

The effect of the nitrous vapour, in preventing and destroying contagion : ascertained, from a variety of trials, made chiefly by surgeons of His Majesty's Navy, in prisons, hospitals, and on board of ships : with an introduction respecting the nature of the contagion, which gives rise to the jail or hospital fever, and the various methods formerly employed to prevent or destroy this.

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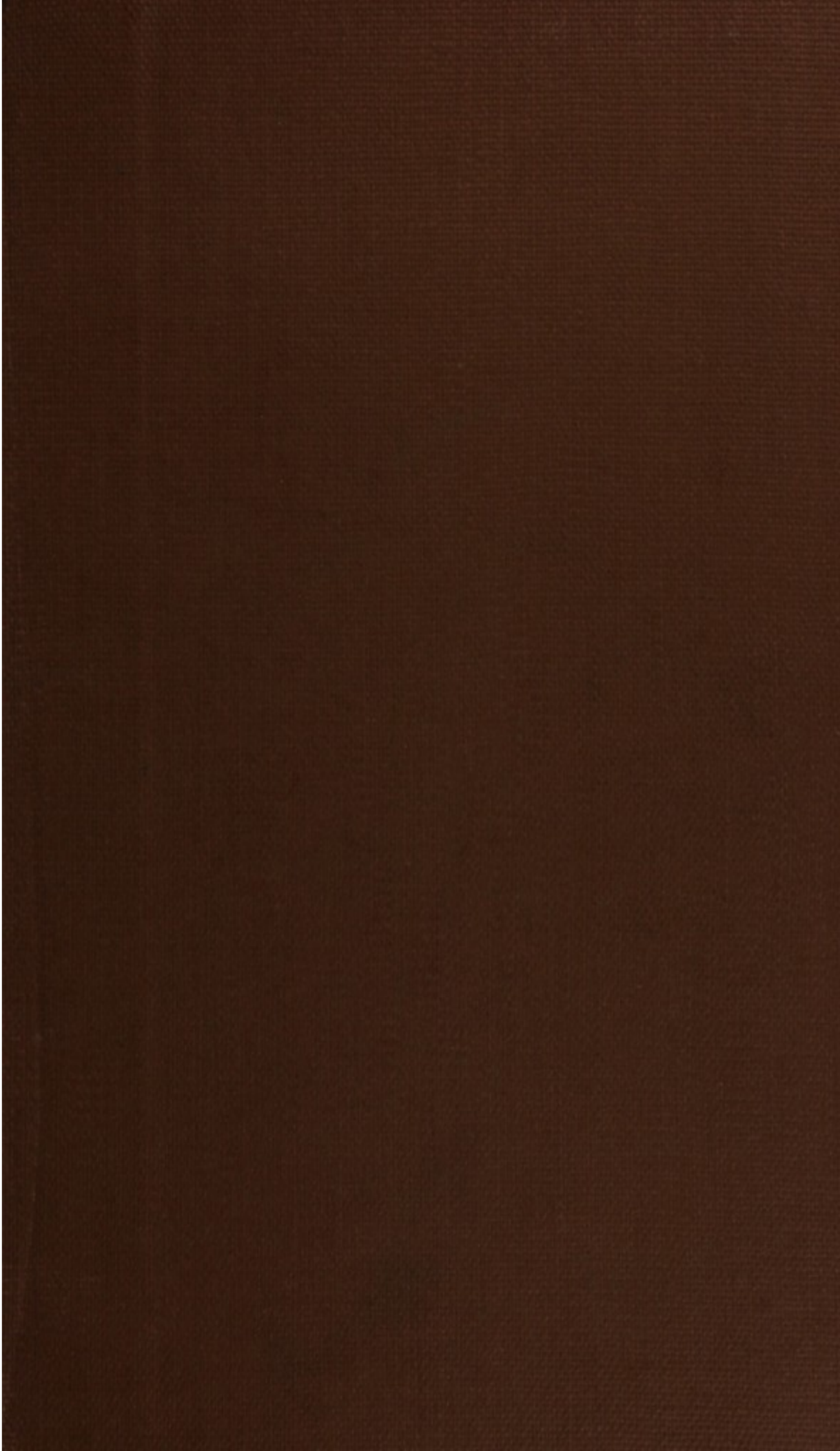
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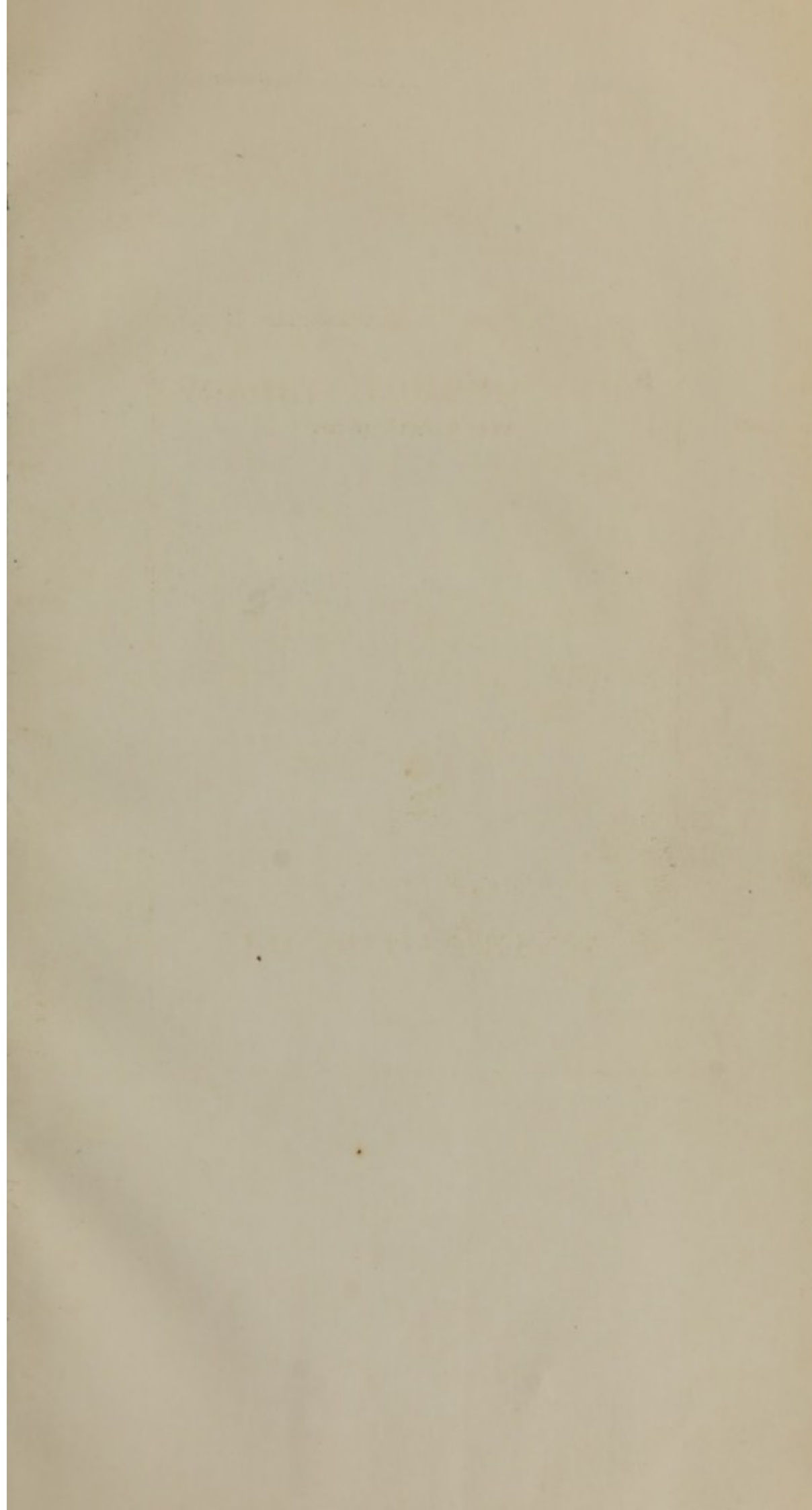
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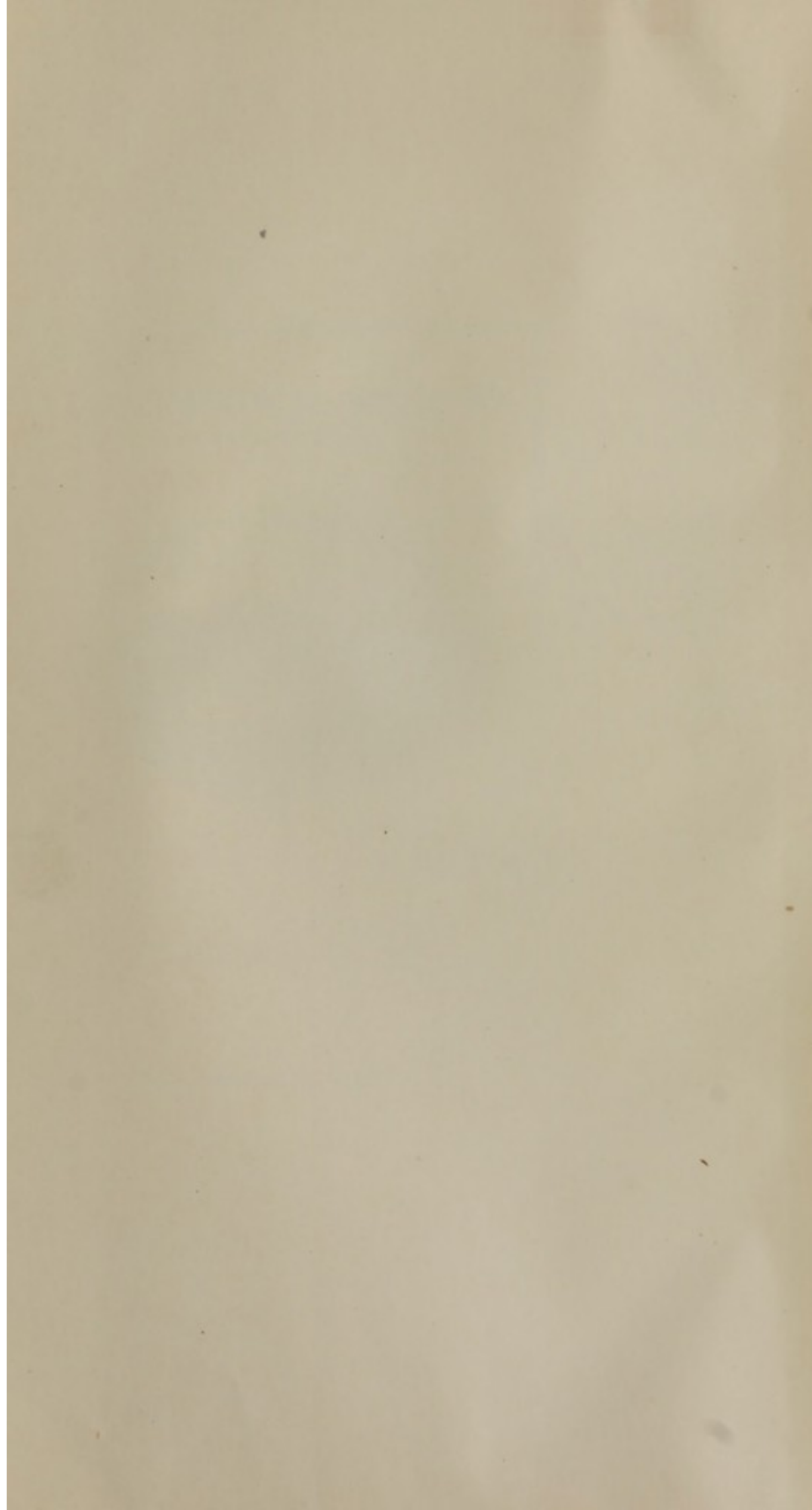
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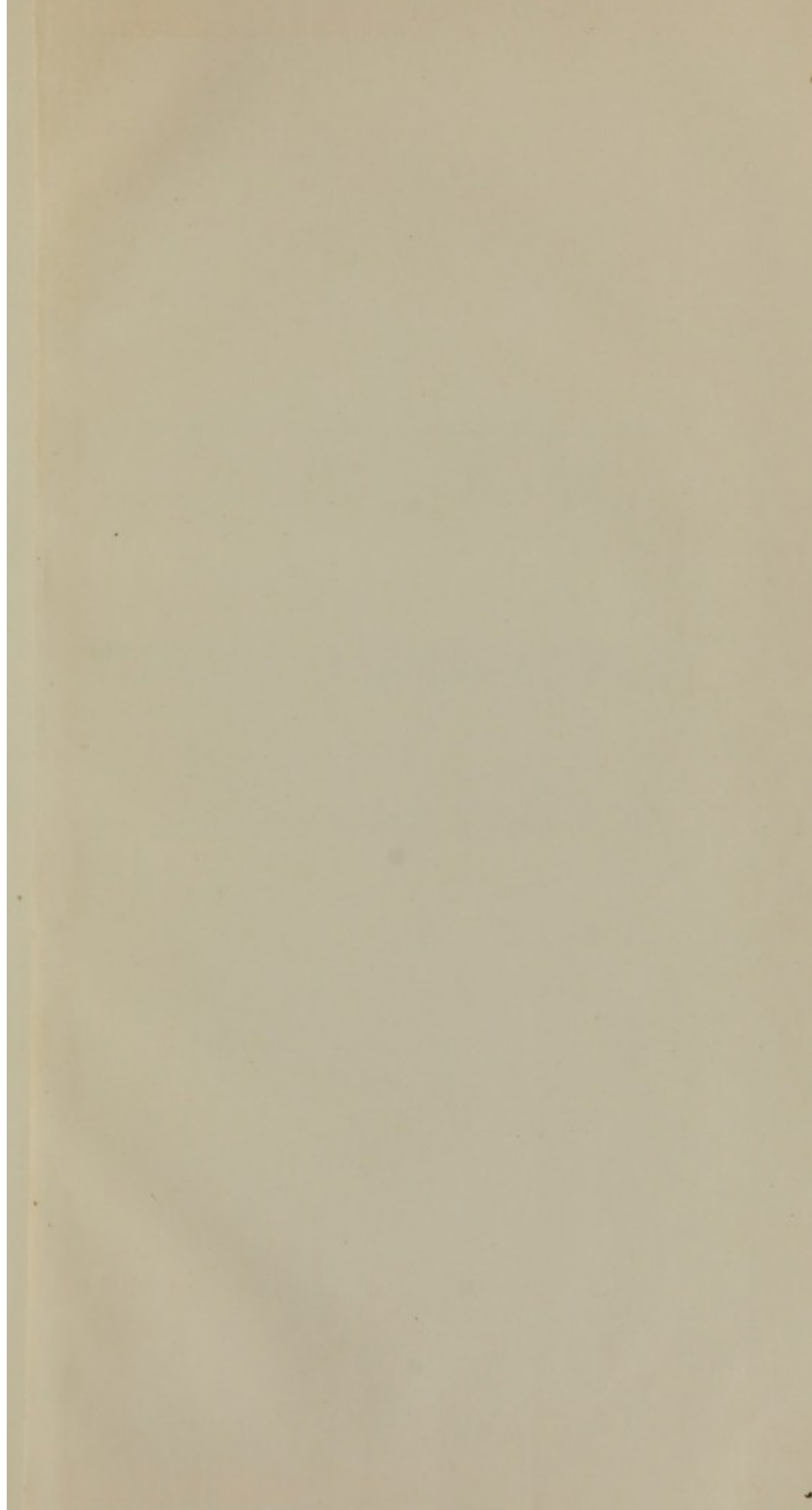
FOUNDED 1836



WASHINGTON, D.C.









OF THE
NITROUS FUMIGATION.

Je ne connois pas de theorie qui puisse decider une question qui interesse la vie des hommes ; il ni a que des experiences faites avec soin, et multipliées à l'infini, qui doivent servir de loi en medicine.

THE
EFFECT

OF THE

NITROUS VAPOUR,

IN

PREVENTING AND DESTROYING

CONTAGION;

ASCERTAINED, FROM A VARIETY OF TRIALS,

MADE CHIEFLY BY

SURGEONS OF HIS MAJESTY'S NAVY,

IN PRISONS, HOSPITALS, AND ON BOARD OF SHIPS:

WITH AN

INTRODUCTION

RESPECTING THE NATURE OF THE CONTAGION,

WHICH GIVES RISE TO THE

JAIL OR HOSPITAL FEVER,

AND

THE VARIOUS METHODS FORMERLY EMPLOYED TO PREVENT OR
DESTROY THIS.

A NEW EDITION.

BY

JAMES CARMICHAEL SMYTH, M. D. F. R. S.

FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS, AND
PHYSICIAN EXTRAORDINARY TO HIS MAJESTY.

PHILADELPHIA:
PUBLISHED BY JAMES WEBSTER.

1815.

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THE UNIVERSITY OF CHICAGO

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P R E F A C E.

THREE years have now almost elapsed since I published an account of the experiment made with the nitrous fumigation on board the Union hospital ship, and of the similar trials made at the same time on board some ships of the Russian squadron.

The accurate and candid narrative of this business, given by those gentlemen, who undertook the conducting it, proved in the clearest and most unequivocal manner, to every unbiassed mind, not only the power of the nitrous vapour in destroying contagion, but the safety with which it might be employed: such, however, is the force of prejudice, as to render doubtful even the evidence of our senses. A considerable increase in the number of deaths, amongst the Russians, happening

pening in the month of January, a rumour was immediately propagated that this mortality was occasioned by the nitrous fumigation, which, though it might seem harmless in the beginning, possessed some latent deleterious quality that in the end proved fatal.

Hearing of this by accident, and knowing how difficult it is to remove impressions that have once laid hold of the public mind, I made application to Lord Spencer, and to the other Lords Commissioners of the Admiralty, requesting that they would have the goodness to appoint proper persons to investigate this matter fully, and to report to their Lordships the result of their inquiry. My request was complied with, and the report of those gentlemen proved in the most satisfactory manner, that the rumour was a direct misrepresentation of the fact; that the mortality amongst the Russians was owing to different causes unconnected with the fumigation; that those who had been longest exposed

TO

THE RIGHT HONOURABLE

EARL SPENCER,

Ec. Ec. Ec.

MY LORD,

AS most of the following trials with the nitrous vapour were made in consequence of an order issued by your Lordship, and the other Lords Commissioners of the Admiralty, for employing it in the navy; it must afford you some satisfaction to observe, that success has followed your Lordship's decision on this, as on more important occasions: nor can you be surprised that I should be desirous of prefixing your name to a publication, which owes its existence, in great measure

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ture to yourself. I have now no occasion to solicit your Lordship's recommendation of a measure, which a conviction of its utility has already led you to adopt; but I have to thank you, which I do most sincerely, for the attention you have given to the subject, and for your candour and politeness to the Author.

I have the honour to be,

With the most perfect consideration and respect,

MY LORD,

Your Lordship's most obedient,

And much obliged servant,

JA^S CARMICHAEL SMYTH.

Earl Spencer.

PREFACE.

exposed to it enjoyed the best health ; and that not a single instance could be adduced of any bad consequence which could fairly be imputed to the nitrous vapour, during the three months it had been employed.

This objection being removed, another still presented itself. It had been said, and said with truth, that the vitriolic acid, in a concentrated state (commonly called oil of vitriol) was a dangerous article to be taken on board of ship, as there had been instances of ships set on fire by it ; and that this accident actually happened to two transports of Admiral Christian's squadron. The fact could not be denied ; but the same objection applied, and with still greater force, to the use of fire, of gun-powder, and of ardent spirits ; all of which are, without doubt, extremely hazardous in the hands of ignorance or of rashness ; but which, when their effects are known, with the proper means of obviating them, may be employed with as much safety as air or water.

To do away, however, every possible objection on this head, I had proper cases made, one for the mineral acids, and another for the purified nitre, with the instruments necessary for the fumigation. The mineral acids were first put into strong glass bottles, fitted with ground glass stoppers, secured with wire; these were placed in a case lined with copper covered with an amalgama of tin and lead, with divisions of the same; the interstices of the divisions were afterwards filled up with saw-dust: by this means the bottles were secured from breaking, and even if that should happen, the acids could not escape, nor affect the lining of the case; so that every danger which could possibly arise was completely foreseen and prevented. A case similar to the former, but entirely of wood, with divisions of the same, was made for holding the nitre: the nitre was put into four stone or earthen jars, adapted to four divisions in the case, which had a fifth division also, the whole width

width of the case, for containing the pipkins, cups, measures, and other instruments necessary for the fumigation. These cases I sent to the Admiralty for the inspection of their Lordships, and as they met with their approbation, their Lordships ordered similar cases to be made and sent on board every ship in his Majesty's service; and that the materials necessary for the nitrous fumigation should be sent also to the different naval hospitals and prisons. I need hardly add, that the greater part of the experiments and trials which I have now the honour to lay before the public, are the result of this order of the Lords Commissioners of the Admiralty.

Many of those communications have been sent to me, as will presently appear, by the Board for sick and wounded seamen; but for several, by far the most important, I am indebted to the friendship of Dr. Johnston, one of the Commissioners of that Board, a gentleman whose humanity and active zeal in
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the service of his country are well known, and whose character stands too high in the public opinion to receive any addition from my praise. He was fortunately one of the extra-Commissioners at Portsmouth, when some of the first trials were made with the nitrous fumigation, and from the happy effects produced by it, became a warm advocate in its behalf; a circumstance which first introduced me to the honour of his acquaintance.

As for the gentlemen themselves who have made the trials with the nitrous fumigation, I shall only observe, that they cannot be suspected, in the reports or opinions they have delivered on this subject, to have been influenced by any partiality to me; as, excepting Captain Lane of the navy, I had not the honour of the slightest acquaintance with any of them; and several, though they had heard of the experiment on board the Union, had never read a word I had written on the subject. It appears, however, very evident from
their

their letters, that there are amongst them men of observation and experience, and if we may judge from the important stations in which some of them are placed, they are men of high and respectable characters in the service. Respecting their observations, I may fairly say, that in general, they carry with them the internal evidence of truth. But I shall examine this subject more particularly, after having presented the public with the letters and communications of the authors.

Of the Introduction I have only to remark, that it contains those general observations on the jail and other putrid contagions, with the usual means of obviating these, formerly published in the Treatise on the Fever at Winchester; and now republished, from a wish to make them more generally known, especially to those persons who are likely to be placed in similar situations, or engaged in similar enterprizes. It does not fall to the lot of every surgeon, or even physician, to the
navy

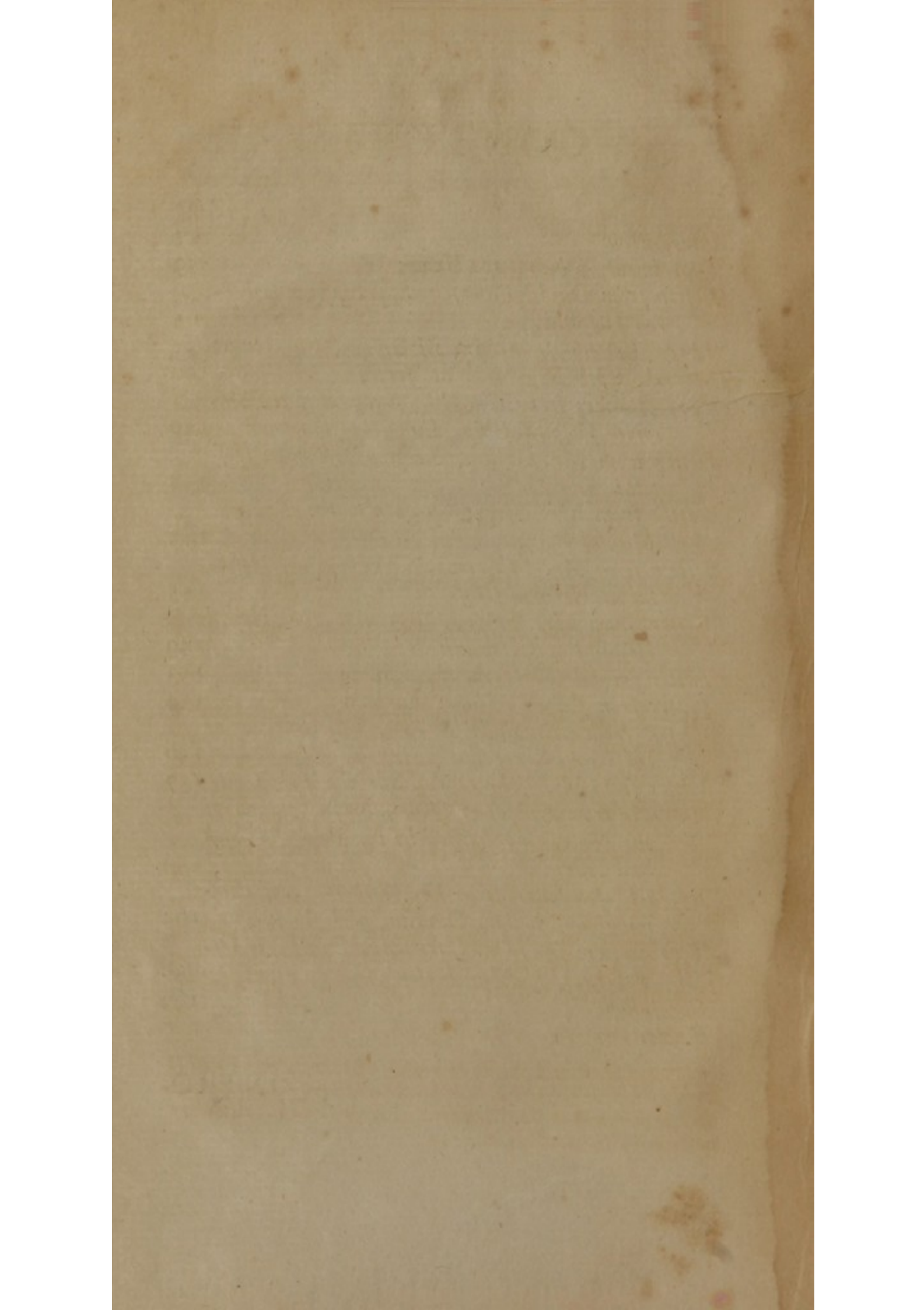
navy or army, to have turned his attention to this subject in the manner I have done, nor to have had the same means or opportunity of information. The chief object of my life has been to render my profession, and the exercise of it as beneficial as possible to mankind ; my endeavours, however, to bring to perfection, and into general use, the present discovery, have been chiefly animated, and I am not ashamed to confess it, by the desire of rendering an important service to my country. She, as the great maritime power in Europe, is the most likely to derive, and I flatter myself, will derive the most essential benefit from my labours.

*Charit Parentes, Charit Liberi, Propinqui
Familiars : sed omnes omnium Charitates, Pa-
tria una complexa est.*

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INTRO-



INTRODUCTION.

*Respecting the Nature of the Contagion, which gives
rise to the Jail or Hospital Fever.*

THAT we may be able to form a more accurate judgment of the nature of the contagion, which gives rise to this species of fever, we shall examine it in four different points of view.

In the first place, how it is generated; 2dly, in what manner it is propagated, with the circumstances more or less favourable to its communication; 3dly, its effects on the human body; and, 4thly, the means of weakening its virulence, or of entirely destroying it.

Whoever has considered contagious fevers with that attention which the importance of the subject demands, must have observed, that they are of two very distinct kinds or *classes. The first may properly enough be called *specific contagions*, as they do not arise from any general quality, or process of nature, with which we are acquainted; and, as they have a peculiar origin, they excite diseases of a peculiar kind; differing in many respects from every other, but in nothing more remarkably, than in this, that the peculiar disease can only take place once in any individual: and there are some persons,

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* This distinction seems so extremely obvious, that we should hardly suppose it could escape the observation of any one who had at all reflected on the subject, and yet I do not know any medical writer who has made it.

in whom this contagion never can produce any morbid symptom. The number of those peculiar or specific poisons is not yet ascertained ; but the small-pox and measles are evidently such to man, and there are others peculiar to certain animals.

The second class of contagious fevers, may be named *general contagions*, as they arise from a general cause ; or they may be named *putrid*, as they will be found, in every instance, to be the result of putrefaction, one of those general fermentative processes, to which water as well as all vegetable and animal substances, under certain circumstances, are liable. That the contagion, or miasma, of the jail or hospital fever derives its origin from this source, admits of every species of evidence which a matter of fact and of observation can do.

It is well known, that this disease is constantly produced where a number of people are shut up together in a close place, without the greatest attention to cleanliness, and a renewal of air. That all the excretions of the human body have made a certain advance or progress towards putridity, and when placed in circumstances favourable to putrefaction, soon become highly putrid. That of all the human excretions, none is more highly animalised, or more susceptible of becoming putrid, than the perspiration or vapour issuing from the surface of the body and lungs. That even the perspiration of vegetables, confined under similar circumstances, becomes putrid, and in a high degree noxious to man : *a fortiori* then, we may conclude, that animal perspiration will more quickly undergo a similar alteration, and must prove still more noxious.

We observe, that the contagion, resulting from animal perspiration, shews its baneful effects more suddenly, and more forcibly, in proportion to its quantity,

quantity, and to its being placed in circumstances the most favourable to putrefaction; consequently, in proportion to the size and closeness of the place, the temperature* and moisture of the air, and the additional or accessory putrid matter with which it is combined.

We observe, likewise, that the formation of this contagion is prevented by causes that renew the air, and carry off the perspiration, or prevent its tendency to putrefaction.

And, it may be mentioned as an analogical proof, that a contagious vapour, differing only in degree of virulence from the human miasmata, is constantly produced from water alone, or from water mixed with vegetable and animal matters, when exposed in sufficient quantity and under circumstances favourable to putridity; but the septic nature of the jail contagion will be farther illustrated, by what we have to notice of its effects on the human body,

* It has been alledged in objection to this, that the jail fever is more frequent in our prisons in winter than in summer. The fact I can neither confirm nor deny, but admitting it in its fullest extent, it by no means invalidates the opinion I have endeavoured to establish. The cold of our winters is seldom so severe, at least for any length of time, as to freeze the moisture of the atmosphere, especially within-doors, and therefore, I run no risk of contradiction, when I affirm, that in general, the moisture or water diffused in the atmosphere, is much greater during the winter, than during the summer months; but the cold, though not in general sufficient to dry the air, is sufficient for those confined in the cells of prisons to endeavour to exclude it, although by excluding it, they must prevent the renewal of the air, and breathe more their own baneful atmosphere. Cold has also the effect of making people in their situation, less attentive to cleanliness, and of inducing laziness and debility; all of which circumstances, when taken into the account, will be found greatly to counterbalance the difference of temperature.

body, and of the methods of destroying it, or of rendering it harmless.

Of the Manner in which Contagion is communicated.

EVERY person knows that contagious fevers, whether *specific* or *putrid*, are usually propagated by an immediate communication with the sick, either by contact or contiguity. How far the contagious atmosphere extends, is impossible to ascertain, as this must admit of *considerable* latitude*, according to the virulence of the disease, situation of the sick, season of the year, state of the atmosphere, &c. My ingenious and respectable friend Dr. Haygarth is of opinion, and indeed has shewn, that in the small-pox it is much more limited than was apprehended. But it is not only from a direct communication with the sick that contagious fevers are propagated; unfortunately, the persons and clothes of those who remain long in a contagious atmosphere, and the excretions of the sick, are capable (even when conveyed to a great distance, or preserved for a length of time) of producing the same mischief as an immediate communication with the sick themselves. Of this fact the examples are so numerous as to put the matter beyond the possibility of a doubt. Here again, the opinion of my friend Dr. Haygarth differs from the opinions formerly entertained by physicians. For, though he admits, that the variolous matter, and the more sensible excretions of the sick, are capable of communicating the disease, and, if close shut up, of retaining that power for a long time, he does not think, that the contagious vapour, immediately arising

* This subject the reader will find treated more fully in two Letters addressed to Dr. Percival, of Manchester.

arising from the sick, can be retained by the clothes of those confined in the variolous atmosphere, or by the furniture in the chambers of the sick, so as to communicate the disease to such as have not themselves been immediately exposed to it. No one can have a greater respect for the opinions and observations of Dr. Haygarth than I have, as no person is better acquainted with his candour and accuracy. I readily agree with him, that the dread of those terrible diseases, and the natural fears of men, have possibly magnified the danger beyond reality; that the risk of propagating the contagion in this manner is by no means so great as had been supposed; and that physicians, or even apothecaries, are seldom so long exposed to this atmosphere, as to be in great danger of conveying the contagion elsewhere; but I cannot go so far as to believe that the persons, and especially the clothes of nurses or assistants, who are constantly confined in the chambers of the sick, sometimes not very well ventilated, will not imbibe the contagious vapour to such a degree, as to be capable of communicating it, especially where they have a direct or immediate intercourse with a person susceptible of the disease. But, putting the small-pox and other *specific contagions* out of the question, that the jail distemper and other *putrid contagions* are frequently conveyed in this manner, cannot be denied. Indeed, wherever a vapour can be distinguished by the smell, we have the demonstration of our senses for what a length of time, not only clothes, but furniture, and even the boards and walls of houses will retain it: therefore, in respect to the contagion of the jail or hospital fever, we may safely affirm, that it affects not only those who are immediately exposed to the original atmosphere, but that this contagion may certainly be communicated by the clothes of persons
who

who have for any length of time been confined in it; and, what is still more surprising, even when the persons themselves have suffered no injury, nor had any disease in consequence of such exposure.

This fact being ascertained, we cannot wonder if those who are seized with the jail fever, owing to such communication, should during their illness generate a contagious vapour; but, however paradoxical it may appear, I have never observed that the sick propagated the disease so readily, as the bodies and clothes of those who, though well, had been long confined in the original atmosphere. From my own experience also, I am led to conclude, that there is little risk of receiving the contagion from dead bodies, even from dissecting them, provided the surgeon does not cut himself during the dissection, the consequence of which has generally proved fatal.

There are several other circumstances, worthy of notice, that increase or diminish the facility with which contagion is communicated. Unless where contagion is very powerful, it is seldom propagated in the open air; I knew only one instance of this at Winchester. It is much more certainly communicated in a room, and especially if there is a current of air, from the contagious person to others capable of being affected. A moist atmosphere* is also more favourable to the communication of contagion than a dry one. A contagious person becomes greatly more so, if his clothes are wet, and his

* Moisture appears not only necessary to the production of putrid contagion, but it would seem to be the medium also by which it is communicated; it is well known, that the plague ceases, in Syria and Egypt, during the prevalence of certain drying winds; and its almost entirely disappearing during the winter, at Moscow, was probably owing to the same cause; viz. the dryness of the atmosphere.

his body heated by exercise, so as to be in a state of perspiration. Those most susceptible of contagion are, young persons, particularly if they come directly from a pure air into the infected atmosphere; persons whose minds are oppressed with fear or anxiety; or who have been weakened by previous illness; even those who have been fatigued, or are fasting, more readily than others whose strength has not been impaired, or which has been again recruited with food. It has been farther remarked, that persons who have issues are seldom affected by contagion.

Of the Effects of putrid Contagion on the human Body.

PUTRID matter, in whatever way generated, if in sufficient quantity, has always some deleterious effect; or, in other words, acts as a poison upon the body. It is true, that the human stomach, and still more remarkably, the organs of digestion of certain animals, have the power of counteracting the septic tendency; but this power, in our stomachs at least, is very limited; and when any matter, whether generated in the body or introduced from without, has acquired a degree of putridity beyond this, it occasions nausea, vomiting, purging, great oppression at the region of the stomach, and often a fever, either of the intermittent, remittent, or more continued kind. Putrid matter, directly introduced into the system by means of a wound, causes swelling and inflammation of the lymphatic glands, often terminating suddenly in gangrene, along with the symptoms of a fever, greatly resembling the hospital or jail fever: the same prostration of strength, tremors, anxiety, headach, and delirium;

delirium; with the same irregularity in the pulse, and, if the disease continues, it induces those appearances of the skin, hemorrhages, and other symptoms, that indicate a relaxation of the solids, and resolved crasis of the blood. The fevers that arise in consequence of exposure to putrid vapour or contagion, assume a variety of types and forms, according to the various circumstances of combination, degree of putridity, season of the year, constitution of the patient, &c. But they, as well as the preceding, will be found to have many symptoms in common, and similar to the jail and hospital fever: and in reality all the fevers of this class, from the slightest vernal intermittent to the true plague, are in my opinion only different shades or varieties of the same disease, and productions of one common cause, viz. putrefaction. I shall not, however, prosecute this subject farther at present, as I have treated it more fully in another work, which, should I hereafter have leisure to complete, I hope to render not altogether unworthy of the public eye.

The contagion then of the jail or hospital fever, may justly be considered as one of the most subtil and powerful vapours of the putrid kind; and, consequently, its immediate and destructive effects upon the body, are not to be wondered at. In ordinary cases of fever, the vital principle is roused into action, and Nature is commonly sufficient of herself to remove the morbid cause; but here, as in the real pestilence, the contagion introduced into the body, seems to act as a narcotic poison upon the heart and nervous system, suppressing the principle of life, instead of rousing it to the conflict. In this distemper therefore, where nature can do so little, and even art, unless immediately called to her assistance, is equally unavailing, it is of the most consequence for

us to know whether the contagion cannot be prevented or destroyed.

Of the Means of preventing, and of destroying the Jail Contagion.

As we are perfectly acquainted with the causes of the jail contagion, we could certainly prevent its formation, provided the means of doing so were always in our power; but as we cannot command these, our next object is to endeavour to correct, or destroy it, when formed. As a knowledge of the nature and origin of the jail contagion naturally led to the proper and effectual means of correcting or destroying it, so, on the other hand, the means that have been successfully employed to destroy it, afford the most convincing evidence of its true nature.

The various means hitherto employed for destroying contagion, may be arranged under two distinct heads, or classes, viz. the Physical and the Chemical.

All contagions, whether specific or putrid, are either checked or completely destroyed, by the extremes of heat and cold; and from a free exposure to air and water, are so diluted or dissolved, as to lose their noxious quality. Heat and cold then, with air and water, may be looked upon as physical agents, which, under certain circumstances, are effectual in blunting or destroying contagion. A degree of heat, nearly that of an oven, is found necessary for the complete destruction of contagion, but as this degree of heat is incompatible with animal life,* its application is solely confined to the

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purifying

* A great heat, like that of an oven, such as would prove destructive to all animal life, effectually destroys this infection in all substances which can be for some time exposed to it. Vide Lind's Observations on the Jail Distemper, Ann. 1779

purifying of such clothes, furniture, &c. as cannot be injured by this treatment. But, although the degree of heat requisite for the complete destruction of contagion can only be used for one particular purpose, heat and fire, judiciously managed, may, in various ways tend to lessen the power, or to check the progress of this pernicious vapour : for as closeness and dampness are favourable to the production and spreading of contagion, drying and rarefying the air, by counteracting these, must, so far at least, be proper antidotes. But, independent of those effects of heat, an open fire, especially where the fuel is burnt in a narrow flue, is of great benefit ; for, by consuming a portion of the air, it causes a more sensible renewal of it, and, in fact, is one of the best ventilators. In employing fire and heat, however, care must be taken not to increase the heat in the apartments of the sick, as this would prove more hurtful to them, than the drying or renewing of the air could be advantageous.

The degree of cold necessary to destroy contagion is probably, like the degree of heat, inconsistent with life ; and, therefore, although we hear of contagion having been checked or suppressed by cold, there are few instances, if any, of its being completely destroyed. Besides, as it is not in our power to employ cold at pleasure, the question respecting its effect, of whatever importance it may be to the pathologist, is of little consequence to the practical physician.

That noxious vapours are hurtful only when concentrated, and are harmless when diffused, are facts or data universally admitted ; and it is upon this principle, that clothes, bedding, or other matters to which contagion adheres, are purified, or lose their deleterious quality, by exposure for a sufficient length

length of time to the open air, or to a current of water; but, as the time requisite for this mode of purification is uncertain, and as contagious clothes, goods, &c. cannot always be exposed in a proper manner,* we are commonly under the necessity of having recourse to those more expeditious means of purification which chemistry affords, and which I shall next examine.

The chemical means hitherto employed for destroying contagion, are the following :

Burning sulphur with charcoal.

————— with arsenic.

nitre.

gunpowder.

portfire.

tar.

tobacco.

wood.

Boiling vinegar.

————— with camphire.

tar.

Washing with vinegar.

White-washing.

Painting.

The vapour produced by the burning of sulphur, is known to be the volatile vitriolic or sulphureous acid, one of the most powerful of the mineral kingdom,

* Dr. Lind has very justly remarked, that no ventilation or admission of air into prisons or hospitals, can remove or destroy contagion when once it is present. The same may be said of water. But though neither one nor the other under those circumstances can destroy contagion, both may be usefully employed in blunting its force, and in preventing the spreading of the disease.

kingdom, the effect of which in destroying contagion has been long established; but as it affects, even in small quantity, the respiration of animals, inducing suffocation and death, it can only be employed for fumigating clothes, furniture, or empty apartments. When burnt with charcoal, in the common way, we obtain not only the sulphureous acid, but also the carbonic, or fixed air, which, though it can have little influence on contagion, renders the common air less fit for respiration; a circumstance hardly deserving attention where the sulphur is burnt in a fumigating room, or a place set apart expressly for the purpose of fumigation, but which is of great importance when sulphur is burnt between the decks of ships, or in hospital or prison wards, where men are soon afterwards to be lodged. The occasional addition of arsenic seems to have been made by Dr. Lind, with a view of increasing the deleterious* quality of the vapour; but it appears unnecessary, as the sulphureous acid is of itself sufficiently powerful for destroying contagion; besides, I doubt much, if the vapour of arsenic is not too heavy to rise with the acid of sulphur.

Burning or deflagrating nitre.—Having had some experience of the efficacy of the nitrous acid in destroying contagion, and being sensible of the disadvantage of fumigating hospital or prison wards by burning sulphur with charcoal, as was commonly practised, I resolved to employ nitre, instead of sulphur, at Winchester; never doubting that I should obtain,

* It was an old and very generally received opinion, that contagious diseases, as well as some infections, were caused by insects, and therefore Dr. Lind might think, that the most deleterious vapour would prove the most effectual in destroying contagion.

obtain, by deflagrating nitre, a portion of nitrous acid, as well as the dephlogisticated nitrous air or oxygene; but a farther acquaintance with chemistry convinced me of my mistake, and that the deflagration of nitre never produced any nitrous acid. It is therefore evident, that deflagrating nitre in the prison and hospital wards at Winchester, could have no effect in destroying contagion, and no farther effect in purifying them, but so far as it furnished a quantity of oxygene, or air much purer than the common air of the atmosphere.

I observe, in Dr. Rush's publication on the yellow fever of Philadelphia, that the physicians of that city lately fell into the same mistake that I formerly did, *viz.* deflagrating or burning nitre as a means of destroying contagion.

Burning gunpowder.—If there is no nitrous acid obtained by burning or deflagrating pure nitre, we cannot expect to procure any from burning gunpowder,* either wet or dry†. The charcoal in the composition possibly yields a small quantity of carbonic acid, whilst the sulphur, uniting chiefly with the alkaline basis of the nitre, forms a hepar sulphuris, as the water used in washing a gun plainly shews.

Burning portfire.‡—This composition of sulphur, nitre, and charcoal, has likewise been employed§ for destroying contagion; and as the sulphur in this
is

* Gunpowder consists of seventy-five parts of pure nitre, fifteen and a half of charcoal, and nine and a half of sulphur.

† Next to the smoke of wood, for purifying a tainted air, I esteem that of gunpowder. This I often use, as being quite inoffensive to the lungs, &c. Vid. Lind on Fevers and Infections, p. 51.

‡ Portfire is made of one half sulphur, one fourth nitre, and as much charcoal.

§ Vid. Chisholm on the West India Fever.

is the predominant article, it will perhaps furnish some sulphureous acid, though I should apprehend not a sufficient quantity to be effectual in destroying contagion.

*Burning tar.**—The use of tar seems natural enough to sailors, who may be supposed partial to what they are constantly accustomed; but, if we examine the subject with attention, it is evident that the vapour arising from tar, whether burnt or boiled, must be a weak agent against contagion. The empyreumatic oil can be of no service but by opposing one disagreeable smell to another, whilst the ligneous acid, at best a weak one compared with the mineral acids, is in great measure destroyed by burning, and is so diffused in the vapour of boiling tar, as to prevent entirely any effect which this acid, in a more concentrated state, might otherwise produce.

Burning tobacco.—There is an ancient prejudice respecting the antipestilential quality of tobacco, founded, I believe, on a tradition which is entirely void of truth, that the plague never entered a tobacco shop. Dr. Lind however seems to have had a high opinion of it,† but upon what this was founded I cannot pretend to say, as the smoke of tobacco, so far as I can perceive, has no advantage over the smoke of any other vegetable matter.

Burning

* By smokeing this ship (Revenge) well with the vapour of tar, the infection had abated. Vid. Lind, p. 2.

† When prisoners can be removed, the infection will most effectually be extinguished by their removal to another prison, and, after thoroughly cleaning the infected one, to fumigate with the smoke of tobacco, &c. Vide Dr. Lind's Health of Seamen, p. 337—Dr. Lind had so high an opinion of the power of tobacco, that he advised the buying up all the damaged tobacco, to be employed for this particular purpose.

Burning wood.—The smoke* of a wood fire was reckoned, by Dr. Lind, one of the most powerful means of destroying contagion, and he gives several examples where it was successfully employed. I might perhaps remark that some of these examples he had from persons who were not such accurate observers as himself; I shall not however call them in question, as I think the advantage supposed to be immediately derived from the smoke of wood, may fairly be ascribed to other causes. In the first place, the smoke of wood consists principally of foot, or of inflammable matter unconsumed, with some carbonic acid, neither of which can have any effect on contagion; whilst the ligneous acid is in very small quantity, too small certainly to be of much service. But we know, that where there is smoke there is heat, and that where there is much smoke, in places where people are present, a free admission must be given to the air; two circumstances which have considerable influence in weakening the virulence, and in preventing the spreading of contagion.

Boiling vinegar.—Vinegar† has, at all times, been considered as the grand antidote to contagion, though

* A judicious application of fire and smoke, is the true means appropriated for the destruction and utter extinction of the most malignant sources of disease. Again it hath been experimentally found, that the smoke of a wood fire serves not only to lessen the force or violence of such poisons, but is also an excellent protection against their being conveyed. Vide Lind's Papers on Fevers and Infection. Paper 1. p. 49.

† The cascarilla bark, when burning, gives a most agreeable scent to the chambers of the sick, and so is at least an excellent preservative, and may prevent bad smells from taking effect. The steam of boiling camphorated vinegar is still more powerful for this purpose. Vide Lind on Fevers and Infection. p. 51.

though I believe it to be one of the most trifling means that has ever yet been employed. I have never once observed the smallest benefit from its use; and have known many fatal examples of contagion having been communicated where it was constantly employed. But although the steam of boiling vinegar can be of no advantage in destroying contagion, yet, as the smell of it is grateful to the sick, it may for that reason be used about their persons; and when camphire is dissolved in it, the smell is still more agreeable and reviving.

Washing the furniture, floors, walls, &c. with vinegar, I consider as little better than washing them with simple water. The same may be said of white-washing, as the lime and size can have no particular effect. Oil painting, another mode of purifying apartments, has little advantage over the preceding; not to mention the expense and inconvenience attending it.

But enough has been said to shew the general want of chemical knowledge, apparent in all the methods hitherto proposed for destroying contagion, and more especially, the inefficacy of the methods employed in places and situations from which people could not be removed; I shall now proceed to a more agreeable task, and explain those improvements, which a more accurate chemistry, and a long attention to the subject, have suggested to me, and relate some experiments which I made, with a view to ascertain the efficacy of the nitrous acid, and the safety with which it may be used, where people are necessarily present.

The mineral acids, particularly when in a state of vapour, with the different gases or permanently elastic fluids produced by them, are probably, excepting fire, the most powerful agents in nature,
and

and the source of an infinite number of the different forms of matter observable in the mineral kingdom and which are constantly undergoing fresh changes, from their various combinations, and decompositions. But their power is not confined to the mineral kingdom; they are known to have great influence likewise over putrefaction, and those other spontaneous changes which vegetable and animal matter, deprived of life, undergoes; and therefore, if the jail contagion, as I have endeavoured to prove, is a vapour produced by putrefaction, there cannot be a doubt that the mineral acids will prove effectual in destroying it. So far we may reason *a priori*; but let us next consult experience, a less fallible guide. From this it appears, that the volatile vitriolic or sulphureous acid, the only one hitherto made use of, proves effectual in destroying contagion; although owing to its deleterious quality, it cannot be employed, except in situations from which people can be removed. But, are the other mineral acids in a state of vapour equally dangerous with the sulphureous? and, are they equally effectual in destroying contagion? To the first of these questions I can give a positive answer; to the second I can give one that, at least, is highly probable.

In the first place, I can safely affirm, that the nitrous acid may be employed in very great quantity without risk, and even without the smallest inconvenience; and, that it is effectual for the destroying of contagion, I have every reason to believe, not only from analogy, but from experience. I had frequently used the nitrous acid, as a fumigation, in hospital wards, and in the private apartments of the sick, without perceiving any unpleasant effect from it; but, to ascertain with more

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precision

precision a fact of this importance, I made the following experiments; in the conducting of which, Mr. Hume of Long-acre, a very ingenious man, and an excellent chemist, was so obliging as to favour me with his assistance.

We put a mouse, confined in a wire trap, under a glass cylindrical jar, capable of holding about 25 pints beer measure, or 881 cubic inches; the jar was inverted upon wet sand, contained in a flat earthen trough or pan; it was then filled with the fumes of the smoking nitrous acid, introduced by means of a crooked glass tube, until the animal could not be very distinctly perceived. The mouse was kept in this situation for a quarter of an hour, when the jar was removed, and the animal exposed to the open air; it immediately ran about the wire trap, as usual, and had not the appearance of having suffered the slightest inconvenience from its confinement. After a few minutes, the mouse was again put under the glass jar, which was now filled with the vapour of pure nitrous acid, detached from nitre by the vitriolic acid. It remained much about the same time as before, and when the jar was removed, seemed perfectly well.

We repeated the same experiments with a greenfinch, only with some little variation in the manner. We placed, on a table covered with green baize, a brown earthen vessel or pan, containing heated sand; in this was put a glass saucer, with about half an ounce of strong vitriolic acid; above which we placed the bird-cage, supported with some small pieces of wood laid across the pan; then, adding a drachm or two of nitre, in powder, to the vitriolic acid, we covered the whole with the glass jar. The nitrous acid rose in such quantity, that, in a very little time, the bird seemed as if in a cloud

cloud or fog. We kept it in this situation fifteen minutes, by which time the cloud had disappeared, and the acid was in part condensed on the side of the glass jar; during the whole time the bird neither panted, nor appeared to suffer any uneasiness, from the atmosphere in which it was confined. We made trial also of the marine acid, by adding common salt, instead of nitre, to heated vitriolic acid: during this experiment, the bird appeared to be, now and then, somewhat uneasy, and opened its bill; but at the end of fifteen minutes, upon removing the jar, it hopped about as lively as before. We then exposed the bird to the fumes of sulphur, burnt with an eighth part of nitre; it immediately gave signs of uneasiness, opened its bill, and seemed to pant for breath in such a manner, that we were afraid to cover it with the glass jar. We likewise made trial, in the open air, of the oxygenated marine acid;* for, as this is so extremely deleterious, we did not think it safe to expose ourselves to the vapour of it in a room, nor did we venture to expose the bird to it in any other way but in the open air, and even there it appeared to suffer very much.

Having made trial of the effect of the different mineral acids, in a state of vapour, upon animals, we determined to render the experiment still more conclusive, by trying what effect they would have on ourselves. With this intention, we filled the
room

* The oxygenated marine acid is a discovery of the famous Scheele, and has been recommended by Berthollet and Chaptal, two French chemists, for the purpose of bleaching. I am informed that it has also been lately used in France to destroy contagion, but the particular circumstances, and manner of its application, I have not yet learnt.

room* in which we were with the fumes of nitrous acid, (obtained by mixing nitre with heated vitriolic acid, in the manner already described) until the different objects became somewhat obscure, by a kind of fog or mist produced. The fire irons and steel fender, lost their polish, and the vapour arising from a bottle of aqua ammoniæ puræ, placed at some distance from the table, was evidently neutralized, as it issued from the bottle, by the vapour of the nitrous acid.

Mr. Hume and I remained in the room the whole time, without perceiving the slightest inconvenience; the fumes did not excite coughing, nor affect the eyes, in the way the smoke of wood commonly does, even when I held my head over the glass saucer, and breathed them immediately arising from it. We made trial likewise of the effect of the marine acid, which we found more pungent and stimulating than the nitrous; but, though it excited coughing, it did not cause that constriction of the windpipe, and tightness at the chest, with the sense of suffocation, which is immediately induced by the volatile vitriolic or sulphureous acid. Indeed we were imprudent enough to try how far we could breathe this last, but I was instantly obliged to run to the window for air, from the sense of constriction, and of suffocation, which it occasioned. We likewise tried the effect of the mixed fumes of the marine and nitrous acid, a kind of volatile aqua regia, which we found more pungent than the marine acid by itself. As for the oxygenated marine acid, perceiving the effect of it on the
bird,

* The room in which we made the experiments was a small parlour 13 feet by 10, and 8 feet high; or about 1040 cubic feet.

bird, and knowing how extremely dangerous it is, we did not venture to go very near it.

From the preceding experiments, the different acid vapours, in respect to the safety with which they may be breathed, may be arranged in the following order :

- 1st. The vapour of nitrous acid, arising from nitre decomposed by vitriolic acid.
2. Ditto—of nitrous acid in its fuming state, or when the nitric acid is mixed with nitrous gas.
3. Ditto—of marine acid, arising from common salt, decomposed by vitriolic acid.
4. Ditto—of nitrous and marine acids, obtained from the decomposition of nitre and common salt by vitriolic acid.
5. Ditto—of sulphur, burnt with an eighth part of nitre.
6. Ditto—of sulphur, burnt with charcoal.
7. Ditto—of oxygenated marine acid,* obtained by putting manganese to marine acid.

As the first vapour is perfectly harmless, in any quantity in which it may be required, it is evidently the most proper to be employed in all situations where people are necessarily present ; and if it should prove efficacious in destroying contagion, of which I have not the smallest doubt, it is the *desideratum*,† so much sought after by Dr. Lind ; but which

* The oxygenated marine acid is obtained, by distilling marine acid from manganese, but may also be procured in small quantity, by putting manganese to heated marine acid, or by gradually adding a mixture of manganese and sea-salt to heated vitriolic acid.

† A certain method therefore of destroying infection in places from whence persons cannot be removed, is a *desideratum* not yet obtained in physic. I have proposed and tried

which he confesses, with his usual candour, he never could find out.

The second, though more pungent than the first, may I believe be employed with the greatest safety; at least, I have never observed any inconvenience from using it. But, as it cannot so easily be procured in considerable quantity, and is attended with greater inconvenience and expense, I have of late years only made use of the first.

Our experiments likewise warrant us to affirm, that the third, or marine acid, though more stimulating, and more apt to excite coughing, than the nitrous, may be safely used, at least in a moderate quantity, where people are present; and where nitre cannot be had, I should have no hesitation in employing it.

Of the fourth I can say but little, only that, in breathing it, I perceived it more pungent than the pure marine acid; and therefore, unless it should be found to possess superior efficacy in destroying contagion, I would not employ it where there are people present.

As the fifth never can be used with safety where there are people present, its use must be solely confined to fumigating empty apartments, clothes, furniture, &c.

The sixth should never be employed, as the carbonic acid may do harm, and never can have any effect on contagion.

Of the seventh I have no particular knowledge, only that it is extremely deleterious, and I believe extremely powerful; but whether it has more effect
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many things for this purpose without success. Vide Lind's Observations on the Jail Distemper. Edit. published in Oct. 1779.

on contagion than the other mineral acids, experience only can determine.

Having now fully proved that the nitrous, and possibly also the marine acid, obtained in the manner already described, may be employed with perfect safety in hospital and prison wards, whilst the people remain in them, I shall, in the next place, relate how far my experience goes to ascertain the efficacy of those acids in destroying contagion.

From all the information I can procure, I do not find that any person has ever made use of the nitrous acid to destroy contagion but myself; for, as this acid is not produced by the deflagration of nitre, or of gunpowder, the employment of these cannot be considered as an instance to the contrary. I formerly mentioned, that I had employed the nitrous acid in two different forms; either the vapour arising from the yellow or smoking nitrous acid, which is a mixture of the acid with nitrous gas, or the more pure nitrous acid, detached from nitre, decomposed by the vitriolic acid. In one or other of those forms I have used it, both in hospitals and in private practice, for sixteen or seventeen years past; and have had the satisfaction to obtain the most decisive evidence of its happy effect, in preventing the spreading, or farther communication of contagion.

The most highly contagious fevers that occur in our hospitals, do not affect the patients in general lodged in the same ward, but only the nurses, or those patients who assist them, or those who lie in the beds contiguous to the sick; to such persons I have frequently seen the fever communicated, and have also repeatedly prevented the farther spreading of the disease, by placing gallipots, with the fuming nitrous acid, between the beds of the sick and
of

of those who were not yet affected by the contagion. And, in private practice, I can declare with truth, that where the nitrous acid has been constantly used as a fumigation, I have not known an instance of a contagious fever having been communicated, even to a nurse or an attendant.

These facts will, undoubtedly, be allowed to be very strong evidence, with respect to the power of the nitrous acid to destroy contagion; still, however, they are liable to some uncertainty, and I will freely confess, that the effect of the nitrous acid, for this purpose, cannot be said to be fully proved, until it has been tried in fumigating tainted clothes, &c. and until its power has been found sufficient to destroy contagion on board of ships, and in prisons and hospitals, where it exists in a much higher degree than I have had occasion to see it, excepting at Winchester.

It will probably be asked, why I did not make a complete trial of it there? To this I answer, that with respect to fumigating infected clothes, bedding, &c. I did not think myself warranted, especially on an occasion of so much importance, to make trial of an uncertain remedy, when a certain one was in my power. As to fumigating the prison and hospital wards, it was evidently my intention to have employed the nitrous acid, but I was mistaken in the means I took to procure it, and have not since had a proper opportunity of repeating the experiment.

The effect of the marine acid, in a state of vapour, on contagion, I have not yet had occasion to try, but have no doubt that it will be found of sufficient efficacy for destroying it; and, from the foregoing experiments, it is evident that, though not so mild or safe as the nitrous acid, it may be used,

used, in a moderate quantity, even where people are present. The only purpose to which I have applied it, has been, when properly diluted, to wash the hammock posts, bedsteads, and furniture; also the floors, and walls, of the apartments of the sick:* and I am persuaded that, even in this way, it was extremely serviceable, certainly more powerful than the most concentrated vinegar.

I shall now conclude this subject with a few practical rules or observations, which may be looked upon as corollaries, or inductions, from the preceding experiments.

The well known efficacy of the sulphureous acid, in destroying contagion, is a sufficient reason for our continuing to use it as a fumigation for clothes, furniture, &c.

The nitrous acid, being attended with no risk or inconvenience to the respiration, and appearing, from our experience, of sufficient efficacy to prevent the farther spreading of contagion, seems the proper antidote to be applied, in all situations where persons are necessarily present, and is, in short, the *desideratum* sought after by the benevolent Dr. Lind.

For purifying empty hospital or prison wards, and ships, I should also prefer the nitrous acid to the sulphureous; as I believe it to be equally efficacious; its vapour is more volatile and penetrating; and it does not leave the disagreeable smell which sulphur does. But, for this particular object, I think it would be adviseable to make trial

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also

* The washing the hammock posts, walls, and floors of the prison wards with the diluted marine acid, and the removal of all clothes, bedding, &c. proved completely effectual for destroying the contagion at Winchester; as it is now apparent, that the burning or deflagrating of nitre could contribute nothing to the success.

also of the marine acid, and of the mixture of nitrous and marine acids, as I am convinced of the efficacy of all the mineral acids for destroying contagion, and our experience is not yet sufficient to determine their relative advantages, and disadvantages.

To obtain the nitrous, or marine acid, in a state of vapour, the method is extremely simple. It consists in decomposing nitre, or common salt, by means of heated vitriolic acid, which may be done as follows :

Put half an ounce* of vitriolic acid into a crucible, or into a glass or china cup, or deep saucer; warm this over a lamp, or in heated sand, adding to it from time to time some nitre or common salt: these vessels should be placed at twenty or thirty feet distance from each other, according to the height of the ceiling, or virulence of the contagion. In hospitals, or prisons, the lamps, or vessels containing heated sand, may be placed on the floor; on board of ships, it will be better to hang them to the ceiling by waxed silk cords. The fumigating lamps, which I have seen at Moyser's, in Greek-street, Soho, a great number of which I was told have been sold to the navy, may be employed for this purpose; although they would answer much better, if the saucer was deeper, and if, instead of a place for a lamp, there was a box proper for containing hot sand, in which the saucer might be placed.

As fumigating with nitrous acid is attended with no inconvenience, and as the process is so simple,
and

* As the quantity of vapour depends, in some measure, on the surface, I think it better to have the vitriolic acid put in a number of small vessels, than in one or two large ones; besides, in this way, it has the advantage of being diffused more readily in any given space.

and the materials so cheap, it should, as a means of prevention, be employed for some hours every day in transports having troops on board, and in crowded hospitals; and, if there is any appearance of contagion, the fumigation should be executed with more care and attention, and the vapour confined for several hours at a time. Fumigating vessels, or lamps, should also be placed contiguous to the hammocks, or beds, of persons affected with any contagious or putrid distemper, whether fever or dysentery.

By taking such precautions, a great deal of mischief would probably be prevented, and a stop put, in the beginning, to one of the most fatal calamities* that ever afflicted mankind.

* The late dreadful mortality in the West-India islands, occasioned by a contagious fever imported from Boulam, has made too deep an impression on the minds of the people of this country to be soon forgotten, and every exertion on the part of the executive government will no doubt be made to prevent a repetition of the same tragedy.

SINCE

SINCE writing the above, I have had the pleasure of seeing the last publication, and, as I imagine, the latest improvements, of the French chemists and physicians on the subject of contagion, and on the proper means of destroying it. It is intitled, “ *Instruction, sur les moyens d’entretenir la salubrité, et de purifier l’Air des Salles, dans les Hopitaux militaires de la Republique, fait au Conseil de Santé le 5 Ventose, l’An 2d de la Republique Française une et indivisible.*”

This *instruction*, or *memoire*, is divided into three parts. The first relates solely to the means of cleanliness; the second to what are called the mechanical means; and the third to the chemical. The two first parts contain nothing new or interesting; the third is of the greatest importance to medical science, and particularly so to me, as it furnishes a proof of the accuracy of some of the preceding experiments, and is a complete confirmation of the opinions I have long entertained respecting the nature of contagion, and the power of the mineral acids to destroy it.

The French physicians, instructed by that excellent chemist *Le Citoyen Guiton*, better known by the name of *Monf. de Morveau*, of *Dijon*, have lately made trial of the marine acid in their hospitals, and have found it equally effectual in destroying contagion as the sulphureous, and, as being more volatile, perhaps even preferable for the purpose of purifying hospital wards. They also remarked that, in a smaller proportion, it may be safely used in hospital wards, even when people are present.* The French physicians however have not

* My experiments shewed the same thing.

not employed the nitrous acid, nor made any trials of its effect on contagion; neither do they appear to have suspected that the power of destroying contagion was a quality inherent in all mineral acids; and probably, to a certain degree, in all acids, under certain circumstances. Although their experience of the effect of the marine acid, together with my observations on that of the nitrous, seems to establish the fact beyond the cavil of scepticism itself.

Their method of obtaining the marine acid is the same that I took to procure the nitrous; they either employed the fuming marine acid, or the acid detached from its alkaline basis by vitriolic acid, using a considerable degree of heat for that purpose.* They likewise, upon the suggestion of M. Fourcroy, recommend adding a small quantity of the oxygenated marine acid; but, as they do not pretend to say that they have had any experience of the superior efficacy of this, and as the common marine acid has been found to answer the purpose, I do not see any reason for making so hazardous an addition.

Another chemical process for purifying foul air in hospitals, recommended in this *instruction*, deserves our notice. It consists in placing, at different distances in the hospital wards, vessels with lime water, for the purpose of absorbing carbonic acid or fixed air. I am inclined, however, to believe, that this advice is more the result of chemical theory than of practical observation; for I do not suppose that carbonic acid is ever present, (where there is a free admittance of air,) in sufficient

* The reader will find at the end an account of their process.

cient quantity to prove hurtful; at least, it can only affect the breathing, and has nothing in common with contagious vapour.

The French physicians appear to me to have fallen into a considerable mistake on this subject, in taking the quantity of carbonic acid present,* in an hospital, as a test of the quantity or malignity of contagion, when, in reality, they are two things totally distinct from each other. The first, or carbonic acid, is a constituent part of the common or atmospheric air, which is greatly increased by the respiration of animals, and by burning candles, lamps, &c. and, when in too great quantity, extinguishes flame, and animal life: the other has no relation with the composition of the atmosphere, never affects respiration, but is produced by putridity, and excites fever.

* The method proposed by the French physicians, for ascertaining the quantity of carbonic acid present, is simple and ingenious. Take two phials; let one be filled with common water, the other with lime water. At the place where you want to try the purity of the air, empty the phial of common water, then, filling it half full with lime-water, and corking it, shake the phial for some time: the quantity of sediment shews the proportion of carbonic acid. But, to render the preceding experiment conclusive, the height from the ground at which the air is taken should be stated, otherwise we are liable to great fallacy.

Extract

Extract from the “ *Instruction, sur les Moyens*
 “ *d’entretenir la salubrité, et de purifier l’Air des*
 “ *Salles dans les Hopitaux Militaires de la Répub-*
 “ *lique, &c. &c. &c.*”

“ *Au nombres des moyens que la chimie a employés*
 “ *avec un succès que tient du prodige pour operer*
 “ *cette depuration, nous citerons le procedé que*
 “ *Guiton, (Mons. de Morveau) representant du*
 “ *peuple, a mis en usage en 1773, dans la ci-devant*
 “ *cathedrale de Dijon, infectée par des exhumations,*
 “ *au point qu’on fut obligé de l’abandonner.*

“ *Ce moyen consiste à repandre dans l’atmosphere,*
 “ *de l’acide muriatique (acid marin) en etat de gaz*
 “ *degagé par l’intermède de l’acide sulphuric ; (huile*
 “ *de vitriol) voici le procedé pour désinfecter une salle*
 “ *de 40 a 50 lits.*

“ *Après avoir évacué les malades sur une des salles*
 “ *de rechange, disposez dans le milieu de la salle*
 “ *vuide, dont les fenêtrés & les portes feront fermées,*
 “ *un fourneau garni d’une petite chaudiere ou capsule*
 “ *de fer, à demi remplie de cendre tamisée sur la-*
 “ *quelle on posera une capsule de verre de grès, ou*
 “ *de fayance même, chargée de neuf onces de muriate*
 “ *de soude, (sel marin,) légèrement humecté avec*
 “ *une demi-once au plus d’eau commune. Le feu*
 “ *étant allumé à la capsule echauffée, on versera sur*
 “ *le sel marin quatre onces d’acide sulfurique, huile*
 “ *de vitriol de commerce. En un instant l’acide sul-*
 “ *furique agira sur le sel marin, dont l’acide se*
 “ *mettra en expansion ; l’opérateur, qui sera le phar-*
 “ *macier en chef, ou un de ses aides, versé dans le*
 “ *manual des operations chimiques, se retirera, en*
 “ *fermant la porte sur lui, et emportant la clef ; douze*
 “ *heures après on entrera dans la salle, on ouvrira*
 “ *portes*

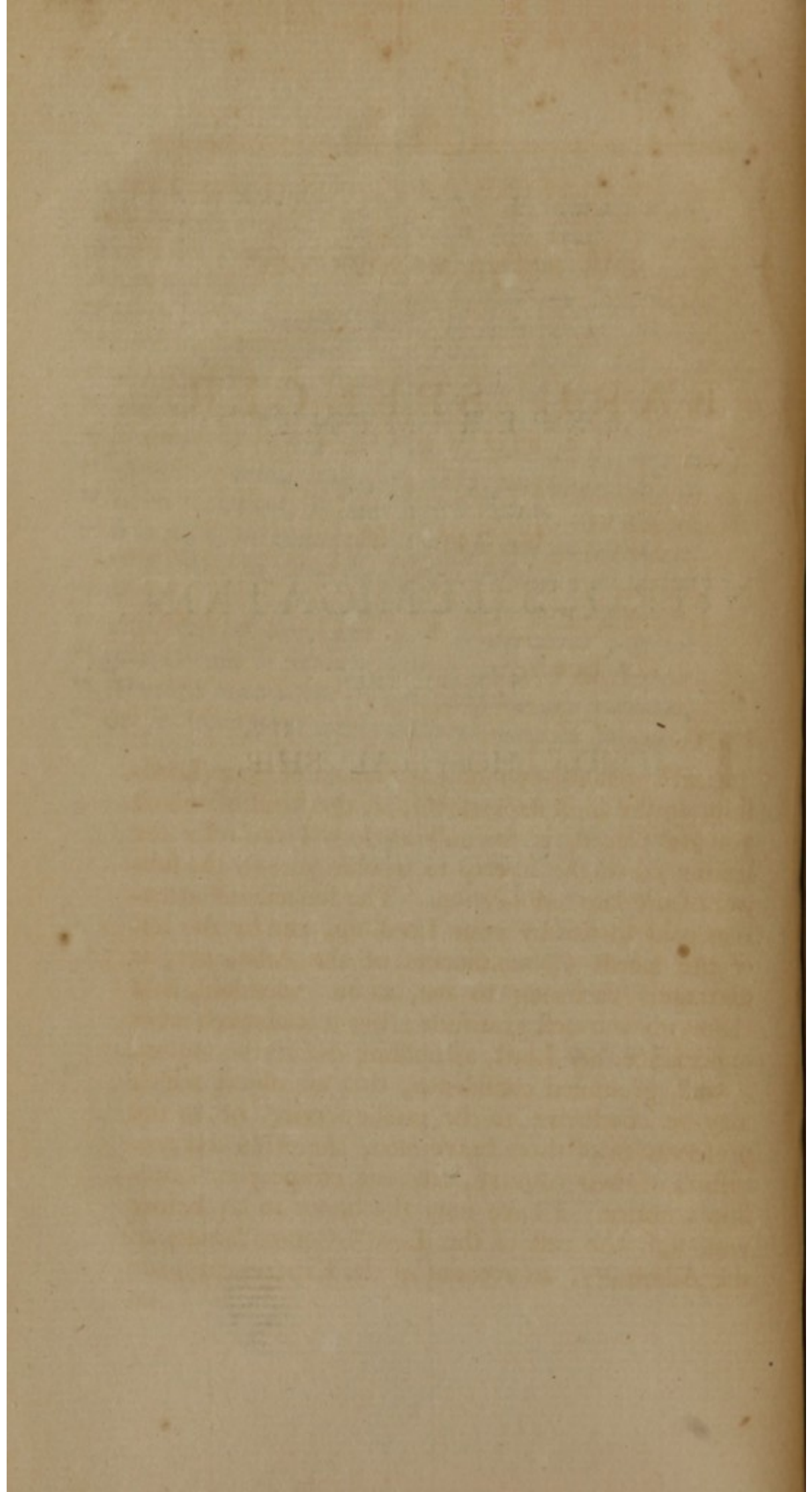
“ portes et fenêtres, pour établir des courans d'air,
 “ et évacuer celui qui pourroit être encore chargé
 “ d'acide. On donnera une plus grande latitude
 “ d'utilité à ce procédé en l'appliquant aux salles même
 “ remplies de malades, toutes les fois que les officiers
 “ de santé le jugeront nécessaire. Ainsi lorsqu'on
 “ aura reconnu que l'air d'une salle est surchargé de
 “ miasmes animaux, et a besoin de cet excellent puri-
 “ ficateur, il suffira de faire le tiers du mélange ci
 “ dessus, et même moins, et de la parcourir plus ou
 “ moins lentement, et dans tout les points, le rechaud
 “ à la main, au moment où le gaz se met en expansion.
 “ Lorsque la salle sera jugée suffisamment rempli
 “ de gaz acide muriatique, on transportera l'appareil
 “ dans les latrines, afin que les dernières portions
 “ gazeuses que le mélange pourra continuer de fournir
 “ servent à neutralizer les gaz ammoniacaux putrides,
 “ qui se developpent continuellement dans les privés.

EXPE.

EXPERIMENT
MADE WITH THE
NITROUS FUMIGATION
ON BOARD THE
UNION HOSPITAL SHIP,
Etc. Etc. Etc.

G





THE RIGHT HONOURABLE

EARL SPENCER,

Es. Es. Es.

MY LORD,

THE general opinion entertained of your Lordship, in the high department, at the head of which you are placed, is the only apology I can offer for having taken the liberty to trouble you on the subject of my late publication. The immediate attention paid to this by your Lordship, and by the rest of the Lords Commissioners of the Admiralty, is extremely flattering to me, as an individual, and claims my warmest gratitude ; but it is of much more importance, my Lord, as holding out to the nation, a well grounded confidence, that no object which may be conducive to the public service, or to the preservation of those brave men, the pride and protectors of their country, can long escape your Lordship's notice. I have now the honor to lay before you, and the rest of the Lord's Commissioners of the Admiralty, an account of the Experiment made
on

on board the Union, at your Lordship's desire, and likewise of those trials that were made at the desire of the Russian Admiral, and with your Lordship's approbation, on board some ships of his squadron. I consider myself, in executing this task, as only performing a duty I owe to your Lordship, and which I do with the greater pleasure, as it may possibly be the means of making public a discovery which should be universally known; and as the only way in my power to bring forward the merit of those Gentlemen, to whose assistance I have been particularly indebted for the fortunate issue of this experiment, and from whose reports I am enabled to present your Lordship with an account of the manner in which it was conducted, and of the particular effects it produced.

Mr. Menzies, late Surgeon to his Majesty's sloop the Discovery, was the person who, at my request, very obligingly undertook the management of the experiment on board the Union, and it is but doing him justice to say, that I could not have found a gentleman better qualified, in every respect, for executing so important a trust. I shall therefore, my Lord, without farther preface, lay before you, and the rest of their Lordships, Mr. Menzies's journal, as affording a better description of the experiment, so long as he continued to conduct it, than any I can offer.

REPORT

REPORT

OF THE

EXPERIMENT

FOR

*Stopping the Progress of Contagion, as executed on
board the Union Hospital Ship, at Sheerness, by
Mr. Arch. Menzies.*

DOCTOR James Carmichael Smyth having been requested, by the Lords Commissioners of the Admiralty, to send a person on board the Union Hospital Ship, laying at Sheerness, to make trial of the effect of a fumigation of the Nitrous Acid, and of other means recommended by him in a late publication, for destroying Contagion, I readily engaged, upon application being made to me by some of our common friends, in the execution of an experiment which I foresaw might eventually be of much benefit to society, and particularly to that service, to which I have the honor to belong.

After

After having, therefore, received instructions, and obtained every necessary information on the manner of conducting the fumigation, I left London on the 24th of November, 1795, and arrived at Sheerness the same evening.

Next morning I waited on Admiral Buckner, the commanding officer of the port, whose politeness and zeal to promote the object of my journey, were equally conspicuous, and deserves my most grateful acknowledgement.

I afterwards went on board the *Union*, where I produced the orders of the Admiralty to Lieutenant Quarme, the commanding officer, and Mr. Baffan, surgeon of the ship, who received me with cordiality, and readily offered every assistance in their power to carry on the experiment, upon the event of which not only the safety of the ship's company, but perhaps, their own, in great measure, depended.

On examining the state of the hospital, I plainly foresaw that fresh contagion would be daily pouring into it from the Russian vessels, under which disadvantageous circumstance, it would be difficult to decide on the success of our endeavours. The lower and middle gun-decks were divided into large apartments, or wards, by cross partitions, with a free communication between each: they were extremely crowded, and the sick of every description lay in cradles, promiscuously arranged, to the number of nearly two hundred; of which about one hundred and fifty were in different stages of a malignant fever, extremely contagious, as appeared evident from its rapid progress, and fatal effects, amongst the attendants on the sick, and the ship's company. For, from the beginning of September last, when the Russian sick were first admitted into the hospital; eight nurses and two washer-women had been attacked

tacked with this fever, and of these three had died. About twenty-four of the ship's company had likewise been ill of the same disorder, and of these a surgeon's mate and two marines died. Upon the whole, however, the mortality had not been so great as there were reasons to dread, from the virulence of the contagion, and malignity of the disease; which can only be ascribed to the great care and attention of Mr. Bassan, surgeon to the hospital, whose conduct in so critical a situation does him the highest honor, and reflects lustre on his professional abilities, in the faithful discharge of so unpleasant a duty.

After I returned on shore from the Union, I employed the rest of the day in collecting and sending on board such utensils and materials as were required for fumigating the ship; these consisted of a quantity of fine sand, about two dozen quart earthen pipkins, and as many small common tea-cups, together with some long slips of glass to be used as spatulas; the other materials I had brought with me from town, viz. the concentrated vitriolic acid, and a quantity of pure nitre in powder.

On the forenoon of the twenty-sixth, I went again on board the Union. I first ordered all the ports and scuttles to be close shut up; the sand, which had been previously heated in iron pots, was then scooped out into the pipkins by means of an iron ladle, and in this heated sand, in each pipkin, a small tea-cup was immersed, containing about half an ounce of concentrated vitriolic acid, to which, after it had acquired a proper degree of heat, an equal quantity of pure nitre in powder was gradually added, and the mixture stirred with a glass spatula, until the vapour arose from it in considerable quantity. The pipkins were then carried through the wards, by the nurses and convalescents, who kept walking about
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with them in their hands, occasionally putting them under the cradles of the sick, and in every corner where any foul air was suspected to lodge. In this manner we continued fumigating, until the whole space between decks was, fore and aft, filled with the vapour, which appeared like a thick haze.

I however proceeded in this first trial slowly and cautiously, following with my eyes the pipkins in every direction, to watch the effect of the vapour on the sick, and observed that at first it excited a good deal of coughing, but which gradually ceased, in proportion as it became more generally diffused through the wards; this effect appeared indeed to be chiefly occasioned by the ignorance or inattention of those who carried the pipkins, in putting them sometimes too near to the faces of the sick, by which means they suddenly inhaled the strong vapour, as it immediately issued from the cups.

In compliance with Doctor Smyth's request, the body-clothes and bed-clothes of the sick were, as much as possible, exposed to the nitrous vapour during the fumigation; and all the dirty linen removed from them was immediately immersed in a tub of cold water, afterwards carried on deck, rinsed out, and hung up till nearly dry, and then fumigated before it was taken to the wash-house: a precaution extremely necessary in every infectious disorder. Due attention was also paid to cleanliness and ventilation.

As the people were at first very awkward and slow, it took us about three hours to fumigate the ship; in about an hour after, the vapour having entirely subsided, the ports and scuttles were thrown open, for the admission of fresh air. I then walked through the wards, and plainly perceived that the
air

air of the hospital was greatly sweetened, even by this first fumigation.

Next morning the ship was again fumigated, beginning with the lower deck, and the people employed being now better acquainted with the operation, were more expert, and finished the whole in about an hour's time; in an hour afterwards, the vapour having entirely subsided, the fresh air was freely admitted into the hospital.

This day the sand was made hotter, and the fumigation was of course much stronger, yet the patients suffered no other inconvenience from it than a little coughing, and even that was not near so general as the day before.

Twelve pipkins were found sufficient for fumigating the lower deck, ten for the middle gun deck, two for the ship's company's bed-room, two for the marines' bed-room, and one for the washing place; in all twenty-seven pipkins. Consequently, about fourteen ounces of the vitriolic acid, and as much nitre, were expended in the forenoon; but, in the evening, as every place was so close, and the fresh air could not be afterwards so freely admitted, it was not thought necessary to employ so many pipkins; so that little more than half the quantity of the fumigating materials used in the morning, was generally found sufficient for the evening's fumigation.

The pleasing and immediate effect of the fumigation, in destroying the offensive and disagreeable smell arising from so many sick crowded together, was now very perceptible, even to the nurses and attendants. The consequence of which was, that they now began to place some degree of confidence in its efficacy, and approached the cradles of the infected with less dread of being attacked with the disorder; so

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that

that the sick were better attended, and the duty of the hospital was more regularly and more cheerfully performed. In short, a pleasing gleam of hope seemed now to cast its cheering influence, over that general despondency which was before evidently pictured in every countenance, from the dread and horror each individual naturally entertained of being, perhaps, the next victim to the malignant powers of a virulent contagion.

On the twenty-eighth, the fumigation was repeated morning and evening, in the same manner as on the preceding day, and with the same pleasing effect, destroying the offensive smell, and purifying the general air of the hospital. But there was, in particular places, a constant source of bad smell, which was not easily overcome, and which was occasioned by the *necessaries*. These were badly constructed, being placed within the ship, to the number of seven on the lower deck, and two on the middle deck, with small funnels that pierced the sides of the ship in a slanting direction, and generally retained the *soil*, unless where a person constantly attended to wash it away, a very troublesome and dangerous office, which chiefly fell to the lot of the nurses, and doubtless tended to spread the contagion amongst them.

I mentioned this nuisance to the commanding officer, who told me that he viewed them in the same light, and that some alterations were making, which he hoped would remedy the evil. I therefore waited a few days the event of these alterations, before I should make any public report on the subject.

For the following eight days I continued the fumigation on board the Union, regularly morning and evening, as already described, without observing any particular occurrence different from what is already related,

related, only that during this time, a considerable number of patients having been discharged from the hospital, all the spare cradles were ordered on deck, to be scrubbed and washed with the diluted marine acid, according to the particular directions of Dr. Smyth.

On the seventh of December, I resigned to Mr. Bassan the further prosecution of the experiment on board the Union hospital ship, but before I leave her, I must say, that it has already produced the most evident and beneficial effects, as not one of the attendants on the sick, nor any of the ship's company have been attacked with the disorder since I began the fumigation, with the exception of one nurse, who suffered a slight relapse from some imprudence; an accident which Mr. Bassan informs me was very frequent in the beginning. And as none of the sick, who have been brought to the hospital since my arrival, have died, it would seem that the fumigation has not only lessened the danger of infection, but also the malignity of the disease.

The process of fumigating as already described, with the *nitrous acid*, is simple and easy, and although the vapour is extremely powerful and penetrating, the sick of every description were observed to bear it, with little or no apparent inconvenience, and to a much higher degree than I could have expected; and as it is found to purify the air from the disagreeable effluvia, produced by so many people crowded together in a confined situation, it will be peculiarly advantageous on board of sickly ships, where the crew, their clothes, and the ship, may be fumigated at the same time without any risk from fire.

December

December 16, 1795.

On the sixteenth of December, I again visited the Union hospital ship, and found that the fumigation had been hitherto carried on regularly twice a day, and with the same evident advantages, in purifying the air of the hospital, and lessening the malignity of the disorder, so that every nurse and attendant on the sick, went now cheerfully and confidently about their duty; without the least dread or apprehension of the contagion, by which means the sick were better taken care of, and the general state of the hospital was in a much more prosperous way. It was therefore, from this time, deemed sufficient to fumigate only once a day.

December 23, 1795.

On visiting the Union again on the twenty-third of December, I found the carpenters employed, from the dock yard, in making the alterations which I formerly proposed in a letter to Dr. Carmichael Smyth, respecting the *necessaries*, and which I was happy to find, the Lords of the Admiralty had ordered to be done upon his application.

My proposal was to remove all the *necessaries* from the inside, and have them rebuilt on the outside of the ship, and by cutting down the lower edge of the same number of port-holes, to form entrances into them from the hospital, by which they would be equally easy of access to the sick, and the nuisance would be totally removed. This I was happy to find the carpenters were now executing, and I am confident it will be attended with beneficial effects, by rendering the hospital much sweeter, and consequently more agreeable and healthy, both to the sick and attendants.

ARCHIBALD MENZIES.

Mr.

Mr. Menzies, as is already mentioned in his Journal, having, on the 7th of December, resigned to Mr. Baffan, surgeon of the Union, the management of the experiment, I must refer your Lordship, for the further detail of this business, to extracts taken from his letters, some of which you have already seen, and which are now arranged according to the order of time in which they were written.

Mr. Baffan's conduct, my Lord, through the whole of this business, does him the highest honour, and cannot fail to recommend him to your Lordship's notice. When the contagion at first began to spread among the ship's company of the Union, he was importuned, by the warrant officers and others, to send them on shore to sick quarters, which he peremptorily refused, saying, with the true spirit of a British sailor: "It is better we should all perish, than have such a contagious fever as this diffeminated in our fleet." He accordingly made application to the Commander in Chief, and not a man was sent out of the ship. His humanity and care of the sick, Mr. Menzies mentions in the warmest terms of praise, and his successful treatment of them, is the best testimony of his professional abilities. His zeal and attention, in conducting the experiment, I shall always recollect with gratitude. He and Mr. Menzies were both of them strangers to me until this occasion brought us acquainted; but I must say, that in the whole circle of my acquaintance, I could not have found two more liberal or candid men.

Extracts

*Extracts of Mr. Baffan's Letters to Dr. Carmichael
Smyth.*

Sheerness, December 4.

I beg leave to inform you, that we have continued to fumigate, in the manner directed, daily; and as only one Russian has died since we began, I consider that circumstance as an early prospect of our future success.

—————*December 7.**

The fumigation is not attended with the smallest inconvenience to any one, the majority of patients being in bed when it is done, and all of them in the wards; the cabins of the nurses, privies, &c. are fumigated, as well as the apartments of the marines, and ship's company. For two months prior to the experiment, very few days elapsed without some of the attendants, or ship's company being seized with the fever; but since the 26th ultimo, the day on which Mr. Menzies began the fumigation, not one has been attacked with the disease; one nurse only having relapsed, a circumstance very common, and occasioned by her not taking care of herself. I beg leave to inform you, that this day I began to take charge of the business, in the absence of Mr. Menzies, who is on board the *Pamet Eustaphia* to try the experiment, (she having been the most sickly ship) where I am certain he will take such measures, as will do himself credit, and you honour.

I intend

* This letter, which by some accident was mislaid, and consequently not inserted in the former edition, I have published in the present, as it renders his correspondence complete, and shews the unremitting attention of that worthy man, (whose services the public have now unhappily lost,) to every part of his duty.

I intend in a few days, sending you a journal from the 1st to the 26th of November, the day Mr. Menzies began in the Union, and another from the 26th ult. to the 11th inst. containing the receipts, discharges, and deaths, by which you will be enabled to make a fair comparison, much in favour of the means used, I am sure. The dejection and melancholy occasioned by the dread of the disease, prior to the commencement of the experiment, was evident in every countenance, and really affecting, and distressing; but the circumstance of its being stopped at present, has diffused joy and cheerfulness, and all look forward with the hopes and expectation of soon becoming a wholesome ship. The symptoms of the fever are certainly much less violent, and at present, I have very few people in a dangerous state.

— *December 9.*

We continue to fumigate the ship as formerly; your other instructions shall be punctually adhered to.

— *December 11.*

I yesterday sent you two lists or journals, one of the Russian sick, and the other of persons belonging to the Union, who have been attacked with the fever; from the last you will perceive that very few days elapsed from the first importation of the disease, to the 26th ult. without some one or other of the attendants, or ship's company, being seized with it; but since that period not one has been taken ill. I intend, very shortly, to send you a brief account of the disease, the symptoms of which are at present much meliorated. I believe that the fumigation has been of great service to the sick. We have very few patients at present who are not in a convalescent

convalescent state, and there is every prospect that, through your assistance, we shall soon become a wholesome ship.

— *December 15.*

Since my last of the 11th inst. I have received eighteen patients with the fever, none of which have died, although some of them were brought to the hospital in a state of the utmost danger. The utility of the fumigation appears now very evident, as, notwithstanding the great number of fever patients brought into this hospital ship, not one of the attendants, or ship's company, have experienced the slightest indisposition since we first began to employ it.—A very satisfactory demonstration of its power in destroying contagion; indeed, Sir, I most sincerely congratulate you on the success of a discovery, which promises to be of such eminent service to society. Believe me, every thing shall be done, on my part, agreeably to your directions, to give it its full effect.

— *December 19.*

The fumigation continues to demonstrate its efficacy, as all the attendants, and ship's company, continue to enjoy perfect health, notwithstanding I have lately received some patients with the contagious fever in as bad a state as any I have seen; nor has a new nurse, or any of the workmen, who are daily employed in the hospital making the proposed alteration of the necessaries, suffered the slightest attack of the disease.—Mr. Menzies goes on with the Russian ships, from which I hope soon to find the infection totally extinguished.

— *December 21.*

— *December 21.*

I am happy to inform you, that the contagion on board this ship appears to be nearly at an end, no one either of the attendants on the sick, or of the ship's company, having been attacked with the fever since we began to fumigate, notwithstanding we have received some patients in as bad a state of fever, since that time, as any from the first importation of the disease. The people bear it exceedingly well, and I frequently stand in the midst of a cloud, arising from the fumigation, as thick as a fog, without the smallest inconvenience, a circumstance of great consequence, as the sick are all in the wards during the fumigation, and their clothes, &c. are consequently impregnated with the acid vapour. In a few days we shall be able to ascertain the success on board the *Pamet Eustaphia*, the only ship at this port in which the fever at present seems to prevail to any degree. I shall then consider the experiment as complete, and shall congratulate you on the success of an invention, that, in all probability, will give you immortal honor, and which, from its public utility, you will so highly merit.

— *December 30.*

Since my last, one nurse and one marine have been taken ill of the fever, although the symptoms are evidently milder than heretofore. As it is impossible to say how long contagion may remain in an infected person before it is put into action, I am not at all discouraged by these two cases; but shall continue every exertion in my power, in prosecuting the experiment, which has already been of such eminent utility. I have received several patients from the *St. Alexander Niewski*, and another Russian ship, returned from sea, five or six of them ill

of the fever. I need hardly observe, that if you could by any means enforce the fumigating all the Russian ships, as well as enjoin cleanliness, it would be of the utmost consequence; and if you can send any person to aid me in the business, I should be very glad; for though Mr. Menzies so strongly recommended, to the Commanders, the necessity of continuing the fumigation, not one at Sheerness has made application to me for any materials for that purpose.

Extract of a Letter from Mr. Bassan to Mr. Menzies.

Sheerness, December 30.

The Russian ships which arrived this week from sea, are sickly. I received several with the petæchial fever, as bad as any I have seen; and am sorry to say that nurse Murray has had a slight attack, and one of the marines is at present ill of the same fever. He was taken ill on Tuesday morning, the symptoms are not so violent as formerly, and I should double my attention in prosecuting the experiment which has already been of so much use.

TO DR. CARMICHAEL SMYTH.

Sheerness, January 4.

I cannot account for the contagion having produced the effects on the people mentioned in my
last

last, otherwise than from the fumigation having been used the preceding week, only once a day, or from their having been infected prior to the commencement of it, which I think is not impossible. I am now determined to use it constantly twice a day, and have done so since Tuesday last, the day on which the marine was attacked; besides, exclusive of the general fumigation, I place a fumigating pot or two in the wards near the worst of the fever patients. The sick not only bear the fumigation exceedingly well, but aid us voluntarily every day, the convalescents carrying the pipkins about, and expressing their conviction of its keeping the wards sweet, which certainly it does, and those persons who have hitherto escaped infection, are so much convinced of its efficacy, and have so much faith in its power, that I should find it difficult to discontinue the use of it, whilst there is a sick man on board. As a week has now elapsed since any person has been attacked with the disease, notwithstanding we daily receive patients in the same putrid petæchial fever, from the ships lately arrived from sea, I have every reason to expect our being once more a wholesome ship. Be assured, Sir, that no pains shall be spared, on my part, to accomplish so desirable an object.

— *January 7.*

I am happy to inform you that no person has been attacked with the putrid fever since my last, though we have received several sick from the Russian ships lately arrived from sea.

— *January 13.*

I am happy to acquaint you, that since we began again to fumigate the ship twice a day, no one has
been

been attacked with the fever, although there are several carpenters at work in altering the necessaries, which are nearly completed on the lower gun deck, and are to be altered immediately on the other deck.

I saw Captain Senevin, Commander of the *Pamet Eustaphia*, the day before yesterday, who informed me that he had continued the fumigation every day since Mr. Menzies's departure, and that he had now no sick on board.

— *February 3.*

I have the pleasure to inform you, that the contagion seems now to be totally extinct, no one having been attacked with the fever since the 26th of December last, and only two since the 26th of November, the time when the fumigation was begun; one of these a marine, who, ten days previous to his being taken ill, had constantly drank very hard, and was often drunk; the other a nurse, who was very slightly attacked, and both, in my opinion, might have received the infection long before it was put into action, as from their duty they were constantly exposed to the contagion when it was first brought into the ship; and this is rendered still more probable, as there have been several artificers at work, making the alteration in the privies, and of course amongst the sick, and likewise a fresh nurse, a young woman immediately employed in the fever ward, none of whom have received the smallest injury. I therefore now consider the experiment as complete, and can bring sufficient evidence to convince any one that the contagion in the hospital, on board the *Union*, has, through Divine providence, been destroyed by the fumigation you recommended;

commended: besides, as the acid vapour keeps the ship sweet, it is my intention to continue it for that purpose constantly, if I am permitted so to do. The sick bear it perfectly well, and, from its power in destroying alkaline vapour, it renders the air pure, and consequently grateful both to the sick and convalescents, as well as to those whose duty it is to attend them. I most sincerely congratulate you on the success of this business.

And am,

Sir, &c.

A. BASSAN.

To the preceding account of the experiment on board the *Union*, I shall take the liberty, my Lord, to subjoin a brief description of the trials made, at the request of the Russian admiral, and with the approbation of your Lordship, on board some ships of that squadron: and here I must again refer you to Mr. Menzies's journal.

REPORT

REPORT

OF THE

EXPERIMENT

FOR

*Stopping the Progress of Contagion, as executed on
board some of the Russian Men of War,
by Mr. Arch. Menzies.*

SOON after my arrival at Sheerness, I had the honor of being introduced to his Excellency Admiral Hannikow, Commander of the Russian Squadron at that port, on which occasion he was pleased to express a particular desire of having the most sickly ships of his Squadron purified by the same process of fumigation, as I was then carrying on, on board the Union hospital ship. This being made known to the Lords Commissioners of the Admiralty, they were pleased to declare their approbation, by requesting Admiral Buckner to confer with his Excellency on this subject: and on the twenty-eighth of

of November, it was agreed between these Commanders, that the fumigation should be tried, under my directions, on board such of the Russian vessels as were then most infected with the contagious fever, which had already proved so fatal to many of their crews; and it is but justice to say, that his Excellency, on this occasion, shewed a particular zeal for its success, by offering me every aid and assistance, and by assuring me of a ready compliance, with every means that might be suggested to accomplish so desirable an object, as the health and preservation of those under his command. But it so happened, that, on the day following, he was ordered, with part of his squadron, to the North Seas, and in this state of hurry, not having time to consider which was the most sickly vessel, he left orders for the trial to be made on board the *Revel* frigate; but on examining the hospital books on board the *Union*, the *Pamet Eustaphia*, of 74 guns, appeared to claim our first attention, from her sickly state: I therefore waited on Admiral Buckner, to acquaint him with this circumstance, and he very readily applied to Capt. Chechagoff, on whom the command of the remaining part of the Russian squadron had devolved, and obtained his leave for the trial to be made on board of her, in preference to the other. After this, some unavoidable delay was occasioned, in waiting for the materials, and collecting together the utensils necessary for the operation.

In the forenoon of the seventh of December, 1795, I went on board the *Pamet Eustaphia*, and having ordered the ports, scuttles, and hatchways to be close shut up, with the ship's company between decks, we fumigated her for the first time, and continued it morning and evening on the following

lowing day, in the same manner that we had done the Union hospital ship.

This ship has of late sent more sick with the malignant fever to the hospital, than all the rest taken together, of the Russian squadron laying at this port, which her Commander, Capt. Sinavin, attributes in a great measure to her shingle ballast being chiefly composed of sand, intermixed with a large portion of wet earth, that keeps up a constant moisture and dampness below, in spite of every means of ventilation: add to this the putrid stench, arising in so close and crowded a situation from the *shubs* or sheep-skin great-coats, which are generally worn by the Russian seamen, with the woolly side next their body, and which undoubtedly must aid to nourish the seeds of contagion, and increase its virulence.

I represented to several of the Commanders of the Russian men of war, the necessity there was of destroying, or at least of suppressing these *shubs* in this country, for though they might be very comfortable, and answer pretty well in dry, cold, frosty weather, such as is generally the case in long winters in Russia, yet they were by no means calculated for the chilly wet weather which generally prevailed in this country; as in a damp state they never fail to impregnate the air with offensive putrid effluvia, that must be extremely hurtful to people's constitution where it is constantly breathed by so many crowded together in such a confined situation.

Early on the morning of the ninth, the *Pamet Eustaphia*, with the *Ratvezan* of 66 guns, were removed up to Chatham, in consequence of which it was not in my power to continue the fumigation, though I went there on purpose. And on the following day, the crew was so busily occupied, in unrigging the ship, and clearing her of stores and provision,

provision, to prepare her for going into dock, that no time could be spared to attend to the fumigation, until that duty was accomplished ; which as it would take up some days, and as her people were then to be put on board a receiving ship, while she was in dock, (a circumstance I considered as very unfavourable to the experiment) I therefore came to London on the eleventh, to consult with Doctor Carmichael Smyth, what plan was best to pursue ; for as this was the only Russian vessel from which a fair estimate could be drawn of the utility and efficacy of the fumigation, I was anxious to continue it, in whatever manner might be thought most likely to secure success in destroying the contagion, or lessening its malignity.

I returned to Chatham again on the fourteenth, with orders to fumigate as many of the Russian vessels, especially such as were most sickly, as I possibly could ; for though the experiment could not be regularly carried on, yet in this manner it might lessen the virulence of the disorder, and diminish the number of sick sent to the hospital.

Next day I waited on Captain Chechagoff and Capt. Sinavin, and found that their vessels were not yet cleared of their stores, &c. so that I could not go on with either. Indeed, the *Ratvezan* was pretty healthy, her Commander, Cap. Chechagoff, being very attentive to every means of purifying his vessel by ventilation and cleanliness, and by destroying and suppressing the *shubs*, as far as he possibly could ; for he told me, he could not do them away altogether, without giving the men other clothing *in lieu*, which must be done by an order from the Commander in Chief.

Captain Chechagoff also informed me, that the *Pimen*, of 66 guns, was arrived at Sheerness, which

had some time ago been so very sickly, that boats from other vessels were forbid coming along-side of her, from a dread of the infection; he therefore expressed his desire of having her well fumigated; and I immediately set out to execute his request.

On the sixteenth of December, I fumigated the Pimen for the first time. Her crew, however, was nowise sickly now, although on visiting her between deck, before the fumigation, the stench produced by the *shubs* was very perceptible, and extremely offensive; and it was pleasing to observe the sudden change produced by the powers of the nitrous vapour in destroying it.

When I went on board, on the following day, to continue the fumigation, I found the officers and crew attending Divine Service, and the Priests sprinkling the decks with Holy-water, so I did not intrude; but left orders with their own surgeon, to fumigate the ship in the evening, if he could conveniently, which he did. As this was a holiday amongst them, I also declined calling on board the Revel frigate till the next day, when, after fumigating the Pimen, I went on board the Revel, to request them to prepare for fumigating her. On visiting this vessel between decks, I found the putrid stench from the *shubs* extremely offensive and disagreeable from the confined air, and want of ventilation; and I had great difficulty to make myself understood, or give any particular directions for want of an-interpreter.

The nineteenth was so boisterous that I could not get on board either vessel, but the Surgeon of the Pimen was so good as to continue the fumigation as usual. Captain Colokoloff, the Commander of this vessel, was extremely civil, and well disposed to promote my endeavours; and the principal

pal officers were equally polite and ready to see my directions executed on all occasions.

Next day I visited the Pimen, which was now quite free from stench or any offensive smell, in consequence of the fumigation having been regularly continued. I also began to fumigate the Revel frigate, and regularly attended both vessels, for the three following days; after which I left the materials and utensils on board them, with directions to their own Surgeons to continue it in the same way daily.

From what information I could collect, the Revel had not been very sickly, yet the few she had lately sent to the hospital, were malignant fevers, which clearly shewed that the contagion was lurking on board her, though it did not spread with much violence.

Being particularly anxious to resume the experiment on board the Pamet Eustaphia, she being the most sickly, and on that account claiming more particular attention, I came up to Chatham on the twenty-fourth, and found she had been just hauled into dock, and her crew put on board the Prince Edward receiving ship, where they were very much crowded. On the following day I began the fumigation, but as many of the ports and hatchways of the ship could not be shut close enough to retain the vapour for a sufficient length of time, a quick and strong fumigation became more essentially necessary; which, however, I could not get them to execute, not being able to make them understand my meaning, for want of a sufficient knowledge of their language.

The fumigation was, notwithstanding, continued regularly on board this ship for the four following days, although it was not in my power to prevail

on

on them to do it sufficiently strong, to do justice to the trial,—and to insure that success we had already experienced on board the Union; their excuse generally was, that the fire was too much occupied to get a sufficient quantity of sand heated.

But, as it was possible, that even this slight fumigation might succeed by long continuance, and as their own Surgeon was now acquainted with the process, and well disposed to carry it on, I left the materials and utensils on board; and, before my departure, waited on Captain Sinavin, who, at this time, lived on shore, and who (after being acquainted with the foregoing circumstances) said that he should order it to be continued while his ship's company were anywise sickly.

The Ratvezan having likewise gone into dock; to prevent her crew becoming sickly on board the receiving ship, I, at Captain Chechagoff's particular request, sent utensils and materials on board to fumigate daily.

Having now put these Russian vessels in a fair train for continuing the fumigation; and finding that my presence, on account of my ignorance of their language, could not be of any further service; at the same time, some urgent business, of our late voyage, pressing hard upon me, I returned to town on the thirtieth of December, leaving the further prosecution of the experiment, as above related, to be conducted by their own Surgeons; and I have the most pleasing hopes that it will be attended with beneficial effects to her Imperial Majesty's subjects, not only in the present instance, but in every similar situation hereafter.

ARCHIBALD MENZIES.

Having

Having now, my Lord, finished with the account of the experiment given by the two gentlemen who have been employed in conducting it, permit me, before concluding the subject, to call for a moment your Lordship's attention to some of the principal circumstances, and to the conclusions which they afford.

In the first place, my Lord, it must be allowed that the present experiment fully justifies all I have said respecting the safety with which the nitrous acid (procured in the manner described) may be employed as a fumigation. No one surely can say that I assume too much, when I consider the safety of the fumigation as established, after a trial of nearly three months, for an hour and a half or two hours, morning and evening, each day, on board an hospital ship, containing from two to three hundred persons of different sexes, and ages, and labouring under different diseases; without a single instance of permanent inconvenience or bad consequence arising from it: for the slight cough, which it at first excited, and which was evidently owing to the awkwardness and ignorance of those who carried the fumigating pipkins, cannot be looked upon as such, and no farther inconvenience has ever been felt by any one on board.

Having established then this important fact, that the nitrous acid is attended with no risk to the health or safety of the people exposed to it, let me next claim your Lordship's attention to the sensible and immediate effects of it.

We are told by Mr. Menzies, that after the first fumigation, and still more remarkably after the second, the air of the hospital was perceived to be purer, and free from any putrid or offensive smell; these immediate effects of the fumigation, are likewise

wife repeatedly mentioned by Mr. Bassan, the last of them indeed was too striking not to be taken notice of by every person on board. That the vapour of the nitrous acid should be found to destroy an offensive smell, the effect of animal exhalations, I was not surpris'd at, having myself had repeated experience of the fact; but that it would also render the air purer and more proper for respiration, I was by no means certain, until I found the repeated observations of those Gentlemen, confirmed by the evidence of Mr. Keir, of Birmingham, one of the first chemists in this country, or perhaps in Europe; an extract of a letter from this gentleman, whom I have not the honor to know personally, to a friend of his in town, I have subjoined for your Lordship's satisfaction, as it affords a convincing proof, from chemistry, of the truth of what Mr. Menzies and Mr. Bassan observed in practice. These two qualities, my Lord, viz. the rendering the atmospheric air purer, and consequently fitter for the purposes of animal life, and the completely destroying the offensive smell resulting from animal effluvia or putrid matter, are, of themselves, considerable advantages, if no others were to be expected or derived from the fumigation; but they are of still higher importance, when considered as presumptive evidence of the power of the nitrous vapour to destroy contagion; for whatever is found to destroy the smell of putridity, and at the same time to render the air purer, we must suppose more or less conducive to this grand object. But presumptive evidence, on a subject of this importance, in which the lives of thousands are involved, is not sufficient to satisfy the mind; and happily for mankind, the present experiment, instituted under your Lordship's

Lordship's auspices, affords complete and direct evidence of the fact.

But to bring this home to the understanding and conviction of all mankind, it is only necessary to look with attention, at the annexed Hospital Return; for by comparing the state of health of the ship's company, with the progress and effects of the contagion, before and after the experiment was begun, a clear and decided judgment may be formed of its effects, even by the most ignorant. They will in the first place observe, that from the 3d of September (the day the Russians, ill of the fever, were first brought on board) to the first of October, there were nine persons seized with the distemper, one of whom only belonged to the ship's company; the others were attendants on the sick. That in the month of October, eight persons more were attacked with the disease, and of those three belonged to the ship's company. But, that from the first of November, to the 26th of that month, twelve persons were attacked with the disease, among whom we find eight belonging to the ship's company. From this short statement it is evident, that the contagion which was at first chiefly confined to the hospital, affecting those only who were immediately employed about the sick, had gradually spread over the ship, and been communicated to the ship's company; by which means the sickness and mortality had increased: and the probability is, that had not a stop been put to it, it would have gone on increasing in proportion to the diffusion of the contagion, and to the increasing despondency of the people, who considered themselves as so many devoted victims. The whole number of persons seized with the distemper, during the first three months that it prevailed on board the ship,

was

was thirty (besides six children) which was more than one-third of all the people in the ship, who were only eighty-five, officers included. Of the thirty seized with the fever, eight died of the immediate effects of it, a large proportion surely, being not much less than one in three, and which sufficiently marks the malignity of the distemper.

Having taken a view of the state of the ship's company, and of the progress of the contagion before the experiment, let us now, my Lord, turn to the other side of the picture, and see what was the situation of things after the fumigation was begun.

On the 26th of November, the ship was fumigated for the first time, and from that day to the 25th of December, not a person on board was attacked with the fever, their despondency was now changed into joy, and their fear into confidence; but as very great confidence is always dangerous, it proved so in the present instance. On the 17th of December, they imagined themselves so secure, that they discontinued the custom of fumigating the ship morning and evening, thinking that once a day was sufficient; the trial, perhaps, was worth hazarding, but on the 25th of December, one of the nurses suffered a slight attack, and on the 26th, a marine, who for a week preceding had been in a state of intoxication, was seized with the fever, of which he died. These two accidents gave immediate alarm; they returned again to the practice of fumigating twice a day, and from that time to the end of the disorder, there has not been an instance of a person suffering from contagion on board the ship. But the advantage of the fumigation was not felt by the ship's company and attendants alone, whom it preserved from the baneful effects of the fever, the sick and convalescents derived almost an equal

equal benefit from it. The symptoms of the disease (as Mr. Bassan expresses it) were meliorated, and lost much of their malignant appearance, and the advantage of a pure air, and free from stench, to convalescents, may readily be conceived.

From the above relation, my Lord, it plainly appears, that whilst the practice of fumigating the ship twice in the twenty-four hours was continued, there was no symptom of contagion or of disease, and that the only two accidents which happened from the commencement of the experiment, to the present hour, occurred on the 25th and 26th of December, nine or ten days after they had ceased to fumigate the ship, in the manner I had directed. The attack of the nurse, indeed, was but trifling, and I think it not improbable that the fever, as well as the death of the marine, were the consequence of his own intemperance; at any rate supposing both the one and the other to have suffered from contagion, these cases do not in the least invalidate the general success of the experiment, and only prove, that in a situation where contagion is constantly generated, it requires to be as constantly destroyed; otherwise it is ready at every instant, like the hydra, to rear again its pestilential head.

But, my Lord, the success of the experiment has not been confined to the Union, the power of the nitrous vapour to destroy contagion, has been equally displayed on board those Russian vessels where it has been employed.

Your Lordship must have observed, in Mr. Menzies's Journal, the many unexpected delays he met with in the execution of this business. The sudden departure of the Russian Admiral, with a considerable part of the fleet, before the ships, the most

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proper

proper for the experiment, were fixed upon; Mr. Menzies beginning, in consequence of not being properly informed, with ships where the fumigation was not so immediately necessary; afterwards when he began to fumigate the *Pamet Eustaphia*, which had sent more sick to the hospital than any ship of the fleet, she was immediately ordered into dock, and the crew turned over into a receiving ship, a situation extremely disadvantageous for such an experiment: not to mention the various difficulties and obstacles arising from the difference of language, usages, religious ceremonies, &c. sufficient to have discouraged a man of a less firm mind, or who was less zealous than Mr. Menzies in pursuing his object. He persevered, however, for some time, but at last was under the necessity of returning to town, and of leaving the farther prosecution of this business to the Russians themselves; and yet, my Lord, owing to the good sense and proper conduct of their officers, who, convinced of the advantage of the fumigation, continued the daily practice of it; those ships that have been fumigated, are free from contagion, and particularly the *Pamet Eustaphia* which was the most sickly, is now one of the healthiest of the fleet, and has no appearance of contagion on board, nor a man ill of the fever; and so great is the opinion entertained by Admiral Hannicoff, of the efficacy of the fumigation, that he lately sent to town for materials for fumigating some more ships.

Such, my Lord, has been the result of an experiment, by which some lives have been already saved, and from which two important facts are clearly established, viz. the power of the nitrous acid to destroy contagion; and the safety with which it may
be

be employed in any situation, without inconvenience or risk of fire.

It would be, perhaps, improper in me to detain your Lordship any longer on this subject, by endeavouring to point out the importance and extensive application of the present discovery; a discovery equally applicable to every species of putrid contagion, even to the plague itself; a discovery therefore, in which all nations are more or less interested, but whose utility must be most sensibly felt by our own; where a commerce, extended to every quarter of the globe, covers the sea with our ships, whilst our gallant navy still maintains the decided empire of it.

Oh fortunatos nimium, sua si bona norint,
Britannos!

I have the honor to be,

My Lord,

With the highest respect,

Your Lordship's

*Charlotte-street,
Bloomsbury,
Mar. 12, 1796.*

Most obedient and obliged

Humble Servant,

James Carmichael Smyth.

Earl Spencer.

A RE-

A RETURN of those persons, amongst the attendants on the Hospital or belonging to the Ship's Company of the Union, who were attacked with the Contagious Fever, from the 3d of September, 1795, when the Russian sick were first brought on board, to the 10th of February, 1796; the date of the last report.

(Signed) A. BASSAN, Surgeon of the Ship.

Before the Ship was fumigated.

Names	Quality	When seized	Recovered	Dead
S. Brown	Nurse	Sept. 6	_____	Sep. 24
H. Warren	_____	_____ 7	_____	
M. Mitchel	_____	_____ 9	_____	
M. Reed	_____	_____ 11	_____	
Mr. J. Gardner*	S ^s 1st Mate	_____ 15	_____	
M. Rawlins	Nurse	_____ 18	_____	
S. Hayes	_____	_____ 20	_____	
Tho. Mitchel	Helper	_____ 22	_____	

* He was discharged from the Union, and entered on board the Sandwich, the 12th of September; was taken ill a few days after and died in about a week.

Names	Quality	When seized	Recovered	Dead
A. Clavering	Nurse	Sept. 24		Sep. 28
Tho. Lee	Marine	— 29		Oct. 1
M. Sawyer	Washer-wo.	Oct. 6		— 15
Mr Meffermidt	S ^s 1st Mate	— 6	— —	
A. Bright	Nurse	— 8		— 11
D. Sawyer	Ab.	— 8	— —	
H. Tuberville	Nurse	— 14	— —	
Mr. Bodker	2d S ^s Mate	— 22	— —	
Cha. Walton	Ab.	— 22	— —	
James Potter	Marine	— 22	— —	
C. Taylor	Nurse	Nov. 2	— —	
S. Parker	Washer-wo.	— 4	— —	
Wm. Crasby	Marine	— 4	— —	
Wm. Welch	—	— 10	— —	
Rd. Welch	Ab.	— 10	— —	
Henry Kelly	—	— 17	— —	
Peter Parker	—	— 17	— —	
Geo. Mantle	Marines	— 18	— —	
Tho. Reed	S ^t Marines	— 18	— —	
Jos. Copeland	Ab.	— 20		Dec. 4
Ja. Tuberville	Marine	— 20		Nov. 24
M. Clay	Washer-wo.	— 24		T. uncertain

Before the Experiment. — Total 30 22 8

After the Ship was fumigated.

Names	Quality	When seized	Recovered	Dead
Marg. Murray	Nurse	Dec. 25	{ Recov. in a few days	Jan. 6
James Farmer	Marine	— 26		

Since the Experiment.—Total 2 1 1

N. B. On the 26th of November, the ship was fumigated for the first time, and the fumigation repeated twice a day till the 17th of December; from that time to the 26th of December, only once; but from the 26th of December to the 10th of February, twice a day, as at first.

A Weekly

A Weekly Return of the Russians received on Board his Majesty's Hospital Ship Union, in the Malignant Fever from the 3d of September, 1795, to the 28th of January, 1796, exclusive of those received in a state of debility after the said Fever, and with other diseases. By A. BASSAN, Surgeon of his Majesty's Ship Union.

Sept. 1795.	Received.	Discharged.	Dead.
Sept. 3	37		
— 10	37	1	
— 17	4	7	
— 24	34	7	1
Oct. 1	17	17	5
— 8	29	15	
— 15	20	5	2
— 22	15	14	1
— 29	18	11	1
Nov. 5	31	9	1
— 12	21	13	
— 19	20	44	5
* — 26	29	39	1
Dec. 3	12	5	1
— 10	12	16	1
— 17	35	48	
— 24	8	25	1
— 31	40	1	
1796.			
Jan. 7	32	25	3
— 14	13	7	2
— 21	20	24	3
— 28	22	23	6
Total	479	356	34

* This day the Ship was fumigated.

From

From the above return it appears, that the number of persons ill of the contagious fever, brought on board the Union, the two last months, December 1795 and January 1796, were nearly equal to the number received the two preceding months, October and November. It also appears that for the first month, after the ship was fumigated, there were few fever patients who died. The increase in the number of deaths in the following month, may fairly be ascribed to the return of the fleet.

N. B. The greater part of the Russian squadron failed on a cruise November 29, and returned into port December 27, two or three ships at a time.

APPENDIX.

A P P E N D I X.

*Extract of a Letter from Mr. Keir, of Birmingham,
to a Friend in Town.*

January 25, 1796.

I CONSIDER Dr. Carmichael Smyth's discovery to be very valuable. The fumes in his process are quite different from the ordinary nitrous vapour in the distillation of aqua fortis, or from that which exhales in the solution of metals, by nitrous acid; the latter is highly suffocating and noxious, and may be called the phlogisticated nitrous acid vapour. The fumes made in Dr. Smyth's manner (if there is no metal employed in the vessel, &c.) is highly dephlogisticated or oxygenated nitrous vapour, and is also mixed with a large quantity of pure dephlogisticated air, which is extricated from the materials, and these fumes are not only not suffocating, but have a very pleasant smell. If the distinction is not made between these two kinds of vapour, it is to be feared that some person, by accident, or in expectation of getting nitrous vapour more expeditiously, may use the metal vessels, or dissolve metals in nitrous acid.

*Extract of another Letter from Mr. Keir, dated near
Birmingham, March 3, 1796.*

The difference between the white nitrous acid, (called by Dr. Priestley, dephlogisticated acid, and by the French chemists, acide nitrique;) and the red acid, called phlogisticated, or acide nitreux, is well known, and was first particularly noticed by Scheele, who shews how the one may be separated from the other by distillation. There is the same difference in the colour of the vapours from these two acids; and Dr. C. Smyth has himself observed, that the vapours, in the distillation of nitrous acid, were not noxious; which observation he has very happily and usefully applied. In distilling the nitrous acid from very small quantities of nitre and oil of vitriol, in glass vessels, and when the materials are very pure, I have seen nothing but the white vapours, such as arise in Dr. C. Smyth's process, but Scheele says, that at the end of the operation, some red vapours, rise, and it may be the case when a very strong heat is applied. But the very noxious red fumes which appear in the usual process of distilling aqua fortis, are occasioned, as you mention, by the iron vessels; and the manufacturers even put in old nails and small pieces of iron into their pots, in order to give a high degree of red smoking quality to the acid. When you acquainted me of Dr. C. Smyth's discovery, it occurred to me, that as the common notion of nitrous acid vapours, is confined to those that are red, some people might, in the first place, be prejudiced against it, from the idea of the vapours being noxious; as the red vapours are undoubtedly, and others might think that they made the process more effectual, by adding to Dr. C. Smyth's mixture, metals, or inflammable substances,

stances, in order to produce those red vapours. I therefore thought it would be proper for Dr. C. Smyth, to point out the difference between the vapours produced in his method, and the red nitrous fumes which are so well known; and also to caution the operators to avoid metal vessels, or the addition of metals or inflammable substances.

There is a good deal of vital air extricated from the mixture, but I cannot agree with those who attribute the medicinal effect to it, we know little of this subject; but the analogy of the destruction of all animal and vegetable fermentation by mineral acids, which is well ascertained, inclines me to believe the agency of the acid, in the destruction of the contagion. The matter of which is, I presume, animal, in some vicious kind of fermentation.

A Letter from Mr. Bassan, Surgeon of his Majesty's Ship Union, to Dr. Carmichael Smyth, under date, the 16th of February, 1796.

DEAR SIR.

WE had an increased mortality amongst the Russians last month, but, thank God, not from the contagious fever, that being now totally extinct; but from some being brought in a dying state, others in the scurvy, the most deplorable cases I ever saw, added to which, several hectic patients,

patients, who had been declining some time, happened to die at that particular period. I hope we shall have no return of so dreadful a calamity.

I remain,

Sir,

Your most obedient Servant, &c.

(Signed)

A. BASSAN.

Extract of a Letter to Mr. Menzies, from Captain Chechagoff, Commanding Officer of the Russian Fleet, in the absence of his Excellency Admiral Hannicoff. Dated Chatham, March 9, 1796.

AGREEABLY to your wish, it is with the utmost pleasure that I expose the proofs of a truth so useful for the human kind, and so much to the honor of those that are the primitive cause of it, and those that put them in execution, with an efficacy, as is acknowledged in the certificate here joined. I beg to present my compliments to Dr. Smyth, for whom I have the respect that is owing to all those who have ensured their renommée,* by the good they have done to the public, and to get its suffrage. I am, with much esteem, &c.

(Signed)

P. CHECHAGOFF.

C E R-

* The public will recollect that Captain Chechagoff is a foreign officer, writing English, and therefore will not be surprised at his making use of one French expression.

CERTIFICATE.

“ It has been observed that the fumigation, with
 “ the nitrous acid, introduced by Mr. Menzies on
 “ board the ship *Pamet Eustaphia*, has produced, in
 “ a short time, the best effect in stopping the pro-
 “ gress of the fever and other evils, which were
 “ then evidently increasing, for which reason it was
 “ not only regularly continued on board of that
 “ ship, even after Mr. Menzies’s departure, but
 “ adopted on board of others, and always found
 “ useful. It is therefore my duty to certify by this
 “ not only the good consequences that have been
 “ observed from that useful contrivance, but even
 “ the advantage that arises from its easy and sure
 “ execution, in comparison with other means of fu-
 “ migating the ships which requires greater atten-
 “ tion from the fire that must be made use of, and
 “ therefore cannot be effectuated in all the parts of
 “ the ship.”

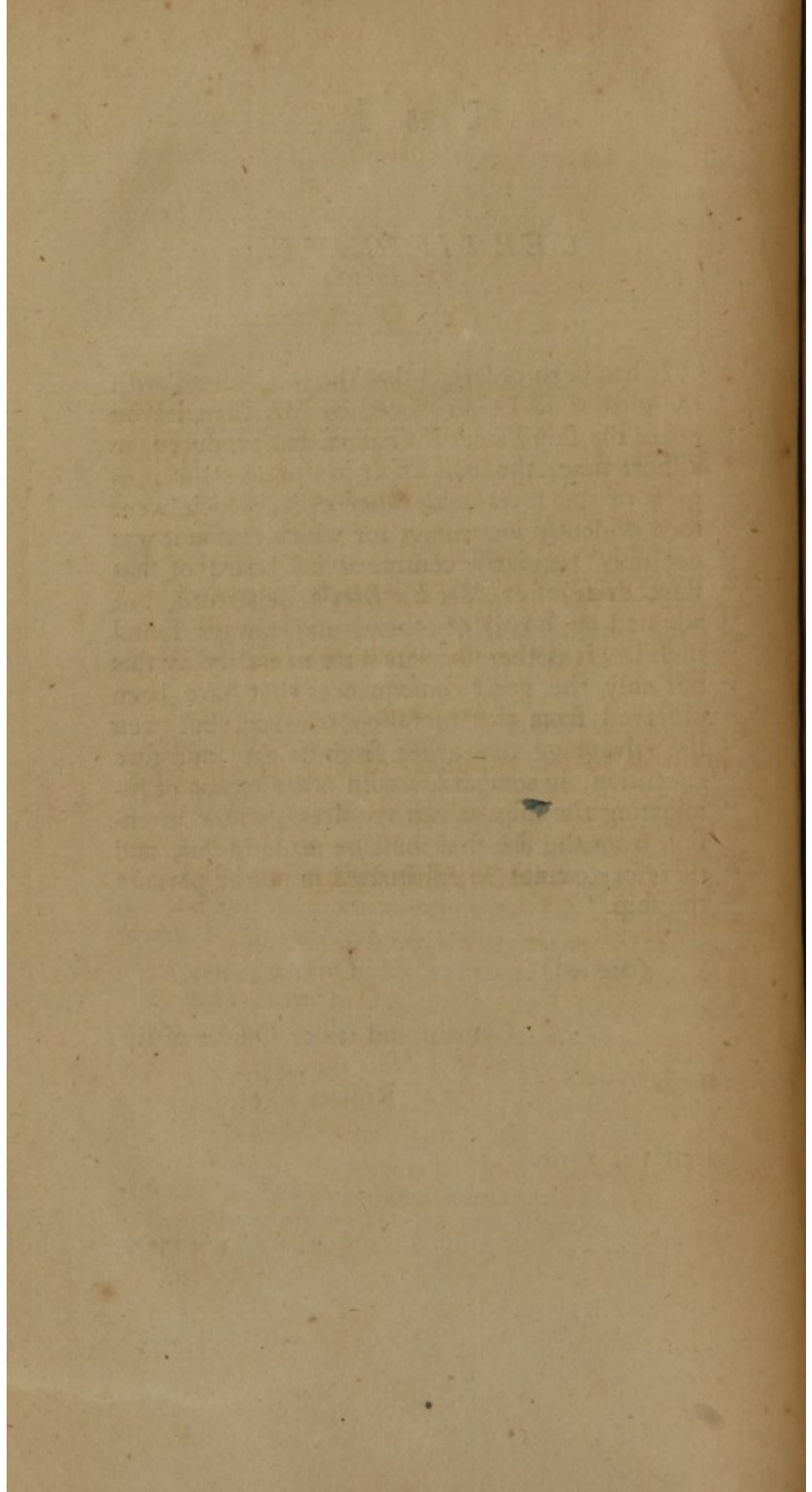
(Signed)

CHECHAGOFF,

Captain and senior Officer of the
 Russian Fleet.

March 10, 1796.

COPY



C O P Y
O F A
L E T T E R

F R O M

DAVID PATTERSON, ESQ.

SURGEON IN HIS MAJESTY'S NAVY,

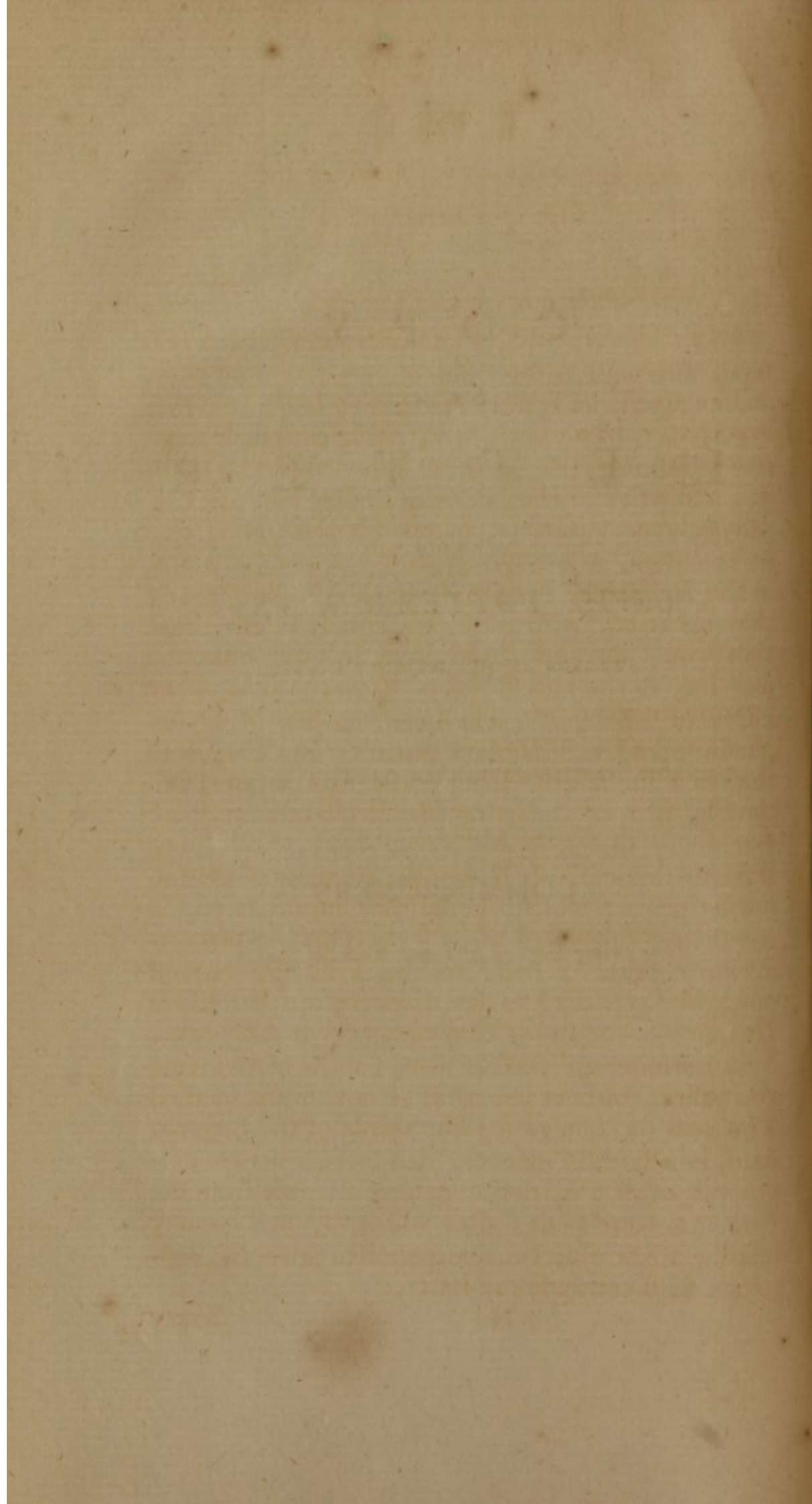
AND LATE

SURGEON TO THE PRISONERS OF WAR AT FORTON;

TO THE

COMMISSIONERS

For taking Care of Sick and Wounded Seamen.



Copy of a Letter, &c.

Gentlemen,

LAST winter, while I had charge of Forton hospital, although in the midst of very fatiguing duty, and engaged, as I was, in making some favourite experiments of my own, yet, being extremely anxious to acquire some practical knowledge of Doctor J. C. Smyth's nitrous vapour, I failed not, after receiving your authority, to put his fumigating plan in execution, as extensively as it was possible; nor, at the same time, to note down the phænomena, as they occurred, with as much accuracy as my leisure time would permit. And now, in order that you may see, in the fairest points of view, some of the effects of the vapour resulting from that highly ingenious, and very salutary process; and also, with the view no less of doing justice to Doctor J. C. Smyth, than of rendering his nitrous vapour more extensively useful, in the Navy, Army, &c. I beg leave to communicate to you the contents of the following pages; which, should they appear to you in any degree calculated to be serviceable, in promoting the welfare of these realms, I humbly request you will be pleased to lay them before the Right Honourable the Lords Commissioners of Admiralty.

In pursuing my present plan, I shall, after giving you a short, but not imperfect account of the method I followed in fumigating the wards of the hospital, state, in a faithful manner, such facts, whether of a general, or of a particular nature, as arose from the trials that were made; after which, by most humbly offering a few observations connected with the subject, I shall conclude my letter.

N

Every

Every evening a certain number of wards were fumigated, each by means of three pipkins, for an hour; the gally-pot in each pipkin containing the quantities of pure nitre in powder, and concentrated vitriolic acid as directed by Doctor Smyth.* Three persons, each carrying one fuming pipkin, went round a ward, following one another at some distance, and holding the pipkins under each bed, for a considerable time, as they went along; and they continued doing so as long as the fumigation lasted. The wards, by opening the windows and doors, were afterwards filled with atmospheric air.

The vapour, proceeding from the decomposition of the nitre, by means of the concentrated vitriolic acid, was in such great quantity, that a ward 57 feet by 20, and 10 feet 6 inches high, was filled with it, by means of three pipkins, in the manner I have mentioned, in the space of fifteen minutes.

On the wards being filled with nitrous vapour, some of the patients who laboured under affections of the lungs were seized with fits of coughing; none of them, however, to any great degree. With little or no exception, the patients, in the wards that were fumigated, bore the vapour without feeling any disagreeable effect from it. If, indeed, a pipkin was, accidentally, held very close to the mouths of any of the patients, which, from awkwardness, was sometimes the case, coughing was immediately produced; and, in one instance, vomiting was occasioned. These circumstances, however, did not prevent the patients from becoming, in a short time, very fond
of

* For a more particular history of the process Vide, Doctor J. C. Smyth's letter to the Right Hon. Earl Spencer, &c. &c. &c. containing an account of the experiment made on board the Union hospital ship, to determine the effect of the nitrous acid in destroying contagion, &c.

of the fumigating business. For my part, I frequently remained in a ward during the whole time of the fumigation, often indeed with a fuming pipkin in my hand, without experiencing any disagreeable effect whatever. The fume was to me pleasant. When, during the fumigation, I remained in a ward, I always wore black clothes, which, even, after being repeatedly exposed to the nitrous vapour, were not in the least either stained, or changed from black to a brown colour.

In the mornings, particularly in dry weather, the wards that had been fumigated the preceding evening, even although they had been washed early in the morning, and the windows kept open, had a very agreeable smell, much more pleasant than that which was experienced during the fumigation. By this agreeable odour, in the mornings, I was able to judge whether or not due pains had been bestowed, the preceding evening, in fumigating the wards.

One dysentery ward, one fever ward, and one surgery ward, containing the worst kind of Ulcers, were, at first, the places filled every evening with the nitrous vapour; but, as the good effects resulting from the fumigation were to me very obvious, I soon used it more extensively. The patients, in general, who laboured under old dysenteries, many of them contracted in the West Indies, seemed to be greatly relieved;* the fevers, which were of no uncommon genus, and which were in their nature very mild, soon disappeared, without exhibiting any symptoms of typhus; and the ulcers, instead of further degenerating or spreading, put on a favourable appearance, and healed.

It

* Ultimately, a great number of the old dysenteries, where the patients were not far advanced in life, did well.

It is, I presume, of no small consequence to observe, that, excepting some marked cases of dysentery, among the servants of the prison and hospital, in the months of August and September, before the arrival of the prisoners from the West Indies, and one case of typhus (in ward 18) with now and then a case of small-pox, among the West Indians, after their arrival, there was not any contagious febrile disorder that made its appearance within the walls of the hospital, while I had charge of it, notwithstanding the many sources of contagion to which, in my opinion, all in and about it were exposed. During the last five months of my time, no fewer than 1686 patients were admitted into the hospital, as may be seen by the hospital books.

The following table serves to shew, at one view, the highest number of patients in the hospital, the number discharged and dead, weekly, for four weeks before, and six weeks after the nitrous vapour was first used; viz. from the 16th of October, to the 26th of December, 1796. To include a greater space of time would be improper; because, before the 16th of October, there were but few patients in the hospital; and, because, after the 26th of December, there were a great number of extremely bad cases of gangrenous feet, pneumonia, &c. received into it, from Portchester hospital, and from the Vigilant and Captivity prison ships.

TABLE.

T A B L E.

Before the Nitrous Vapour was used				After the Nitrous Vapour was used			
Weeks	Highest Number in the Hospital	Number discharged	Number dead	Weeks	Highest Number in the Hospital	Number discharged	Number dead
1	223	2	8	1	340	27	6
2	372	4	21	2	332	7	5
3	371	0	13	3	342	11	8
4	369	1	9	4	340	8	4
				5	486	12	1
				6	539	63	5
		7	51			128	29

After these general observations on the nitrous vapour, I shall humbly beg leave to offer the following Cases, in which it was, undoubtedly, used with very remarkable success.

CASE I.—Jean Louis, French prisoner, of colour, eighteen years of age, from the West Indies, was admitted into the hospital on the 28th of October 1796, for an ill-conditioned Ulcer on the inferior and interior part of the right leg. After he had been some time in the hospital, the ulcer began to put on a favourable appearance, and was soon considerably diminished in its size, merely by means of simple dressings.

On the 29th of November, however, the ulcer according to the common phrase, became foul ; and, by next day, it had spread to such a degree, that it was nearly as extensive again as it ever had been, attended with very acute pain, and with a very copious thin dark-coloured fetid discharge. The patient's pulse, at this time, was 120, tongue clean ; appetite impaired, belly open ; sleep much disturbed.

31st. From the 29th to this time, a common poultice, thrice a day, was the only application ; but
now,

now, in addition to the poultice, the ulcer was dressed with the powder of Peruvian bark; a cooling medicine, with an opiate at bed-time, was ordered; and a vegetable diet with milk was enjoined.

2d December. The ulcer still more extensive than it was on the 31st ult. It now extended from the Tarsus six or seven inches upwards, and from the Tibia more than half round the leg: it was still in a sloughing state, with high, reflected edges. The other symptoms much the same as before. Finding that the plan hitherto pursued had not produced any good effect, either on the ulcer or on the system, the whole of it, excepting the poultice, was abandoned, and the nitrous vapour adopted. The ward in general, and the bed of the patient in particular, were carefully fumigated, the ward once, the bed twice a day.

3d. The ulcer had stopt spreading, and in some places looked clean. Such a sudden change was to me astonishing. Pulse now 110; tongue clean; belly open; slept better on the night of the 2d than for some time before, notwithstanding the omission of the opiate.

4th. The ulcer was clean, and discharged good matter. The patient felt himself comfortable. Pulse about 90.

6th. The discharge continued to be good; and the ulcer had made considerable progress in healing. The patient felt himself perfectly easy, and his health was already very much mended.

The fumigation was continued until the 26th of December; from which time, owing to a want of materials, it was discontinued until the 11th of January, 1797. The ulcer, during the time the fumigation was used, and even to the 1st of January, 1797, continued to heal kindly, and rapidly; but,
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at that period, it again became foul and sloughing, and was soon as extensive as before. The appetite was again impaired; pulse 120, and small; belly open; the patient much weakened and emaciated. Half a drachm of Peruvian bark, thrice a day, and eight ounces of wine in the twenty-four hours, were ordered; and the ulcer was dressed twice a day with the powder of common Peruvian bark and common poultice. An opiate was occasionally allowed at bedtime. This treatment was preserved until the 11th, when, having experienced no good effects from it, it was discontinued, and recourse again had to the nitrous vapour, and common poultice, as on the 2d of December, 1796.

12th. The ulcer had stopt spreading, and in some places had begun to clean. The pulse was less frequent, and more full; and the patient was, in every respect, better, and more comfortable. The nitrous vapour, &c. were continued.

13th. The ulcer was perfectly clean, with florid granulations, and with about the eighth of an inch of new skin round the edges. The plan was continued.

20th. The ulcer looked very healthy, and was contracting rapidly. The plan was continued.

5th February. The ulcer had contracted more than one half. The plan was continued.

12th March. The ulcer was nearly healed, (not so much as the breadth of a sixpence being open) and looking healthy. On this day I finished my duty, and, consequently, my observations, at Forton hospital.

I have here to observe, that about the 1st of January 1797, all the ulcers in the same ward (N^o 14) with the above, were more or less in a bad state; and that they all, about one and the same time, began

gan to put on a favourable appearance; and also that, in a short while, many of them healed. Likewise, it is necessary to observe, that particular attention was paid all along to cleanliness and ventilation.

CASE II. La Granade, French prisoner, aged 26 years, from the West Indies, was admitted into the hospital on the 16th of December, 1796, for chilblains. In the end of February 1797, an ulcer broke out on his left leg, which became very foul and sloughing, and did not yield to common remedies. On the 7th of the following March, the nitrous vapour was used, exactly in the same manner as in the preceding Case, and by the 12th the ulcer was perfectly clean.

CASE III.—Elie Double, French prisoner, aged 22 years, from the West Indies, was admitted into the hospital on the 28th of October 1796, for an ulcer on the anterior and middle part of his left leg. By the middle of February, 1797, the ulcer was cicatrised, but with a considerable protuberance remaining over that part of the tibia, as if the periosteum and even the bone itself, had been in a diseased state. About the end of February the cicatrix became inflamed, soon suppurated, and degenerated into a foul sloughing ulcer, which, instead of yielding to any of the various applications, got worse and worse every day. From the end of February, (I cannot exactly tell the day,) cataplasms of different kinds, myrrh, and Peruvian bark, were tried externally; and wine, Peruvian bark, opium, &c. were administered internally. At the same time, great attention was bestowed in keeping the ward extremely clean, and thoroughly ventilated. Finding not only that no good effect was produced by any of these means, but even that the ulcer, the
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found parts being still in a mouldering state, grew more and more extensive, I came to a determination, considering myself sufficiently authorised, from the experience I had had, to make trial, in this untoward case, of Dr. J. C. Smyth's nitrous vapour. Accordingly, on the 7th of March the fumigation was put in practice, in the same way as in the foregoing cases; and, it is with heart-felt pleasure I relate it, by the 12th, that was in five days time, and on the day I finished my duty at Forton, the ulcer was perfectly clean and healthy.

CASE IV.—Francois a negro French prisoner, age unknown, was admitted into the hospital on the 26th of January 1797, for a wounded little finger. On examining the wound, I found that the last bone and the surrounding ligaments were the parts most materially injured. The bone was fractured, and the soft parts were contused to a very great degree, with a small lacerated wound at the tip of the finger. Deeming it necessary, I immediately amputated the limb at the joint formed by the second and last phalanges. The stump, the bone being well covered, and the soft parts looking healthy, had all the appearance of doing well, during the first fortnight; but, unfortunately, at the expiration of that period, it began to put on a very unfavourable aspect. Instead of the diseased parts being sinuous, or having, what is perfectly understood in surgical language, a glassy appearance, which sometimes indicate a diseased bone, they became enlarged to a prodigious degree, reflecting very considerably, so as to resemble a ball on the end of the stump; and, at the same time, appeared foul, discharging a dark thin fetid matter. In this state, Peruvian bark, opium, &c. were tried, as also cataplasms, but to no purpose. In
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the end of February, recourse was had to the nitrous vapour ; and, by means of it, in six days time, the ulcer was perfectly clean.

CASE V.—Bastern, a negro French prisoner, age unknown, was admitted into the hospital on the 28th of January 1797, for an ulcerated toe. This case very similar to the finger of which I have just taken notice, and, like it, after various ineffectual applications, was cleaned, and put, seemingly, in a healthy state, by means of the nitrous vapour used according to the manner I have already related. The four last cases were in the same ward, No. 4.

Having, with respect to Dr. J. Smyth's nitrous vapour, agreeably to my promise, finished the most important part of my experiments, with the phenomena resulting from them, in order to shew you that vapour, under proper management, is capable of producing very happy effects on the human frame, I shall now most humbly offer a few observations which appear to me to be connected with the subject.

And, to proceed ; I am in great hopes that the facts detailed in these pages, while they serve as so many proofs of the utility of Dr. J. C. Smyth's fumigating plan, will, at the same time, answer the happy purpose of not only removing the ill-grounded fear of Dr. Trotter, and of convincing him, as well as those who think as he does, that no danger is to be apprehended from the combination of azote with the nitrous vapour ; but, also, of conquering the prejudices of those gentlemen who imagine (for some highly respectable medical practitioners have lately mentioned to me their apprehensions) that that vapour, from its being loaded with vitriolic acid, must be intolerable
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to the lungs, and of course highly pernicious to persons subjected to its influence.

With regard to the bad, or deleterious effects of the nitrous vapour, I cannot say, from experience, that I am acquainted with any of them. The trials that I made of that vapour were on a great number of diseased persons, who, although crowded together within the walls of an extensive hospital, and from that circumstance, as well as others of at least equal moment, exposed to the influence of noxious effluvia, were obviously, in many instances, as already mentioned, benefited by its salutary effects. Many patients were cured; others were put in a fair way of being cured. And, I must add, for it is not, I presume, altogether improbable, that by means of the nitrous vapour, with other no less important measures, which I adopted, and incessantly followed when in my power, the patients who were under my charge, in Forton hospital, were preserved from the attacks of contagious fever. I have ventured to say with other no less important measures, because I am well aware, as Dr. J. C. Smyth undoubtedly is, that, without the most strict attention to cleanliness, and to the circulation of pure or atmospheric air, neither the nitrous vapour, nor any thing administered with similar intentions, can prove so efficacious as we could wish, in preventing or putting a stop to contagious fever, as well as other diseases, though perhaps not so immediately, yet ultimately as fatal. I am here under the necessity of observing, having forgot to do it in the proper place, that the solitary case of Typhus, which, as before mentioned, was in ward eighteen, did not originate in the hospital, but in the Captivity prison ship. What the nature of the disorder had been primarily, I am at a loss

to say. The patient died, and, fortunately, so did the disease; for I saw not another fever of a similar nature in the hospital.

As no contagious fever (I mean typhus, or what some authors have called jail fever, others hospital fever, &c.) prevailed, during my time, in Forton hospital, I cannot say positively that the nitrous vapour solely prevented such a fever from prevailing. All that I can say is only, that the circumstance of no contagious fever having prevailed in Forton hospital, during my time, may be considered as being of a very singular nature; more especially when we take into our view the vast number of patients, in the most filthy state, from the West Indies, &c. that were received. The very particular attention that was paid to the patients, on their being received, in stripping them of all their clothes, in bathing them, in shaving their heads, in burning all their clothes, and also in keeping the hospital, at all times, extremely clean, and thoroughly ventilated, may, it is probable, have contributed not a little towards preventing contagious fever. And, further, another circumstance which, perhaps, had operated very powerfully in assisting to obviate contagious fever, and which deserves to be very particularly remarked, was the changing of the wards as frequently as it was possible, and that according to the nature of the complaints they contained; for instance, and by comparison, wards that contained convalescents, and also those that contained slight or chronic diseases, were changed frequently; those that contained febrile diseases more frequently, and those that contained very bad surgical cases most frequently. By the changing of wards, I mean the removing of the patients from one that they had

had occupied for some time, to another that was perfectly purified.

When a ward of whatever description was changed, it was first emptied, by the patients being removed into another, and by its bedding being sent to be baked, fumigated, or washed; and then it was without loss of time fumigated by means of sulphur; then white-washed; then its cradles cleaned, and washed with vinegar; then the floor of it thoroughly cleaned; and, lastly, its windows on the one side, and its scuttles on the other, were kept open, always when the weather would permit, until it was again occupied by patients, which, if the state of the hospital admitted, was not before eight days had expired. Such regulations as the above ought, in my humble opinion, to be constantly and very particularly observed, by all medical men who have the immediate charge of hospitals for prisoners of war: many of them, I presume, might, with propriety and utility, be observed in any hospital; and, in concluding this subject, I beg leave humbly to suggest to you that no hospital ought to be full, but, on the contrary, that there should always be, in all, according to their different sizes, two, three, four, or more wards left empty, for the very salutary purpose of changing.

Cleanliness, ventilation, and changing of the wards, whether with the view of obviating or removing diseases, are, in all hospitals, as well as in all places where prisoners of war are confined, &c. absolutely necessary: where they are observed, medicines will become less needful; and when needful, they will, in their operation, be more effectual; but, where they are neglected, the physicians and surgeons will be subjected to the very unpleasant trouble of giving their attendance, and of prescribing,

ing, to very little purpose. Warmth ought also to be attended to.

In such establishments as Forton, cleanliness, a free circulation of air, proper diet, &c. ought, agreeably to the very particular orders which you issue, to be most rigidly attended to, from one end of these establishments to the other. But, I am afraid, orders are not always rigidly executed. The unpardonable neglect of servants, in not executing, with promptitude and scrupulous punctuality, the orders with which they are entrusted, is to be lamented, but, I fear, not to be, on all occasions, either prevented or corrected. From what I know of the establishments in question, I shall venture to say, that, were they always to be properly conducted by the servants who have the immediate charge of them, we should hear less frequently of the prisoners, &c. falling a prey to contagious fever than we have hitherto done. This is a subject, however, with which, at present, I shall not further concern myself, excepting to make the following observation, which is, that while due care is not taken, in the first instance, to prevent contagion from taking effect, the use of Dr. J. C. Smyth's nitrous vapour becomes, undoubtedly, the more particularly necessary: but I am extremely sorry to think that Dr. Smyth's plan, as well as others equally well intended, should not always be put in execution, but more especially in cases of emergency, with that facility, with that eagerness, with that candour, which duty, justice, and humanity, continually require.

Although I have, in the course of these observations, laid very considerable stress on cleanliness, ventilation, changing of wards, &c. yet I would not, by any means, wish it to be supposed that

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I have done it with the view of superseding the use of the nitrous vapour: on the contrary, while on the one hand I am sensible that the nitrous vapour cannot, without cleanliness, ventilation, changing of the wards, &c. be so efficacious as we could wish, in putting a stop to contagious fever; I am, on the other hand, no less sensible that that fever, when raging to a violent degree, cannot be exterminated by means of cleanliness, ventilation, &c. without the assistance of some other means. With respect to hospitals, ships, prisons, &c. where people are crowded together, where the introduction of contagious fever is dreaded, or where it actually prevails, the nitrous vapour, with due attention to cleanliness, ventilation, &c. may, at once, I presume, not only be considered the most convenient, the most elegant, and the most ingenious, but also the most efficacious remedy for the purpose of counteracting different species of contagion, that has yet been offered to the public.

Further, although cleanliness, ventilation, and the changing of wards, very strictly attended to, might, in a very great measure, prevent contagion from taking effect, or from spreading extensively, yet, supposing them to be attended to as strictly as, from the nature of things, it is possible, they could not, I am too much afraid, destroy contagion, when prevailing in an extensive hospital, &c. For example, let us suppose only five or six hundred patients confined in Forton hospital, and labouring under contagious fever; and let us also suppose it necessary, for the sake of cleanliness, and of putting a stop to the contagion, to completely shift all these patients once, perhaps many of them twice, and some of them even thrice, every day; how, give me leave to ask, would it be possible to furnish

nish such a great number of patients so frequently with the clean things required? For my part, I am fully persuaded that it would prove difficult; so extremely so, indeed, that it would amount even to an impossibility. With respect to ventilation, has it not been found, even when it has been attended to very particularly, to be, without the assistance of other means, inadequate to the speedy destruction of contagion? And, with regard to the changing of wards, were it sufficient of itself to destroy contagion, might it not, I shall say sometimes, from the number of patients received being equal, nay even more than equal, to all the wards of which the hospital consists, be utterly impracticable? Other examples, and other queries, to the same effect, were they not deemed superfluous, might be advanced: then, considering the business in this point of view, does it not become a duty incumbent on us to look out for, and to try other means more active, and more diffusive, which, with the assistance of cleanliness, ventilation, changing of wards, &c. may be employed for the purpose of more speedily, and more effectually destroying contagion? and may not the nitrous vapour of Dr. J. C. Smyth, as I have already mentioned, be deemed, of all other remedies extant, the most convenient, the most elegant, the most ingenious, and the most efficacious for answering the wished-for purpose, whether at sea or on shore?

The extraordinary effects which we have seen the nitrous vapour produce, in cases of putrid ulcers, are facts of the utmost importance to mankind, and certainly deserve the most serious attention of medical practitioners. They not only shew, in the most satisfactory manner, the power of that vapour in such cases, but also point out, in my
humble

humble opinion, the probability of its having, in a similar way, as salutary a power in contagious fever, and in many other diseases proceeding from other species of contagion. This opinion may, perhaps, seem singular; but I shall endeavour to evince its consistence with reason and experience.

In hospital practice, it has been frequently observed, not only by me, but by other medical practitioners, that all the ulcers of patients in the same ward have on a sudden, and nearly at one and the same time, changed from, apparently, an healthy, to a foul, sloughing, or putrid state. I have bestowed considerable attention in observing this change; and, in the course of my practice, have been able to make the following remarks, which I shall here arrange as they stand among my memorandums.

That, first, one ulcer degenerated, then another, and so on, until all the ulcers, in the same ward had taken on a similar disposition.

That those ulcers nearest the one which first degenerated were sooner affected than those at a greater distance.

That this lamentable change did not happen in all the surgical wards at the same time.

That the patients, when their ulcers were in this degenerated state, laboured, more or less, under symptoms of fever, such as a frequent, small pulse, unnatural heat, sometimes chilliness, dry skin, loss of appetite, &c.

That common dressings, common poultices, carrot poultices, turnip poultices, myrrh, Peruvian bark, applied to the ulcers, had no good effects.

That Peruvian bark, wine, opium, given internally, had, I thought, instead of good, bad effects.

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That,

That, in one case, yeast was tried, both internally and externally, but the disease evidently gained ground under the course.

That the acetum nitrosum,* whether used internally or externally, seemed to have good effects.

That the changing of the wards had always good effects.

That the nitrous vapour, with the like attention to cleanliness and ventilation as was in common bestowed, had, without changing the ward, as in the five cases mentioned, as well as in many others, effects superior to those resulting from the changing of the ward, without the use of the nitrous vapour.

That the nitrous vapour had not the like good effects, without cleanliness and ventilation, as with them.

From these premises, I have thought it warrantable to draw the two following conclusions:

1. That such a degeneration of ulcers, in hospitals, from, apparently, an healthy, to a foul, sloughing, putrid state, can only be accounted for on the principle of contagion.

2. That the nitrous vapour, with due attention to cleanliness, ventilation, changing of the wards, &c. is, seemingly, the remedy, of all others extant, best calculated for preventing, or speedily destroying that contagion; and from this naturally arises the following query:

As, under such regulations, the nitrous vapour has such great power in preventing or destroying one species of contagion, may it not, under the same regulations, be equally powerful in preventing or destroying other species of contagion?

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* Vide Paterfon on Scurvy.

I must here observe, that the second conclusion does not exclude the use of other medicines. Suitable remedies, both internally and externally, used at the same time with the nitrous vapour, will, no doubt, forward the cure. But, as these pages are intended for the purpose of pointing out some of the effects of Dr. J. C. Smyth's nitrous vapour, and not as a treatise on ulcers, I cannot, with respect to the latter, make, with any degree of propriety, an attempt on either the indications of cure or remedies.

On the present subject, I might, to what has been advanced, add many more medical observations, were I not ^{of} opinion that, after the experiments of Dr. Smyth,* they would appear superfluous; and I might, with equal propriety, have recourse to chemical reasoning, were I not prepossessed with the idea that, considering what has been already said, respecting Dr. Smyth's nitrous vapour, by that very ingenious chemist Mr. Keir, of Birmingham,† it would be extremely presumptuous.

On the whole, and to conclude, I cannot help being of opinion, as well from the facts with which Dr. Smyth has favoured the public, and from what Mr. Keir has advanced, as from my own experience, that very great benefit must result to mankind from the *proper use* of the nitrous vapour, on board of ships, in hospitals, in prisons, in all places where people may be crowded together, and even in private families, in preventing and in putting a stop to contagion, as well as in mitigating and removing other diseases, in which other medicines would not perhaps have the like good effects.

And,

* Vide Dr. J. C. Smyth's letter to the Right Honourable Earl Spencer, &c. &c. &c.

† Vide Dr. J. C. Smyth's letter to the Right Honourable Earl Spencer, &c. &c. &c. Appendix.

And, therefore, I most sincerely wish that the plan of Dr. J. C. Smyth may be universally adopted; and that it may, for the good of our navy and army, for the honour of our country, and for the benefit of mankind, be practised by medical men, and others, without their conceiving any prejudice against either it or its ingenious Author.

I have the honour to be,

Gentlemen,

Your most obedient,

Very humble Servant,

Montrose,
12th August, 1797.

DAVID PATERSON.

POSTSCRIPT.

SINCE finishing the preceding letter, I have had an opportunity of making further trial of the nitrous vapour, in a disease of a singular nature. The hooping cough, which has been prevailing here all this summer, made its appearance in my family last month, this being a contagious disease, and a change of air having been found useful in removing it, I supposed that the nitrous vapour might not only operate in counteracting the contagion, but also have effects similar to the changing of situation; and hence,

hence, that it might, providing the lungs of my little patients could bear it, prove a convenient, an elegant, and useful remedy, on the present occasion. It was from these conjectures, and knowing that it would have been extremely inconvenient for me to have sent my children from home, that I ventured to make trial of Dr. Smyth's fumigating plan; the result of which I shall state, as briefly as possibly, by sketching the following cases.

My third child, a girl of five years old, was seized with a slight inflammation of the throat, attended with hoarseness, about the 6th of last month; and about the 10th with a cough on which the inflammation and hoarseness went off, the cough for some days, seemed to be of a common kind, from cold; but by the 15th it assumed the appearance of whooping cough, accompanied with a slight degree of fever. By this time my second child, a girl of six years, and also, my fourth or youngest, a boy of fifteen months, had begun to cough.*

On the 17th, the third child had frequent and violent fits of coughing, with the hoop strongly marked; and the second and fourth, though not so ill, evidently laboured under the disease. In the evening of this day, I began the use of the nitrous vapour, I shut up my little patients, with a servant, in their bed-room sixteen feet by twelve, and six feet nine inches high, myself superintending the business. Instead of a pipkin for holding the hot sand, I used an iron pot, in which was placed two gallipots, containing the concentrated vitriolic acid and nitre, according to the directions of Dr. Smyth. In about five or six minutes the room was filled with vapour, and continued so for an hour, without any
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* My oldest child had the whooping cough about three years ago.

of the children coughing or shewing any signs of uneasiness.

18th, 19th, 20th. The fumigation was repeated every evening, and continued an hour, without coughing or any uneasiness occurring.

21st. Now, all my little patients seemed better, the fits of coughing recurring less frequently, and the mucus being more easily discharged than before.

14th September. From the 20th ult. to this time, the fumigation was repeated only six times, exactly in the same manner as before, without the children complaining of, or apparently feeling any disagreeable effect from it; and now, on account of the mildness of the disease, the cough not being troublesome even in the night, it was discontinued.—At this time the youngest child evidently laboured under symptoms of teething; the cough, however, did not appear in the least aggravated.—To the second and third child, during the course of the nitrous vapour, no other medicine was given; but to the youngest, who was frequently constipated, a weak solution of antimon. tart. which always operated downwards, and sometimes upwards, was occasionally administered.

23d. The second, and third child, continue well; and the youngest, though much distressed with teething, coughs but seldom, and very gentle.

Now after having stated these facts, whether or not the nitrous vapour, had any effect in counteracting the contagion, or otherwise rendering the disease mild, and of short duration; or whether or not the disease would have naturally appeared mild, and have continued but a short time, without the interference of art, are points which I shall not take upon me to determine. Further trials are undoubtedly necessary for the purpose of forming a judgment.

ment. It must be confessed, however, that, even the few trials which have already been made, serve, in the mean time, a very useful purpose; they clearly shew, that even young children labouring under a disease, in which there is always, more or less, a determination to the lungs, &c. are capable of inspiring the nitrous vapour without feeling from it any disagreeable effects: hence there cannot, I presume, be any objections to further trials of it being made in the whooping cough. Also these facts lead naturally to other important inferences, but as they must be to you sufficiently obvious, I avoid making them.

I have the honour to be, Gentlemen,
Your obedient humble servant,
DAVID PATERSON.

Montrose. 23^d Sept. 1797.

E X T R A C T

O F A

L E T T E R

From Mr. Abraham Baffan, Surgeon of his Majesty's Hospital Ship Union, to the Commissioners of Sick and Wounded Seamen, dated the 22d of November, 1797.

“ I USE the nitrous fumigation every day through the Ship, and, as formerly, in the ulcers, from the Sandwich, I found they spread and became foul from local debility, being never apparently benefited by the bark, wine or generous diet, and I used the nitrous fumigation to the ulcers, after washing them clean, with great success.”

Three

Three Letters from Mr. JAMES M^c GRIGOR, Surgeon to the 88th Regiment, at Jersey. The two first addressed to Dr. CARMICHAEL SMYTH, and the last to Dr. GARTHSHORE, of London.

Jersey, October 8, 1797.

SIR,

As Surgeon to the 88th regiment, I have for these last four years, been witness to the dreadful ravages of an infectious fever in different quarters of the world. In England, in the island of Jersey, on the continent of Europe, during a voyage to, and in different islands of the West Indies, this fever has been the scourge of the regiment to which I have the honour to belong, and after a trial of every mode of practice which I could learn, it proved extremely fatal.

On my return from the West Indies, having seen in Duncan's Annals of Medicine, an account of your work on fever, I determined to take the earliest opportunity of giving a trial to the mode which you recommended, of weakening and destroying contagion.

The 88th regiment, for nine months previous to their landing in Jersey, had been in the most healthy condition; they landed on the 6th of June last, and continued in the same healthy state till the middle of last July. On the 17th of July, the first case of a fever, which has since very generally prevailed, made its appearance. The person was seized with the worst symptoms of low typhus fever, and died on the 5th day. Having four years before, in this island, in the course of ten weeks, lost fifty men in the same fever,

fever, I determined to give the fullest and fairest trial to any thing recommended by you. I had every assistance from one of the ablest commanding officers, Col. Bursford.

To diffuse the contagious poison, I ordered the men, on the first appearance of fever, to be moved from the barracks, (which are in an unhealthy situation) to tents pitched at some distance, on a dry and healthy spot.

To destroy the virulence of the contagion, where it evidently existed, I made my two mates regularly fumigate the barrack rooms and hospital with nitrous vapour, in the manner you direct, the event will shew the success, of perhaps the first trial of your excellent invention, in the army.

Of fifty-four cases of this fever, which occurred from the 17th of July to the 24th of September, the first is the only one that I have lost. The very remarkable effect of the nitrous fumigation, appeared from the great diminution of the number taken ill, after it was used. During the first week twenty-four cases appeared, in the second week, ten, in the third, seven cases; and to this date,* the number of cases continue to lessen.

The effect of the nitrous fumigation, is evident, not only in the diminished number of cases, but also in their degree of virulence. The cases that have of late appeared, have been gradually becoming milder, and are now what a late writer would call cases of simple fever, having neither petechiæ nor any dangerous symptom.

As your work on fever has but lately fallen into my hands, I have been able, only in few instances, to follow the practice which you recommend; every thing indeed has been so completely effected, by following

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* The 8th of October.

lowing your manner of destroying contagion, that, in general, little has been left for me, but to obviate debility.

If you should wish to make any use of this communication, or should favour me with any thing further regarding your truly valuable discovery, please address for me to the care of our agent, A. M^c Donald, Esq. Pall-Mall court, London.

In a Memoir which I transmitted to the Army Medical Board lately, after an account of the fever which appeared in the 88th regiment, I gave an account of the success of your plan, and thought it my duty to recommend it to the attention of the Board.

I have the honour to be

Sir,

Your very obedient humble servant,

JAMES M^cGRIGOR,
Surgeon 88th Regiment.

Dr. Carmichael Smyth.

Jersey, December 9, 1797.

SIR,

By a letter of yours of the 26th of October, with which I was favoured, I was happy to learn that my conduct had met your approbation.

In September last, I sent to my friend Dr. Garthshore, a copy of my Memoir to the Army Medical Board on the fever that lately prevailed in the 88th regiment. At his desire, I about three weeks ago, sent him an abridged account of two memoirs on this fever, which, I believe he intends to transmit to Dr. Duncan, for the second volume of the Annals of Medicine.

Medicine. Presuming that it would be satisfactory to you to see them, I herewith inclose you copies of my first memoir, and of the abridged account sent to Dr. Garthshore. I had nearly finished a second memoir, and hoped to be able to have concluded my *statement* of the fever, with an account of its extirpation; but a few more cases have of late occurred. The appearance of these last cases is however very naturally and easily accounted for, and the treatment of them adds a still further testimony to the efficacy of the nitrous fumigation, and of the treatment formerly pursued.

About the middle of October last, from the almost total disappearance of the fever, we relaxed considerably in the fumigation, the only cases then in the fever-hospital, were convalescents from fever. About this time, the different encampments breaking up, we were obliged to admit a good many pneumonic and some dysenteric cases which crowded this small hospital, (an old farm-house hired for an hospital) and I was alarmed to see the fever break out again with all the original symptoms in six or seven convalescents. By attention to the different circumstances regarding fumigation, following the former treatment, and thinning the different rooms, matters are now brought to nearly the same good state as before the re-appearance of the fever.

The re appearance of the fever, has however, not been entirely without its advantages, it has been the means of shewing me a fact, which especially in military practice, I conceive to be of the first importance. It has pointed out to me the efficacy of the nitrous fumigation in destroying dysenteric contagion. I have often been witness to the rapidity with which the contagion of dysentery flew through the wards of an hospital, and how apt convalescents from other diseases,

diseases, and in particular from fever, were to be seized with this disease. Though thirteen cases of dysentery were sent to the hospital, and some of them with very severe symptoms, I know only of two instances where the disease was communicated in the hospital, and with the exception of two chronic cases, the cure in all, has been much speedier than I have formerly seen it under the same treatment.

Confident of success, I with much for opportunity of trying the fumigation in other contagious diseases, particularly small-pox. In two cases of cynanche, attended with low fever, I used it, and both patients (officers) are now well. I should be glad to hear if you have extended the trial to other diseases.

Some other circumstances regarding our fever, I think proper to mention to you.

So sanguine was I at one time, in my expectations from the fumigation, that in some cases of the fever which I set apart, I trusted solely to nature and industriously fumigating, but I soon saw that in these cases I was rapidly losing ground. I next in conjunction with the fumigation, followed Dr. Cullen's plan of treatment; this in every case protracted the cure, and in several instances, I was obliged totally to abandon the plan. Being in possession of such powerful means of destroying the contagion, as the nitrous fumigation, I ventured to take the opportunity of giving trial to, and comparing several of the modes of practice recommended in fever; but a comparison of cases as nearly equal as could be collected, gives the most decided superiority to that recommended by Dr. Robertson of Greenwich. But I think it likewise proper to mention, that under the type which fever lately assumed in this island, however proper the immediate exhibition of the bark was here, that it was by no means found so proper a remedy in other situations.

situations. In the West Indies, every trial given to the bark in the yellow fever during the paroxysm, failed, and this not only with me, but in the hands of the physicians who had the charge of the largest hospitals there.

I shall never sufficiently regret my being unacquainted with your discovery, while in the West Indies; and though doubtless it will for a time, meet with the fate of every other that has been made for the benefit of mankind; yet, if candid and liberal practitioners will but do their duty, and give it a trial, I am confident it must soon carry conviction, and that you will derive that credit from it, which you so justly deserve.

I have for some time been in the practice of keeping journals of my cases; every case of this fever that has occurred since its origin, has been registered either by myself or by one of my assistants. The garrison surgeon here, and his assistants likewise, have witnessed the treatment: and the different facts mentioned in my memoir, are not unknown to several practitioners in the island. Any information which you may require from me at any time, regarding the trials of the nitrous acid, and the other means recommended by you, I shall most readily give.

I have the honour to be

With the greatest respect,

Sir,

Your most obedient humble servant,

JAMES M'GRIGOR.

Dr. Carmichael Smyth.

**St.*

* *St Owen's, Jersey, Nov. 1, 1797.*

S I R,

As perhaps the confirmation or refutation of an *opinion* in medical science, especially of one that so nearly concerns mankind in general, as a mode of obviating contagion, is not less useful than a new theory, a new medicine, or a new mode of curing a disease; I shall lay before you some facts, which, I think, confirm the method of obviating and expelling febrile contagion, which has been recommended by Dr. C. Smyth.

On the 17th of July last, a contagious fever of the typhus form, appeared in the 88th regiment in this island. In different situations, this regiment had suffered severely for the last four years, from a fever of the same kind. In this island, three years ago, I had the misfortune to lose, in the course of ten weeks, forty† men from this fever. Soon after our arrival in Jersey, in last June, and but a short time before the first case of this fever appeared, Dr. Smyth's work on fever came into my hands: I, therefore, on the first appearance of the fever, gave the fullest trial to the use of the nitrous acid, and as the result shews, with the best success.

The account which I here give, is extracted from two official memoirs, which I transmitted to the Army Medical Board on the subject.

The fever had nothing remarkable in its appearance from typhus fever, as I have usually seen it occur,

* This letter has been already published in the second volume of the *Annals of Medicine*, and is only republished here from a wish to bring the whole of the evidence on this subject into one point of view.

† There seems to have been a mistake here, as in his first letter to me, he states the number to have been fifty.

occur, if I except the suddenness of the attack, often with delirium or epilepsy; a very remarkable degree of debility; and a great proneness to relapse. Two cases had the scarlet eruption with angina, and the most of the first cases, until they were sent to camp, and were exposed to a current of air, had petechiæ. In most of the first cases, the contagion could be clearly traced.

On the first appearance of this fever, alarmed at the fatal issue of the first case, I myself not only carefully fumigated the hospital, the clothes, and bedding of the sick, with nitrous acid, but my two assistants, Messrs. Bruce and Brown, likewise constantly fumigated the different barrack-rooms*.

Every man as soon as seized with the fever, was removed from the barracks, which are unhealthily situated, to tents pitched in a dry and airy situation, about a mile distant. The barracks were likewise thinned by encamping or removing from them, near half the regiment.

The *treatment* in general was, by immediately exhibiting the bark after giving an emetic or cathartic, and afterwards giving cordials, blisters, &c. as indicated. The *lavatio frigida*, in several cases, seemed to answer exceedingly well.

The *first* case, which appeared on the 17th of July, died on the fifth day, with symptoms which are usually called highly putrid. This excited a very general alarm in the regiment.

I shall here from my journal of cases, and the copies of reports made to the Medical Board, give a statement of the appearance of the cases of the fever: nothing can afford stronger proof of the efficacy

* The rooms, by this process, were rendered sweet, and the men themselves soon became sensible of the comfort of it. Vide first Memoir sent to the Army Medical Board.

efficacy of the means adopted to obviate and remove this disease.

From July 17 to July 28,	20 cases appeared.
From July 29 to Aug. 4,	16 ——— ———
From Aug. 5 to Aug. 11,	10 ——— ———
From Aug. 12 to Aug. 18,	8 ——— ———
From Aug. 19 to Aug. 25,	3 ——— ———
From Aug. 26 to Sept. 1,	2 ——— ———
From Sept. 2 to Sept. 8,	4 ——— ———
From Sept. 9 to Sept. 15,	1 ——— ———

From this time, till the sick were removed from the tents, to a house where they were crowded, hardly another case appeared. At this period, however, about the 20th of October, the fever with the original symptoms again appeared among some convalescents and pneumonic cases; but by putting in practice the nitrous fumigation, and thinning the wards of the hospital, the fever was again very soon got under.

Of the total number of cases of this fever that occurred, viz. sixty-six,* the first is the only one that was lost; this, no doubt, is remarkable, and I not only ascribe this success to the use of the oxygenated nitrous acid, but I likewise think it highly probable, that by fumigating with this acid, the contagion is now nearly extinct, and that by its use, more cases of this fever have been prevented from appearing.

I have nothing at present to add to what Dr. Smyth has said of the use of the nitrous acid; every trial which I have made hitherto, tends to confirm his experiments. I have set on foot a trial of different other acids,† which however is yet so incomplete,

* A very large proportion this of the regiment, which consisted only of four hundred men.

† We attempted, likewise, the extrication of the muriatic acid gas, but with great inconvenience, and it is obviously not so proper as the nitrous. Vide first Memoir.

plete, as not to allow me to say any thing of their comparative merits. Justice to the author of so valuable a discovery, and a wish to make more public, what is so interesting to mankind, has induced me to say so much.*

I am, &c.

JAMES M'GRIGOR.

Dr. Garthshore, London.

For the following COMMUNICATIONS, I am indebted to my Friend Dr. JOHNSTON.

Queen Street, Portsea, December 23, 1798.

DEAR SIR,

WHEN I had the pleasure of seeing you at Portsmouth, I had experienced the good effects of the nitrous fumigation in arresting contagion, and would have communicated my observations to you on this subject ere now: but unfortunately the disease has been *re-introduced*, by receiving men ill of typhus fever, and dysentery, from the Hillsborough transport, bound to New South Wales with convicts. I am, therefore, still pursuing Dr. Smyth's method of fumigation, and am happy to say, that, I have, a second time, experienced the most happy and beneficial effects from it. I will, as soon as possible, forward to you, through Mr. Palmer, the particulars of my success, and one advantage, at least, will arise from this unavoidable delay, viz. the pleasure

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of

* I am very confident, that in various situations the attaching to every regiment one large tent, and allowing the materials for the nitrous fumigation, would materially benefit the service. Vide first Memoir.

of seeing the fumigation succeed a second time, under the very unfavourable circumstances of *bad weather*, and direct communication with the said transport, from on board of which twenty-two sick convicts have been received, and placed under my care at Langstone harbour. I believe if we had not received the said twenty-two men, that we should not at present have a single sick man among the convicts.

I am, &c.

(Signed) SAMUEL HILL.

Dr. Johnston.

Queen Street, Portsea, January 13, 1799.

DEAR SIR,

HEREWITH I have the honour of forwarding to you some remarks I have made on the effects, very happy effects, of the nitrous acid fumigation, in stopping the progress of a contagious fever on board the hulks in Langstone harbour; and I am happy to convey to you my decided opinion in its favour; an opinion, not hastily formed, but founded on facts, which occurred on trying that excellent method of preventing, and lessening some of the miseries of our fellow-creatures.

I will esteem it a particular favour, if you will peruse the inclosed letter, and forward it to Dr. Smyth.

I remain, dear Sir, &c.

(Signed) SAMUEL HILL.

Dr. Johnston.

Portsea,

Portsea, January 13, 1799.

SIR,

HAVING with great pleasure perused your publication on the fever, which prevailed among the Spanish prisoners of war at Winchester, and also, your account of the success attending the nitrous fumigation, in destroying contagion on board the Union hospital ship, and on board a squadron of Russian ships of war at the Nore; I determined to try its effects on board the hulks in Langstone harbour, near this town, the first opportunity that might offer.

A fever of a contagious nature made its appearance on board the said hulks, in the month of July 1798, which soon became alarming, not from the number of sick only, but from the rapidity with which it advanced to its last, or fatal stage. The number of patients continued increasing from the 6th of July, to the 29th of August; in the former month sixteen were received, in the latter sixty-six. Upon my representing to Mr. Dyne, contractor for the care of convicts on board the said hulks, that I thought great benefit would ensue, if the method of fumigating recommended by you, was put in practice at Langstone harbour, he with a liberal hand supplied the concentrated vitriolic acid and nitre, and humanely ordered that no expense might be spared in attempting to stop the progress of the fever.

Pipkins, &c. were procured here without loss of time, and we began fumigating on board the Sincerity hospital ship, on the 29th of August, 1798, at which time it contained fifteen very ill of fever, fifteen recovering from fever, (and three of other complaints left in July) thirty-one had returned to
the

the prison cured, and five had paid the debt of nature.

It was with extreme pleasure I observed the effects of the vapour on many of the fever patients. I will state them on one, which, with little variation, will serve for the rest.

Daniel Stowell, aged twenty-seven, was received into the hospital-ship on the 21st of August, where he had continued getting worse till the commencement of the fumigation; he was then in the following state. A most severe and confused pain in his head, with intense heat on the skin, and insatiable thirst; tongue rough and extremely dry, appearing like a burnt crust, and of a blackish colour, inability to put it out of the mouth when desired; teeth and gums covered with the same kind of fur as the tongue. Pulse one hundred and thirty-one, small and weak. The vapour made him cough very much, and he requested (his own words) *to be smoked no more*; it was, however, repeated three times this day. August 30, Pulse one hundred and one, and stronger, some moisture on his tongue and gums, heat on the skin greatly decreased; head-ach much the same; thirst not so intense: fumigated three times this day. Thirty-first, He was in every respect better; continued the fumigation three times. September 1st, Pulse seventy-nine, and still stronger than the two preceding days; other symptoms much relieved: continued the fumigation. Second, Pulse sixty-eight, strong and regular; his appetite permitted him to take more nourishment than he had been able to do since his illness: from this day to the ninth, he continued getting better, and I now considered him in a state of convalescence.

It is proper here to remark, that this man had an ulcer on his right leg, extending from the outer
 ankle

anle across the anterior part of the tibia to the gastrocnemius muscle, at which part it was four inches broad and very deep, and discharged a thick ill-conditioned matter, which was very offensive. Its length was rather more than six inches. After some days fumigating, I observed a change for the better in the appearance of the ulcer, and as I had tried a variety of methods to heal it, for many months before he became ill of the fever, without producing any good effect; I laid this change to the effects of the vapour. I now directed it to the ulcer itself, and continued its use till October the 30th, when his ulcer was cicatrised; and I verily believe, to its efficacy is owing this poor man's cure. He is gone to New South Wales in the Hillsborough, which sailed just before Christmas last; I saw him the day before he embarked on board her, and the cicatrix was very firm: the ulcer was the consequence of an old gun-shot wound.

There is another case of ulcer which I think has mended greatly since I fumigated it; I am proceeding as in the former case, and I have great reason to believe it will ultimately prove successful. The only dressings used during the fumigation, or more correctly speaking, after the commencement of the fumigation, were dry lint and ung. resin. flav. over which was laid a rag of linen, constantly kept wet with aqua lytharg. acetat. diluted with water.

Finding such beneficial effects from the fumigation on board the hospital ship, in bringing the fever sooner to a conclusion, by shortening all its stages, I determined to apply it to the source of the contagion; and accordingly the prison-hulks, la Fortune and Ceres were fumigated every night from October the 15th to November the 20th, (except two nights, the servant who was sent for the acid to town (Port-sea)

fea) having staid the first night at a public house, and did not arrive in time to fumigate the next night,) and I had the pleasure of finding the sick reduced to eight; and seven days had elapsed, and not one patient had been sent to the hospital-ship. The fumigation was now discontinued.

November the 21st, eight men were received from the Hillsborough Botany Bay ship, one of which number was in the last stage of a contagious fever, and two laboured under dysentery. Several patients in a state of recovery caught the new contagion, and many attendants were taken ill with the diarrhoea and dysentery; and as it was impossible to prevent communication with the prison-hulks, the prisoners again became sickly, and many died; some of whom were not ill three days before that awful event took place; and one man in particular died delirious twelve hours after he was received into the hospital-ship.

The fumigation, which I considered as the anchor of hope, was again resorted to November the 26th, and continued to the present time, January * 13th, 1799; and it is with superlative satisfaction I add, that there has not been a patient received for the last eighteen days, neither is there a single fever patient in the hospital.

It is not my intention, neither is it necessary, to trouble you with a detail of my method of treating this fever; what I have to say relating only to the happy effects of the fumigation, and it is with peculiar pleasure I assert, that the progress of the fever

* Dr. Smyth will be pleased to add three days more to the time which had elapsed on Sunday last (the 13th) without having received any patient whatever from the hulks into our hospital-ship — Postscript of a Letter to Dr. Johnston, dated the 16th of January.

ver has been *twice* completely arrested by perseverance in its use; it may, however, be necessary and proper to say a few words on its first introduction, and on its fatal effects on many who were its victims; I will, therefore, relate the case of one patient, which will shew incontestably the nature of the disease.

The first person taken ill, was John Smith, a convict, who had been sent from Newgate a short time before. He informed me, July 6th, 1798, the day he was received on board the hospital-ship, that he had been ill of a fever in Newgate, and had not recovered his strength when he was sent to the hulks, at Langstone harbour. The convicts having been remarkably healthy, previous to the reception of this man, and becoming very sickly immediately after his admission, I considered the fever as introduced by him. He complained this day, (July 6) of head-ach; pains in his back, loins, and extremities; his skin was very hot and thirst great; tongue covered with a yellowish mucus; countenance of a yellow tinge, and great dejection of spirits; pulse ninety-six, and weak. Seventh, All his symptoms seemed aggravated, his pulse one hundred and seventeen. Eighth, He was delirious, and required, at least, two attendants to keep him in his cradle; pulse one hundred and forty. Ninth, He was covered with myriads of petechiæ, and became extremely offensive: I was now unable to reckon his pulse. Tenth and Eleventh, His petechiæ had run into each other so as to form large blotches. Twelfth, There was a great discharge from his nose and ears, of a very dark colour and very thin. Thirteen and fourteen, The stench from him was offensive in the extreme. On the fifteenth, he died universally convulsed.

The

The annexed table will shew the numbers taken ill before and after the commencement of the fumigation. The ninth and tenth of November were the days on which it was omitted, and it is remarkable, that although on the former day no patient had been sent to the hospital, on the two succeeding days seven were brought each day.

I have not, Sir, the honour of being known to you; but liberality and love of truth induce me to forward to you the above particulars, which I hope will be received as a token of that esteem and regard with which

I am, Sir,

Your most obedient humble servant,

SAMUEL HILL.

Dr. Carmichael Smyth.

N. B. There were 748 convicts on board the two hulks on the 6th of July, 1798, of those, 418 were received into the hospital with the jail-fever, besides 24 from on board the Hillsborough. Total 442, of whom 71 died of the distemper.

A Monthly

The READER is requested to examine these TABLES with Attention, as they afford, perhaps, the most complete Evidence, of a Medical Fact, that ever was presented to the Public.

Office for sick and wounded Seamen, &c.

A Weekly progressive State of the Sickness and Mortality among the Spanish Prisoners, confined in the King's House, at Winchester, from the first Appearance of the Jail Distemper, until the 8th of July, 1780.

Date of Weekly Accounts.	Number of Spanish Prisoners.		
	In Custody.	Sick.	Dead.
March 26, 1780	1247	60	1
April - 2, —	1243	106	4
— 9, —	1475	150	10
— 16, —	1457	172	18
— 23, —	1433	142	21
— 30, —	1412	171	21
May - 7, —	1388	191	25
— 14, —	1351	197	27
— 21, —	1523	205	30
— 28, —	1494	226	31
* June - 3, —	1461	262	33
— 10, —	1437	212	25
— 17, —	1426	173	9
— 24, —	1420	167	5
July - 1, —	1414	143	5
— 8, —	1433	122	2

* The time of Dr. Carmichael Smyth's going to Winchester.

A Weekly Return of the Patients in Forton Hospital, &c. from the 16th of October to the 26th of December, 1796. By D. PATERSON, Esq. Surgeon to the Hospital.

Before the Nitrous Vapour was used.				After the Nitrous Vapour was used.			
Weeks	Highest Number in the Hospital	Number discharged	Number dead	Weeks	Highest Number in the Hospital	Number discharged	Number dead
1	223	2	8	1	340	27	6
2	372	4	21	2	332	7	5
3	371	0	13	3	342	11	8
4	369	1	9	4	340	8	4
				5	486	12	1
				6	539	63	5
						128	29

A Return of the Attendants on the Hospital, or Persons belonging to the Ship's Company of the Union, who were attacked with the Contagious Fever, from the 3d of September, 1795, to the 10th of February, 1796.
(Signed) A. BASSAN, Surgeon of the Ship.

Before the Nitrous Vapour was used.			
Quality	When seized	Recovered	Dead
Nurse	Sept. 6	—	—
—	7	—	—
—	9	—	—
—	11	—	—
S ^t 1st Mate	15	—	—
Nurse	18	—	—
—	20	—	—
Helper	22	—	—
Nurse	24	—	—
Marine	29	—	—
Washer-w.	Oct. 6	—	—
S ^t 1st Mate	6	—	—
Nurse	8	—	—
Ab.	8	—	—
Nurse	14	—	—
2d S ^t Mate	22	—	—
Ab.	22	—	—
Marine	22	—	—
Nurse	Nov. 2	—	—
Washer-w.	4	—	—
Marine	4	—	—
—	10	—	—
Ab.	10	—	—
—	17	—	—
—	17	—	—
Marines	18	—	—
S ^t Marines	18	—	—
Ab.	20	—	—
Marine	20	—	—
Washer-w.	24	—	—
Total	30	23	8

After the Nitrous Vapour was used.			
Quality	When seized	Recovered	Dead
Nurse	Dec. 25	{ Recov. in a few days	—
Marine	26	—	—
Total	2	1	1

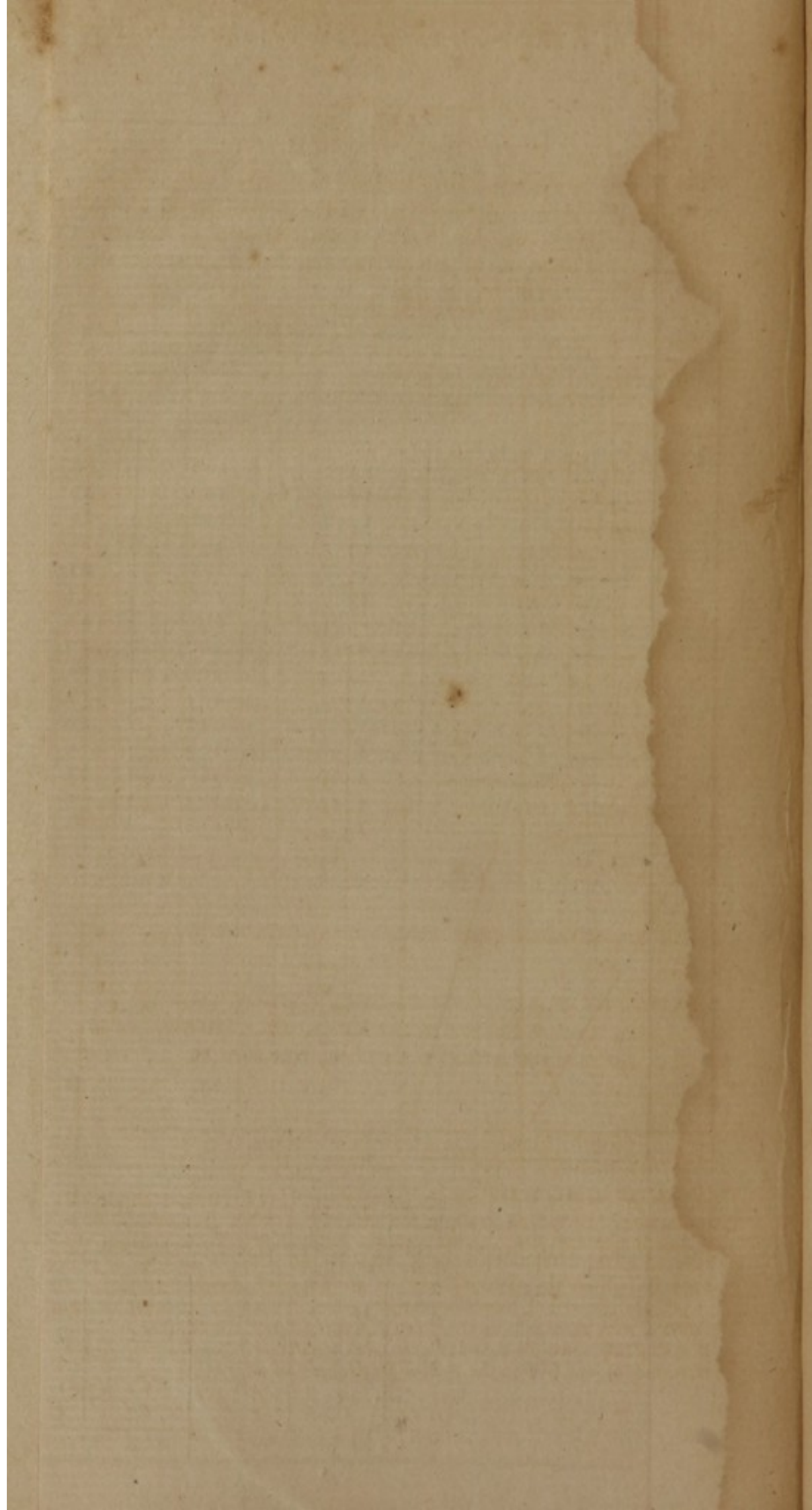
N. B. On the 26th of November the ship was fumigated for the first time, and the fumigation repeated twice a day till the 17th of December; from that time to the 26th of December, only once; but from the 26th of December to the 10th of February, twice a day, as at first.

A Monthly and Daily RETURN of the CONVICTS attacked with the Jail-Fever on board the Hulks, and received into the Sincerity Hospital Ship in Langstone Harbour, from the 6th July to the 26th Dec. 1798. By S. HILL, Surgeon to the Hospital.

Month	Days	Numbr	Month	Days	Numbr	Month	Days	Numbr
July	—	15	Oct.	16	3	Nov.	1	1
Aug.	—	66	—	17	2	—	2	1
Sept.	—	120	—	18	1	—	3	—
Oct.	1	5	—	19	2	—	4	1
—	2	3	—	20	3	—	5	—
—	3	7	—	21	4	—	6	5
—	4	11	—	22	3	—	7	1
—	5	3	—	23	1	—	8	3
—	6	7	—	24	3	—	9	2
—	7	3	—	25	2	—	10	7
—	8	4	—	26	1	—	11	7
—	9	2	—	27	2	—	12	3
—	10	2	—	28	1	—	13	1
—	11	6	—	29	1	—	14	2
—	12	8	—	30	0	—	15	1
—	13	3	—	31	1	—	16	3
—	14	5	—	—	—	—	17	2
* 15	9	—	—	—	—	—	18	2
—	—	—	—	—	—	—	19	H 6
—	—	—	—	—	—	—	20	2
—	—	—	—	—	—	—	21	2
—	—	—	—	—	—	—	22	3
—	—	—	—	—	—	—	23	2
—	—	—	—	—	—	—	24	1
—	—	—	—	—	—	—	25	1
—	—	—	—	—	—	—	26	2
—	—	—	—	—	—	—	27	3
—	—	—	—	—	—	—	28	2
—	—	—	—	—	—	—	29	2
—	—	—	—	—	—	—	30	H 3
—	—	—	—	—	—	—	31	—
To the 16 th		77	To 31 st		30	50		64

* On the evening of the 13th of October we began to fumigate the hulks, and continued to do so every day to the 20th of November, (the 9th and 10th of this month excepted); on the 20th, the fumigation was discontinued, but resumed on the 26th, and continued without interruption to the 13th of January, 1799, though on the 26th of December the sickness had entirely ceased.

[H] On the 21st of November, eight persons ill with the jail-fever, or dysentery, were received into the hospital, from on board the Hillsborough Botany-bay ship, outward-bound; eleven more were received on the 30th of the same month, and five on the 19th of December: in all, twenty-four.



A Monthly and Daily RETURN of the CONVICTS attacked with the Jail-Fever on board the Hulks, and received into the *Sincerity* Hospital Ship in Langstone Harbour, from the 6th July to the 26th Dec. 1798. By S. HILL, Surgeon to the Hospital.

Months	Days	Numbr	Month	Days	Numbr	Month	Days	Numbr	Month	Days	Numbr
July	—	16	Oct.	16	3	Nov.	1	1	Dec.	1	3
Aug.	—	66		17	2		2	1		2	2
Sept.	—	120		18	1		3	—		3	3
Oct.	1	5		19	2		4	1		4	5
	2	3		20	3		5	—		5	—
	3	7		21	4		6	3		6	5
	4	11		22	3		7	1		7	4
	5	3		23	1		8	1		8	3
	6	7		24	3		9	—		9	2
	7	3		25	2		10	7		10	2
	8	4		26	1		11	7		11	3
	9	2		27	2		12	3		12	2
	10	2		28	1		13	1		13	1
	11	6		29	1		14	—		14	2
	12	8		30	0		15	—		15	1
	13	3		31	1		16	—		16	3
	14	5					17	—		17	2
	*15	9					18	—		18	2
							19	—		19 ^H	6
							*20	—		20	2
							21 ^H	—		21	2
							22	—		22	3
							23	1		23	2
							24	7		24	1
							25	4		25	1
							*26	2		26	2
							27	3			
							28	2			
							29	2			
							30 ^H	3			
To the 16 th 77			To 31 st 30			50			64		

* On the evening of the 15th of October we began to fumigate the hulks, and continued to do so every day to the 20th of November, (the 9th and 10th of this month excepted;) on the 20th, the fumigation was discontinued, but resumed on the 26th, and continued without interruption to the 13th of Jan. 1799, though on the 26th of December the sickness had entirely ceased.

[H] On the 21st of November, eight persons ill with the jail-fever, or dysentery, were received into the hospital, from on board the Hillsborough Botany-bay ship, outward-bound; eleven more were received on the 30th of the same month, and five on the 19th of December: in all, twenty-four.

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SIR,

Forton Hospital, Jan. 17, 1799.

SIR,

A friend of mine having informed me that you were preparing for the press some additional experiments to prove the utility of the nitrous acid fumigation, in destroying contagion, I take the liberty of submitting to your notice some facts which have occurred to me on this subject. If you will honour them with a perusal, and think them of sufficient importance, I shall feel myself highly flattered, should they, through your sanction, become more publicly known.

From the 4th to the 12th of April, 1797, we were employed at this hospital in receiving prisoners infected with the jail-fever. These men had recently arrived in some transports from Wales: They formed part of a new regiment who had landed there, and who, previous to their sailing from Brest, had been released from various prisons in France.

This fever was generally attended with petechiæ, and, in some cases, the parotids were affected. From these symptoms, and from its being highly contagious, it was thought immediately necessary to fumigate with the nitrous acid in greater quantity than we had hitherto done, and, instead of *three* fumigating pipkins in each ward, we increased them to *six*. This method appeared to have a very desirable effect, for by filling a fever-ward with the vapour to such a degree that the smallest part of it could not escape the influence of the nitrous gas, we never failed to render the air of that ward sweet and refreshing for some hours. Here I must beg leave to remark, notwithstanding the prejudices that are abroad, that I never remember the vapour having appeared too powerful for any fever-patient to bear, and although phthically inclined myself I could always

ways bear it without inconvenience. If, however, some inconvenience should occur, I conceive it only a secondary object of consideration, when compared with the good effects to be derived from the fumigation, in checking contagion.

The increased demand for the nitrous vapour, from the number of wards occupied in the hospital, occasioned the consumption of nearly three pints of the concentrated vitriolic acid, and a proportionate quantity of the purified nitre, each day. The expense of so increased a consumption, if an object, is certainly over-balanced by the considerable advantages resulting from its use; for, notwithstanding fresh contagion was every day brought into the hospital till the month of July, by means of prisoners received from the prison-ships, we had the satisfaction to see the malignity of the fever subdued; and by the unremitted attention of the physicians of the royal hospital at Haslar, with a due observance of cleanliness, we were authorised early in the month of August, to report to the commissioners for sick and wounded seamen, that the jail fever which lately raged among the French prisoners at this port, existed no longer. The prisoners then, in proportion to their number, enjoyed an usual share of health, and which, previous to the introduction of the jail-fever, had been equal to the state of health of any number of working men in the manufacturing towns of England.

During the continuance of the jail-fever, *very few* of the establishment of the hospital caught the distemper, considering the length of time it prevailed at Forton. Those who received the contagion first, and were fond of drinking, either died, or had a very severe illness. Others, not so partial to liquor,
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and who received the infection later, in general recovered.

No putrid disease of any consequence made its appearance again in the hospital until the 3d of January, 1798, when we received some prisoners from his Majesty's prison-ships, *Fame* and *Portland*. These men, who had lately arrived in a transport from Falmouth, were affected with jail-fever; and on many of them petechiæ appeared. I immediately acquainted the commissioners for sick and wounded seamen of the circumstance, who gave orders to the physicians of Haslar hospital to visit Forton, and report to them accordingly.

At this time the government of France had agreed to victual, clothe, and attend in sickness, their own prisoners. The sub-contractor in the medical department did not, however, take charge of the hospital at Forton, till the 11th of February following. We had, previous to that time, an opportunity of fumigating with the nitrous acid with apparent good effect. The business of the hospital from that time, came under the guidance of the French, but although they had two hundred and eighty-two patients put under their care, and upwards of one hundred of them affected with putrid fever, the acid vapour was totally discontinued for near five months. The state of the hospital, from the 11th of February, was highly alarming, and extremely unfavourable to the health of the prisoners; the number on the hospital books increased daily, the wards were so neglected that they soon appeared dirty, and had an offensive smell; the œconomy of the buildings was not at all studied for the advantage of the sick; fever and convalescent patients were not separated, and in the course of twenty weeks two hundred and thirty-five prisoners died,
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five hundred and thirty-seven remained sick in the hospital; and the jail-fever was raging with great violence.

On the 20th of May, Dr. Forzy, and Mr. Brunet, Surgeon, arrived here from France, who were appointed by the French government, inspectors over their sick and wounded prisoners in England. These gentlemen were placed at this depôt to see that justice was done to the French prisoners. As they were versed in the management of hospitals, they soon perceived the great inattention that had been paid to the sick; and the irregular manner in which the duty of the hospital was carried on. They soon convinced Mr. Vochez of this situation of the sick prisoners, who lost no time in breaking the contract, and putting the management of the hospital into other hands, thinking it preferable to subject himself to the penalties of the law, than that one helpless prisoner should suffer by the hand of insatiable avidity and unfeeling neglect; a transaction highly honourable to Mr. Vochez, and the memory of which should always remain strongly impressed on the minds of those who were, or might be benefited by it.

On the 1st day of July, Dr. Forzy and Mr. Brunet commenced the management of this hospital in the medical department. Their chief object was to put the buildings into a general state of cleanliness, and to fumigate the wards of the hospital with the nitrous acid. For this purpose Mr. Vochez very liberally purchased all that remained in the English store, and likewise sent down from London a large quantity of the concentrated vitriolic acid and purified nitre. The acid vapour, together with the new system of cleanliness, at the expiration of even so short a period as seven days, caused a very sensible change

bour. I imagine that the typhus fever was introduced into the ship by women, two of whom I sent on shore as soon as I discovered, one with a scarlet eruption, and certain degree of fætor—Both Dr. Lind and Dr. Hope, are of opinion, the fever was of a very dangerous and infectious nature, and from Dr. Hope's opinion, I was more particularly led to be very attentive in removing the sick early to the hospital, but the nitrous vapour was scarcely used two days, when the symptoms abated, and has now entirely ceased.

The method I used, was by holding the pipkins under the hammocks of those with feverish symptoms, and at night, eight were carried about the decks, when all the hammocks and people were below, and this was attended with very little inconvenience to those in health. I have also used the nitrous vapour in the manner mentioned by Mr. Pater-son for ulcers and foul sores, and I think, with obvious good effect, at least the patients themselves acknowledged it. I in general have a pot in fumigation, when I visit the sick in the cock-pit, which I really think, independent of the utility of applying sores over it, tends to purify the air and dispel fætor, its smoke is particularly pleasant to me, and I often have it in my cabin, when the sick are below. I shall be happy if these cursory observations appear to you at all satisfactory.

And I ever am,

Your obedient servant and friend,

JAMES GLEGG.

J. Johnston, Esq.

Norman

Norman Cross, August 8, 1798.

DEAR SIR,

AGREEABLY to the wish you expressed, of being informed of any observations I might happen to make on the effects of the nitrous acid fumigation, in checking or destroying contagion; I have for a considerable time past, carefully attended to the consideration of that subject, especially since I read Mr. Paterfon's ingenious letter addressed to the Commissioners of the Sick and Wounded Board: and although I have not been able to draw similar conclusions, with respect to its beneficial effects on patients afflicted with ulcers, it is because I was less observant and attentive perhaps, to that point, not having perused this gentleman's publication previous to my adopting a more successful mode of treating ulcers, I hope than is generally practised or known.

Whether the nitrous vapour has peculiar specific powers for destroying contagion, is difficult to say. I have constantly fumigated the hospital wards three times a week, sometimes oftener, and I have strong reason to believe that the nitrous acid fumigation not only tends to prevent the spreading of contagion; but answers other salutary purposes.

Among the various trials I had occasion to make with the intent of ascertaining its effects on putrid effluvia, a circumstance occurred worthy of notice. The water closet adjoining the agent's office, became in the very hot weather of June and July last, so extremely offensive, that Mr. Perrot and his clerks complained, that unless the fautor was in some degree removed or mitigated, it would be impossible to continue much longer in the apartment. It is a room of twelve feet square: I ordered three pipkins in, and proceeded to fumigate for an hour, filling the place completely with the nitrous vapour. During

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this period, the door was unavoidably opened several times; but the agent, two clerks, and myself, continued there the whole time. It at first caused a little coughing; but in a few minutes that irritation ceased, and the vapour became rather grateful than otherwise. At the end of forty-five minutes, Mr. Gardner one of the clerks, declared he had felt for some time, an unusual sensation of hunger, which at the conclusion was extremely importunate, and he that day ate, as he expressed himself, voraciously. Mr. Richards the other clerk, felt nearly similar effects, though not so much exposed to the vapour as the former, who kept stirring one of the pipkins frequently. As I did not feel sensations of a similar nature at the time, I paid little attention to their observations; but on returning home, somewhat better than an hour after, my stomach became equally importunate and craving for food, in so much so, that it was with the utmost difficulty I could refrain till the usual hour of dining; and I may venture to say, that I ate nearly twice my ordinary quantity on that day.

Ten days after this I had the wards more than usually fumigated, in which I remained till the expiration of the process, and I felt equally affected with hunger, but although a more than common degree of flatulency attended it. I ought to mention that the agent's apartment was rendered perfectly sweet and pleasant, the fætor being wholly removed or destroyed. Mr. Perrot was so sensible of the change, that he requested some days after, to have the fumigation repeated, because the smell had again become offensive.

Do not these facts evince the propriety of diffusing the nitrous vapour copiously in the convalescent wards, where loss of appetite, and want of tone in
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the digestive organs, often retard the perfect restoration of health?

Another circumstance well deserving our regard; with respect to the effect of the nitrous fumigation on contagion, occurred. Some time ago we had nearly forty patients in the Dutch hospital dangerously ill with typhus fever; old men who had been recently captured in the Greenland ships, and who laboured under great dejection of spirits. They were taken ill in the prisons, shortly after their arrival at Norman-Cross, and although we had a great many patients with slight complaints in the hospital, on the admission of those with typhus fever, yet not one of them, nor of the nurses, caught the disease.

This was not the case in the prisons, for several of the old standards there, were attacked with the fever. During the continuance of the disease, we were unremitting in our attention to fumigate the wards of the hospital daily, with the addition of several pipkins more than were commonly employed.

Are we not warranted then, in concluding that these prophylactic measures, prevented the contagion from spreading and infecting the patients in the hospital; whilst those in the prisons not having equal advantages, were attacked with the fever?

We were however fortunate enough to lose no more than one patient, who died on the seventh day in a highly putrid state; a clear proof of the malignant tendency, and contagious nature of the disorder.

I could enumerate a variety of other instances, where it appeared to me that the nitrous acid fumigation was attended with salutary effects; but what has been already said is, I hope, sufficient to shew that many benefits are likely to accrue from a more extensive use of this medicine; and that it ought almost

almost on every occasion, to have the preference to all other modes of fumigating, where contagion is prevalent.

It might certainly be used with much propriety and advantage in the sick births, and between decks, on board his Majesty's ships of war. It is true, where great moisture prevails, which is unavoidably the case in men of war, fires are absolutely necessary; after which the nitrous gas should be liberally diffused throughout the ship: but prejudice, which frequently warps the best understanding, prevents many from adopting salutary measures, because these means had not been originally suggested by themselves, or because they happen to militate against some preconceived and favourite opinion.

But before gentlemen decide on any remedy held out to the public in a fair and candid manner, they should first subject this remedy to actual experiment, and then determine for or against it, according to the unprejudiced result.

I do not pretend to say that the nitrous acid ought to supersede all other preventive remedies; on the contrary, ventilation and cleanliness must likewise be conjoined with it: but where contagious fever prevails, there is every reason to believe that these will prove the most effectual external means to subdue it.

I thought it my duty to say thus much in justice to the ingenious inventor of the nitrous acid fumigation.

I am, with the greatest respect,

Dear Sir,

Your very humble and

Obedient servant,

(Signed)

JAMES MAGENNIS.

Dr. Johnson.

Extract

Extract of a Letter from JOHN SNIPE, Esq. formerly Surgeon of the Sandwich, now Surgeon to the Naval Hospital at Yarmouth. Dated Yarmouth, June 17, 1798.

ON the 9th of March, when I joined the Sandwich, a contagious fever raged in that ship, there were daily ten, twelve, or fifteen men sent to the hospital with fever and ulcerated legs. You are already acquainted with the steps that were taken to subdue this. Our success I attribute to cleanliness, free ventilation, and the diffusing daily the nitrous gas through every part of the ship, and I am convinced, that had that ship been fumigated three or four times a week, with the nitrous vapour, no such fever would ever have been generated, notwithstanding the great number of men that were on board. Suffice it to say, that in three months, this ship was as healthy as any other of her class, although we never had less than 1000 and often 1500 men on board. During the last twelve weeks that she was in commission, I only sent eight men to the hospital. When I first joined her, the smallest scratch rapidly degenerated into a foul ulcer, but after the febrile contagion was subdued, sores healed as kindly as in any other ship.

About three weeks before she was paid off, an Italian cut one of the seamen in the thigh with his knife, the wound was about six inches long, and nearly two deep, it was stitched up, and a double-headed roller applied; it healed by the first intention, which was a proof that no contagion remained in the ship.

From some experiments I have made, I am induced to think that febrile contagion, and the general exhalations from the human body, are of an
alkaline

alkaline nature, and that the nitrous vapour equally subtile, penetrating into every crevice or corner, wherever it meets the former, destroys its pestiferous qualities, and renders it as inactive as a drop of water. I have repeatedly condensed the breath and perspiration of patients in typhus fever, and upon adding an acid to it, an effervescence was visible: the method I took to obtain a sufficient quantity of liquid for the experiment, was to make the patients breathe on cold panes of glass, and to put the same under the bed-clothes, close to the skin, when in a state of perspiration; in this way half an ounce may be procured in a short time.

Fumigating with the nitrous vapour cannot be too strongly recommended on board of all ships, in barracks, hospitals, prisons, close cellars, and houses that are not constantly inhabited. Some time ago I had occasion to go to a store room, that had not been looked into for three weeks or a month, it contained the bedding used by the Dutch prisoners before they were sent to Holland, the whole of which had been fumigated, exposed to the sun for two days, afterwards washed and perfectly dried before they were put in store; yet the room smelled very badly. I immediately ordered it to be fumigated with six pipkins, and next morning it smelled perfectly sweet: for which reason I have, and mean to fumigate all the store-rooms, every week.

Last winter I tried the nitrous vapour with some of the worst ulcers that perhaps were ever seen in any country; the pipkins were placed under the naked sores. It gave some pain, and I could not observe any good effects from it, but I beg leave to observe that this was not the fault of the remedy, but the untractable nature of the disease, for in many cases, no internal medicine, nor external application, had

had the least effect, amputation alone saved the patient's life. I mentioned this in a letter to Dr. Blane, at the time, but since then, I have found it of essential service in cleaning foul ulcers, buboes, and stumps; and I do not hesitate to give it as my opinion, that if it is properly applied in time, it will be found to be of more service than most of the external applications that are at present used. You are well aware that in many cases, we have to lament the failure of every exertion.

It is with heartfelt pleasure I say, that I have lost very few in fevers, since I have been at Yarmouth, although we have received a great number in the low typhus fever into the hospital; nor is there one instance of the contagion being communicated to the surrounding patients, which I attribute to the nitrous gas, cleanliness and free ventilation.

When the wards were filled with the nitrous vapour, patients who had weak lungs, coughed violently at first, but they breathed more freely afterwards, especially if the atmosphere was thick and heavy, but I never observed any bad effects from it, even with patients in the last stage of consumption. The nitrous vapour has a most astonishing effect in correcting the factor in the wards, arising from extensive bad ulcers: this alone is a great comfort both to the patients and attendants. I have so high an opinion of the nitrous vapour for destroying contagion, and as a corrector of foul air, that I have in the strongest manner recommended the use of it to several of my friends, in the different factories in the Mediterranean.

There are many navy surgeons prejudiced against the nitrous fumigation, besides it gives some trouble, which will at all times operate powerfully with the indolent.

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Much praise is due to the ingenious author of the nitrous vapour. I have not the honour of his acquaintance, nor did I ever read a word he wrote (for which I blush) on the subject, but I should be wanting in candour if I did not faithfully relate facts as I found them; and in my opinion, the nitrous vapour tends greatly to destroy contagion, and is a most powerful corrector of foul air. Query, Whether or not does it give an additional quantity of oxygen (*pabulum vitæ*) to the surrounding atmosphere, where it is diffused.

I do not expect to have fewer patients in the hospital than we have at present: there are fifty-three ships of war employed in the North Sea, and they never go to Sheerness but when in want of repairs. When the fleet comes in, I expect to get fifty or sixty fresh patients, and they are weekly sending in sick by the frigates and cutters. There are only two men in the hospital that were wounded in Lord Duncan's action, and the bad ulcers that were received last winter are mostly gone, yet the number is still kept up. There are more cases of ulcer received into this hospital, in proportion, than into the two royal hospitals, ulcers as well as pectoral complaints being more frequent in the North Sea, than in the Channel. I have also remarked that those who had the most obstinate ulcers had been for some years during the war in the East or West Indies, or in the Mediterranean.

I have an ample field here for observation, but little time to put my observations on paper, as between the hospital, sick quarters, and prison, I am kept constantly employed.

(Signed)

JOHN SNIPE.

Dr. Johnston.

Extract

Extract of a Letter from I. Blatherwick, Esq. Surgeon. Dated Farham, June 17, 1798.

SIR,

NOT having taken minutes of any observations I may have forwarded to you on the subject of the nitrous vapour, I am not enabled to state with the precision I could wish, the particulars relating thereto.—At the time we began to use the nitrous vapour as a fumigation, our hospitals were free from any contagious disease, and on the whole, as healthy as I ever knew them. But we never had so long a continuance of that healthy state, as while this vapour was used in the hospital; and it deserves notice, that soon after it was discontinued, under the French administration, the typhus fever again made its appearance with considerable severity. No instance, to the best of my recollection, has occurred of that disease being communicated either to nurse or patient, whilst the nitrous fumigation was employed; whereas many instances occurred from time to time, previous to its use. The difference on entering a surgery ward, after using the fumigation, is more remarkable than any other, as it deprives those wards of the smell peculiar to them. I have also remarked, that fewer patients, with extensive ulcers, whilst this was used, became hectic, than formerly. In regard to consumptive patients, I am not at present qualified to speak decidedly from any proofs I recollect of its effects, but judging from analogy, I am induced to believe that patients of this description are as likely to receive relief (in so far at least as the nature of the complaint admits) as patients in any other disease; for whatever dislodges from the air, or corrects the noxious particles accumulated from the effluvia of diseased bodies, must mitigate the symptoms of this

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disease.

disease. No arguments I am master of can induce the French surgeons to adopt it; they complain of its exciting cough, and injuring the catarrhal complaints. They content themselves with burning a few pounds of juniper berries, daily in each hospital, notwithstanding the effect of the discontinuance of the former practice, has been evident enough to convince any unprejudiced person which deserves the preference. On the whole, I infer, that the *nitrous vapour* is possessed of strong antiseptic qualities—is capable of being administered in every disease—can be procured with facility in all places—requires no extra information in the operator; and, in short, is the best fumigation I am acquainted with, to be employed where the patients remain in the wards.

(Signed)

I. BLATHERWICK,
Superintendant, &c.

James Johnston, Esq.

Letter from Captain Lane, of the Navy. Dated Plymouth, June 19, 1798.

SIR,

HAVING been particularly engaged with the Admiral for some days past, I have not been able to answer your letter before, otherwise I should not have been so tardy in expressing the satisfaction I feel, in offering my testimony of the apparent advantages derived from fumigating with the nitrous acid, in checking at least, if not in stopping contagion. Had I supposed that the smallest doubt remained on the subject,

subject, I should have kept a very minute account of every experiment, but as I conceived the thing to have been uncontrovertibly proved before, I satisfied myself with having recourse to it, whenever there was any appearance of occasion for so doing, and I can with safety say, without ever having been disappointed. On receipt of your letter, I immediately sent it to Mr. Harris, who has returned it to me, and who I find is exactly in the same predicament as myself, having been prevented making any particular remarks, by entertaining the same opinion of its efficacy as I had, and having been equally satisfied with the result of his experiments.

With regard to the comparative degree of sickness between the prisons and ships, I must refer you to the weekly returns. I can however say, that when I first obtained Dr. Smyth's fumigating materials for the latter, a typhus fever was raging on board the *Prudent*, which in Mr. Harris's opinion, was so far alarming as to induce me to remove the people from her for a few days, during which time I had her twice fumigated and the decks white-washed, after which, the same prisoners were returned to her, and she has since been as healthy as the other ships. When it is considered how hot the weather has been, and that I have at times been obliged to put as many as 600 prisoners in the sixty-fours, I am induced to attribute the preservation of their health, to the effect of the fumigation, which regularly takes place every Thursday morning in all the ships when the weather permits, having long since established a signal to ensure its never being neglected in any of them. With respect to the prison and hospital, I am informed by Mr. Harris that whilst he had the materials for the nitrous fumigation, it was made use of when wanted, and always with the desired effect, but on
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the French government taking charge of the sick, the fumigating materials were returned to the Royal hospitals along with the other stores.

Sorry I am indeed not to have it in my power to be more particular, for nothing can be more satisfactorily proved in my mind, than the efficacy of Dr. Smyth's means of checking, if not of destroying contagion, and I cannot but congratulate that gentleman on a discovery which I certainly consider as highly beneficial to mankind, as it must be grateful to his feelings.

(Signed) CHA. HEN. LANE.

James Johnston, Esq.

*Extract of a Letter from Alexander Brown, Esq.
Surgeon of the Royal Sovereign. Dated Torbay,
May 27, 1798.*

As a fumigation for a sick room, I consider the *nitrous vapour* as an elegant, ingenious, and useful one. In the morning whilst dressing the sores, two pots are employed for fumigating them, the smoke or vaporous gas evidently sweetens the air, and I do not observe that any particular irritation of the lungs is excited; I have two patients labouring under phthisis pulmonalis, they are commonly placed near to the persons fumigating. I do not find that they cough more than usual, unless they hold their heads over the fumigating vessel. I commonly fumigate the sick birth every night, and the people who sleep there, say the place feels wholesomer than
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it does when not fumigated. As for its producing contagion, I have no reason to believe it does, at least I have never as yet found correctors or sweeteners of foul air, have that effect.

Some of my brethren here declare that there never was such a heavenly discovery for the cure of ulcers of all kinds, as the fumigation with the nitrous gas; and that it possesses a singular healing power (in all habits) which never fails; if so, I am singularly unfortunate. I have heard of Paterson's pamphlet sent to the Captains and Admirals; I am promised a reading of it; I shall then be able to judge how far I have administered the vapour with propriety.

(Signed)

ALEX. BROWN.

Dr. James Johnston.

*Extract of a Letter from John Drew, Esq. Surgeon,
dated London, the 17th of June 1798.*

Allow me to lay before you the following observation on the salutary effects of the nitro-vitriolic fumes, of which I was an eye-witness, whilst Surgeon of his Majesty's ship l'Unité. The ship was in general unhealthy, but there were two men in particular ill of putrid fevers, who lay on the lower deck; by constantly fumigating under their hammocks, I found the disease so much checked in its progress as not to extend to any other part of the ship's company.

(Signed)

JOHN DREW.

Dr. Johnston.

Extracts

EXTRACTS

FROM THE
LETTERS OR JOURNALS

OF

SURGEONS OF THE NAVY,

(On the Subject of the Nitrous Fumigation;)

TRANSMITTED TO

DR. CARMICHAEL SMYTH,

BY ORDER OF THE

BOARD FOR SICK AND WOUNDED SAILORS.

*Extract from the Weekly Return of Mr. George
M'Grath, Surgeon of his Majesty's Ship Ruffel,
dated Oct. 26, 1796.*

Since we have had the Dutch prisoners on board I have found particular benefit from fumigating with the nitrous acid in purifying the foul air, and preventing contagious fevers, which otherwise would have originated from the uncleanness, and filthy indolent dispositions of those men.

Extract

Extract from the Journal of Mr. John Drew, Surgeon of his Majesty Ship, l'Unité, between the 22d of November, 1796, and the 28th of June, 1797.

All the intermittent fevers and aguish complaints mostly proceeded from the badness of the weather, and the lowness of, and dampness of the Unité, as the breathing of the people, and the wetness of the ship produced an infectious kind of air, which never failed to cause numbers to be taken ill, notwithstanding the use of stoves, and constant fumigation composed of vitriolic acid and nitre, which I found to be very useful, particularly in two cases of putrid fevers, as by constantly fumigating the place where they lay, the infection did not attack any more of the ship's company; the exhalations, I think would answer better if the fumigating pots were of another construction, which I refer to your determination.

Extract from the Journal of Mr. James Runcie, Surgeon of his Majesty's Sloop, l'Espiegle, between the 19th of February, 1797, and the 10th of February, 1798.

We had a great many scorbutic cases but they were so similar in symptoms and treatment that I have not thought it worth while to mention them; there were also a variety of febrile and other complaints, of which the above are the most considerable: the fever introduced by the French prisoners we had a great deal of difficulty in subduing, as the infection spread very fast among the people, owing to our being so much crowded, and the sick lying
among

among the ship's company, not having room in the brig for a sick birth; we, however, got at last clear of it, by persevering in smoking the vessel with sulphur and tobacco every time we went into port: we found the method of fumigating with nitrous acid peculiarly serviceable.

Extract from the Journal of Mr. Alexander Aberdour, Surgeon of his Majesty's Ship Alexander, between the 24th of July, 1797, and the 23d of February, 1798.

I would only here observe, that I have tried the fumigation with the nitrous acid upon coming from Gibraltar, when we had the fever, and apprehend that its progress was arrested by it.

Upon superintending the business, I was seized with a head-ache and slight degree of stupor; every one enveloped in the fumes was affected with coughing.

Extract from the Journal of James Farquhar, Surgeon of his Majesty's Ship Theseus, between the 25th of February and the 26th of May, 1797.

I ordered the sick birth to be regularly fumigated every morning and evening at the time we were dressing the ulcers, and found that the nitrous vapour not only purified the air, but in great measure destroyed the very foetid, and almost intolerable smell occasioned by the discharge from the ul-

cers ; the patients themselves likewise found it very refreshing.

I found myself frequently at a loss for want of a proper vessel to heat the sand in ; if one or two small iron pots were ordered to be sent on board with the fumigating materials, they would be found to be very useful.

Extract from the Weekly Return of Mr. Thomas Moffatt, Surgeon of his Majesty's Ship Triumph, June the 24th, 1798.

Since last return, the ulcers have been carefully fumigated morning and evening, and I am happy to add, with considerable success. They all look clean, and some have made a little progress in healing already ; the fever, which attended several, in a very great degree subsided after three or four days application.

The improvement of the smell in the sick birth is sensibly perceived by all.

Extract from the Journal of Mr. Robert Cinnamond, Surgeon of his Majesty's Ship Assistance, between the 9th of November, 1797, and the 5th of June, 1798.

The only diseases from which infection was to be dreaded were the fluxes, but from a proper attention to cleanliness, and a constant use of the fumigating medicines, I was happy to observe there was not one man during these last seven months who
suffered

suffered from contagion, their complaints being evidently produced either from exposing themselves to wet and cold, or drunkenness. From the small experience I have had of the fumigating medicines, I consider them of extreme great service.

Extract from the Weekly Return of Mr. James Roloff, Surgeon of his Majesty's Ship Galatea, dated the 5th of August, 1798.

I find the fumes of the* vitriolic acid of great service.

Extract from the Journal of Mr. Robert Sabine, Surgeon of his Majesty's Ship Melampus, between the 20th of August, 1797, and the 19th of August, 1798.

The ship in general has been very healthy, having had no bad fevers on board, which I attribute to fumigating with the vitriolic acid and nitre, (when the weather was so bad as not to allow the beds to be got up) which always took away the disagreeable smell there was between her decks, and by airing between her decks with stoves when they were wet.

Extract

* This gentleman meant the nitrous acid.

Extract of a Letter from Dr. Withering, of Birmingham, to Dr. Duncan, of Edinburgh, published in the third Volume of The Annals of Medicine.

It is but seldom we see much typhus at Birmingham. The use of the nitrous vapour, in every instance of its adoption, stopped the further progress of infection, so that I am persuaded we are much obliged to Dr. C. Smyth on this occasion.

*Two LETTERS addressed to Dr. PERCIVAL, of Manchester, originally published (by Order of the *BOARD OF HEALTH) in the Manchester Chronicle, and republished here, as containing a more full Explanation of the Author's Sentiments on the limited Sphere of Contagion, &c. than is to be met with any where else.*

London, July 7, 1796.

MY DEAR SIR,

I am now to acknowledge your obliging favour of the 17th of February last, to which I did not give an immediate answer, being engaged in the experiment on board the Union, which I undertook at the request of the Lords Commissioners of the Admiralty

** Manchester, August 3, 1796.*

“ That the thanks of this Board be given to Dr. J. Carmichael Smyth, for his letters, communicated by Dr. Percival, and that they be made public.”

Signed by order of the BOARD,

THOS. BELLOTT, *Secretary.*

Admiralty, and the result of which I was desirous to communicate to you, as the best and most satisfactory reply I could give to your letter. I desired Mr. Johnson to send you a copy of my pamphlet on that subject, as soon as it was printed. Although I have been prevented from writing to you till now, owing to a variety of engagements and business, which it is needless here to explain, I can assure you I have not been forgetful of the benevolent undertaking of your Board of Health, which reflects so much honour on the gentlemen engaged in it, and to which I shall be at all times happy to contribute any assistance in my power to give. The very limited sphere of contagion is so well ascertained, that I have occasion to say little on the subject. In my book on the jail-fever, I have mentioned, after many year's experience as physician to an Hospital, into which more typhus fevers were admitted in proportion than into any other, that the most highly contagious fevers, that occur in our hospitals, do not affect the patients in general, lodged in the same ward; for we had no appropriate fever wards; nor did I ever see the necessity for such, as the communication of infection was in general easily prevented by the means I employed. I have also mentioned, that there is no, or very trifling risk of contagious fevers being propagated in the open air, still less from one room or ward to another; and that I never knew contagion propagated by a dead body, even from the dissection of it, unless by inoculation. But, independently of all these observations, the fumigation with the nitrous acid, if properly employed, not only certainly destroys contagion, but improves greatly the atmospheric air, by supplying a quantity of dephlogisticated air, or oxygen gas; and it effectually

effectually destroys all offensive smell. I also, as you must have observed, use the diluted marine acid for washing the floors, bedsteads, &c. and put marine acid in the pails of water used for immersing the foul linen, &c. In bed-chambers and private apartments I generally keep up, where there is a contagious disease, a constant fumigation; which can easily be done by means of a lamp, over which is placed a china cup or saucer, with oil of vitriol and nitre, an ounce and a half or two ounces of each being sufficient for twenty-four hours. If you have any queries to put to me, I need hardly assure you, that I shall take a pleasure in answering them, and at all times of convincing you of the regard and esteem of, my dear Sir,

Your sincere friend,

J. CARMICHAEL SMYTH.

Dr. Percival.

London, August 1, 1796.

MY DEAR SIR,

I am this moment favoured with your letter of the 30th of July. I can have no objection to your making any use, public or private, of my letter to you. The accuracy of the facts I will be answerable for; but as it was a private communication to a particular friend, I was little attentive to style or manner. Respecting the limited sphere of contagion I said the less, as I considered it a matter so well ascertained, and by such a body of evidence, as required no additional proof. Mankind have been led into error, on this subject, by confounding

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ing under the general name of contagious or epidemic, diseases of very different natures and origin. But of all those contagions, that are propagated from one diseased person, or his clothes, to another person, the sphere of the deleterious power is in general so extremely limited, that there have been, and still are, some physicians, who believe they are only propagated by contact. At Winchester, during my stay there, one soldier only, whilst doing duty on the prisoners in the airing-ground, was seized with the distemper; and very few of the military suffered, although the guard-room was immediately under one of the prison-wards, and the sentinels mixed with the prisoners even in the courts and passages of the king's house or prison. And lately, on board the *Union*, none of the officers suffered, and few of the petty-officers; nor would the ship's company have suffered so severely as they did, could their intercourse with the nurses and assistants in the hospital have been prevented. But, independently of the limited sphere of contagion, I will venture to ensure even the nurses and hospital assistants, in any situation, if they will be induced to use the proper precautions, and if the hospital is properly fumigated; the wards sprinkled with diluted marine acid; the dirty linen, &c. immediately immersed in pails, filled with cold water impregnated with marine acid; the chamber-pots, soil-tubs, &c. quickly removed and washed with the same; the bedsteads washed every time they are empty with the diluted marine acid; and the bed-clothes fumigated with the nitrous vapour. In hospitals crowded with sick, in ships, prisons, &c. it is necessary to fumigate completely every part of the ship, prison, &c. twice a day. But in common cases, and in private practice, such means are not necessary;

necessary; and one, two, or three fumigating lamps, in which a constant fumigation is kept up, night and day, so as to pass over the beds of the sick, are perfectly sufficient. In this manner I have not only stopped the common contagion in the hospital and in private, but I have equally succeeded, which is of great consequence to be known, in preventing the scarlatina anginosa, or putrid sore throat, from being communicated to the rest of the family, living under the same roof. Whether this will apply to the small-pox, I cannot say from my own experience; but I have been told by Dr. Rollo, Surgeon to the Artillery, and Mr. Cruickshank, Professor Royal of Chemistry to the Academy, that it destroys the *miasma* of the small-pox; and that of two quantities of matter, taken for the purpose of inoculation, one was exposed to the nitrous vapour, the other not: the persons inoculated with the first were not seized with the disease, whilst the inoculation took the usual effect, when performed with the second.

I ever remain, with sincere regard,

Your's truly,

J. CARMICHAEL SMYTH.

Dr. Percival.

CONCLUSION.

CONCLUSION.

WHSOEVER reads the preceding pages with attention, must be struck with the great conformity of opinion, observable amongst the different individuals, in regard to the principal object of our inquiry, viz. the power of the nitrous vapour to destroy contagion.

But although the same sentiment universally prevails, I cannot help remarking, that whilst the opinion of some gentlemen is founded on general observation alone, the opinion of others is supported by such an accurate detail of facts reduced to the certainty of arithmetical calculation, as carry with them a conviction, little short of demonstration itself.

The power of the nitrous vapour on contagion once established, all its other effects can easily be understood and explained; one of the most obvious of these is its destroying putrid smell. Although I am far from imagining that putrid smell and contagion are one and the same, on the contrary, am convinced that they often exist independent of each other, yet as they are of the same family, and arise from a common cause, we may fairly suppose from analogy, that what destroys the one, will prove effectual in destroying the other. I confess, that where there is a direct and positive proof, as in the

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present instance, reasoning from analogy is of little consequence. The observation, however, is in itself important, particularly for those whose duty leads them to an attendance on the sick, as the offensive smell to which they are exposed, constitutes not the least disagreeable part of such an office.

But besides removing the offensive smell of hospitals and prisons, another advantage of the nitrous fumigation is that of rendering the air purer and fitter for the purposes of animal life; a fact which chemistry readily explains. From it we learn, that in the decomposition of nitre by the vitriolic acid, a certain proportion of vital air,* or oxygen gas, is let loose; and physiology informs us, that this air, which constitutes a very interesting part of our atmosphere, is necessary for the respiration of animals, at the same time that it is constantly consumed by it.

In a former publication I did not hesitate to give a decided opinion, (judging partly from experience, and partly from the similarity of putrid contagions) that the nitrous vapour would be found equally an antidote to all,† even to the plague itself. I have
now

* “ In answer to Dr. Smyth’s question, What is the proportion of oxygen and nitric acid, disengaged by adding half an ounce of oil of vitriol to half an ounce of nitre ?”
“ I reply that I do not recollect any experiment which has been published to ascertain the proportion of oxygenous air thus extricated, though the fact of its extrication is well known, &c.”—*Extract of a Letter from Mr. Keir of Birmingham.*

† This fact becomes the more important, it being now clearly ascertained, that the yellow fever, in America at least, is produced by imported contagion. The advantage to a commercial country of being able to counteract all communications of this kind, without subjecting the merchant to the expense and delay of quarantines, is hardly to be calculated.

now the satisfaction to see this opinion confirmed, in so far at least, as relates to the dysentery, a putrid disease equally contagious with the jail fever, and in military hospitals, at least, still more fatal.

The efficacy, however, of the nitrous vapour, as appears from almost the whole of the reports, is not confined to the destroying or preventing the communication of contagion; its salutary influence is no less remarkable on the sick and on those recovering from sickness; but on this very important subject, I could wish the reader to consult Mr. Paterson's Table of the Weekly Returns at Forton Hospital, from which it appears, that during the short space of six weeks, in an hospital containing from 300 to 400 men, there was a difference, from employing the nitrous fumigation, of about 50 lives saved, and about 110 men restored to a state of health fit for active duty; but if the reader is desirous of forming an accurate judgement of the immediate effect of the nitrous vapour on those ill of typhus fever, I would advise him to read with attention, what Mr. M'Grigor and Mr. Hill have written on the subject.—By Mr. M'Grigor we are told, that some years back, during the prevalence of a fever similar to the one he describes, in the same place, the island of Jersey, the 88th regiment to which he belongs, in the space of ten weeks, suffered a loss of 40 or 50 men; whereas during the present illness, when he employed the nitrous fumigation, of 64 men seized with the fever, he did not lose a single patient. He further remarks, that by using constantly the nitrous vapour, the malignant symptoms of the disease disappeared, and that from a typhus it became a simple fever.

But of all the advantages to be derived from the use of the nitrous vapour, none is more remarkable or likely to be of such extensive application as its effect

fect on ulcers, an effect first taken notice of by Mr. Paterfon, and which has been confirmed, upon every subsequent trial.

That the nitrous vapour, by correcting the malignant and contagious air of hospitals, which is known to affect* more or less, all persons confined in them, should so far at least prove serviceable to those affected with ulcers, and in general to surgical patients; we can readily believe, and indeed it is an induction to which we should have been led, reasoning as it called *a priori*. But the nitrous vapour seems to be not only useful in this way, it is found of efficacy also as a topic or local application; its operation, however, as such, must have its limits; to suppose that it will prove a universal remedy for all ulcers, is an idea that cannot be entertained for a moment, by any one in the least conversant with the animal œconomy, or with the history of diseases. Those persons who are too precipitate in general conclusions, have commonly some ground to go back again.

Were I to form a conjecture respecting the kind of ulcers in which the nitric acid, either in a gaseous or liquid state, is likely to be found most serviceable; I should say, the sloughy or sphacelous, the scrophulous, and the scorbutic: but those gentlemen, who are professionally engaged in the treatment

* “ Having related the most distinguishing marks of this fever, I shall only add, that there are sometimes slight degrees of it hardly to be characterized; and which can only be discovered in full hospitals, by observing the men to languish, though the nature of illness for which they came in should seem to admit of a speedier cure. In such cases the only symptoms are slight head-achs, a whitish tongue, want of appetite, and other inconsiderable feverish symptoms.” Vid. Pringle on the Jail or Hospital Fever.

ment of such complaints, will look upon this observation more as a hint than an opinion.

The preceding effects of the nitrous vapour are what have been observed by all or by many; but there is one which rests as yet on the authority of Mr. Paterfon alone. He only has made trial of it, and with success, in the whooping-cough. His remarks on this subject, I must say, are extremely interesting, and open a wide field for the reflexion and experience of the practical physician.

Having finished the few observations I had to offer, on the letters and reports which I have now the honour to lay before the public; the reader I hope will pardon me if I detain him a few minutes longer, to make one remark which relates principally to myself. It cannot have escaped his notice any more than it has done mine, that, as appears by several of the letters, there are prejudices entertained against the nitrous fumigation by many surgeons of the navy. At this I am by no means surpris'd; we are all children of habit, and unwilling to relinquish opinions which we entertained in early life: the introduction, however, of the nitrous fumigation into the navy, has been oppos'd not by prejudice only, but by arguments drawn from chemistry. It would be no very difficult task for me to point out the fallacy of such chemical reasoning, but to endeavour to refute by argument what is directly contrary to experience and observation, would be an abuse of time, and an insult to the public judgment. The only answer then that I shall give to such philosophers, is to address them in the words of an author, whose opinion must be considered of high authority on such a subject, as he was not only a physician of character, but certainly one of the first chemists in Europe; the circumstances and occasions were perfectly similar.

Comme

“ Comme il* n’a certainement eu en vue que le
 “ bien de l’humanité, il me permettra quelques re-
 “ flexions qui ont bien pu échapper au savant chi-
 “ miste, mais que ne pouvoient manquer de frapper
 “ un médecin, qui quoique amateur zélé de la chimie
 “ & convaincu des avantages qu’elles peut procurer
 “ à l’art de guérir, a été trop souvent témoin des
 “ erreurs que cette science a portées dans la médi-
 “ cine, pour n’être pas toujours en garde contre
 “ elle ; d’autant plus même, que ses raisonnemens
 “ sont plus seduisans, & ses expériences en appar-
 “ ence plus concluantes.”

Mémoire par Monsieur Bucquet,

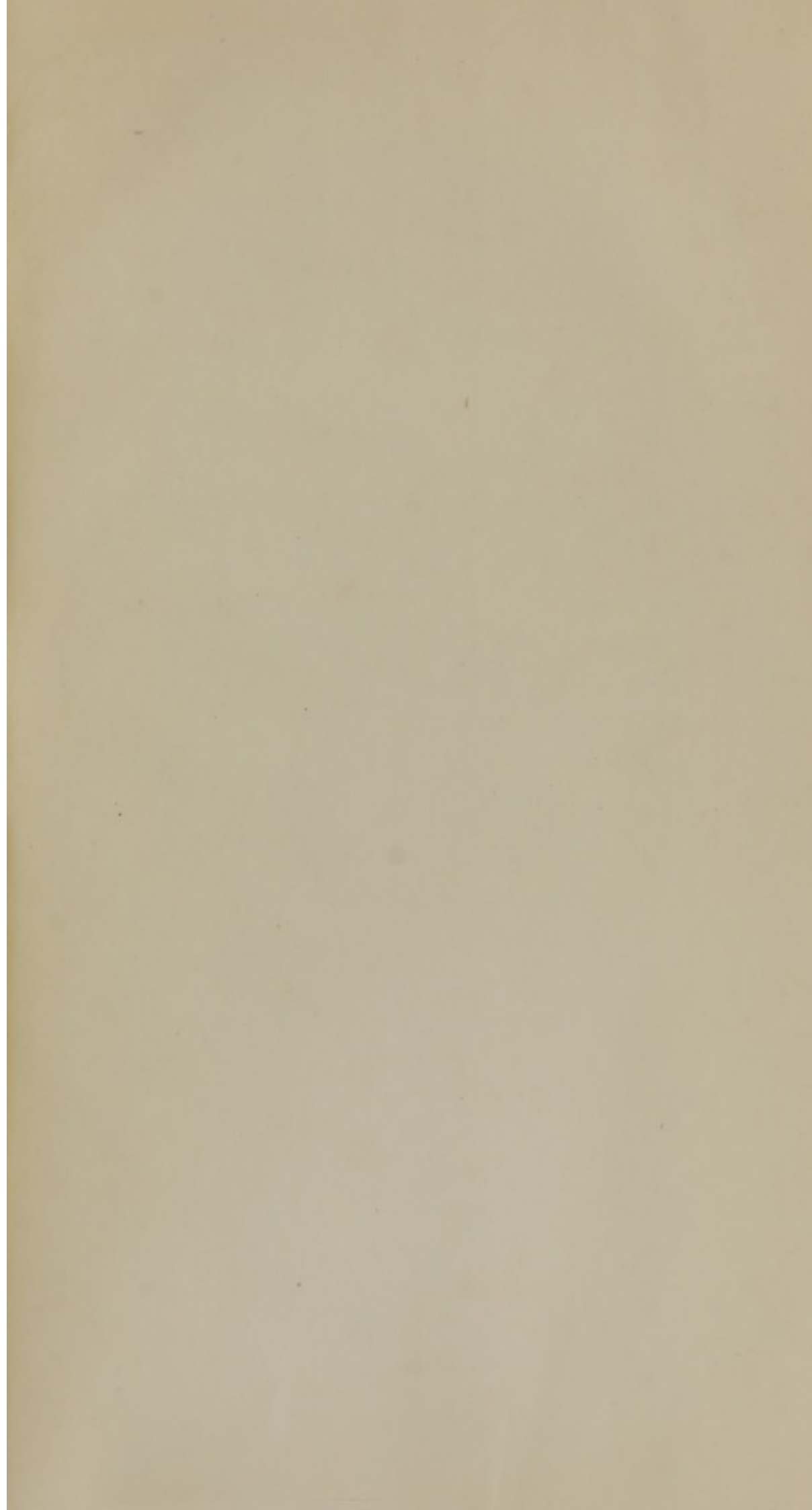
Professeur de Chimie, Censeur Royal

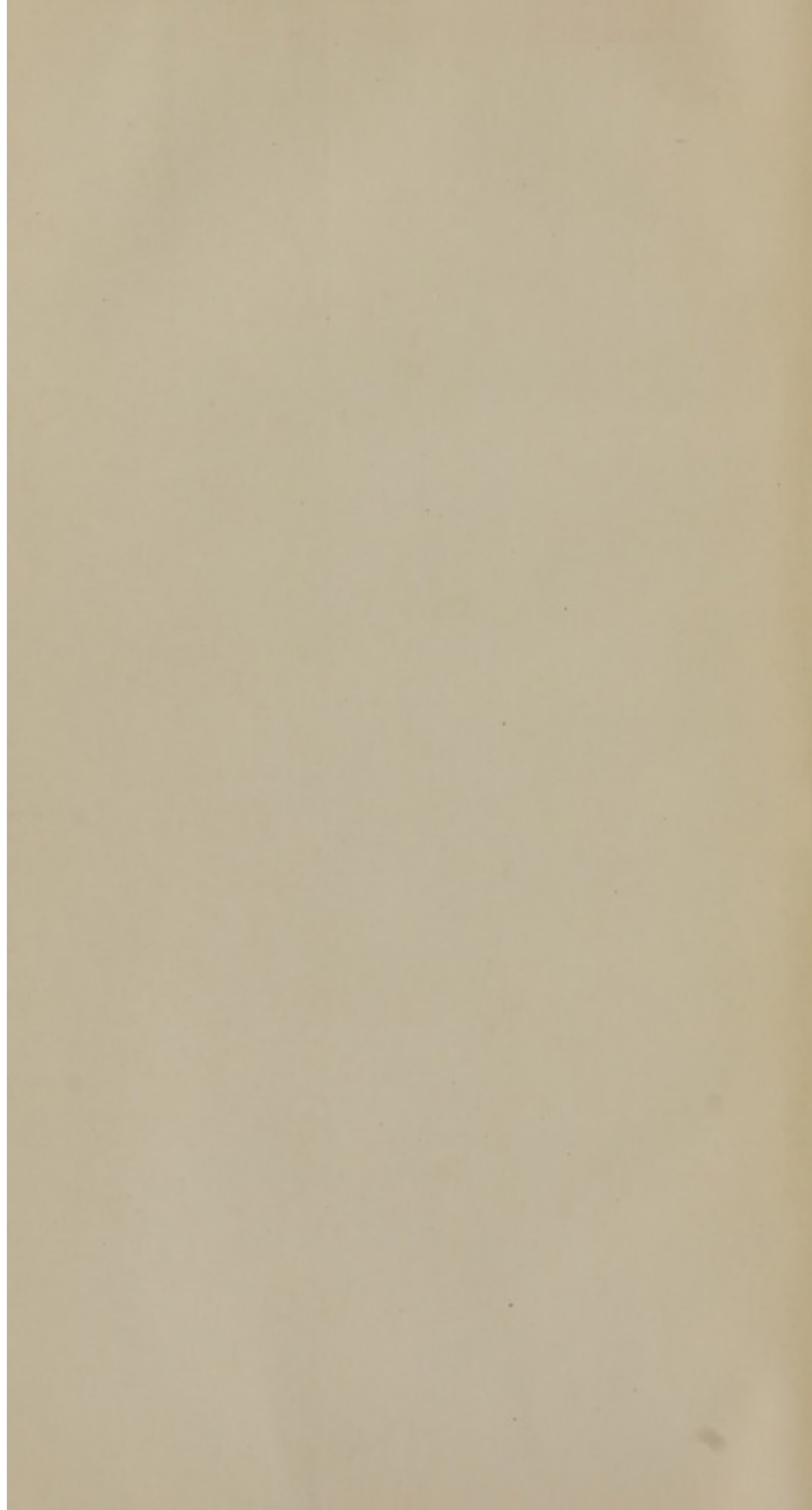
De L’Academie Royal des Sciences, &c. &c.

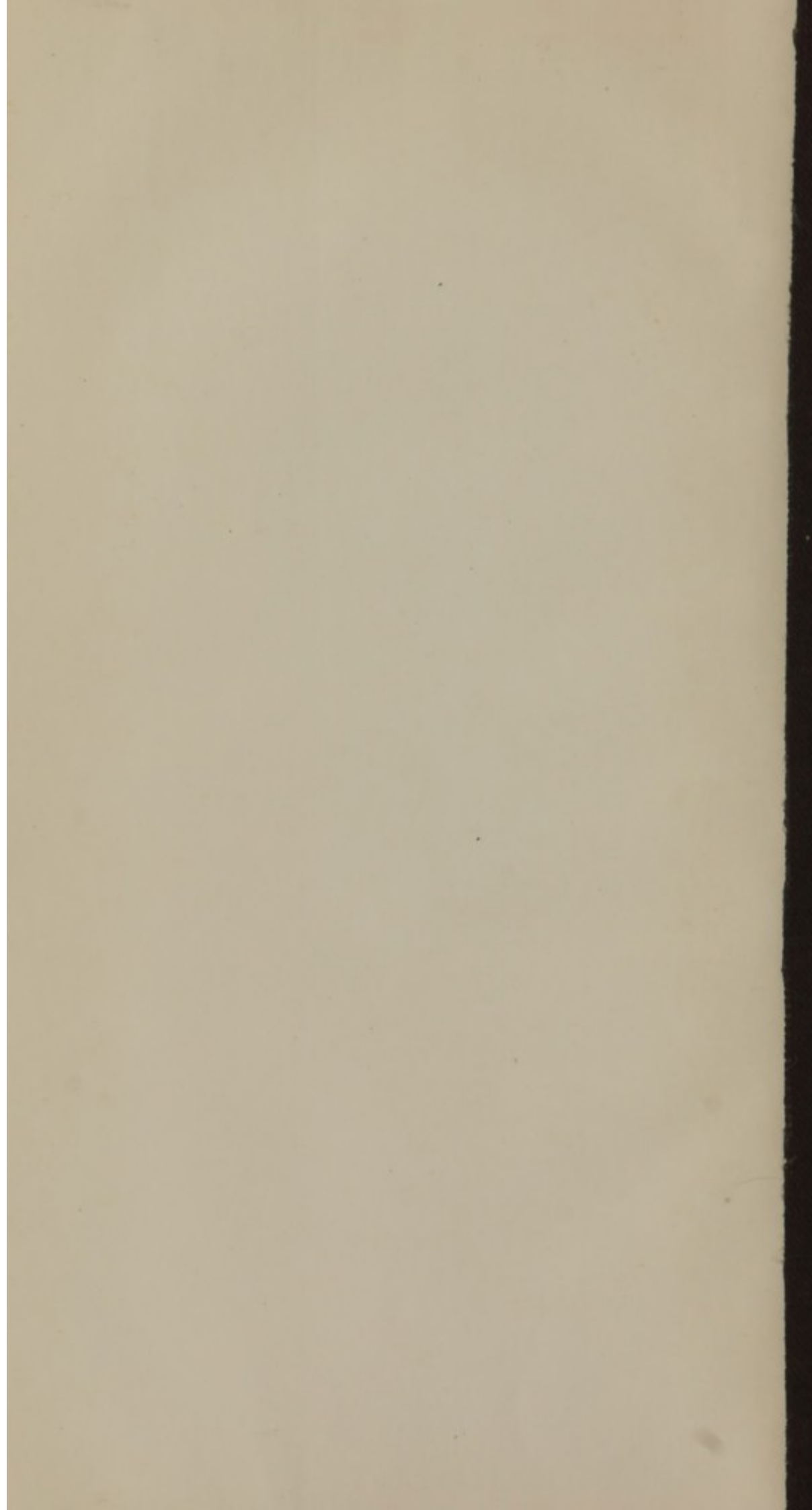
* The person alluded to was Le Sage, who opposed che-
 mical reasoning to experience and observation.

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