

Mr. Page explains many of these same facts by supposing that one attack of a disease so modifies the blood, as well as the nutrition which replenishes it, that the body is for a long time or for ever less susceptible of the influence of the same disease. These theories do certainly all seem to explain many of the facts of contagious diseases; but it is apparent impossible to explain decide which of these will ultimately prove true.

Having premised these short notices of the theories of contagion and infection, I will now adduce some proofs that at least certain epidemic diseases are propagated from individual to individual by their agency. But I will have in mind, before proceeding to detail cases,
a few remarks regarding the kind of proofs which we have a right to demand before we concede the contagious nature of a disease. These proofs are divided into 1. Cases in which persons coming from a district infected with an epidemic disorder into one previously healthy spread their disease in that district. 2. The spread being proportionate to the amount of intercourse between the healthy and the sick. 3. The absence of any other assignable cause for the disease, as weather, soil, climate, season, &c. 4. The immunity procured by rendering contagion impossible, i.e. by segregation of the healthy from persons or things connected with the disease. 5. The inoculability of the distemper.

The first case I shall relate is that which I read one of the Elkins and this of itself seems almost sufficient to decide the question in favour
of the contemporary records of Yellow Fever.

The Relief, man of war steamer, left Plymouth on Nov. 22, 1844, for the coast
of Africa. She took on board 146 officers and men. On Dec. 20, she arrived at the
river Gaboon, and coasted along to Sierra Leone, which she reached on the 23rd.

She left Sierra Leone on the 28th, having
taken on board 40 Kru men (native Af-
ricans) in addition to her crew. She con-
tinued off the coast till Feb. 14th, watching
slaves. During this time the boats were
often sent ashore, and some of the men
died on shore on several occasions.

Though the vessel herself could approach
the land nearer than 3 miles, owing to the shelving nature of the coast.

Most of the men who had slept ashore were
attacked with fever, and 90% of them died,
but two of the ship's company, who had
never left the ship, also had the disease
develop. The ship returned to Sierra Leone on
July 14th, and was then healthy, the above
Mortality having occurred during the preceding 3 months. From July 4th till July 23rd the crew was engaged in clearing out the "Albert," an iron ship, and some of them went ashore and slept there. Of these last 24 were attacked with fever, on the 19th, 21st, 22nd, 23rd respectively: one was landed but the other 23 were treated on board, and died. Sir W. Pym states that this fever was undoubtedly yellow fever. From July 23rd to August 21st, on which last date the relieving arrived at Boa Vista, there were attacked among her crew, 1 of them died. The disease had also appeared among the crew of the Albert.

At Boa Vista the disease continued to spread, and it was determined to land all the people from the ship, and put them in a fort let apart for their accommodation by the Portuguese authorities of the place. This fort was situated on a small island about two miles from Boa Vista. This convenience was probably placed at the
Service of a claim Captain, partly at least because it had been represented to the Portuguese governor that the disease was the ordinary intermittent fever of the coast.

After the crew was removed the ship was thoroughly cleaned and fumigated by workmen hired for that purpose at Boa Vista. Three planks were thoroughly carried out by the hired labourers, the Broomen, all of whom remained on board with the exception of 130, who were engaged in tending the sick on shore. notwithstanding all these precautionary measures, however, 31 men of the ships' company died between August 21st and Sept. 13th. In consequence of this alarming fatality of the disease a council of medical men was called by them, it was resolved that the ship should proceed to England as soon as possible. Accordingly she left Boa Vista on Sept. 13th, and between this period and that at which she arrived at the destination 41 men were attacked
12 of them died. Even after her arrival in England it was the virulence of the disease that 9 cases occurred 5 of which proved fatal. After this, however, the epidemic began to decline and soon ceased altogether, owing it is presumed, to the combined influence of the November cold, and the precautionary measures adopted by the quarantine authorities.

On reconsideration of this case it seems impossible to account for its devastations without supposing that the disease was contagious. It was introduced into, spread through, Rio de Vera to a fearful extent—this island having been quite free of epidemic diseases for many years previously. How was it that this distemper should break out at the precise time when a diseased ship visited the island, and not during the long period preceding this? It is absurd to suppose that here is mere coincidence and very difficult not to perceive the relation of cause and effect between the two circumstances. Again, if attached the
majority of the ship's company after it had been introduced, apparently from the shore, had not been of a recalcitrant or non-contagious nature this would not have been the case. It was assailed by the native Africans, who are not subject to the recalcitrant of the coast, though they are, become instant, liable to suffer from yellow fever, and lastly it attacked every large number of those who went aboard the ship during her stay at Boia Vista.

When we examine more nearly into the fungi of the contagion, and trace its spread step by step, as could be done, through the island of Boia Vista -- the argument seems to be complete as such an object will admit of. Few days after the vessel left, one of the Portuguese soldiers, who had been housed with the sick crew, died of yellow fever, and 3 other soldiers, who had communicated with him, also contracted the disease. The jeton the island was then abandoned, and the 2 of the above who alone remained alive...
were brought to the town of their two miles from the island on which was placed the fort. The disease now began to spread, among their neighbours first, and then wider and wider circles. The first fatal case occurred in the house in which the sick soldiers had been conveyed, and then it became disseminated all through the town, and by degrees through the neighbouring villages, so that in the beginning of December the deaths averaged four daily. This, then, is the history of one of the cases of contagion—the following is the other.

And here I would remark that the minuteness and completeness of the particulars of the spread of the disease in this case, as detailed in the Brit. Med. Jour., Chin. Review for 1848, are altogether conclusive of the question—albeit in the instance before us. The following is a summary of the facts just adverted to:

There were labourers who were engaged in clearing out the Elain at Aisne Viate.
was one named Luis Patti, who alone was sick with the fever up till Septr. 18. He was an inhabitant of the village of Rabil in the island of Boa Vista. Immediately upon being attacked by it he was removed to his own house. In a short time thereafter his two daughters, his son and his wife, his more intimate neighbours, and then their neighbours were successively attacked by the disorder. Both the sick solders and Luis Patti had had communication with the Eclair or her crew, both were infected with the disease, and from both of them did it spread in gradually increasing circles among the population. In this case the fever would seem to have had an endemic origin to have afterwards assumed epidemic characters. This, however, is by no means unexamined, as it is well established that the Plague is subject to the same law. After this proof of the contagiousness of fellow fever, it may refer to the cases of the Barrie, the Hume,
but my space will not permit me dilate upon them—for, indeed, are they necessary for proving the point at issue; viz. that yellow fever is sometimes contagious; seeing that one so well established a case as that of the Eclair is quite sufficient for our purpose. For the same reasons I will omit the cumbersome mass of arguments derived from the various visitations of the yellow fever to the United States of America.
To take another disease—Puerperal enteritis. The following facts seem to prove that this disorder is distinctly contagious. Dr. Gordon, writing of the puerperal fever which took place in Aberdeen in the year 1789-90, says that "the disease seized such women only as were visited by a practitioner or taken care of by a nurse, who had previously attended patients afflicted with the same disorder." (Watson.)

Also it was observed that, of the out of the 43 cases which happened at Forfar, 7 died in 1813, 40 happened in the practice of one surgeon and his assistant.

It is so universally admitted that smallpox is contagious that to adduce instances in proof of its possession of this property would be superfluous. And this seems to be a convenient place to insert some remarks upon the fallacy which exists in the arguments of those who assert that when the conveyance of the contagion from the sick to the healthy cannot be
Discovered that, therefore, that disease does not possess contagious properties. Dr. Gregory tells us that of the numerous cases received into the Smallpox Hospital during the twenty is capable of being referred to any known source of infection. Agincourt shut up in solitary confinement in the Penitentiary at Millbank was seized with Smallpox. So the proofs of the contagiousness of Smallpox are strong and numerous that the conclusions based upon them cannot be overthrown by these two cases, and therefore we conclude that these were attributable to the same laws as regulated all those cases in which the spread of the contagious contagion became, but that in them the efficacy of the poison had been so great as to elude all efforts to detect it. "Surely this should warn us," says Dr. Watson, against inferring analogous disorders (continued from, for example), that they are necessarily but contagious, because we often fail to discover
Any way in which the poison could have been applied.” – Regoes went a step further: “I once 
observed that this kind is decided, proved to be 
sometimes the effect of Contagion, we cannot 
help entertaining a doubt whether the dis- 
order in question really ever has any other 
cause.”

Acting more solely directly upon this 
subject I may allude to the fact that the 
human body varies in its susceptibility 
for Contagious disorders. Partly this 
may be owing to the violence or quantity 
of the poison; sometimes to the age of the 
person exposed to the infection, some-
times to a certain hardening or accimi-
rative to the poison which seems to be 
attained by along contact with it in a 
diluted state, sometimes to inherent in- 
susceptibility to the disease, and at other 
causes of which little or nothing is 
known.

The Contagious nature of cholera is 
not quite so well established perhaps.
As is that of the foregoing disease, but the following facts appear to indicate
that it does spread by contagion.

Captain Lyte says of it in India that it did not break out in any village "until
that village had communication with a neigh-
bowing place in which the disease
spread." (Bombay Report). Mr. Crow says
that 50 attendants, constituting the
whole of the hospital staff of the 66th
Regiment, when it was afflicted with the
cholera, were attacked by the disease.

I will give one more instance from the
Calcutta Reports: "A Sepoy died of the pesti-
lence (cholera). Five of the corps, who had
shown no signs of illness, were employed
to carry the body to the grave. They were
all seized with the disorder during the
evening, eight, and all died." Notwith-
standing the strong evidence of infal-
libility afforded by these cases, the history
of the disease in this country especially,
shews that it is not quite so contagious.
as some others usually are - yellow fever for instance.

Rather than give along string of cases which have been recorded as proving the contagiousness of plague I will content myself with noticing the conclusions arrived at from a consideration of a large number of them - "It is most liable to attack those who approach patients affected with it, and that in proportion to the number of the approach.
2. Those who avoid all intercourse with persons affected with the plague generally escape the disease" (Copland). The fact indisputably prove contagion.

It seems unnecessary to adduce proofs of the contagious properties of all epidemic diseases, and therefore have merely given the above as examples of the class to which they belong. Further particulars will be given in the following pages of some other epidemic diseases, which will be best understood when
Considered in connection with the causes which produce them.

Now come to the most practically important part of my subject, viz. the measures to be adopted to prevent the spread of epidemic diseases; though the matters which have hitherto occupied my attention are not without importance, because if we wish to prevent the operation of any set of causes surely it is best first to acquire what are the intimate features and causes, and modes of operation of these causes before proceeding to adopt the means best suited to destroy them or render them ineffectual.

In order to ensure success of consideration I will adopt the following arrangement:

I. Means to be adopted towards the prevention of epidemic diseases when prevailing in communities

II. Measures calculated to prevent their spread
from one country to another from which they are absent. Quarantine.

As my subject is the prevention of the spread of epidemic diseases already existing, I will confine myself more especially to that subject, not omitting, however, some notice of the question of the origin of diseases.

It seems to be almost universally admitted that one means of preventing, or at least one means which is unfavorable to, malignancy and wide dissemination of epidemic diseases is—The removal as soon as possible, of all animal excreta and unstable to the decaying materials from the vicinity of the living, as well as avoidance of ill-ventilated and over-crowded quarters.

2. Abundance of pure water for purposes of cooking, cleanliness, etc., ought to be supplied.

3. Panners of stagnant water, as cesspiles
in sufficient or obstructed drains, &c. must be respectively removed and rectified.

I. Under the first of the above heads, I will remark that that the collections of human excreta in the large towns of this Country are sometimes immense, and are for years allowed to remain uncensed, giving off their fetid and health-auguring emanations. Many of these have no connection whatever with sewers, and can only be cleaned by night soil men. As might be expected these collections of filth spread their emanations for a considerable distance—say even for hundreds of yards sometimes.

Although specific diseases can usually be traced to these causes, it is undoubtably they very much favour the action of epidemic poisons when they have been introduced among people breathing such a tainted atmosphere. And this effect seems chiefly to be brought about by their debilitating effects upon
The general health of these effects as
rightly suspected, the most common are
all forms of debility, mental and bodily,
tuberculosis and tabicile in all their forms.
General debilities and slow rate of long-
evity: visceral diseases, and acute
forms of almost all diseases, and especially
of dysentery, virulipelas, and Contaminated
sewage are often seen under the above
circumstances, and then assume
peculiarly malignant character.

Active measures of cleaning cannot
therefore, be too soon or too often had
recourse to: Cleaning out foul drains
by a full stream of water, emptying
privies, ditches, etc., connecting all
houses with an efficient system of
sewage, and other precautions which
fail, in their details, more immediately
under the notice of the architect or en-
gineer.

I ought here to remark that when an
epidemic disease has once been introduced
into a foul and denser population. Neighborhood cleaning, operations will come too late and will then be worse than useless, for the suppression of the filth, necessary to its removal, will increase the taint in the atmosphere.

It has long been a popular belief and it seems a natural one, that an overcrowding state of burial grounds constitute a source of disease. Almost the same effects have been observed to follow from exposure to an atmosphere tainted by the effluvia of dead human bodies, as from the other kinds of decaying matters which we have just been considering, that is to say, general deterioration of health, and a greater malignancy of, and less power of resistance to, all diseases whatsoever. But it has been asserted and argued that even worse effects than the above, bad as these are, spring from this
source. It has been said that cases of malarial fever of the proto-adynamic type have been caused by an exposure to an especially concentrated state of these emanations, and that such fevers have proved contagious to persons communicating with those labouring under them. The weight of evidence, however, seems sufficient to approve this assertion—in respect to our common contagious typhus at least.

By those who support this doctrine the other circumstances of the poor in whom the fever is usually said to arise from the above causes, are not sufficiently taken into consideration—as for instance in temperance, overcrowding, destitution, and other causes of predisposition. And even though these last mentioned causes be not in operation that are yet known many others which exert a harmful influence on many persons. And as we know some which act powerfully in this manner why may there be the others.
instances of those with which we are
acquainted may be cited the incurable
matter of smallpox and plague, and we
have only to suppose these emanations
mentioned to form to obtain a view of
the possibility of specific causes of disease,
floating in the atmosphere though not discover
able by any means yet known command.
It is incumbent upon us to make some
such supposition as this if we show that
fetid emanations are not alone capable
of producing contagious diseases.

A case related by Mr. Hutchinson may
here be given - A girl, from being in a
chapel, under whose floor dead bodies had
been buried for many years, was seized
with fever which he calls typhus. But
the symptoms detailed are not those
which identify that disease; she certainly
had a fever, but it was not a true typhus
fever, and was probably caused by the
fetid emanations affecting the health.
Does introduce febrile symptoms—
This has often been remarked—and partly
constitute the state called Dysentery.
Although overcrowding, deficient ventilation,
and putrid emanations are combined in
their highest degree on slave ships, with the
additions of defective nourishment and atrop-
ic al climate, W. D. Horton, who was him-
self surgeon on a slave ship, says that
though many of the slaves die of suffoc-
ation & fever, "Contagious fevers are
not their diseases."
Further "Fever used to infect our English
jails; but that it was always imported
and never endemic there by filth and
defective ventilation, and by the accum-
ulation of human effluvia, may be con-
eluded from the fact that the benevolent
Howard, when he visited the prisons on
the Continent, found, to his great surprise,
that they were free from fever, although
they were so close crowded, vice-
more than our own." (Watson).
Little ill-drained homes about the ditch, in London, much fever was observed one year, which was attributed to the putrid effluvia in the neighborhood, but though the conditions remained unchanged there was no fever observed for 3 years subsequent to this.

Also the cholera ( Asiatic ) was never known before 1832 to arise from putrid emanations, but since then we are liable to the epidemic of it every few years, when its specific contagion is added to the putrid emanations.

Moreover notwithstanding that putrid emanations, in a state of the highest concentration, have often existed in crowded communities, yet continued fever has not appeared, and undoubtedly would have done had these emanations been at all comparable in virulence to the real putrid contagion. The effluvia from the Knackers yard near Paris are so abounding and so poisonous that they may be perceived by smell at a distance of from
2000 to 2000 yards. It is not uncommon to see in this establishment as many as 15,000 to 20,000 adephores, in all stages of decomposition, and yet with all this the men employed in the place say that they enjoy remarkably good health, and assert that the horrid stench ever produces any disease among them. It is also said that they present every appearance of robust health that they attain a good old age, and are exempt from many of the infirmities usually attendant upon that period of life.

In the reservoir for the impurities of Paris the same things have been observed. These impurities are here dried in order to make Poudrette, a large number of men are employed in the manufacture. The stench in the neighborhood is described as being of the most abominable character conceivable, and it would seem that here if anywhere all the conditions favorable to the development of epidemic poisons, if such be possible,
are present. The fact, however, is that these men are remarkable for their strong health and exemption from epidemics, and this is observable not only in those accus-
to me to breathe this tainted atmosphere
between the two hands.

I might also adduce the fact that in
the celebrated case of the Black Hole of Cal-
cutta no fever arose; but it is hardly
fair to argue from this instance of putrid
emanations of foul air, because the
period of confinement was so short that
these causes (if such they be) could not
have had time to operate. The above
facts, however, and numerous others,
which might be given, give strong
grounds for the argument that putrid
emanations alone are not capable of
producing epidemic diseases. Mr. Lister

These arguments derive additional force
when we consider that about 24 out
every 25 persons thoroughly exposed
for any length of time to the Contagin
of typhus catches the disease, while in the above cases multitude of men are constantly exposed to very concentrated putrid exudations, and yet no disease arises amongst them. In fact, contagion of the Contamination of the air by in-efficient drainage, and remarks show us wholesome propagation the atmosphaire may thus become; it cannot generate cholera, unless the specific venereal poison of that disorder be present also... this poison, although it may strike and destroy individuals here and there, can never create a spreading pestilence, unless it meets with a congenial atmosphaire. It is not meant here to deny that when putrid exudations are very concentrated, and especially when occludedly applied, they may give rise sometimes to many ill effects, as dyspnoea, headache, nausea, depression, tenderness, throbbing of the heart, high pulse, tachycardia, and many symptoms of feverish
day ever sudden death within 36 hours has been attributed to this cause. But in no case can any of the contagious fevers or common epidemics be satisfactorily proved to have arisen from these causes alone.

Among all measures of sanitary reform the establishment of rural or suburban cemeteries and a decently occupied a prominent place, and, combined with the other means of draining, now beginning to be introduced, will improve the atmosphere and other circumstances of the masses as to enable them to offer a much stronger resistance to the introduction of epidemic diseases than formerly.

It cannot indeed be inferred from what I have above stated that I underrate the evil effects of putrescent animal and vegetable remains, but surely it is more to advocate the sanitary operations, which I have indicated above, for reasons
the true force of which we can appreciate than for those of a less firmly established nature.

2. In the above remarks I have noticed the frequent want of water in houses, and of any connection between many houses and a common system of drainage. And I must here insist upon the great importance for the object which we have in view that abundance of good water should be attainable for all purposes of personal and domestic cleanliness and convenience. Though in many instances this defect may be difficult or expensive to supply, yet the subject has won been brought to prominence recently before the legislature that it is to be hoped no large town in this country will long lie without this essential requisite of health. The awakening sense of this country to the requirements of cities in this respect is evidenced by the enormous undertaking now in progress to remedy the defect.
3. My third means of destroying partly the pages for the for other strengthening of contagious poison is the removal of masses of stagnant water, as marshes, ill-made drains, etc. from the neighborhood of human habitations; if these cannot be removed, or are indispensable to comfort, they should be so regulated as not to be permitted to give off their excreta into the breathed air. The source of the evil influence of this class of agencies is very much the same as those upon which I have dilated above, i.e. the exhalations arising from them into the atmosphere. But I mention this here in order that I may allude to some differences of management to which these questions of epidemic distempers are amenable, and which are not applicable to the others.

In common with the other debilitating and predisposing causes noticed above, many exhalations have
have deleterious influence upon the general health, though they differ
signally from them in giving rise
confusely & distinctly marked evident,
though non-contagious diseases.
These malariae from marshes have
an remarkable affinity for foliage so that
they are capable of being arrested by a
belt of vegetation interposed between
them and the population thus protected
from their influence. This peculiarly
has taken advantage of in many tropical
settlements of Europeans in India, Ame-
ricas. They also seem to possess a higher
specific gravity than common so
that they always seek the ground,
unless when they are rarified and
rendered lighter by the heat of the sun,
and thus it is advisable that persons
forced to pass the night in a marshy dis-
trict should sleep as high from the
ground as possible, reaching the
lower flat of a house if an upper one
be available.

The removal of the marshes, rectification of drains falls within the province of the agriculturist and the labourer.

Having now rapidly run over the influences which seem to foster the seeds of contagion, and the means of removing or mitigating these on the large scale, I come to the subject of more active endeavours to check these diseases when introduced into a community. Here I shall consider the different means to be which have been proposed to destroy the matter of contagion.

All the processes of disinfecting are conducted upon the principle of destroying some matter or presence in the air “emanations from the sick.” This of course may be done in various ways, and though many of the plans adopted by the older physicians may not be so effectual as those which the more advanced state of modern science has put into our
hands, yet, in the absence of the latter they are not to be despised. Poisonous stimulant substances were often used by them, being usually burned near the infected articles. They employed chiefly camphor, myrrh, tar, etc., though these cannot but be supposed to have had some beneficial action, if only by diluting the poison. If it was asserted in this branch of medical science when astringent substances came into use, because there must have a more powerful action on any organic substance, which the matter of infection is supposed to be, than the before-mentioned drugs, which would act more upon those who protect from the infection by their stimulant and diluent properties than upon the poisons themselves. Then, therefore, men began to use vinegar, but especially sulphuric, boric and citrous acids, they said more powerful means than did their ancestors.
Thee, however, led to the introduction of our most powerful and most generally employed agent - viz. Chlorine. The great power which this element possesses in destroying organic matters may be illustrated by its bleaching effects on vegetable colours - appearing totally to destroy them - whether by placing their component atoms in some different arrangement or otherwise is unknown. These colours when thus acted upon cannot be restored by any means.

Every good plan to disinfect the atmosphere of a sick room, as regards others, as well as to prevent the patient from constantly aspiring and coming in contact with his own discharges, is to dip pieces of cloth in a solution of Chloride of Lime or Chloride of Soda, and hang them up over strings stretched across the room. Care should be taken so to regulate the supply of chlorine let free as that there shall never be too
much of it for the patient’s comfort. After the patient shall have left the
room it will be advisable to pass a
stream of coamy dry air through it,
whetwash the walls, and to make a
plentiful supply of chlorine play about
it for some time. All the patient’s clothing
and every thing which has been in the
little room and will not take harm
by the process ought to be soaked in
boiling water and then dried in a
current of warm air. It is also said
that a considerable body of pure water
has the power of destroying and destroy-
ing infection; it will, therefore, be
proper to place large open vessels full
of water in the room.

As to the power of heat over infectious
matter it has been ascertained that
many of these poisons are destroyed with
perfect certainty by a heat of 200°, and it
has been rendered probable that they can
all be decomposed by a temperature little

was more intense than 200°.
above this—as that of boiling water.

The measures of precaution to be adopted by those coming in contact with the sick, or who live in attain'd atmospheres may be comprised in the general injunction to avoid all causes which are certain to have debilitating effect on the body, as for instance, exhaustion, dissipation, mental and bodily inactivity, insufficient nourishment, good, exposure to extremes of temperature or wet, insufficient clothing, etc. Those who can conveniently do so will be wise to remove themselves altogether from the neighbourhood of infection, as this is undoubtedly the most certain means of preventing its operation.

Though it has been denied yet it does seem true, that alcoholic stimulants in small quantities, and taken just before entering an infectious atmosphere, exercise a protective influence. This, indeed, might have been expected, because we know
that all the functions of the body appear
formed with increased vigour after the
administration of a diffusible stimulant,
like alcohol, and can therefore the better
resist all morbid influences. A cup of
coffee or tea and some food are also
beneficial, though in a less degree, for
the same reasons. Avoidance of the
night air is also prudent in such cases.
It seems to be the result of very many
observations made in all parts of the
world that the stronger men are in
physical health the less liable are
they to be affected with contagious
diseases. In all cases, therefore in which poisons
are exposed to infectious poisons it is
proper to strengthen and corroborate
the nervoux vitalisation systems as much
as possible; for these purposes bitter tonics
and stomachics, as gentian, Calumba,
but above all Quinine® are very eligible.
The bowels ought to be kept gently open
by means of laxatives if necessary, never by
drown by purgatives, because these irritate the intestinal canal, and weaken the body. Great personal and domestic cleanliness are essential, and the diet should be generous but not over-stimulating. cheerful mind and moderate amusements should also be encouraged. The evil effects of mental dependence may be illustrated by the sudden appearance and severe forms of diseases in an army which has sustained a defeat, though it may have been free of these disorders previously. These results cannot, of course, all be laid to the score of mental dependence, but part of them we doubt acknowledge it as their cause.

Fire ventilations should never be neglected by those in danger of catching infectious distempers. Fire ventilations also ought to be had recourse to not only in the chambers of the sick, but also in those of the healthy. These should, as above stated, consist of the former of various warm aromatics odorifera...
Substances, or chlorine discharged from its lime or soda salt.

The importance of separating the healthy from the sick of infectious diseases is admitted by most of those who have written on the subject. The very greatly increased mortality among those coming into close contact with the infected, as nurses, medical students in hospitals, sufficiently demonstrates the utility of separation. Dr. Welch, in his account of the epidemic continued fever in the fever hospital at Rainbow House in the year 1817-18-19 reports as follows:

"In this hospital, since it was opened (which was the year before the time when Dr. Welch was writing) my friends, Drs. Stephenon, Christian, the Sexton, two apothecaries in succession, the shop boy, washerwoman, 138 nurses have been infected; and four of the nurses have died. With the exception of two or three nurses who have been sick a short time in the hospital, 

..."
From how the only person who has not caught the disease, either here or at the Infirmary (Watson). For this was so very much above the ordinary rate of those attacked among the general population that it cannot be attributed to anything but their close and frequent contact with the sick. Aselli gives instance in the case of the Plague I have before adduced some of yellow fever, purpuric puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal puerperal
houses may be fumigated and purified
with a good hope that in this way they
will be rendered incapable of becoming
foci of contagion to the surrounding
neighbourhood. Dr. Watson speaks thus
of these institutions as devoted forever.
It is, moreover, found that when persons ill
afflicted are taken away from their own
close and crowded houses, and when means
of purification are adopted, the fever ceases
dispersing in those houses. This well-accentuated
fact is which gives to fever hos-
nitals their greatest hope, their only value.
They would otherwise as we have already
seen, be detrimental and dangerous to all
concerned with them, by concentrating
the poison that produces the fever, with-
out equivalent benefit. Besides, they
cause, indeed, a certain amount of dis-
erase and of death; but, by affording
opportunities of cleaning an infected
neighborhood of the seeds of the fever,
by so preventing its diffusion among
alarge healthy community, they save
many more lives than they sacrifice.*
The same remarks are applicable to sim-
ilar institutions in most other epidemics.
The application of this principle sep-
oration to cases where compact bodies of
men are capable of being shut out from
the general population is often very easy
and complete: at other times, as when
an epidemic breaks out in a garrison,
ship, prison or poor's house, it is
almost impossible— but it must al-
ways be carried out to the greatest in-
tent possible— for it must never be for-
gotten that even a very slight separation
may be, and often is, quite effectual in
preventing the successful operation of
contagious poisons. In the case of per-
sons of independent means removed to
adistance is the best measure of prece-
tions. In garrisons the spread of the infection
may be prevented by the adoption of the
strictest possible precautions: when the

* Should fire be

home to home, visitation by con-
pact persons approved by the au-
thorities is

"required to be

done: as it is

much easier

to carry

out the

full benefit

of the above

directions.

...
Disease discovered the sick should be at once removed from the fort or encampment hospitals beyond; or they should be separated by some means from their comrades; their quarters should be subjected to processes of cleaning and disinfection. It is best to select, if possible, the attendants of the sick from those who may fairly be presumed the non-susceptible to the disease in particular. This insusceptibility seems to be acquired to some extent from a previous attack of the disease, from living long in neighborhood of those sick, and from advancing age, etc.

When a ship conveys an epidemic to a healthy port the sick on board should be placed at once in the Quarantine hospital of the place, with all precautions to prevent the spread of the disease to those susceptible of the disease should be sent to an observation hospital, fumigations to their means of disinfection put in operation in the ship, she should be removed to a dis-
tence from the port by the shipping act. On the other hand, should a ship, previously healthy, be infected in an unhealthy port, the sick should be sent to the quarantine hospital, and the ship herself should leave the place if possible in order to avoid the chance of those still uninfectcd in her catching the disease.

When these measures cannot be enforced, or from the ship being at sea, or from other causes, the sick should be kept simply under coverings upon deck, if the climate be fine, and attended by uninfected individuals, if possible. And in all cases they must be separated strictly from the rest of the crew by partitions, &c. The same principle is applicable to prisons, paupers, &c.

Now come to the second great division of my subject of prevention of the diffusion of epidemics—viz. Quarantine. By this term I understand the adoption of certain means calculated to oppose the introduction
A contagious disease from one country into another.

If driven to deal upon this subject in proportion to the amount which has been written out I would swell the limits of this essay into volumes.

Those who argue that certain diseases are not contagious are of course opposed to the enactment of Quarantine laws, whose object is to prevent the operation of Contagion; but those who do believe in a specific Contagion in many diseases assert that in Quarantine regulations we possess almost valuable means of checking their adventuaries.

From the case which I have related above it will be seen that the prevention of intercourse between the sick and the healthy is very powerful in checking this spreading, and also that this latter is most often proportioned to the amount of intercourse.

All that has been written in opposition to Quarantine merely serves to throw a doubt on certain cases of Contagion; but
but there are innumerable instances in which it is impossible to avoid the conclusion that Contagion has been at work. I feel constrained to range myself on the side of the Contagionists, and consequently on that of the Sanitarians— for if it once be proved that diseases are capable of transmission from country to country by commerce or otherwise, then we have a strong argument in favour of Quarantine.

The Parliamentary Committee appointed to inquire into the subject of Quarantine laws as affecting commerce obtained a very large amount of evidence, their conclusion from all of which is “we have no reason to question the validity of the principles on which Quarantine regulations appear to have been adopted.”

From 1751 till 1822 Quarantine regulations were imperfectly or not at all enforced in the United States of America— in N. York especialy—and during this time the
Yellow Fever appeared there several times (being always distinctly traceable to ships from the W. Indies), becoming gradually more frequent as well as more violent into attacks in proportion to the increased intercourse with the W. Indies until 1822, since which year Quarantine laws have been strictly enforced. Since then no fever has been observed in the city. (Oppland). These facts weigh strongly on the side of Quarantine, because all the conditions were the same both before and after the rigid enforcement of Quarantine—may even more favorably to the spread of the disease after that occurrence than before it from the constantly increasing traffic between New York and the West Indies, and yet the disease, instead of increasing, as it ought to have done if Quarantine were useless, has entirely disappeared.

The following is one of the many cases which have been urged against Quarantine—
This story by Dr. Watson in the Monthly Journal, May 1853—Her Say of N. M. S. Highflyer, quite healthy, arrived at Havanna on Nov. 3rd, 1852, when yellow fever was raging. She remained there till Nov. 19th, and then went to St. Thomas, where she arrived on Nov. 30th. Here too, had epidemic yellow fever raged. At Havanna as well as St. Thomas, there was communication between the infected port and the healthy ship, though not much greater's rate than at the former place than at the latter. The ship then went to Trinidad, where no fever then was, and the fever first showed itself on board her two days after leaving St. Thomas, and fifteen days after leaving Havanna. On that day 1 man was attacked, on the next day moretook it and 1 died; and up to Decr. 23rd, 43 men passengers had had the disease. The disease ceased soon after the vessel arrived at Jamaica, the sick were sent ashore. It is said that no per...
sick, where were infected with the distemper. This last circumstance does not prove, against the overwhelming mass of facts upon the other side, that the disease is not contagious; but it argues better with most of our recorded instances to suppose that it is reappealable on the ground that those attending the sick were enabled to resist the influence of the poison either by natural peculiarity of constitution; acclimatization hardening acquired by long exposure to diluted contagion; the ventilation; or, more likely than all, by the small quantity of it which could alone be brought ashore under such circumstances. Even this small quantity must have been freely diluted with air.

Dr. Watson's own narrative, indeed, shows that the disease in question must have possessed highly contagious characters. This is proved by the fact that while the ship was affected with the disease four of the crew died without an accident.
Captain: Both of these were utterly attached to the Antelope. One died—also, she was visited by the marine officer assistant surgeon of the Calypso, both of whom soon died of the disease. If these men had held no communication with the ship it is only reasonable to suppose that they would have escaped the disorder, as others did. The rapidity of their seizure after exposure to the infection leaves no room for the supposition that they could have contracted the disease elsewhere.

This case, therefore, properly considered, ought rather to weigh in favour of quarantine than against it—because, the contagious nature of a disorder being proved, the greater is the necessity for separating the sick from the healthy—which principle is the basis of all quarantine laws.

The introduction of the sick men from the ship into the town, though in this
case it did not give rise to other cases ashore, yet it certainly makes a much smaller draft on our credulity to suppose that this happy result was brought about by some special circumstances, circumstances affecting those who were subject to the infection than that disease, which so shortly before had instilled such unmistakable evidences of virulent contagion, should suddenly have lost that character.

And the favourable effects here observed to follow removal of the sick from the ship to the shore also tells on the side of Quarantine—became the establishment of such institutions holds a chief place in all schemes of Quarantine. These establishments should be large size, removed from the vicinity of towns & houses, fitted up with every convenience & comfort which can be needed by sick persons from abroad. The chief point, however, must always be that such hospitals strictly
Separate from the general Community, to the neglect of this degradation, of strict Quarantine, must be attributed the dreadful epidemics of Yellow Fever which were introduced into Boa Vista by the Eclair, and into Ascension by the Bruna respectively.

I now proceed to make some remarks upon the mode in which Quarantine regulations should be prudently carried out. When we consider how greatly Conveniences to overcome are often intruded with by these regulations, it must be a matter for small account. The account is that the reason of it lies —

The first important point which strikes us in entering upon this subject is the care showing the length of the period of incubation of the different infectious diseases; and these particulars can only be obtained by taking the average of a large number of cases. The following will be found probably as nearly correct
as the discrepancies of many authors will allow us to judge—Malarious fevers incubate for about 20 days; typhoid, though variable, for about 10 to 12; measles the same; hooping cough 80 days; scarlatina 2-3 weeks; smallpox about the same, though it varies; plague about 7 days (clothy), and not 15 arias usually supposed; yellow fever about 15 days; cholera 1 week.

There is often during the incubation of disease a gradual loss of health. The symptoms to which this gives rise are, however, so irregular in occurrence as to be indefinite in character as not to afford grounds for any but the basest presumptions that the subjects of them will eventually contract the disorder.

While on this matter I should state that it is of some moment to be aware that a person previously ill of disease may infect others with it for an uncertain time after the distemper has left him. This infection cannot take place, it is
usually supposed, after the space of about a fortnight has elapsed from the time that convalescence was decidedly pronounced, and after all the patient's clothing, rooms, &c., have been disinfected she has been able to take exercise in the open air.

Again, it should not be overlooked, that quarantine regulations must be carried into effect with due regard to the habits and circumstances favorable or otherwise to the spread of the different diseases. Thus it has been ascertained that yellow fever never exists where the temperature is below 70°; it is also discovered by loftiness of situation, free currents of air, and a sparse population; and it attacks men usually only once in a lifetime.

Plague can be introduced at all temperatures from about 36° to 75°, but usually heat or cold beyond either of these limits destroys its powers of dissemination. It also very rarely attacks more than
once in a lifetime.

Cholera is not absolutely barred from admission by any particular temperate, but it flourishes most luxuriously in a moist warm atmosphere and among crowded populations.

Dr. Copland's asserts from experience that infection by vomitus is the most dangerous source of disease which has to be dealt with by the Quarantine officers. And the cause of this danger is easily perceived when we learn how frequent it is the neglect of cleaning & disinfection of all clothing, and the ease with which these articles are smuggled ashore from the Commissariat or inspection of the guards.

In prescribing the length of time during which a ship must perform Quarantine, yard must be had to the length of time which may have elapsed since she left the suspected or infected locality—otherwise manifest
injustice, maybe done by forcing individuals to perform a quarantine on arrival at a port which has virtually been performed during the voyage.

All articles of merchandise, clothing of every description, all textile fabrics, ought to be fumigated, or at all events, freely exposed to currents of dry air, and if they will stand it, immersed in boiling water. It is also advisable to disinfect letters from tainted places or ships, for the usual process of exposing them to the fumes of crete acid is probably just so efficacious as about the same of the more powerful disinfectants as chlorine, &c.

Where countries are separated merely by river, or mountain range, or an imaginary frontier line, it is, of course, extremely difficult to enforce quarantine rules, and it is almost hopeless to expect that they can be of much use. True convictions, however, should overcome any excuse for a total suspension of them, for the are undoubtedly productive of some benefit.