

An essay addressed to captains of the Royal Navy, and those of the merchant service, on the means of preserving the health of their crews, with directions for the preservation of dry rot in ships / by Robert Finlayson.

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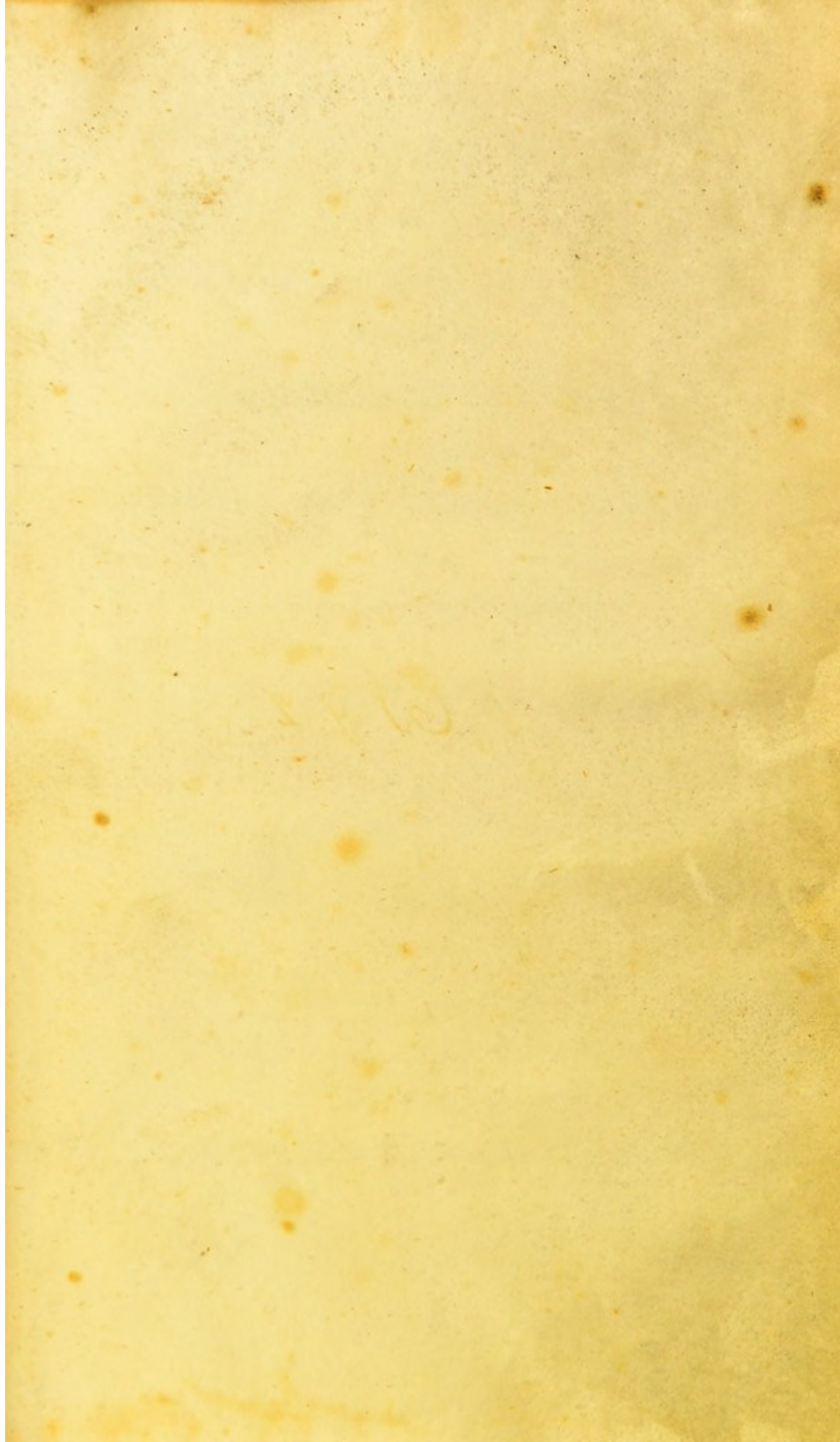


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AN
ESSAY

ON THE DUTY OF THE
CAPTAINS OF THE ROYAL NAVY,

AND THEIR OFFICERS OF THE
MERCHANTS' SERVICE;

IN PRESERVING THE HEALTH OF THEIR CREWS;
WITH
SUGGESTIONS FOR THE PREVENTION

OF FETTER FEVER IN SHIPS.

BY
JOSEPH FINLAYSON, M.D.

PHYSICIAN IN CHARGE OF HOSPITALS OF THE ROYAL NAVY,
AND SURGEON OF THE ROYAL ARMY.

By special authority of the Admiralty.

LONDON:

PRINTED BY THOMAS AND GEORGE UNDERWOOD,

STATIONERS' COURT.

1844.

AN

ESSAY

ON THE

CAUSE OF THE

DESTRUCTION OF THE

SHIPS

AND THE

REMEDY

FOR THE PREVENTION

OF THE

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ESSAY

ADDRESSED TO

CAPTAINS OF THE ROYAL NAVY,

AND THOSE OF THE

MERCHANTS' SERVICE;

ON THE MEANS OF

PRESERVING THE HEALTH OF THEIR CREWS:

WITH

DIRECTIONS FOR THE PREVENTION

OF

DRY ROT IN SHIPS.

BY

ROBERT FINLAYSON, M.D.

MEMBER OF THE ROYAL COLLEGE OF SURGEONS OF LONDON,
AND SURGEON IN THE ROYAL NAVY.

“ Ex aquâ oritur aër, ex aëre morbus.”

LONDON:

PRINTED FOR THOMAS AND GEORGE UNDERWOOD,
FLEET STREET.

1824.

ESSAY

CAPTAINS OF THE ROYAL NAVY,

AND THOSE OF THE

MERCHANTS' SERVICE;

ON THE MEANS OF

PRESERVING THE HEALTH OF THEIR CREWS;

WITH

DIRECTIONS FOR THE PREVENTION

OF DRY ROT IN SHIPS.

BY ROBERT TINKAYSON, M.D.

MEMBER OF THE ROYAL SOCIETY OF MEDICINE OF LONDON,
AND SURGEON IN THE ROYAL NAVY.

AND THE FOLLOWING CERTIFICATE OF THE MEDICAL BOARD

OF THE ROYAL NAVY, IN TESTIMONY OF THE HIGH REGARD

THEY HAVE FOR HIS SERVICES, AND OF THE VALUE OF HIS

WORKS TO THE SERVICE OF HIS COUNTRY.

SIGNED BY THE MEDICAL BOARD OF THE ROYAL NAVY,

IN TESTIMONY OF THE HIGH REGARD THEY HAVE FOR HIS SERVICES,

PRINTED BY G. HAYDEN, LITTLE COLLEGE STREET, WESTMINSTER.

TO
THE RIGHT HONORABLE
LORD VISCOUNT MELVILLE,

K. T. F. R. S.

First Lord Commissioner of the Admiralty,

&c. &c. &c.



MY LORD,

The rapid progress which every branch of Nautical Science has made under your Lordship's Administration ; a deep sense of veneration for the Memory of your noble and illustrious Father, to whom the Medical Department of the Royal Navy owe so much ; and the fullest conviction of the salutary tendency of the means recommended ; have induced me to address the following Essay to your Lordship ; being fully aware that, under your auspices, no measure has ever been omitted, by the present enlightened Board of Admiralty, which could clearly be shown would

contribute to the health and comfort of our mariners, or add to the physical strength of His Majesty's ships.

It was not so much with a view of protecting my opinions from the prejudices of long-established custom, as to obtain for them that consideration which so important a subject as the preservation of the health of British seamen and His Majesty's ships demands, that I ventured to solicit your suffrage ; and if any thing can add to the honor I have in dedicating these Observations to your Lordship, it is that facility in which you were pleased to grant me permission.

I have the honor to be,

My Lord,

Your Lordship's

Most obedient humble Servant,

ROBT. FINLAYSON.

London,

12th August, 1824.

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AN

ESSAY.

PROEMIAL OBSERVATIONS.

ON taking a retrospective view of the progress of Nautical Medicine, one cannot help being struck with the rapid improvements which have taken place in Medical Science, within the last forty years, in the Royal Navy.

During the first American war, and down to the beginning of the late French war, *Sea-scurvy* made such dreadful ravages in our fleets, as frequently to enervate the arm of Power; and it was not uncommon in those days, to find 300 men at once on the sick-list of a line of battle ship; and as many as 250 men have actually died in the short space of one year, by this prevailing malady.

Hence, it was justly observed, by some of the most experienced officers, “that the blockading system of warfare, which annihilated the naval power of France, could never have been carried on, unless sea-scurvy had been subdued; and more than one hundred thousand British seamen have thus been saved to the country, by as many thousand pounds.”

Shortly after this disease was subjected in the royal navy, another very remarkable æra took place in the Medical Department, which considerably changed the character and quality of the naval medical officers: *viz.* the late Lord Viscount Melville, by his generous interposition with Government, obtained an Order in Council, dated the 23d January, 1805, to give the medical officers of the royal navy the same rank and pay as their brethren in the army; and, from that period, better qualifications were insured, by the candidates undergoing severe examinations at the Royal College of Surgeons, and the then Transport Board; and thus the general character and professional skill of medical officers made rapid advances, under their noble and illustrious patron. Indeed, many, who had been allowed to enter the navy on the spur of necessity, were required to mend their medical and surgical education, or be expelled the naval ser-

vice; and those who now offered themselves as candidates for examination, were gentlemen of more extensive information, owing to the rank and respectability which had thus been assigned them in the British navy.

Sea-scurvy, by far the greatest calamity that ever visited the British fleet, had long been on the wane; and, at the beginning of the last French war, made its farewell visit. Since that time, the diseases which have continued to thin our ranks, have been chiefly of the inflammatory kind; *viz.* fevers, inflammations of the lungs and their membranes, consumptions, &c.

Indeed, the long list of inflammatory complaints had become most formidable in those days, in consequence of the difference of opinion that then existed amongst practitioners, respecting the treatment of such diseases. A small party admitted that bleeding and other antiphlogistic measures were necessary, yet had not sufficient confidence in the means they recommended to carry them into practice; and the more numerous party totally exploded depletion, and trusted to mild cathartics and antimonial remedies.

Such conflicting modes of practice were as painful to the practitioner, as detrimental to his patients; and, what between the cavil of party,

and dilatory measures, great numbers were allowed to be swept off by the powerful arm of inflammatory disease.

Happily, however, for humanity, and for the British navy, one of the present Medical Commissioners* (then the *principal* Examiner at the Transport Board) saw the magnitude of the evil arising from such contrary and dilatory practice; and from the high public situation he held, was enabled to impress on the minds of the young medical gentlemen, (whose professional tenets were reviewed by him,) the great propriety of early and prompt antiphlogistic means; not only in all the different species of *phlegmasiæ*, but, also, in certain types of fever.

Such principles, from their success, as well as from the high authority by which they were stamped, soon became disseminated, and, ultimately, universally adopted; and in the present day, such inflammatory diseases are cured with nearly a mathematical certainty, by almost every surgeon in the navy.

This revolution in the treatment of inflammatory complaints ranks next, in point of consideration, to the subjugation of sea-scurvy; it has already saved some thousands of seamen to

* Dr. Weir.

their country, and ought to be accompanied by a corresponding gratitude to the indefatigable labours of this distinguished individual.

“ A wise physician, skill'd our wounds to heal,

“ Is more than armies to the Public Weal.”

It would be unpardonable to pass unnoticed, even in this short survey, the very popular and scientific works of Dr. James Johnson:—His “Essay on the Influence of Tropical Climates, more especially the Climate of India, on European Constitutions,” &c. stands like a beacon for the direction of the medical officer on *oriental service*, while his other works are equally important to the home practitioner.

The late preference held out by the Commissioners for Victualling His Majesty's Navy, to such as may have graduated at the different universities, cannot fail to have the most beneficial tendency, by exciting more vigorous exertions on the part of the young medical officer; and, in this way, the best interests of the navy have been advanced.

In taking, thus, a rapid survey of the revolution which has lately been effected in nautical medicine, it will appear that sea-scurvy has been almost totally exterminated in our fleets; that the treatment of inflammatory diseases is now so well understood, that they are generally soon

cut short, or subdued; and that some of the most formidable diseases within the Tropics, such as *fever*, *dysentery*, and *liver complaints*, have become, at least, manageable, under the salutary directions of certain tropical writers.*

Yet, owing to the existence of certain long-established and *pernicious* regulations with regard to WASHING DECKS, and the sudden vicissitudes to which sailors are exposed in consequence, this class of men is rendered peculiarly liable to repeated attacks of inflammatory disease. And it is to be, moreover, lamented, that such diseases, even when subdued, have a strong tendency to weaken the constitution, and render the individual more liable to the invasions of chronic affections and consumption afterwards—the *two* great scourges of the British navy at the present day.†

It is with a view, therefore, of being the means of removing some of the existing causes

* See Dr. Wm. Burnett's (one of the Medical Commissioners) most excellent "Practical Account of the Mediterranean Fever;" see, also, Dr. James Johnson's Essay already mentioned, and Bampffield on Tropical Dysentery.

† The principal part of the *obituary* of the royal navy, at present, takes place at our great naval hospitals, whither the men are usually sent with chronic disease or consumption, after having been frequently attacked, and worn down by the acute forms.

of such inflammatory complaints, that this Essay has been written; for every one will admit, that the prevention of disease (when it can be effected) is better than its cure.

Before finishing these proemial observations, I have to remark, by the way, that while the medical department of the royal navy has thus been making the most rapid march towards perfection, the advancement of naval discipline and naval tactics has not been less conspicuous in the executive.

Within these last ten years, corporal punishments have been reduced to a very limited extent, without any concomitant bad effect; and the *ci-devant* customs of *black-listing*, *black-holding*, and *burnishing* of bolts, bars, and cannon-balls, have all been entirely exploded.

The young gentlemen who have lately entered the navy as midshipmen, have received a most appropriate education for the service, either at the Royal Naval College at Portsmouth, or elsewhere, which not only renders them more eligible at their entry, but, also, furnishes them with a store of elementary information, which may be turned to the advancement of nautical science hereafter.

The theory of gunnery is now much better understood among sailors than it was formerly;

and the practice of *fencing*, lately introduced into the Royal Marine Corps, has rendered them a most formidable body of men.

Furthermore, clothing has been better suited to the different climates; and pensions for wounds or servitude have been granted to seamen, regulated by the most liberal principles. Thus, it is most gratifying to observe how the health and interest of British seamen have lately been promoted by their generous countrymen, in a strong feeling of attachment, accompanied by pecuniary rewards for past services. Is there a Briton who can for a moment forget the blessings that have been enjoyed for centuries, under the safeguard of our brave tars?—and who can look with apathy on a class of men to whom we are indebted for our riches and commerce in war and peace, and who are our only safe and permanent bulwark in the trying hour of invading hostility? Can we neglect a body of men whose energy increases with the *raving* of the storm, and whose constant practice and highest pride is to shew the greatest dexterity in the most imminent danger? Never shall we abandon the brave tar who mounts with alacrity on the quivering shroud, when

“O'er his head the rolling billows sweep.”

Besides, our gallant “sons of the waves” have not been less celebrated in human than “elemental war;” for, when the united powers of Europe were in league against us, British seamen most undauntedly stood forward to wield our naval thunderbolts, and hurl destruction on our most malignant enemies; then, the victorious peals of our artillery resounded from one extremity of the globe to the other—then, the British flag, triumphant, waved her *red lion* o’er all watery space.

But, alas! good and glorious actions are soon forgotten, or swept away in the current of passing events, inasmuch as this humorous and thoughtless class of men are too often seen in the most unfavourable point of view, spending their holydays on shore; when they commonly indulge in drinking, and make use of loose and indecorous language, leaving the very worst impression on the mind of the public, respecting their general character, and rendering themselves an easier prey to a gang of *harpies*, who lurk in all our sea-ports.

British seamen, however, are a class of men to whom any general character may be given by their superiors, from the very best to the very worst. They have long and justly been esteemed for a *disinterested generosity* toward

others in distress; and self-interest and personal safety have always been thrown aside, when wanted by their country.

“ Alike to him each climate and each blast,

“ The first in danger, in retreat the last.”

In concluding these introductory observations, I think it proper to remark, that no particular ship or officer has been kept in view; but a fair and general statement of the evil has been attempted to be given, and its concomitant bad effects pointed out.

It is, therefore, against the system of *washing decks*, I have to enter my most solemn protest, hoping my humble efforts may call the attention of the scientific world to a fuller investigation of the subject, and that the opinions here set forth may stand or fall according to their merits.

OF THE
BANEFUL INFLUENCE OF SO FREQUENTLY
WASHING DECKS

ON THE HEALTH OF BRITISH SEAMEN.

“ Ex aquâ oritur aër, ex aëre morbus.”

THE bad effects of *humidity* in our habitations, and *moisture* in the atmosphere, have been mentioned by almost all physicians of all ages, as being highly prejudicial to the human constitution. *Heat* and *cold* themselves, in warm blooded animals, are, in a great measure, regulated by the different changes the skin and lungs are capable of performing, in order to preserve an uniform degree of animal heat; and, hence, the most sudden transition is frequently not attended with any bad consequence.*

But *moisture*, when applied to the surface of the body, has the power of robbing it of a large portion of its *heat*, and leaving the extremities of the vessels, which terminate there, in a weak-

* “In passing from the cabin to the open air, and vice versa, the men were in the habit of undergoing a change of from 80° to 120° without any inflammatory disease being produced.”—*Parry's Voyage to the Arctic Circle*.

ened and paralyzed state, thereby rendering them less vigorous in resisting the impressions of passing vicissitudes.*

Besides, *moisture*, when applied to the *lungs* and *capillaries* on the surface of the body, always produces cold, owing to the large quantity of heat it requires to convert water into vapour; and, in this way, the size of the blood-vessels on these extensive surfaces become lessened, whereby the *balance* of the circulation is destroyed, by being directed chiefly to the main trunks in the interior. The course of the blood being thus confined more to the centre, its impetus there, will, in consequence, become increased or deranged; and when there is the least disposition to disease in any internal organ, it is evident how much it will be aggravated, by thus receiving the sudden shock of the circulation from the surface to the centre. Indeed, it is by the *injudicious* application of *water*, that three fourths of all the diseases in the navy are induced.

It excites inflammations of every species and degree, from the simple *catarrh* to the severest *pneumonia*, and generates complaints of every kind, from the mildest *functional* derangement, to the most hopeless *organic* disease.

* "It has been remarked before, that an animal might be frozen to death in the midst of summer, by repeatedly sprinkling ether upon him."

On board of His Majesty's ships, where several hundred people sometimes live together in so small a space, much attention to cleanliness and ventilation becomes absolutely necessary; and every Englishman, "from the prince to the peasant," is ready to exclaim, "cleanliness is next to godliness," and this is frequently the motto under which the advocates for *diurnal irrigation* take their stand; forgetting, that *water*, like *wine*, may be misused; and that it is easy and common to convert the greatest blessing into the veriest curse, by misapplication.

Science, however, has always been slow and wavering in its march, and every age and profession have their prejudices; and it is common to shake off one class, only to embrace another.

Thus, under the oscillation of public opinion, I am aware of the great difficulty there will be in attempting to effect any change on a system that has been long established: for, in endeavouring to introduce any improvement, a necessity is naturally implied, and thus the character or judgment of the individuals concerned becomes implicated.

They, on the other hand, set themselves in array against innovations, and regard with strong veneration, the customs, and even the prejudices of their puerile years; and the older

the individual is, the more obstinate will he be to relinquish his early conceptions, however erroneous they may be. Hence, Dr. Cullen used to say, "habit makes us believe and revere the grossest absurdities." But to return to my subject, *viz.* the consideration of the pernicious effects of so repeatedly WASHING DECKS on the health of British seamen: and first—

Of Washing the Main and Quarter Decks.

WASHING DECKS in His Majesty's navy, is generally conducted under the direction of the lieutenant of the morning watch, while at sea, and by the first lieutenant, or, more frequently, the mate of the morning watch, in harbour. The watery operations most usually commence about half past four, or five o'clock A. M. and are generally finished just in time to go to breakfast a little before eight o'clock.

And as the quality of the officer is frequently estimated by the style in which he performs this piece of service, the greatest pains is, consequently, taken, on the part of the lieutenant or mate, to give complete satisfaction. When the ship is at anchor, *all hands* are turned up at half past four; but when she is at sea, *the morn-*

ing watch only is called. Immediately the watch comes on deck, water is pumped from the main deck, and drawn from the head, and thrown on the main and quarter decks in the utmost profusion; and this is followed (or sometimes preceded) by buckets of sand being strewed on the decks, and the seamen, during the whole of this period, are compelled to work without their shoes and stockings, (although the thermometer may range at or below the freezing point) dragging the *large holy stones*, working the *hand holy stones*, pumping and carrying water, and, ultimately, using brooms and swabs to dry the decks, before going to breakfast.

The large holy stones, are stones, *en verité*, with smooth under surfaces, slung in the middle by a rope, and dragged backward and forward by means of six or eight stout hands; these stones (as may be anticipated) have the property of rendering the deck whiter and smoother, as well as of grinding every species of animal and vegetable matter into a fine pappy consistence.

The hand stones are used in the corners, and where the larger ones cannot be applied; and, during the whole of this process, the weight of the body is sustained on the naked knee, as they can only be conveniently used in that posture. It would be endless to enumerate the diseases

of the knee-joint I have seen excited by thus throwing the whole weight of the body upon the knees.

After the *large* and *small* holy stones have been kept in play for upwards of two hours, by which the decks have been *worn* and *saturated* with moisture, the men's clothes *drenched*, and every atom of matter finely ground down, they are set aside, and this well blended heterogeneous fluid is suffered to escape by means of the scupper holes.

The *dumb-scrapers* are next used to take out *stains*, which could not be acted on by either of the holy stones; and, thus, by the assistance of more water, brooms and swabs, the operations (as already mentioned) are completed about half past seven or eight o'clock.

Let us now examine the effects of this system of cleaning the ship on those individuals who had just been turned out from their hammocks, and who have passed three hours and a half of an amphibious existence, previous to going to breakfast. Let us also remember that, in this *watery circle*, the victims of venereal pleasure, who have just completed their six weeks course of alterative medicine, meet with the hepatic valetudinarian after a long residence in a tropical climate; or the friend of his youth, who

has a predisposition to, or is already affected with, *incipient consumption*, &c. all performing their various parts in the watery throng. But the evil arising from those early and tedious forms of ablution, has not yet been seen in its most alarming shape; for during the period that water was so lavishly dashed on the decks and sides of the ship, it is evident the seamen could not escape being wetted; and in this state they go down to breakfast; and from which they rise to the cleansing or

Washing the Lower Deck.

THE washing or cleaning of the lower deck, after breakfast, now remains to be described. This piece of service is performed in one of the three following ways: *viz.* 1st, by *dry holy stoning*, *i. e.* using dry sand and rubbing it on the deck without water; 2dly, washing the deck after the same manner as the main and quarter decks which have already been spoken of; and, 3dly, by *sprinkling* and *scrubbing*, that is, watering the deck in a different way, either by throwing it out of a bucket with the hand, or applying it by means of wetted swabs to the whole surface of the deck. Afterwards *dumb scrapers*

are used, and where those implements cannot be applied, the seamen's knives are generally called into action, for scraping the previously wetted tables and ladders, &c. and the *second ablution* is usually finished about half past ten or eleven o'clock.

In those ships where sprinkling and scrubbing are practised to do away with the name of washing decks, (but its effects are nearly the same,) there are, in general, *two days* set apart in every week, (Thursday and Sunday,) for making the utmost effort in the cleaning art. On those days, every wooden surface below is doomed to be visited by holy stones, sand and water, dumb scrapers, knives and swabs, so that the decks, &c. may be put in a proper state to meet the approbation of the commanding officer, who generally *goes round* after such occasions, to bestow praise or censure, as he may judge necessary.

After breakfast, on the abovementioned days, the bustle of working the holy stones, carrying water, and strewing sand on the deck, becomes general over the ship; and, as the washing is supposed by many to do good, and be salutary, according to the quantity of the element used, I have frequently seen the whole lower deck covered with water to a considerable depth, while

the small and great eight-handed holy stones were ploughing the water on the surface of the deck in every direction.*

After these measures have been pursued for a certain length of time, regulated by the opinion of the superintending officer, an effort is at last made to dry the deck, either by swabbing up the water, or allowing it to escape by means of two small *scuttle holes*, that are usually cut through the deck close to the ship's side, by which the sand and water, vegetable and animal matter, pass down between the ship's side and her lining, and, ultimately, percolates into the hold.

I sincerely trust the time is nearly past for any one to assert, that no bad effects will arise from this exposure, and the accumulation of such a mass in the lower department of a ship; in any place or climate, but more particularly within the

* It will hardly be credited, that the *rage* for washing in some ships, is carried so far, that the midshipmen's chests and others, on the lower deck, are regularly *white-washed* about thrice a week, by a man who goes round with a bucket and brush for that purpose. The injury done by this custom is beyond calculation, not only in diffusing moisture, but, also, by the lime or chalk absorbing the oxygen or vital part of the air, for which it has so strong an affinity; and, from this cause, the constitution of the atmosphere of the lower deck becomes greatly deteriorated.

tropics, where the putrefactive process runs its course most rapidly.*

Let us now return and take a careful survey of the lower deck, half an hour after this system of washing has been finished; and let us observe

* On going first to a warm climate, one is instantly struck by the rapidity with which even metallic substances become rusted.

In the West Indies and at Bermuda, polished iron surfaces and buttons, become partially oxidized in a few days; while at Quebec, but yet more particularly at Montreal, some houses which have been covered with tinned plates for forty years, remain still untarnished; and scythes, &c. exposed to the open air, in that country, continue nearly free from rust till the ensuing year.

It is generally admitted, that iron has the property of decomposing water, by uniting with its oxygen to form rust, while hydrogen, the other component part of water, is carried off by caloric in the form of hydrogen gas.

It would appear, however, this process does not take place rapidly, unless the atmosphere has been previously charged with marine evaporations. For to what are we to attribute the little or non-oxidizement of metal at Montreal, but to its great distance from the sea; or, in other words, from all the oceanic exhalations having been condensed on their passage hither by the tops of mountains, and immense tracts of cold desert land, over which the wind has to pass before it reaches that city.

Rain-water, in Europe, according to Margraaff, always contains traces of the *muriatic* and *nitric* acids; it would be interesting to learn, if rain near Montreal (at a distance of 500 miles from the sea) is impregnated with marine acid.

the influence of the moisture on the health of its inmates. It ought to be kept in mind, that the men have been labouring in water since half past four o'clock, with the exception of the breakfast hour; and then, their clothes had been wetted by previously drawing, carrying, and throwing water on the main and quarter decks. Under this system of cleaning the ship, (let us suppose the month of December has been ushered in,) we shall find, on examination, the deck and every other article below, thoroughly saturated with moisture, and in this most miserable situation, will generally be found the following persons, sitting or lying on deck, and that most probably in canvas trowsers, *viz.* individuals resting from fatigue; the habitual drunkard taking his nap after last night's debauch; tailors, who are compelled to sit on deck *professionally*; seamen and marines, making, mending, or cleaning clothes; the lazy, the delicate, and those undergoing a course of medicine, are all doomed to suffer by this *humid* enemy, from which they cannot fly, and which has now become fixed in the decks after such constant previous application; and long before it can be dried by *animal* or *combustible* heat, it is again deemed necessary to have recourse to ablution, and so on ad infinitum.

It will appear, on reading the foregoing statement, that British seamen are in the habit of labouring in water at least three hours daily, before breakfast, and nearly double that time (twice a week) in those ships where washing the lower deck is practised; and every morning after breakfast, in other ships where sprinkling and scrubbing is deemed salutary. But, as any thing in the shape of exaggeration would defeat my purpose, I would rather be *under* than over the truth; and certainly it cannot be denied, that British seamen, on an average, are daily three hours employed working in water, and the remainder of the 24 hours under its pernicious influence.

Although washing the lower deck is so very hurtful to the constitution of seamen in the temperate zones, by producing a continual train of inflammatory complaints; yet it is, sometimes, far more dreadful in its consequences within the Tropics. It being generally admitted, where ablutions of the lower deck are most frequent, the greater will be the quantity of vegetable and animal matter, which finds its way into the lower department of a ship; and, consequently, the greater will be the danger of fever; admitting animal and vegetable matter in a state of putrefaction, to be its great common cause.

All vegetable and animal substances, when deprived of life, have a tendency to perform a retrograde process, and are dissipated in the atmosphere in the form of putrid gas.

In tropical climates, this process is known to be quickest, owing to the greater strength of the putrefactive agents there; which are, 1st, a high range of temperature; 2dly, a certain quantity of moisture; and, 3dly, the free admission of atmospheric air.

And it is not a little wonderful that, even by the partial abstraction of either of these destructive agents, (heat, air, or humidity,) we are enabled to preserve vegetable and animal substances from decay, for a great length of time.

I am aware, that the present pernicious practice of so frequently washing decks, is founded on the venerable monument of ancient custom, rather than want of attention towards the health of our mariners: and it would be wonderful indeed, if there did not exist some difference of opinion between officers, respecting the best mode of cleaning a ship, as well as on every other subject.

It cannot be denied, however, that executive officers generally adhere strictly to that method of cleaning which is best adapted to give the fairest show; while, on the other hand, the

surgeon usually recommends those measures, which he thinks will give him the least trouble.

It is painful to remark, that there generally exists an unbending disposition on the part of an executive officer, to yield to the suggestions of a surgeon, however salutary his injunctions may be; partly, it is true, because this is not the source from which orders should be issued; and partly too, from a certain *esprit du corps*, and a belief that the customary means are preferable.

For instance, I was once in a line of battle ship, where the surgeon recommended *dry holy stoning* the lower deck, in place of washing it. The captain preferred the latter method, and firmly persevered in it. The consequences were, that the lancet was kept going by the surgeon, to retard the ravages of inflammatory disease, occasioned by continual humidity; and the water buckets were daily kept plying on the lower deck, by the captain's orders, on the alleged principle of allaying the dust and sweetening the ship.*

In the following year, the same ship was

* After the diurnal operations of bleeding and washing were gone through, the waggish tars used to say, "now the doctor has taken his blood and the captain given his water, they hoped the purser's steward would soon follow with their grog."

commanded by another captain, attached to the same station, and performing exactly the same kind of service. This officer happened to be one of the few who recommended keeping the lower deck *perfectly dry*: and such were the happy consequences of this change, that not a single case of acute disease appeared for several months, and the medium number on the sick-list did not amount to one third of that of the preceding year.

I will leave the scientific world to judge, which of the above modes ought to have been adhered to; yet, I am fully convinced, both individuals had the welfare of the ship's company equally at heart. Hence, the propriety of having certain salutary regulations made official, or so intimately blended with the service, that they cannot be deviated from. It was by having demands for vegetables and lemon-juice interwoven with forms of service, that sea-scurvy was subdued; and it is only by putting certain *barriers to washing decks, &c.* that the dreadful class of inflammatory diseases are now to be diminished; and it was under a hope of obtaining so desirable an object, that this Essay took its origin.

Of cleaning a Ship's Hold.

THE practice of allowing filth to accumulate in a ship's hold to a great extent before it is cleaned out, is another link in the morbid chain of *humidity*, by which the inmates of the lower deck are often doomed to suffer.

No rule can be laid down for cleaning a ship's hold so good, as that it must be done as often as it becomes filthy; and it follows, as a consequence, that those ships, which are most famed for having their lower decks washed, soonest acquire an accumulation of filth in their holds.

In *tropical climates*, we are most imperatively called upon to be punctual in this respect, in order to prevent *fever* being generated by such a cause.

Again, in colder regions, such punctuality is not necessary, as cold has the power of partially arresting the process of decomposition.

I am here compelled to observe, that cleaning a ship's hold is a duty that is in general carelessly performed, because it is an unpleasant part of the service, and one that leaves no external mark for approbation, like *washing* and *scrubbing*. Hence, it is usually neglected or

evaded, by saying there is no necessity, until fever has commenced its ravages.

Cleaning a ship's hold, however, is *genuine* cleanliness, and as salutary as washing the body and putting on dry clean linen; while washing decks may be compared to shifting oneself into *wet clean clothes*. It will appear rather paradoxical to assert, that an extraordinary ship for *washing* is *always* a *dirty one*; but when we recollect the general tendency of the operation is that of washing filth from the surface of the lower deck into the holds, through the medium of the scuttle holes, &c. the observation then becomes less objectionable.

Of Bilge Water.

WATER is never obtained quite pure from Nature, for even *rain water* is known to contain small traces of the muriatic and nitric acids:—and, in *watering a ship* from *spring water*, it is always found to hold a certain quantity of earthy salts in solution.

When *river* or *marsh water* is used, they are constantly found impregnated with animal and vegetable exuviae in a *suspended* state, undergoing decomposition. On going to sea, after being so watered, the heat and impure air of the holds,

together with the motion of the vessel, soon produce a spontaneous change in the water in cask, and that oozing through the ship's sides, and these united agencies give origin to that fetid smell, commonly said to arise from the "Bilge Water." This is, in fact, a mixture of impure sulphuretted and carburetted hydrogen gases, varying in strength, in proportion to the quantity of foreign matter contained in the water, newness and tightness of the ship and casks, and degree of heat and motion at the time.*

Both these gases are highly deleterious to animal life, and, from their being of greater specific gravity than atmospheric air, they will not give up their residence in the lower department of a ship, (where they were generated,) unless dislodged in the way hereafter to be mentioned in the chapter on Dry Rot.

* *Carburetted* and *sulphuretted* hydrogen gases are formed in the following way:—When water is partially decomposed, either by being kept long in cask, or subjected to great heat and pressure in oozing through a ship's sides, the carbon of the wood unites with the hydrogen of the water, to form an impure carburetted hydrogen gas. During hot weather, and when there is great motion in a ship at sea, this gas may be collected in the well of a ship's hold, by a bottle, after the same manner that gases are collected in a pneumatic trough. *Sulphuretted hydrogen* gas is formed thus: during the putrefaction of the animal and vegetable matter contained in water, sulphur is evolved, in union with hydrogen, to form this fetid gas.

Of wet Hempen Cables.

THE common practice of coiling down *wet hempen cables* in the *tier*, immediately after they have been hove in, fully saturated with moisture, is another very injurious and unskilful custom in the royal navy. First, by conveying moisture into the tier, from which a continual evaporation is kept up; and, thus, the inmates of the lower deck are not only doomed to suffer, by internal, but from all circumambient causes. 2dly. Every one who is only acquainted with the rudiments of science, must be fully aware, how much the destruction of a cable is promoted by adding moisture to the heat of the tier (the chief agents of decomposition,) on a perishable article like a hempen cable.

Farther, *humidity*, like *caloric*, has a tendency to equilibrium: hence, the hammocks, men's clothes, and every article on the lower deck absorb moisture, until they reach an equal state in point of saturation with the *mean* of the surrounding objects.

Should a due regard for health not be sufficient to deter us from this unsalutary practice, surely, the great expence the country is put to

on that account, and the yet more important consideration of greater personal safety, ought to induce us to abandon this custom.

Moreover, when we consider that, in many perilous situations, a cable is the only *connecting link* between life and death to a ship's crew, one would not, *a priori*, anticipate any objections to preserving it in as perfect a state as possible. I would, therefore, recommend, that cables should uniformly be allowed to dry on the main deck, (except in cases where it is necessary to have it clear for action,) before being coiled down in the tier.

The iron cable, from its uniformity in point of strength, and its non-absorbing qualities, possesses advantages over the perishable hempen one, both in regard to *safety* and *salubrity*, which ought not to be forgotten in comparing them.

Of Impure Air.

“ The vital air

“ Pervades the swarming *sea*, and heaving earths,
 “ Where teeming Nature broods her myriad births ;
 “ Fills the fine lungs of all that breathe or bud,
 “ Warms the new heart, and dyes the gushing blood ;
 “ With life’s first spark inspires organic frame,
 “ And, as it wastes, *renews* the subtil flame.”

DARWIN.

THE absolute necessity of animals breathing pure air, in order to enjoy good health, has been admitted, even by those who entertain opposite opinions on almost every other subject.

Even food itself is of less importance to warm blooded animals than pure atmospheric air. The one, we only require at stated periods, but our demand for the other is continual, during the whole of our existence.

Happily for man, he has not to depend on his own industry, nor the caprice of others, for his atmospherical supply, otherwise his preservation would have been in continual danger. But the great and bountiful Author of Nature has secured us against such a risque, by the universal diffusion of atmospheric air over all habitable space.

Yet, although we are liberally supplied, so far as regards quantity, we are frequently doomed to suffer from aerial changes, and its occasional insalutary impregnations.* But, as atmospherical mutabilities arise from causes we are seldom able to counteract, they are only to be guarded against by suitable clothing.

Impurities of the air are sometimes more within our range of action, being frequently generated by known causes, as putrid marshes, filth in a ship's hold, &c. and this leads me to consider its bad effects on those exposed to its influence.

It has been calculated, that the internal surface of the lungs of a man of common size, measures upwards of 21,000 square inches. It is evident, when this extensive surface comes in contact with air, loaded with moisture or charged with pestilential gases, disease must be generated in the latter instance, and heat abstracted in the former; owing to water being a most powerful conductor of caloric.

Besides, air, thus saturated by humidity, is incapable of giving a due degree of excitement

* This seems to be in unison with the great divine plan; something is generally left us to perform, and it is only in making such attempts, that talent is developed, and discoveries made.

to the circulation, consequently, digestion, and all the secretions and excretions become impaired.

It is furthermore certain, that moist air is *lighter*, and contains less of the vital stimulus, than *dry air*; hence, it follows, that the heat of the body is reduced two ways; first, by moisture, and secondly, by a deficiency of oxygen in the atmosphere, the source of animal heat.

Of Wind-sails and Stoves.

THE popular system of washing the lower deck would be less lamentable, if its effects were only temporary, or if we possessed the means of counteracting its baneful influence. But hitherto we know of no remedy which has the least claim to being even generally useful, and thus a strong disposition to disease is planted, with the most limited means of removing it.

Wind-sails and *stoves* are the means resorted to at present, for *drying* and *ventilating* a British man of war; and they may very properly be nominated a *remedium miserabile*.

In ships where wind-sails are put down every morning, after the manner of other routine duty, and suffered to remain, though rain or strong wind should supervene, they are often produc-

tive of much harm, by being a medium for the introduction of moisture and strong wind into the lower deck.

In fact, wind-sails cannot be used at all, (at least with advantage,) either during the presence of strong wind, rain, calm weather; and seldom when the ship is under way.

When air is introduced into the lower deck, through the medium of these *canvas conductors*, they, of necessity, end abruptly near some of the men's berths, and if the wind should happen to be at all strong at the time, the current of air will be such, as to be very hurtful to those who sit in the vicinity of their termination.

Again, during the continuation of fair weather, with gentle breezes, (when they are least wanted) windsails will have a salutary tendency, if carefully trimmed and shifted.

But whenever the wind is strong, the termination of the windsail should be directed from the men's berths towards the *ceiling* of the deck, by means of an *elbow*, to be attached and detached at pleasure, as recommended by the Right Hon. Sir John Sinclair, Bart.*

* During the period I belonged to the Royal Squadron, on His Majesty's visit to Scotland, the Right Honorable Sir John Sinclair, Bart. did me the honor to give me a plan explanatory of his "Improved Mode of ventilating

Thus it appears, from what has been observed, that there are many circumstances which render the operation of windsails uncertain, negative, or detrimental; and that, on the whole, they are far from being a remedy against moisture.

Of Stoves.

STOVES are not allowed to a sufficient extent in the royal navy, nor are the small number issued, often put under requisition.

But, if both these defects were remedied, any number of stoves would not be capable of drying in ten hours, that which had been wetted in as many minutes. For, owing to the peculiar construction of a ship's stove, the rays of heat are totally radiated upwards, drying only the atmosphere and ceiling of the deck; leaving the lower deck in nearly its original humid state.

Moreover, there is usually a sulphurous smell

Houses," and, at the same time, suggested to me the propriety of attaching an *elbow* to the bottom of the windsail now in use in His Majesty's ships, in such a way, that the force of the current might be expended on the ceiling of the lower deck, between the beams. By such an alteration, (as the Right Honorable Bart. observed,) "the air would be more uniformly diffused, and any possibility of the bad effects of a draught totally prevented."

emitted from such stoves, impregnated with the deleterious fumes of carbonic acid gas; which, upon the whole, does more harm than its heat does good.

Indeed, I never saw any advantage derived from the application of combustible heat; and I am sorry to add, the only permanent means of drying the decks, which has come under my observation, has been through the medium of animal heat; I mean the evaporation of moisture from the decks, by the *abstraction of heat* from the human body.

Of Drunkenness.

“ Who hath woe? who hath sorrow? who hath contentions? who hath babbling? who hath wounds without cause? who hath redness of eyes?

“ They that tarry long at the wine; they that go to seek mixed wine. At the last, it biteth like a serpent, it stingeth like an adder.” *Prov. of Solomon.*

THE bad effects of Drunkenness in the Navy stands next, in point of fatality, to the pernicious influence of humidity on the health of British seamen. It is not only the sin which most easily besets English sailors, but British subjects in general.

It has long ago slain its tens of thousands, and its seducing and soothing influence over the sensorium, seldom or ever suffered mortal to escape, that once came under its powerful dominion. Drunkenness may truly be nominated an incurable disease, and is only to be evaded by guarding against its commencement.

Spirits, however, are the means of retaining many seamen in the British navy, and often serve as a kind of opiate to those who may have been driven by necessity to enter, or who have been pressed; and are frequently highly useful to qualify bad water. Under these circumstances, our attention ought to be directed, to the best mode of giving them to do the most good, with the least accompanying evil. This will be found, however, to be a most difficult undertaking; for how shall we be able to name a quantity of rum, that would be uniformly salutary, as a daily allowance, to men of every constitution, exposed to the vicissitudes of all climates. Placed in such a position, that quantity which is best suited to the majority of men, ought to be adhered to, and our naval predecessors have been induced to consider half a pint of rum, mixed with three half pints of water, as the most salutary quantum for a British seaman in 24 hours. Doubtless there are a number of mariners who can drink

this quantity, and on many occasions with much benefit, yet there are many, otherwise strong men, who are literally made drunk by their grog;* and many men who are weakly, and those labouring under incipient pulmonary, and hepatic affections, are hastened to that “ bourn from whence none return,” by the daily stimulus of their allowance.

As a suitable allowance to valetudinarians, and those of a certain idiosyncrasy of constitution, cannot be laid down by rule, it is only to be regulated by an officer having a minute knowledge of the respective individuals.

I think, the admiral's mixture (grog,) might still be improved, by adding about 1lb of sugar

* Admiral Vernon was the first who introduced the salutary practice of mixing the sailors' allowance of spirits with water, and, like every other man, who ventures to depart from the beaten path, was branded with the name of *Innovator*, and had the nick-name of *Old Grog*, or *Grogram*, (from a kind of silk gown he wore) attached to him through life. The great advantage derived from this change to the seamen, is best calculated, by observing the confusion and intoxication which take place on certain days, when they are allowed, by way of favor, to receive their spirits unmixed. I venture to assert, that the change (simple though it may appear) was of infinitely more advantage to the country, than the taking of Porto Bello, for which the gallant Admiral received the thanks of both Houses of Parliament.

to 16 men's allowance of grog. This addendum would render the beverage more nutritive and agreeable to the seamen, and I will venture to say, the sugar will unite the spirit to the water by a stronger affinity, and on this account, intoxication would be less frequent. It is well known, spirits and water is more inebriating than a quantity of fermented liquor, (as wine, cider, porter, &c.) containing the same quantity of alcohol. The cause is as follows.

When spirits are diluted with water in any proportion, their mutual affinity for each other is so weak, that the heat of the stomach soon separates the former, which, from its volatility, attaches itself to the superior parts of the stomach, and its effects are thus indirectly communicated from the stomach to the brain, through the medium of the nervous system. Whereas, in fermented liquors, the spirit, water, and other component parts, are so strongly united, that the heat of the stomach is not sufficient to separate them; and they are, in this combined state, directly introduced into the system, and conveyed to the brain through the medium of the circulation only.

The truth of this observation may be proved by experiment out of the body, and accounts for the different effect of fermented liquors and diluted spirits on the human stomach. I have

frequently remarked, that grog is less intoxicating, when combined with sugar. Inebriety being a crime for which punishment is very justly awarded in the navy, the greatest care ought to be taken, never to give that with one hand, for which we are obliged to inflict punishment with the other. Power, therefore, might very properly be given, to issue only half or two thirds of the usual allowance to those individuals who cannot drink the whole with benefit to themselves. In the mean time, I am not aware that a man's grog can be legally stopped or lessened, unless he is actually on the sick-list.

When a man is charged with the crime of drunkenness, on examination, he is said to be either drunk or sober; but, in many cases, it will be found exceedingly difficult to point out the exact line of demarkation, or to say where sobriety ends, and inebriety begins; in all such doubtful cases, the odds should be, and of late years generally are, given in favor of a British tar.*

* It ought to be highly gratifying to every British subject, to learn how very sparingly the *rod of correction* is now used in the naval service, without any falling off in point of discipline or morality, on the part of the seamen.

During my late triennial period of servitude in His Majesty's ship *Phaeton*, punishment has been exceedingly rare, but well directed; yet, I never served in a ship with so few drunkards.

It has long been remarked, that sailors are the most imprudent class of men any where to be found, consequently, the least capable of taking care of themselves in any one way. Doubtless, this peculiarity of character, or apathy respecting their own interest, arises out of the circumstances by which they are surrounded; namely, by having a complete supply of food and raiment provided for them by Government, put under the charge of the purser, to be issued to them when wanted. Since seamen, therefore, are so perfectly insensible to their own welfare, it becomes necessary, that their officers should be on the alert for them, by guarding them against intemperance; regulating their clothing to the climate and season of the year; judiciously ventilating their berths; frequently airing their bedding; and sheltering them (as much as possible) from rain and a scorching sun, &c.

And it is in proportion to the care and patience which an officer displays in thus administering to the comforts of the men under his charge, that he is useful to the service and valuable to his country. Moreover, those individuals in the service require the most attention, to whom we are disposed to give the least; for the more abandoned a character is, the more care is necessary to preserve his health. Hard drinkers, for ex-

ample, are well known to be most subject to disease in the royal navy ; and this arises from two causes ; first, the greater degree of exposure to which such individuals are subjected in this state ; and, secondly, the subsequent weakened state of the circulation.

I have here to observe, before leaving this subject, that inebriety is not only hurtful to man in a moral point of view, but some of the most noble of his physical qualities are not a little deteriorated by it. It has often been observed, “ that men, whose spirits have been exhausted in the revel and danger of a debauch over night, are nerve-shaken, timorous, and unenterprising, on the succeeding day.”*

It is true, British seamen have rarely been found wanting in physical courage, yet, if the majority were drunkards, we might tremble for the result ; but this is supposing a state of morality different to what exists, or applying the faults of the few to the many : happily, we still

* This doctrine would almost lead one to conclude, that a man's courage depended on the strength of the circulation, or action of the heart and arteries. Be that as it may, most men are undoubtedly fitter to meet danger, when the circulation has been a little excited by spirits or wine, than after its stimulant effects have ceased. Moreover, I have observed, that those persons whose pulses were slower than the animal standard, have at least been *timorous*.

retain that steady native courage, the legitimate offspring of an unconquered ancestry, who, for centuries past, have kindled with indignation at an invading foe,

“And stand a wall of fire around their much lov'd isle.”

Remedy against Humidity on the Lower Deck.

It would serve no good purpose, thus to have pointed out the destructive influence of washing decks, if prophylactic means were not, to a certain extent, within our reach. In order, therefore, to preserve the health of a ship's company, the lower deck ought never (or very seldom) to be washed in any season or climate, but, uniformly dry holy stoned, and any water that may have been accidentally spilt there, should be carefully and speedily swabbed up, and afterwards dried by means of *warm sand* or *saw-dust*, kept in a stove in the galley for that purpose.

When the lower deck has been kept after these directions for a short time, it will be found, on examination, that it has become *white, dry, and comfortable*; and, in the event of seamen sitting, lying, or even sleeping, upon it, they will not sustain the least injury: and, not only the bedding and clothing, but, even the usual hy-

grometric state of the atmosphere between decks, will be materially improved, and general good health will be the happy result.

*Of the Time and Method of Washing the
Main and Quarter Decks.*

As the main and quarter decks will occasionally require to be *washed*, the best judgment ought to be exercised in selecting the fittest hour of the day, and taking care never to continue the operations longer than is absolutely necessary for cleanliness' sake.

Ablution can never be necessary or salutary on the quarter deck in a morning after it has rained, nor should it ever be practised in cold climates, in winter, before breakfast, (at least in the present tedious plan which requires full three hours,) but an hour in the forenoon ought to be reserved for that purpose. It has been remarked by many, that the human constitution suffers severely from standing long in water, soon after rising in the morning. I think this may be accounted for in the following way.

It is well known that, during sleep, the heat of the hammocks, crowded state of the lower deck, and fuller action of the heart, elicits the

circulation more to the surface of the body than in the erect position.

When, therefore, seamen are called up in this state to work in water, under the diminished temperature of the morning, the rush of blood from the surface to the centre is such, that no individual, having the least tendency to internal disease, can sustain the shock, without suffering the most manifest injury.

Whereas, if washing decks were performed after breakfast, time would be given for the seamen to recover from the effects of the heated and vitiated atmosphere in which they had slept, and the system, being now fortified by breakfast, would sustain little injury by washing decks, under the increasing temperature of the forenoon.*

The transition from a warm hammock, in a crowded lower deck, to the main and quarter decks, early in the morning, on many occasions, in winter, is greater than the shock from the warm to the cold bath; and this evil is much augmented by its long continuation. Yet custom, and the robust health of many seamen, prevent them from complaining: but we are not to measure the

* Few seamen have a healthy colour: this undoubtedly arises from humidity and the vitiated constitution of the atmosphere of the lower deck.

bad consequences of *cold* and *moisture* by their effects on such individuals; it is on the delicate their baneful influence becomes daily evident; who are, in fact, a kind of test to the rest of mankind, by which they are enabled to judge of the salutary tendency of the place they live in, and the habits they practise.

I am fully aware, that the time here pointed out for washing the main and quarter decks, will be objected to by many officers, on account of its breaking in upon the forenoon; but, *magna est veritas et prevalebit*. Let such individuals recollect, that every thing in the shape of show or parade, and even ordinary duty itself, ought to be sacrificed to the most important of all purposes; *viz.* taking care of the health of our brave seamen, the real source of strength and national independence.

But, unfortunately, we seldom hear the interrogatory—under what regulations will a ship be most healthy? The great consideration is, generally—under what system will she *look best*?

*Of the Means of preventing Drunkenness, and
ascertaining the Air's capacity for Moisture.*

“ O'er the dread feast malignant *Chemia* scowls,
 “ And mingles poison in the nectar'd bowls;
 “ Fell *Gout* peeps grinning through the flimsy scene,
 “ And bloated *Dropsy* pants behind unseen;
 “ Wrapp'd in his robe, white *Lepra* hides his stains,
 “ And silent *Frenzy* writhing bites his chains.”

DARWIN.

To trace out the extent of human calamity produced in the different classes of society by the varied effects of wine, spirits, and malt liquor, would furnish materials for one of the most melancholy tales ever heard by the human ear: for, alas! there are too many “ who drown the memory of the past, the frightful anticipations of the future, the remains of moral feeling, and the bloom of health, in the ocean of ebriety. There is an external character, a manner, an aspect in the inebriate, even when sober, which stamps him from the man of habitual temperance; he becomes heavy and awkward in his gait, bloated in his countenance, his eyes and eyelids are inflamed, he falters in his speech, his nose is red, his complexion sallow, his face covered with

eruptions, his breath fetid, his skin and muscles are flaccid, and his hands tremble.”*

Yet, with this most frightful picture of human misery before our eyes, there are a great many who maintain that drinking to excess, occasionally, has a salutary tendency on the human constitution:—

“ Qu’il faut à chaque mois

“ S’enivrer au moins une fois.”

And having this belief confirmed by its temporary soothing effects on the sensorium, they are soon induced to consider *chaque jour* a more agreeable period to repeat the stimulus, than *chaque mois*, and thus the habit becomes established.

It will be found more difficult to remove drunkenness from a ship than any other evil of the present day: for it is neither to be cured by actual punishment, nor by any other means whatever, when it has once taken deep root in human nature. Yet, a well regulated and effective police, under the immediate direction of a patient and judicious first lieutenant, will greatly lessen the *unequal distribution* of grog, and prevent, at least, tumultuous drunkenness.

Particular care ought to be taken, that every one drinks his own allowance, or that it be stopped; and, thus, the possibility of borrowing and

* Medico-Chirurgical Journal.

ing, buying and selling, will be effectually checked. The bad effects arising from, and the great extent to which these practices were carried on in many ships, during the late war, were truly wonderful, and difficult to detect.* If *espionnage* is to be tolerated on any occasion, this is where it would have the most salutary effect. In some ships, I have observed that the first lieutenant had a few sober and confidential men to help him to unriddle the drunken mysteries of the lower deck, by which means he was enabled to detect, regulate, or punish the offenders.

It is interesting to know, that large potations do not exert an uniform influence over the same individual. This seems to be owing to the state of the atmosphere at the time; for instance, during the continuation of moist or foggy weather, a greater quantity of ardent spirits may be drank without producing the same baneful effects on the brain or constitution, that would have taken place under a cold, dry atmosphere.†

* During the late war, (when prize money was plentiful,) a private marine informed me, he was in the habit of saving thirty pounds per annum by selling his grog.

† Sir Walter Scott has observed that, in the Hebrides, where moisture is frequent, less harm is sustained by drinking spirituous liquors than elsewhere.

This, I believe, is to be accounted for on the well-known chemical principle, "that all condensation produces heat, and all evaporation cold."* Hence, it will follow, that the greater capacity the air has for moisture, the greater will be the abstraction of heat from the body by it. On the contrary, when the air is nearly saturated with humidity, little heat will be evaporated; and, when fully saturated, none at all: the point of saturation being where the cooling process stops. And thus the sensation of cold is produced not altogether from the low temperature of the atmosphere, but, partly, from the difference there is between the air and the point at which condensation of vapour takes place; and, partly too, from the strength of the wind at the time.†

These observations are important, as, by the

* "Water, in being converted into vapour, combines with more than five times the quantity of caloric that it required to bring ice-cold water to a boiling heat, and occupies a space 800 times greater, than it does when in the form of water."

† "The natural heat of the human body is 98° of Fahrenheit's thermometer—any temperature applied to it lower than 98°, gives a sensation of cold, but if the temperature applied is not below 62°, the sensation of cold will not continue long, but be soon changed to a sensation of heat; and in this climate, air, &c. applied to the living man, does not

hygrometric state of the atmosphere, we are enabled to calculate, pretty accurately, the quantum of injury the men will be exposed to in washing decks, and to ascertain the fittest weather to be chosen for that purpose.

The best hygrometric measure is that recommended by Mr. Colebrooke. Two thermometers, with the scales detached from the bulb, are to be used. The bulb of the one is to be wetted with a rag, and, after a short time, the mercury will be observed to fall to that point at which condensation of vapour takes place. And the *difference* between this *point*, and the *other thermometer*, shewing the temperature of the atmosphere, will give the exact degree of *dryness in the air*; or, in other words, its capacity for moisture.

When (as already stated) the air has a great capacity for moisture, much injury will be sustained by those exposed to it, and vice versa.

diminish the temperature of the body, unless the temperature of it be below 62° ; if it is above that, it increases it." — *Cullen's First Lines*, vol. I. p. 130.

Although this observation may be generally correct, yet there are circumstances where I most humbly beg to differ from this celebrated physician. An individual, living in a moist lower deck, for instance, at a time when the air has a great capacity for moisture, will experience the sensation of cold, though the thermometer may range several degrees above 62° : besides, the cooling process is much increased by diminished atmospheric pressure.

Of Sick-Lists.

EVERY surgeon in the royal navy ought to keep two sick-lists; (some now do,) the first, containing those men's names who are totally incapable of performing any kind of duty, called the *Sick-list*; and, in the second, or *Convalescing-list*, those men's names are to be entered, who are in a state of progressive improvement from disease to full health; those also who have recently been under the influence of mercury, and those who have a disposition to pulmonary and hepatic affections, (although they may be free from complaint at the time,) are to be considered on this list, at least, *during washing of decks*.

All convalescing patients should only receive half allowance of grog, and this ought to be considered the *sine qua non* of that list, as it will have a beneficial tendency two ways; first, inasmuch as it will be sufficient for the patient's present state of health, and secondly, the high regard he generally has for it as *a whole*, will prevent him hanging on the surgeon's hands.

By following the above regulations, we should have a large convalescing-list, it is true; but then the sick-list would be proportionately kept down, as well as so frequent recurrence of acute disease.

OF
DRY ROT IN SHIPS.

—
“ Water restrain’d gives birth
“ To *grass* and *plants*, and thickens into earth.”

PRIOR.
—

THE following observations on Dry Rot in Ships, will be considered, by many, as going out of my department; but, perhaps, I may be excused, when it is recollected, that a Man of War in a rapid consumption, is not only a melancholy spectacle in itself, but is rendered doubly so, in associating this national loss with a conviction that a ship’s crew cannot remain long in a healthy state, when the martial walls of their habitation are quickly mouldering into dust. Moreover, the study of the laws which regulate heat and cold, moisture and aridity, (the chief agents of destruction) are closely linked with the duties of a professional man, and the growth and dissolution of all organized bodies, ought to be

familiar to him. Besides, the means hereafter to be pointed out for the preservation of His Majesty's ships, will also have a salutary tendency on the health of our seamen, and, on that account, have a double claim to our attention.

Notwithstanding that apparently endless variety which we observe in the vegetable kingdom, it appears, on analysis, that Nature has employed only *three* simple substances, oxygen, hydrogen, and carbon, in the formation of all the gradations of vegetable productions, from the majestic oak, to the dunghill mushroom.*

And, what is equally wonderful, the natural *food* of the fifty thousand plants already known, is as simple and uniform as their component parts: they all require atmospheric air and water only, with the addition of light and caloric to produce vegetation.†

* Some plants are said to yield, also, small traces of nitrogen, silex, and lime, &c. but these substances have undoubtedly been taken up by the roots.

† When we attempt to follow Nature farther, and consider the endless variety there must be in the vessels and secreting organs of plants, in order to endow them with the power of producing that countless number of fruits, oils, resins, wax, sugar, &c. which we observe in Nature; and when we remember, that trees of every description, from the cedar to the shrub, and plants, from those of the most sensitive kind within the Tropics, to the most hardy ever-

Mr. Parkes observes, that all living vegetables have the power of decomposing water, and combining, in different proportions, the hydrogen of the water with the carbon of the soil, as well as that of the carbonic acid of the atmosphere, to form the numberless productions of vegetable nature.

It is delightful to trace the chain of connexion between life and death in vegetables, and contemplate on the important offices which water has to perform, during the growth and dissolution of the vegetable kingdom.

Death is the common consequence of all life, and, during that continual decomposition of one generation of plants after another, which takes place in every part of the terrestrial globe, a great quantity of carbonic acid is liberated in union with hydrogen, by which our atmosphere would soon have become contaminated, had not some means been provided for its renovation.

green in our own regions—and herbs, of every shade of colour and quality, the most delicious, as well as those of the most poisonous nature, are *all* formed from the same simple substances, (*though combined in different proportions;*) we arrive at the *ne plus ultra* of human understanding, and are compelled to stop and wonder that such *different* products should be heated by one sun, fed by the same common nutriment, and grow in the same medium.

Living vegetables are the agents which have been employed by Nature for protecting us against the effluvia arising from dead ones, and clearing the atmosphere of the carbonic acid thrown off by animal respiration. For, by making what is noxious to animals, the natural food of vegetables, this most important office has been fulfilled.

Again, during the life of a vegetable, water is put under contribution for a large portion of its support, and after its death, water and heat hasten its dissolution, and set its elementary parts at liberty to enter into new combinations. And, in this manner, the elementary particles of all animated nature, (whether in life or after death,) are never suffered to be at rest; but perform their offices in the vegetable or animal to which they belong, only for a limited time, and after death, are again destined to occupy another place in the *great circle* of composition and decomposition.

But, a propos, it appears by observation, as well as by every information I have been able to procure, that the *alternate changes* from heat to moisture, and again from moisture to aridity, are the most favorable circumstances for hastening the destruction of timber.

The *modus operandi*, I think, may be ex-

plained in the following way. Caloric has the power of expanding nearly all bodies with which it unites, by insinuating itself among their particles;* and, during its operation on timber, the pores of the wood become dilated, by which means, moisture or rain is more completely admitted into its texture; and, after rain, the atmosphere will generally be found to have the greatest capacity for moisture, consequently, the evaporation from the woody fibre will then be most abundant, and, by a continuation of such vicissitudes, the decay of wood is greatly accelerated.

In this country, there seems to be only two modes by which wood may be preserved from decay, for a very long period of time: the *first*, by expelling the natural sap and humidity from wood before it is used, and keeping it continually dry afterwards; and, the *second*, by totally excluding atmospheric air under a low range of temperature, and the intervention of some dense substance.

Thousands of examples of the first kind of preservation are to be met with in old houses, where fires have been constantly kept. In such

* Clay, water, cast iron, and some saline substances, excepted.

houses, even those species of wood, which, under the usual changes from aridity to moisture, and again from moisture to heat, run most rapidly to decay, are preserved for a great length of time.

The second mode of preserving timber, by the total exclusion of atmospheric air, &c. is fully proved by the trunks of large fir-trees being found, in many places in Scotland, several feet deep in moss, in so high a state of preservation, that the wood is frequently split by the country people and used as a kind of rush-light.*

In certain climates, there are still other means of preventing the elementary substances of animal and vegetable bodies taking their primitive forms, *viz.* through the medium of eternal frost, as proved by large quadrupeds having been recently found incased in ice, in Siberia;† and, secondly, by excessive heat, providing there is

* The remains of those fine trees afford us a miserable picture of the degenerated state of our climate, probably owing to the rapid growth and insidious advances of that vegetable substance, *moss*.

† “An elephant was recently found by M. Adams, near the mouth of the Lena, (a river in Siberia,) the flesh of which was still in so high preservation, that it was eaten by dogs.” It is certain, nothing but the eternal frost in those regions, could have arrested the putrefactive process in so large a quadruped, for so many centuries.

little or no humidity in the air, as is sometimes the case in Africa.* But, as neither of these means of preserving bodies can be reduced to any practical utility in this country, it is useless to follow them farther.

In Great Britain, the woods which resist the powers of the destructive agents longest, are those which are of the greatest specific gravity, and closest texture, as the oak, for example; while the most porous, and, consequently, that of the least gravity, falls the easiest prey to destruction.

These considerations naturally led me to enquire, what is the cause or causes of dry rot in ships, in order that we may be enabled to guard against it?

The answer to this most important question is involved in considerable difficulty, owing to the different circumstances under which it is said to

* "We observe, (says Captain Lyons, in his Travels in Africa) many skeletons of animals which had died on the desert, and occasionally the grave of some human being; all these bodies were so dried by the extreme heat of the sun, that putrefaction did not appear to have taken place after death. In recently expired animals I could not perceive the least offensive smell. Such was the dryness of the air, that the horse-tail, in beating off the flies, the blanket, and other clothing emitted electric sparks and crackled on being rubbed."

have taken place, and from the great diversity of opinion there exists amongst men on the subject.

Its *cause* has been attempted to be traced to a *vegetable substance*, to *moisture*, *insects*, *impure air*, *putrescent juices of timber*, and to the *vegetable juices of timber*.

It would be departing from my original intention, to follow, in an Essay, the different individuals through their various opinions on this subject. But I am not inclined to impute the decay of timber to any one of those causes, abstractedly considered, but to an *alternate action* of certain destructive agents, to be hereafter mentioned.

Owing to dry rot being accompanied by the vegetation of fungi, some individuals have been induced to consider this as its chief cause, but, I trust, I shall be able to show, that it is only a link in the chain of causes, or rather a consequence of a certain state of the ship's timbers.

Linnæus has placed the order of the vegetable substance which accompanies dry rot, under the 24th Class, (Cryptogamia,) and in the 4th Order of that Class: but Dr. Smith has added a 5th Order, in which he places *fungi*.*

* This Order is determined by the plant "having no leaves, and the fructification is in a fleshy substance."

The vegetable nature of this order of plants was long doubted by some naturalists, who were disposed to ascribe

Those individuals, who assert that vegetation takes place, *sui generis*, from the juices of the timber, have been forced to this conclusion, from not being able to account for the universal diffusion of the seeds of fungi in any other way. But it is well known to naturalists and botanists, that the seeds of the mushroom may be disseminated by the wind, like the pollen, or *poussière séminale*, of many other plants;* or they may be conveyed from the forest to the dock-yard, and again, from the yard on board a ship, by adhering to the timbers, provisions, stores, &c. and there remain in a *quiescent state*, until called into vegetable existence, by favorable circumstances, *viz.* the united influence of heat, atmospheric air, and humidity.

It has already been stated in this Essay, that to them an animal origin; but the labours of Dryander, Schaeffer, and Hedwig, have shewn that they possess a vegetable character, by detecting their seeds, and explaining the parts of fructification.

In the Synopsis Methodica Fungorum of Persoon, the order of mushrooms is divided into such as produce their seeds internally, or in vessels, and such as have them exposed or imbedded in an appropriate membrane.—*Miller's Guide to Botany*, p. 181.

* *L'erigeron du Canada*, cultivé d'abord au Jardin des Plantes de Paris, s'est disséminé dans toute la France, à l'aide d'une aigrette soyeuse.—*Nouveaux Elémens de Botanique*.

the decomposition of vegetable and animal bodies is greatly retarded by any of the three following circumstances; 1st, the total exclusion of atmospheric air; 2dly, great aridity of the aerial fluid; 3dly, the eternal cold of a deep flow-moss and that of the arctic circle—the most powerful antiseptics with which we are acquainted.

It appears, therefore, from the above data, that the abstraction of air, and even a partial abstraction of heat and humidity, will arrest the decay of all substances for a great length of time.

These conclusions seem to be sanctioned by all I have seen, and by every sensible observation I have read or heard, on the subject of dry rot in houses and in ships.

In houses, we continually observe, that the decay commences first, where the change from one to the other of these states is most frequent. The ends of joists inserted into damp walls, for instance, and the *upper* and *lower* timbers of a house, are most liable to decay: the latter, arising from the evaporation of moisture from the ground, and the former, by the breaking in of the elements from above.

The same laws are uniformly obeyed in the decay of ships: for, in their *upper works*, where moisture, heat, and evaporation, follow each other in excess, the timbers run sooner to des-

truction than in their holds: this is owing, first, to the almost constant application of water to the decks, by rain or washing; 2dly, to the higher range of temperature produced there by animal and solar heat; and, 3dly, to the greater subsequent evaporation. Whereas, in the hold of a ship, the exclusion of solar and animal heat, and the low temperature maintained there by the iron ballast and ambient salt water, usually, in a great measure, preserve her timbers from decay.

These observations are further corroborated, by the yet more rapid decay of ships in warm and tropical climates, where moisture is more abundant, and heat more powerful, than in the temperate zone.

Much controversy has taken place, of late, respecting the causes and difference between the *dry* and *wet* rot in ships. I believe it consists simply in this; the former is accompanied by vegetation, and the latter is not; or, in other words, air, heat, and humidity, (besides their usual destructive qualities in dry rot,) call the dormant seeds of fungi into life: while, in the *wet rot*, the same agents only hasten the decomposition of the woody fibre.

But these distinctions are little necessary, owing to the remedy for both being the same;

for, admitting this spongy vegetation to possess the power of absorbing moisture, and maintaining a higher range of temperature than the surrounding dead matter, still, as we have no means of preventing the diffusion of the seeds, all we can do, is to endeavour to starve them, by expelling the sap, before the timber is put into a ship, and keeping her as free from moisture as possible afterwards; by which means the *pollen* will remain in a dormant state, and by the same measures, the *wet rot*, occasioned by air, heat, and humidity, will also be arrested. Indeed, our means of preserving a ship from decay, will be in exact proportion to the powers we possess of freeing the timber of its natural sap and moisture, and keeping it dry afterwards.

It is not a little remarkable, that some of the most able writers on dry rot should have fastened on causes which are hardly hypothetical; while those laws which are well established, and continue in perpetual activity, in the vegetable kingdom, should have been passed unnoticed by them.

Morrison "attributes the production of this vegetation (dry rot) to the mixture of salt and sulphur, mixed with oils from the dung of quadrupeds." While Mr. Bowden, at page 82 of his

Treatise, says, "The causes of dry rot are heat acting on the vegetable juices;" by which, says he, at page 87, "they (the juices) will rise from their dormant state into life and action, and the timber will be consequently destroyed."

Had these gentlemen not been sufficiently acquainted with the physiology of the seeds of plants to know that all vegetables perpetuate their species through the medium of seeds, suckers, slips, &c. they ought, at least, to have known, that when the great Author of Nature separated the sea and earth from the chaotic mass, and called animals and vegetables into existence, he set certain limits to their sphere of action, by giving them the faculty only to multiply "after their kind." And although man has dominion over, and is invested with power to kill, and drive back ferocious animals to the desert, and root out certain noxious weeds from the garden; yet he has never been able to exterminate a single species of either from the face of the earth. Power, therefore, has never been given to the most exalted in the class of animated existence to produce the vilest insect, nor is the stately oak, the king and pride of the forest, (during life or after death,) capable of generating even a mushroom. But, under decay, this wood yields a suitable nourishment to that

species of fungi, whose seeds had been previously disseminated by the wind, or otherwise.

I have here to mention, by the way, that although vegetables have not the power of *locomotion*, yet the diffusion of many of them is not less certain, by wings, spines, hooks, and scales; for instance, the downy appendages by which the dandelion wafts itself through the air is familiar to every one. Moreover, Nature seems less tenacious in the preservation of animal and vegetable life themselves, than she is in giving to the one a strong desire to propagate its species, and to the other the power of retaining life until that object is accomplished.*

It has been urged by the advocates for spontaneous germination from the juices of the timber, that the dry rot is an *internal disease*, from the vegetating fungi always inclining towards the exterior. But I have never seen a specimen

* Ray, rapporte qu'à la suite d'un incendie arrivé à Londres, peu de temps après, les murs furent couverts de *sisymbrium irio*. Il ajoute que cette plante étoit rare et éloignée de cette ville. Les graines s'étoient sans doute conservées dans le mortier, puisque la génération spontanée est une chimère, et que tout ce qui a vie, provient d'un œuf ou d'une graine.—*Nouveaux Elémens de Botanique*.

The living principles of seeds, eggs, and vegetables also enable them to resist congelation: this is said to be owing to their peculiar attraction for caloric.

of fungus growing from the centre, where a *fissure* could not be detected sufficiently large for the previous admission of seeds and moisture.*

Ignorance of the well-known circumstance of seeds, wherever they may be placed, growing always towards the air and light, on that side where they are most powerful, has induced them to believe the dry rot is an internal disease.

“A plant, in a shady place, inclines all its branches to that side where the action of the air and light are most powerful; and plants, confined in a hot-house, turn all their leaves and branches towards that side from which the light proceeds.”

As nothing, therefore, can be more ridiculous than the supposed germination of fungi from the juices in the heart of oak, I shall only make another quotation from a very able author, pointing out the means by which fungi are propagated.†

* “Ex nihilo, nihil; in nihilum nil posse reverti.”

† Que cette poussière que l'on trouve entre les feuillets de ce champignon, lorsqu'il a acquis un certain développement, n'est autre chose que sa graine qui, vue au microscope, ressemble assez à des graines de pavot. J'ajouterai que ces graines, semées avec profusion par-tout, sont en si grand nombre, que celles d'un seul individu de cette espèce, suffiroient, à en juger par leur extrême finesse, pour couvrir de champignons des terrains immense; mais que,

*Of the Prevention of the Dry and Wet Rot
in Ships.*

THE success that we may expect to arrive at in arresting the decay of ships, will be in proportion to the power we possess in performing the three following operations, *viz.*

1st. Freeing the wood of its natural sap and moisture, before it is put into a ship; 2dly, keeping her perfectly dry during the time she is on the stocks; and 3dly, protecting her, as much as possible, from the *alternate action* of impure

malgré qu'il faille peu de circonstances réunies pour favoriser leur développement, il en faut encore auxquelles l'art a souvent moins de part que le hazard, et que c'est par cette raison que ces graines ne lèvent pas par-tout où elles sont semées. J'ajouterai encore que, semées naturellement sur de terrains convenables, elles produisent ce qu'on appelle *blanc de champignon*; c'est à dire, des petits plants enracinés, que les maraîchers trouvent tout formés sur du fumier ou sur d'anciennes couches, et qu'ils sèment sur de nouvelles couches préparées pour cet effet; que ces même couches, sans qu'on y eût mis du *blanc* auroient pu produire à la longue des champignons de cette espèce, mais que le cultivateur fait en bien moins de temps, avec ces plants enracinés, ce que la nature auroit fait avec les graines.—*Louis Chaude Richard, Professeur de Botanique à l'Ecole de Médecine de Paris.*

air, heat, and humidity, after she is put in commission, or sent into *ordinary*.

Now, as the power we possess over the different states of the atmosphere is very limited, the *methodus medendi*, on that account, must be always defective; for we can set no limits to ever varying and diffusible caloric, and have very little more influence over “thin air.” But, fortunately, *humidity* is more tangible, and equally formidable, with any of the other destructive agents; and, on that account, I have fastened upon it, as being the only means left of stopping the march of destructive action in timber; always keeping in mind, it is the united action of these three which produces the premature decay of ships, and that the abstraction of either will arrest the vegetation of fungi, and the destruction of timber.

In order to fulfil the above injunctions, the trees of which His Majesty's ships are to be built, should always be *felled* in winter, (December and January,) for the following important reasons:—because, at this season, there is least sap in the wood, and Hibernian felled timber is of greater specific gravity, than that cut in summer, (when the ligneous vessels are filled with sap and air;) and, owing to this greater density, it is not only stronger, but its contracted pores

are less pervious to present and subsequent moisture. Winter felled timber will also require shorter time to season than that cut in summer, from there being less sap in it to evaporate.

The following operations now practised in our great naval dock-yards, of *building ships under cover*, and *housing them over in ordinary*, after having been well *caulked* and *painted* are very complete *external* means, and admit of little improvement. But the *internal* measures, with regard to *drying* and *ventilating* ships, (in my opinion,) are, in many respects, defective.

I have been informed, by many intelligent carpenters, that the pump in the well of a ship's hold, does not dry her of water by nearly a foot, even when newly sucked. Now, however necessary this arrangement may be in *sea-going* ships, no excuse can be made for it in *ordinary*, where ships are always on an even keel, and in no danger of having their pumps choked.

By remedying this defect, and enjoining greater punctuality with regard to keeping ships clean pumped out, that evaporation would be prevented from the well, &c. which keeps the under surface of the decks in a *half dry state*; and this condition I consider to be most destructive to a ship's timbers.

Of Ventilating Ships.

THAT great care and attention which used formerly to be paid to *ventilation* in the British Navy, has been rather on the decline of late years, amidst the exigencies of a long and arduous war; for, so early as the year 1756, the Lords Commissioners of the Admiralty issued an order for the ventilators of the celebrated Dr. S. Hales to be used in the Royal Navy. This order was followed by the most happy results in our men of war, and its salutary effects were yet more eminently felt in *transports* and *store-ships*.*

On active service, however, those ventilators were found to take up much room, and require more time than could well be spared to work them; and for this reason, they gradually gave way to the common windsail now in use. But, for the *peace* establishment at any rate, and for ships in *ordinary* and *guard ships*, they are very superior to the windsail of the present day.

* Dr. Hales says, "The Earl of Halifax has often informed me of the benefit they found by the use of ventilators in Nova Scotia transport ships; *twelve* to *one* more having been found to die in unventilated, than in ventilated ships."

In ventilating a ship, we ought to have three objects in view :—1st, supplying her with a current of pure air, for the purpose of animal respiration : 2dly, air is wanted to dry the decks and timbers of a ship ; and, 3dly, we must draw upon the atmosphere for diminishing the temperature of the interior of a man of war, by which her timbers, provisions, and stores, will be longer preserved. Now, it is evident, from what has been stated, that the common windsails, in this variable climate, cannot be used with advantage more than one day out of three, and during the remainder of the time, their operation will often be *null*, and sometimes even detrimental.

But, under all changes of weather, Dr. Hales' ventilators were useful in pumping out the vitiated air from the hold of a ship, while the atmospheric pressure supplied its place, with that of a cold and pure quality ; by which means, the atmosphere of the lower deck, &c. could be renovated at pleasure. It ought to be remarked here, that, owing to air becoming specifically lighter by being heated, it will continue to ascend from the interior of a ship, through the different apertures, while its place will be supplied by colder air from the exterior. This, to a certain extent, is true, and in continual opera-

tion : yet, when we recollect the great quantity of carbonic acid gas which is thrown off by animal respiration during the night, and the proportion in which this ponderous air enters into chemical combination with the atmosphere, we are compelled to admit (from its greater specific gravity) that the holds and store rooms, &c. will become the receptacles of this pestiferous gas. But the evil does not end here, for fixed air furnishes a natural and luxurious nourishment for fungi ; carbon being part of the food and the base of all the vegetable kingdom. Indeed, this is a process which Nature employs for the double purpose of nourishing plants and renovating our atmosphere.*

The method I would recommend for ventilating ships is as follows. During the continuation of wind, and while there is considerable motion in a ship, the windsail now in use and Mr. Perkins' ventilator will answer the purpose most completely : but when neither wind nor motion is present, we must have recourse to manual strength and machinery to pump out the vitiated

* I once saw the hold of a ship so filled with fixed air, that a candle would not burn in it ; and a dog, which was thrown in, instantly became convulsed. The hold of a ship may thus be rendered as hostile to the canine tribe as the famous "Grotto del Cane" in Italy.

air; and the atmospheric pressure will supply its place with that of a cold and pure quality.

The windsail and Mr. Perkins's ventilator will be best suited to *sea-going* ships; while an engine for pumping out the foul air, (after the manner of ventilating the Session House at the Old Bailey,) will be better adapted for ships in ordinary and guard ships, where the rolling is inconsiderable.

Mr. Perkins's method of ventilating the hold of a ship, will at once be understood, by referring to the plate—the Frontispiece.

A SECTION OF THE VENTILATOR.

a a, tanks, or water butts.

b b, hose for conducting the foul air *into* the tanks.

c c, hose for conducting the foul air *from* the tanks.

d, connecting water pipe.

e e, valves for admitting the foul air into the tanks.

f f, valves for allowing the foul air to escape.

The operation of this self-acting ventilator is as follows: Each tank or butt is half filled with water, which flows freely from one to the other through the pipe *d*. The quantity of water running alternately from each depends upon the motion of the ship. When one of the tanks is elevated by the ship's motion, the water will run through the pipe *d* into the depressed tank, and thereby discharge as much foul air through the valve *f* as the additional water displaces. The elevated tank at the same time is receiving the foul air through valve *e*, from the hold of the ship, to supply the vacuum that would otherwise be

made by the escape of the water. If the tanks are fixed at right angles with the keel of the ship, the ventilator will operate only with the roll of it; but, if placed diagonally, both the pitch and roll of the vessel will discharge the foul air. It would be most economical to fill the tanks at the beginning of the voyage. The first water for the ship's use should be taken from the ventilating tanks, leaving, however, half of it behind for operation. If the remaining water should ever be wanted for the ship's use, it can be drawn off, and replaced by salt water. It will be seen that, by this mode of ventilating, nothing but the hose and valves are to be added to what must necessarily be on board every ship.

Any improvement in the Arts generally becomes valuable in exact proportion to its strength and simplicity; for when an implement is complicated or easily deranged, it is only useful in the hands of the inventor and the scientific. Mr. Perkins's ventilator not only combines those properties in a most eminent degree, but, from its principle, works hardest when most wanted. In a gale of wind, when the hatchways are on, and when there is much straining and rolling in a ship, the noxious gases are then generated to the greatest extent; then, also, the operations of the ventilator become most powerful, both in admitting fresh, and expelling foul, air. If another ventilator be placed parallel with the keel of a ship, it would, on many occasions, be useful in forcing out the gases, when she is pitching deep

at anchor. I will venture to say, if ships were built of well-seasoned timber, protected from the excess of washing decks, and ventilated after the principle here laid down, their decay would never be premature.

The *application of heat*, by means of stoves, to dry the holds and under works of a ship, is as useless as kindling a fire in a parlour to dry the cellar. Besides, combustible heat is altogether a very doubtful remedy; for when a ship shall happen to have been built of wood containing part of its natural sap and moisture, heat, applied short of expelling them completely, will unquestionably do harm, by calling into vegetation the seeds of the fungi, which, under a lower range of temperature, would have remained in a quiescent state.

As the *juices of the oak* are known to abound with tannin and gallic acid, those individuals who imagine vegetation proceeds from the sap of the timber, have recommended it to be drenched in solutions of the alkalies and alkaline earths, in order to decompose them: and speak of the union of the acid with the alkali in the ligneous fibre with the same confidence as if it were in the mortar of an apothecary. For my own part, I would as soon believe soda capable of absorbing the phosphoric acid from the human bones,

on applying it to the skin, as expect it would neutralize the gallic acid in the heart of oak.

Farther, alkaline solutions, owing to their great affinity for water, would hasten that decay in timber which they are intended to prevent; moreover, men could not live in a ship so saturated.

All the benefit, therefore, to be derived from lime-water, solutions of glue, common salt, oil, &c. is to be obtained from common paint alone; so far as they are capable of closing the pores, and rendering the wood less pervious to heat and humidity, are they useful, and no farther.*

Of the Growth and Properties of Moss in preserving Timber.

Moss is produced by an accumulation of dead vegetables, preserved in a partially decayed state, by a steady range of low temperature.

* *Moisture* has another destructive influence on timber, viz. that of causing it to throw off its coat of paint. If a piece of timber is painted, after having been previously saturated with water, on the arrival of the first frost, the paint will be observed to scale off. This is owing to water obeying different laws from most other substances, or occupying a greater space in the frozen, than it did in the aqueous, state.

Upwards of *three* hundred different species of Moss have been enumerated by naturalists ; but as *Flow-Moss* only, is capable of preserving timber from decay, I shall confine myself chiefly to that species.

Flow-mosses are to be found, in the greatest perfection, in flat situations, at considerable altitudes from the sea, and where water cannot easily make its escape. In Great Britain they thrive best when exposed to, and fed by, the moist winds of the western ocean. Hence it is, that more extensive mosses are to be found on the West than on the Eastern coast of Scotland : for, when these occidental winds, loaded with humidity, come in contact with the cold mountainous districts of the West, but more particularly with the flow-mosses there, condensation of moisture instantly takes place ; and, owing to the prevalence of such winds, the most abundant supply of food is thus furnished to the different species of plants indigenous to moss. After the death of one race of flow-moss plants, the medium, (moss) in which they had vegetated, maintain so low a range of temperature, that their elementary parts are not suffered to be dissipated in the air, by *repulsive caloric*, after the usual manner, but are arrested on the site of their germination : and thus, in process of time, mosses

have accumulated from five to fifty feet in thickness.*

“ Captain Duff, R. N. in a paper lately read before the Royal Society of London, after stat-

* A flow-moss, situated in the middle of a country, of perhaps thirty feet thick, ten miles long, and three or four miles in breadth, (there are several larger than this in Scotland and Ireland) is like an immense ice-berg floating in the ocean; it maintains a low temperature itself, and diminishes that of all surrounding bodies. During the continuation of Westerly and Southerly winds, such a huge mass of cold matter generally acts as a CONDENSER; hence, we observe mist precipitating on the “mountain’s brow,” and fogs descending into the bosom of flows in such weather.

Under ordinary circumstances, condensation and evaporation are nearly equal on a given surface: but moss is of a more greedy nature, it *takes* more than it *gives*, and, in a great measure, preserves that which it had taken.

The action of moss on Boreal wind, on the other hand, is of a more negative kind, from such wind containing less moisture, and being nearer the heat of the flow, it seldom yields up much of its humidity.

On other occasions, when the atmosphere has a great capacity for moisture, the most exuberant and pernicious exhalations are carried off from these immense *arsenals* of humidity, chilling and deteriorating the ambient air to a great extent around. Indeed, when we consider the great quantity of water carried off from the equatorial regions, (where evaporation is excessive) to be eternally fixed near the Poles by congelation; as well as the immense reservoirs of water, arrested in all our accumulating mosses, we are enabled, in some measure, by those increasing receptacles, to account for the receding of the ocean.

ing the well-known effects of peat moss in preserving wood for ages unaltered, suggests, that a series of experiments should be made to ascertain the effects of impregnating timber, both sound and already partially decayed by the dry rot, with the water from peat mosses, with a view to determine whether it possesses any power in preventing or suspending the insidious operation of that destructive agent."

The experiments here recommended to be tried by Captain Duff, have been most extensively tried by Nature, in all the different varieties of moss, and have uniformly failed, except in *deep flow-mosses*. For, neither in hill-moss, bent-moss, nor even in the edges of flow-mosses, (where it is of little depth) is timber ever found in a preserved state. But in deep flows, I have frequently seen the remains of stately trunks of fir trees in so high a state of preservation that part of them is often split by the country people, and made into a kind of rope.

The antiseptic qualities of *flow-moss*, therefore, is solely to be attributed to its maintaining an uniformly low temperature, and to the exclusion of atmospheric air by the interposition of several feet of wet moss, to the bottom of which solar heat never penetrates, and where a thermometer, when buried, oscillates only from 35°

of Fahr. in winter, to a few degrees above 40° in summer.* In such mosses the bodies of certain human beings shot by the military in the reign of Charles II. in the struggle to establish episcopacy in Scotland, have lately been found in a state of high preservation.

Some individuals have attributed the preservation of fir-trees to a large quantity of resin and turpentine found in their composition; but these cannot be the antiseptic agents, otherwise, timber would be found equally fresh in all the different varieties of moss, which is never the case. I have observed, in some wretched hovels in the highlands of Scotland, where the smoke was suffered to find its way out of the house by different apertures, that the wood which supported the heath or thatch covering, had resisted the efforts of all destroying time, accompanied by heat and humidity to an amazing degree. The timbers, in such houses, are covered with a black

* In chemical language, the cohesive attraction of all organized substances must first be overcome by caloric or *insensible* repulsion, before their constituent parts are suffered to enter into chemical affinities, or form new combinations. Now, owing to the great cold at the bottom of flow-mosses, the cohesive attraction of an animal or vegetable substance is never overcome there by heat; consequently, no putrefaction nor decomposition can rapidly follow.

oleaginous substance, arising from the diffusion of the smoke of the wet peat fuel. Now, as an impure pyroligneous acid, and empyreumatic oil, may be obtained by destructive distillation from peat fuel, as well as from the beech and birch, there is no doubt it is through the agency of these substances the wood is preserved.

Smoaking timber, therefore, deserves a trial, and bids fairer than any of the topical applications to preserve it to a good old age.

In these times of peace, when the growth of timber must be considerably more than its expenditure, it would be interesting to deposite a certain number of trees, annually, in some of our *deep flow-mosses*, for the double purpose of preserving them, and of ascertaining if wood, so saturated, possessed more durability than other timber afterwards.

On the principles laid down in this Essay, the driest and coldest haven ought to be selected for laying ships up in ordinary, in preference to a warm and moist one. Plymouth harbour, on account of the heat and humidity of the atmosphere, is undoubtedly the worst suited for this purpose of any in England.

To *recapitulate*—I feel convinced that I have made good the burden of my charges against the abuse of water in so frequently washing

decks. Its deleterious effects on the lower deck, in exciting inflammatory disease, in robbing the body of its heat, and saturating the decks, men's clothes and bedding, with moisture, no one can attempt to deny.

The *cold* and *moisture* to which seamen are exposed on the main and quarter decks, (early in the morning, even in the winter months) immediately after sleeping on a warm and crowded lower deck, must be equally evident to every unprejudiced mind; and the injury done to them, and His Majesty's ships, by the aggregate of *moisture* and *impure* air, arising from a great accumulation of filth and bilge water in a ship's hold, and the coiling down of wet hempen cables in the tier, cannot be calculated, because windsails and stoves afford little or no relief from such nuisances. Besides, it has been well authenticated, that if two ships shall happen to be cruising together on salt provisions, the one making the most abundant use of water in washing decks, will invariably have the greatest number of scorbutic patients on the sick-list.

The remedy pointed out against humidity on the lower deck is complete, and a more salutary time for washing the main and quarter decks will be seen in that chapter.

The measures recommended to prevent drun-

kenness will, I hope, be found useful, and the method of ascertaining the air's capacity for moisture, and the consequent injury sustained by individuals exposed to washing decks at the time, will be valuable in a practical point of view.

I think I have, also, satisfactorily proved, that the decay of timber is never *premature* unless exposed to the alternate action of impure air, a high temperature, and humidity; and, that the only power we possess in retarding it, is by endeavouring to abstract one of its destructive agents: and water and the juices of timber being the most tangible, I have recommended that the timbers should be well seasoned before they are put into a ship, and that the decks be protected from the excess of washing, and well ventilated afterwards, by which means, the men's health will be much benefited, and the decay of wood greatly retarded. Moreover, from the windsails now in use being incapable, on many occasions, of dislodging the ponderous gases, generated in the lower department of a ship, I have recommended that they should be pumped, out by certain ventilators.

To the *few* officers in the royal navy who keep the hold clean, dry holy stone the lower deck, and select a mild period for washing the main

and quarter decks, the foregoing observations cannot apply: and, by the *many* equally zealous officers, who come within their limits, I hope they will not be taken amiss: “my object is not to give offence, but to convince;—not to attack in person, but in principle;—not to interfere with motives, but point out the abuse of them.”

The above conclusions on the baneful effects of humidity on our seamen, have been the result of ten years observation in actual service, during which period, I had almost daily reason to lament the abuse of washing decks, and with this strong conviction on my mind, I was induced to throw my observations together in manuscript, and shew them to some of the most eminent physicians of this great metropolis, who so completely accorded with me in sentiment, that I have been encouraged to lay them before the public.

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