

A discourse upon some late improvements of the means for preserving the health of mariners. Delivered at the anniversary meeting of the Royal Society, November 30, 1776 / [Sir John Pringle].

Contributors

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A
DISCOURSE

UPON

SOME LATE IMPROVEMENTS

Of the MEANS for

Preserving the Health of Mariners.

DELIVERED AT THE

Anniversary Meeting of the ROYAL SOCIETY,

November 30, 1776.

By Sir JOHN PRINGLE, Baronet,

PRESIDENT.

PUBLISHED BY THEIR ORDER.



LONDON,

PRINTED FOR THE ROYAL SOCIETY.

MDCCLXXVI.

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GENTLEMEN,

BEFORE we proceed farther in the business of this day, permit me to acquaint you with the judgment of your Council, in the disposal of Sir GODFREY COPLEY'S medal; an office I have undertaken at their request, and with the greater satisfaction, as I am confident you will be no less unanimous in giving your approbation, than they have been in addressing you for it upon this occasion. For though they were not insensible of the just title that several of the Papers, composing the present volume of your Transactions, had to your particular notice, yet they did not hesitate in preferring that which I presented to you from Captain Cook, giving *An account of the method he had taken to preserve the health of the crew of his Majesty's ship the Resolution during her late voyage*

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round the world *. Indeed I imagine that the name alone of so worthy a member of this Society would have inclined you to depart from the strictness of your rules, by conferring upon him that honour, though you had received no direct communication from him; considering how meritorious in your eyes that person must appear, who hath not only made the most extensive, but the most instructive voyages, who hath not only discovered, but surveyed, vast tracts of new coasts, who hath dispelled the illusion of a *terra australis incognita*, and fixed the bounds of the habitable earth, as well as those of the navigable ocean, in the Southern Hemisphere.

I shall not, however, expatiate on that ample field of praise, but confine my discourse to what was the intention of this honorary premium, namely, to crown the Paper of the year which should contain the most useful and most successful experimental inquiry. Now what inquiry can be so useful as that which hath for its object the saving the lives of men? and when shall we find one more successful than that before us? Here are no vain boastings of the empiric, nor ingenious and delusive theories of the dogmatist; but a concise, an artless, and an incon-

* The Paper itself, read at the Society in March last, with an Extract of a letter from Captain Cook to the President, dated Plymouth, the 7th of July following, are both subjoined to this discourse.

tested relation of the means, by which, *Under the divine favour, Captain Cook, with a company of a hundred and eighteen men, performed a voyage of three years and eighteen days, throughout all the climates from fifty-two degrees North to seventy-one degrees South, with the loss of only one man by a disease**. What must enhance to us the value of these salutary observations, is to see the practice hath been no less simple than efficacious.

I would now inquire of the most conversant in the study of Bills of Mortality, whether in the most healthful climate, and in the best condition of life, they have ever found so small a number of deaths in such a number of men, within that period of time? How great and agreeable then must our surprize be, after perusing the histories of long navigations in former days, when so many perished by marine diseases, to find the air of the sea acquitted of all malignity, and in fine that a voyage round the world may be undertaken with less danger to health than a common tour in Europe!

But the better to see the contrast between the old and the present times, allow me to recall to your memory

* This was a *phthisis pulmonalis* terminating in a dropsy. Mr. PATTEN, Surgeon to the *Resolution*, who mentioned to me this case, observed that this man began so early to complain of a cough and other consumptive symptoms, which had never left him, that his lungs must have been affected before he came on board.

what you have read of the first voyage for the establishment of the East-India Company. The equipment consisting of four ships, with four hundred and eighty men, three of those vessels were so weakened by the scurvy, by the time they had got only three degrees beyond the Line, that the merchants, who had embarked on this adventure, were obliged to do duty as common sailors; and there died in all, at sea, and on shore at Soldania (a place of refreshment on this side of the Cape of Good-Hope) one hundred and five men, which was near a fourth part of their complement. And hath not Sir RICHARD HAWKINS, an intelligent as well as brave officer, who lived in that age, recorded, that *in twenty years, during which he had used the sea, he could give an account of ten thousand mariners who had been consumed by the scurvy alone?* Yet so far was this author from mistaking the disease, that I have perused few who have so well described it. If then in those early times, the infancy I may call them of the commerce and naval power of England, so many were carried off by that bane of sea-faring people, what must have been the destruction afterwards, upon the great augmentation of the fleet, and the opening of so many new ports to the trade of Great-Britain, whilst so little advancement was made in the nautical part of medicine?

But passing from those old dates to one within the remembrance of many here present, when it might have been expected that whatever tended to aggrandize the naval power of Britain, and to extend her commerce, would have received the highest improvement; yet we shall find, that even at this late period few measures had been taken to preserve the health of seamen, more than had been known to our uninstructed ancestors. Of this assertion the victorious, but mournful, expedition of Commodore ANSON affords too convincing a proof. It is well known, that soon after passing the Streights of Le Maire, the scurvy began to appear in his squadron; that by the time the *Centurion* had advanced but a little way into the South-sea, forty-seven had died of it in this ship; and that there were few on board who had not, in some degree, been affected with the distemper, though they had not been then eight months from England. That in the ninth month, when standing for the island of Juan Fernandez, she lost double that number; and that the mortality went on at so great a rate (I still speak of the Commodore's ship) that, before she arrived there, she had buried two hundred; and at last could muster no more than six of the common men in a watch capable of doing duty. This was the condition of one of the three ships which reached that island; the other two suffered in proportion.

Nor

Nor did the tragedy end here; for after a few months respite, the same fatal sickness broke out afresh and made such havock, that before the *Centurion* (which now contained the whole surviving crews of the three ships) had got to the island of Tinian, there died sometimes eight or ten in a day; insomuch that when they had been two years on the voyage, they had lost a larger proportion than that of four in five of their original number; and, by the account of the historian, all of them, after their entering the South Sea, of the scurvy. I say by the account of the elegant writer of the voyage, for as he neither was in the medical line himself, nor hath authenticated this part of his narrative by appealing to the surgeons of the ship or their journals, I should doubt that this was not strictly the case; but rather, that in producing this great mortality that pestilential kind of distemper was combined with the scurvy, which, from the places where it most frequently occurs, hath been distinguished by the name of the *jaundice* or *hospital-fever* *. But whether the scurvy alone, or this fever combined with it, were the cause, it is not at present material to inquire, since both, arising from foul air and other sources of putrefaction, may now in a great

* Dr. MEAD, who had seen the original observations of two of Commodore ANSON's surgeons, says, that the scurvy at that time was accompanied with *putrid fevers*, &c. See his Treatise on the Scurvy, p. 98. & seq.

measure be obviated by the various means fallen upon since Lord ANSON's expedition. For in justice to that prudent as well as brave Commander it must be observed, that the arrangements preparatory to his voyage were not made by himself; that his ship was so deeply laden as not to admit of opening the gun-ports, except in the calmest weather, for the benefit of air; and that nothing appears to have been neglected by him, for preserving the health of his men, that was then known and practised in the navy.

I should now proceed to enumerate the chief improvements made since that period, and which have enabled our ships to make so many successful circumnavigations as in a manner to efface the impression of former disasters; but as I have mentioned the sickness most destructive to mariners, and against the ravages of which those preservatives have been mainly contrived, it may be proper briefly to explain its nature, and the rather as unless among mariners it is little understood. First then I would observe, that the scurvy is not the ailment which goes by that name on shore. The distemper commonly, but erroneously in this place, called the *scurvy* belongs to a class of diseases totally different from what we are now treating of; and so far is the commonly-received opinion, that *there are few constitutions altogether free from a scor-*
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butic taint, from being true, that unless among sailors and some others circumstanced like them, more particularly with respect to those who use a salt and putrid diet, or live in foul air and uncleanness, I have reason to believe there are few disorders less frequent. This opinion I submitted to the judgment of the Society several years ago and I have had no reason since to alter it. I then said (contrary to what was generally believed) and seemingly on the best authority, that the sea-air was never the cause of the scurvy, since on board a ship, on the longest voyages, cleanliness, ventilation, and fresh provisions would preserve from it; and that upon a sea-coast, free from marshes, the inhabitants were not liable to that indisposition, though frequently breathing the air from the sea*. I concluded with joining in sentiments with those who ascribed the scurvy to a septic resolution, or beginning corruption, of the whole habit, similar to what every animal substance is more or less disposed to when deprived of life †. This theory seemed to be sufficiently verified by the examination of the symptoms in the scorbutic sick and of the appearances in their bodies after death ‡. O

* Diseases of the Army, part I. ch. 1. Append. Pap. 7.

† Ibid. Pap. 7.

‡ WOODALL's Surgeon's Mate, p. 163. POUPART, Mem. de l'Acad. des Sc. A. 1699. PETIT, Mal. des Os, t. II. p. 446. MEAD on the Scurvy p. 104.

at occasion I remarked, that salted meats after some time become in effect putrid, though they may continue long palatable by means of the salt; and that common salt, supposed to be one of the strongest preservatives from corruption, is at best but an indifferent one, even in a large quantity; and in a small one, such as we use at table with fresh meats, or swallow in meats that have been salted, so far from impeding putrefaction, it rather promotes that process in the body.

This position concerning the putrefying quality of sea-water, in certain proportions, hath been since confirmed by the experiments of the late Mr. CANTON, F. R. S. in his Paper on the Cause of the luminous Appearance of sea-water †.

It hath been said, that the scurvy is much owing to the coldness of the air, which checks perspiration; and is therefore the endemic distemper of the Northern nations, and particularly of those around the Baltic*. The first is partly true, but I doubt not so the cause. In those regions, by the long and severe winters, the cattle destitute of pasture can barely live, and are therefore unfit for use; that the people, for their provision during that season,

* BARTHOLIN. Med. Danor. Domestic. p. 98.

† Phil. Transact. vol. LIX. p. 446.

are obliged to slaughter them by the end of autumn, and to salt them for half the year. This putrid diet then, to which they must subsist so long, and to which the inhabitants of the South are not reduced, is the chief cause of the disease. And if we reflect, that the lower people of the North have few or no greens nor fruit in the winter, little fermented liquors, and often live in damp, foul and ill-aired houses, it is easy to conceive how they should become liable to the same indisposition with seamen; while others of as high a latitude, but who live in a different manner, keep free from it. Thus we are informed by LINNÆUS, that the Laplanders, one of the most hyperborean nations, know nothing of the scurvy*; for which no other reason can be assigned than their never eating salted meats, nor indeed salt with any thing, but their using in the winter the fresh flesh of their rein-deer.

This exemption of the Laplanders from the general disposition of the North is the more observable, as they seldom taste vegetables, bread never, as we farther learn from that celebrated author. Yet in the very province which borders on Lapland, where they use bread, but scarce any other vegetable, and eat salted meats, they are

* LINNÆI Flora Lapponica, p. 8, 9.

much troubled with the scurvy as in any other country*. But let us incidentally remark, that the late improvements in agriculture, gardening, and the other arts of life, by extending their influence to the remotest parts of Europe, and to the lowest people, begin sensibly to lessen the frequency of that complaint, even in those climates that have been once the most afflicted with it.

It hath also been asserted, that men living on shore will be affected with the scurvy, though they have never been accustomed to a salt-diet; but of this I have never known an instance, except in those who breathed in an air that is marshy, or otherwise putrid, and who wanted exercise, fruits and green vegetables: under such circumstances it must be granted that the humours will corrupt in the same manner, though not in the same degree, with those of mariners. Thus, in the late war, when Sissinghurst Castle in Kent was filled with French prisoners, the scurvy broke out among them, though they had never been served with salted victuals in England; but had daily had an allowance of fresh meat, and of bread in proportion, though without greens or any other vegetable. The surgeon

* LINNÆUS in several parts of his work confirms what is here said of salted meats, as one of the chief causes of the scurvy. See *Amœnitat. Acad.* vol. V. p. 6. & seq. p. 42.

who attended them, and from whom I received this information, having formerly been employed in the navy, was the better able to judge of the disorder, and to cure it. Besides the deficiency of greens, he observed that the wards were foul and crowded, the house damp (from a moat that surrounded it) and that the bounds allotted for taking the air were so small, and in wet weather so floughy, that the men seldom went out. He added, that a representation having been made, he had been empowered to furnish the prisoners with roots and greens for boiling in their soup, and to quarter the sick in a neighbouring village in a dry situation, with liberty to go out for air and exercise; and that by these means they had all quickly recovered. It is probable, that the scurvy sooner appeared among these strangers, from their having all been taken at sea, and consequently being the more disposed to the distemper. My informer farther acquainted me, that in the lower and wetter parts of that county, where some of his practice lay, he had now and then met with slihter cases of the scurvy among the common people; such, he said, as lived the whole winter on salted bacon, without fermented liquors, greens, or any fruit, a few apples excepted; but, he remarked, that in the winters following a plentiful growth of that fruit, those peasants were visibly less liable to that ailment.

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I have dwelt the longer on this part of my subject, as I look upon the knowledge of the nature and cause of the scurvy to be an essential step towards improving the means of prevention and cure. And I am persuaded, after long reflection, and the opportunities I have had of conversing with those who to much sagacity had joined no small experience in nautical practice, that upon an examination of the several articles, which have either been of old approven, or have of late been introduced into the navy, it will appear, that though these means may vary in form and in their mode of operating; yet they all some way contribute towards preventing *putrefaction*; whether of the air in the closer parts of a ship, of the meats, of the water, of the clothes and bedding, or of the body itself. And if in this inquiry (which may be made by the way, whilst we take a review of the principal articles of provision, and other means used by Captain Cook to guard against sickness) I say, if in this inquiry it shall appear, that the notion of a septic cause is not without foundation, it will be no small encouragement to proceed on that principle, in order to improve this important branch of medicine.

Captain Cook begins his list of stores with *malt*: Of this, he says, *was made sweet-wort, and given not only to those*

those men who had manifest symptoms of the scurvy, but to such also as were judged to be the most liable to it. Dr. MACBRIDE, who first suggested this preparation, was led (as he says) to the discovery by some experiments that had been laid before this Society; by which it appeared, that the air produced by alimentary fermentation was endowed with a power of correcting putrefaction. The fact he confirmed by numerous trials, and finding this fluid to be *fixed air*, he justly concluded, that whatever substance proper for food abounded with it, and which could be conveniently carried to sea, would make one of the best provisions against the scurvy; which he then considered as a putrid disease, and as such to be prevented or cured by that powerful kind of antiseptic*. Beer, for instance, hath always been esteemed one of the best antiscorbutics; but as that derived all its *fixed air* from the malt of which it is made, he inferred, that malt itself was preferable in long voyages, as it took up less room than the brewed liquor, and would keep longer sound. Experience hath since verified this ingenious theory, and the malt hath now gained so much credit in the navy, that there only wanted so long, so healthful, and so celebrated a voyage as this, to rank it among the most indispensable articles of provision. For though Captain COOK remarks, that *A*

* MACBRIDE'S Experimental Essays, *passim*.

proper attention to other things must be joined, and that he is not altogether of opinion, that the wort will be able to cure the scurvy in an advanced state at sea; yet he is persuaded, that it is sufficient to prevent that distemper from making any great progress, for a considerable time; and therefore he doth not hesitate to pronounce it, one of the best antiscorbutic medicines yet found out.*

This salutary *gas* (or *fixed air*) is contained more or less in all fermentable liquors, and begins to oppose putrefaction as soon as the working or intestine motion commences.

In wine it abounds, and perhaps no vegetable substance is more replete with it than the fruit of the vine. If we join the grateful taste of wine, we must rank it first in the list of antiscorbutic liquors. Cyder is likewise

* Having been favoured with a sight of the medical journal of Mr. PATTEN, surgeon to the *Resolution*, I read the following passage in it, not a little strengthening the above testimony. *I have found the wort of the utmost service in all scorbutic cases during the voyage. As many took it by way of prevention, few cases occurred where it had a fair trial; but these, however, I flatter myself, will be sufficient to convince every impartial person, that it is the best remedy hitherto found out for the cure of the sea-scurvy: and I am well convinced, from what I have seen the wort perform, and from its mode of operation, that if aided by portable-soup, sour-kroot, sugar, sago, and courants, the scurvy, that maritime pestilence, will seldom or never make its alarming appearance among a ship's crew, on the longest voyages; proper care with regard to cleanliness and provisions being observed.*

good, with other vinous productions from fruit, as also the various kinds of beer. It hath been a constant observation, that in long cruizes or distant voyages the scurvy is never seen whilst the small-beer holds out at a full allowance; but that when it is all expended, the disorder soon appears. It were therefore to be wished, that this most wholesome beverage could be renewed at sea; but our ships afford not sufficient convenience. The Ruffians however make a shift to prepare at sea, as well as at land, a liquor of a middle quality between wort and small-beer, in the following manner. They take ground malt and rye-meal in a certain proportion, which they knead into small loaves, and bake in the oven. These they occasionally infuse in a proper quantity of warm water, which begins so soon to ferment, that in the space of twenty-four hours their brewage is compleated, in the production of a small, brisk, and acidulous liquor, which they call *quas*, palatable to themselves and not disagreeable to the taste of strangers. The late Dr. MOUNSEY, member of this Society, who had lived long in Ruffia, and had been *Archiater* under two successive soveraigns, acquainted me that the *quas* was the common and wholesome drink both of the fleets and armies of that empire, and that it was particularly good against the scurvy. He added,

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that happening to be at Moscow when he perused the *Observations on the Jail-Fever*, published here, he had been induced to compare what he read in that treatise with what he should see in the several prisons of that large city: but to his surprize, after visiting them all, and finding them full of malefactors (for the late Empress then suffered none of those who were convicted of capital crimes to be put to death) yet he could discover no fever among them, nor learn that any acute distemper peculiar to jails had ever been known there. He observed that some of those places of confinement had a yard, into which the prisoners were allowed to come for the air; but that there were others without this advantage, yet not sickly: so that he could assign no other reason for the healthful condition of those men than the kind of diet they used; which was the same with that of the common people of the country, who not being able to purchase flesh-meat live mostly on rye-bread (the most acescent of any bread) and drink *quas*. He concluded with saying, that upon his return to St. Petersburg he had made the same enquiry there, and with the same result.

Thus far my informer, from whose account it would appear, that the rye-meal assisted both in quickening the fermentation and adding more fixed air; since the malt

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alone could not so readily produce so acidulous and brisk a liquor. And there is little doubt but that whenever the other grains can be brought to a proper degree of fermentation, they will more or less in the same way become useful. That oats will, I am satisfied, from what I have been told by one of the intelligent friends of Captain Cook. This gentlemen being on a cruize in a large ship*, in the beginning of the late war, and the scurvy breaking out among his crew, he bethought himself of a kind of food, he had seen used in some parts of the country, as the most proper on this occasion. Some oatmeal is put into a wooden vessel, hot water is poured upon it, and the infusion continues until the liquor begins to taste sourish, that is, till a fermentation comes on, which in a place moderately warm may be in the space of two days. The water is then poured off from the grounds, and boiled down to the consistence of a jelly†. This he ordered to be made, and dealt out in messes, being first sweetened with sugar, and seasoned with some prize-wine he had taken, which though turned sour, yet improved the taste, and made this aliment no less palatable than medicinal.

He assured me, that upon this diet chiefly, and by abstaining from salted meats, his *scorbutic* sick quite re-

* The Effex, a seventy-gun ship.

† This rural food, in the North, is called *sgoins*.

covered on board; and not in that voyage only, but by the same means in his subsequent cruizes, during the war, without his being once obliged to send one of them on shore because they could not get well at sea. Yet oatmeal unfermented, like barley unmalted, hath no sensible effect in curing the scurvy; as if the *fixed air*, which is incorporated with these grains, could mix with the chyle which they produce, enter the lacteals, and make part of the nourishment of the body, without manifesting any elastic or antiseptic quality, when not loosened by a previous fermentation.

Before the power of the *fixed air* in subduing putrefaction was known, the efficacy of fruits, greens, and fermented liquors, was commonly ascribed to the acid in their composition, and we have still reason to believe that the acid concurs in operating the effect. If it be alledged that mineral acids, which contain little or no *fixed air*, have been tried in the scurvy with little success, I would answer, that I doubt that in those trials they have never been sufficiently diluted; for it is easy to conceive, that in the small quantity of water the elixir of vitriol, for instance, is given, that austere acid can scarce get beyond the first passages, considering the delicate sensibility of the mouths of the lacteals, which must

force them to shut and exclude so pungent a liquor. It were therefore a proper experiment to be made in a deficiency of malt, or when that grain should happen to be spoilt by keeping*, to use water acidulated with the spirit of sea-salt, in the proportion of only ten drops to a quart; or with the weak spirit of vitriol, thirteen drops to the same measure †; and to give to those that are threatened with the disease three quarts of this liquor in the day, to be consumed as they shall think proper.

But if the *fixed air* and acids are such preservatives against the scurvy, why should Captain Cook make so little account of the *rob* of lemons and of oranges (for so they have called the extracts or inspissated juices of those fruits) in treating that distemper? This I found was the reason. These preparations being only sent out upon trial, the surgeon of the ship was told, at a conjecture, how much he might give for a dose, but without strictly limiting it. The experiment was made with the quantity specified, but with so little advantage, that judging it not adviseable to lose more time, he set about the cure with the wort only,

* Captain Cook told me, that the malt held out sufficiently good for the two first years; but that in the third, having lost much of its taste, he doubted whether it retained any of its virtues. Mr. PATTEN however observed, that though the malt at that time was sensibly decayed, yet nevertheless he had still found it useful, when he employed a larger proportion of it to make the infusion.

† In these proportions I found the water just acidulous and pleasant.

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whereof the efficacy he was certain; whilst he reserved these *robs* for other purposes, more particularly for colds, when to a large draught of warm water, with some spirits and sugar, he added a spoonful of one of them, and with this composition made a grateful sudorific which answered the intention. No wonder then if Captain Cook, not knowing the proper dose of these concentrated juices for the scurvy, but seeing them fail as they were given in the trial, should entertain no great opinion of their antiscorbutic powers. It may be also proper to take notice, that as they had been reduced to a small proportion of their bulk by evaporation upon fire, it is probable, they were much weakened by that process, and that with their aqueous parts they had lost not a little of their aërial, on which so much of their antiseptic virtue depended. If therefore a farther trial of these excellent fruits were to be made, it would seem more advisable to send to sea the purified juices entire in casks, agreeably to a proposal I find hath been made to the Admiralty by an ingenious and experienced navy-surgeon some years ago. For in truth, the testimonies in favour of the salutary qualities of these acids are so numerous and so strong, that I should look upon some failures, even in cases where their want of success cannot so well be accounted for as in this

voyage,

voyage, not a sufficient reason for striking them out of the list of the most powerful preservatives against this consuming malady of sailors.

It may be observed, that Captain Cook says not more in praise of vinegar than of the *robs*; yet I would not thence infer, that he made no account of that acid; but only, that as he happened in this voyage to be sparingly provided with it, and yet did well, he could not consider a large store of it to be so material an article of provision as was commonly imagined. And though he supplied its place in the messes of the men with the acid of the *sour-kroust*, and trusted chiefly to fire for purifying his decks, yet it is to be hoped that future navigators will not therefore omit it. Vinegar will serve at least for a wholesome variety in the seasoning of the salted meats, and may be sometimes successfully used as a medicine, especially in the aspersions of the berths of the sick. It is observable that though the smell be little grateful to a person in health, yet it is commonly agreeable to those who are sick, and particularly to such as are confined to a foul and crowded ward. There the physician will smell to vinegar, as much for pleasure as for guarding against infection.

Now the wort and the acid juices were only dispensed as medicines, but the next article was of more extensive use.

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This was the *sour-kraut* (four cabbage) a dish of universal request in Germany. The acidity is acquired by its spontaneous fermentation, and it was the four taste which made it the more acceptable to all who ate it. To its farther commendation we may add, that it held out good to the last of the voyage.

It may seem strange, that though this herb hath had such high encomiums bestowed upon it by the ancients (witness what CATO the elder and PLINY the naturalist say on the subject) and hath had the sanction of the experience of nations for ages in its favour, it should yet be disapproved of by some of the most distinguished writers of our times. One finds it yield a rank smell in decoction, which he confounds with that of putrefaction. Another analyzes it, and discovers so much gross air in the composition as to render it indigestible; yet this flatulence, so much decryed, must now be acknowledged to be the *fixed air*, which makes the cabbage so wholesome when fermented. Nay it hath been traduced by one of the most celebrated physicians of our age, as partaking of a poisonous nature: and little better founded was that position of the same illustrious author, that cabbage being an alcalescent plant, and therefore disposing to putrefaction, could never be used in the scurvy, except when

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the disease proceeded from an acid. But the experiment which I formerly laid before the Society evinced this vegetable, with the rest of the supposed alcalescents, to be really aciescent; and that the scurvy never is owing to acidity, but, much otherwise, to a species of putrefaction that very cause of which the ill-grounded class of alcalescents was supposed to be a promoter*.

Among other of the late improvements of the naval stores we have heard much of the *portable-soup*, and accordingly we find that Captain Cook hath not a little availed himself of it in his voyage. This concentrated broth being freed from all fat, and having by long boiling evaporated the most putrescent parts of the meat, is reduced to the consistence of a glue, which in effect it is, and will like other glues, in a dry place, keep sound for years together. It hath been said, that broths turn sour on keeping, though made without any vegetable†. Now whether any real acid be thus formed may be a question: I incline at least to believe, that the gelatinous parts of animal substances, such as compose these cakes, are not of a nature much disposed to putrefy. But however that may be, since Captain Cook observes, that this

* See this remark more at large, *Dis. of the Army*, App. Pap. 7.

† La seule matiere qui s'aigrisse dans le sang est la matiere gelatineuse, &c. **SENAC**, *Structure du Cœur*, l. iii. ch. 4. § 5.

soup was the means of making his people eat a greater quantity of greens than they would have done otherwise, in so far we must allow it to have been virtually antiseptic.

So much for those articles that have of late been supplied to all the king's ships on long voyages, and in which therefore our worthy brother claims no other merit than the prudent dispensation of them; but what follows, being regulations either wholly new, or improved hints from some of his experienced friends, he may justly appropriate to himself.

First then, he put his people at three watches instead of two (which is the general practice at sea) that is, he divided the whole crew into three companies, and by putting each company upon the watch by turns, four hours at a time, every man had eight hours free, for four of duty; whereas at watch and watch the half of the men being upon duty at once, with returns of it every four hours, they can have but broken sleeps, and when exposed to wet they have not time to get dry before they lie down. When the service requires it, such hardships must be endured; but when there is no pressing call, ought not a mariner to be refreshed with as much uninterrupted rest as a common day-labourer?

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I am well informed that an officer distinguishes himself in nothing more than in preserving his men from wet and the other injuries of the weather. These were most essential points with this humane commander. In the torrid zone he shaded his people from the scorching sun by an awning over his deck; and in his course under the antarctic circle he had a coat provided for each man, of a substantial woollen stuff, with the addition of a hood for covering their heads. This garb (which the sailors called their *Magellan jacket*) they occasionally wore, and found it a most comfortable one for working in rain and snow, and among the broken ice in the high latitudes of the South.

Let us proceed to another article not less material; which is the care to keep clean the persons, bedding, and cloaths of the sailors. The Captain acquainted me, that regularly one morning in the week he passed his ship's company in review, and saw that every man had changed his linen, and was in other respects as clean and neat as circumstances would permit. It is well known how much *cleanliness* is conducive to health; but it is not so obvious how much it also tends to good order and other virtues. That diligent officer was persuaded (nor was perhaps the observation new) that such men as he could induce to be more cleanly than

than they were disposed to be of themselves, became at the same time more sober, more orderly, and more attentive to their duty. It must be acknowledged that a seaman has not indifferent means to keep himself clean, had he the greatest inclination to do it; for I have not heard that the commanders of ships have yet availed themselves of the *Bill* for providing fresh water for washing; and it is well known that sea-water doth not mix with soap, and that linen wet with brine never thoroughly dries. But for Captain Cook, the frequent opportunities he had of taking in water among the islands of the South-Sea, enabled him in that tract to dispense to his ship's company fresh water for every use; and when he navigated in the high latitudes of the Southern Oceans, he still more abundantly provided them with it, as I shall take notice in the sequel of this discourse.

Of the hammocks and bedding I need say little, as all officers are now sensible how much it concerns the health of their people to have this part of a ship's furniture kept dry and well-aired; since by the perspiration of so many men, every thing below, even in the space of twenty-four hours, is apt to contract an offensive moisture. But Captain Cook was not satisfied with ordering upon deck the hammocks and bedding every day that was fair (the com-

mon method) but took care that each bundle should be unlash'd, and so spread out that every part of it might be expos'd to the air.

His next concern was to see to the purity of the ship itself; without which attention all the rest would have profited little. I shall not however detain you with his orders about washing and scraping his decks, as I do not understand that in that kind of cleansing he excelled others; but since he has laid so great a stress upon *fire* as a purifier, I shall endeavour to explain his way of using it, more fully than he has done in his Paper. Some wood being put into a proper stove or grate is lighted, and carried successively to every part below deck. Wherever fire is, the air nearest to it being heated becomes specifically lighter, and by being lighter rises and passes through the hatchways into the atmosphere. The vacant space is filled with the cold air around, and that being heated in its turn, in like manner ascends and is re-placed by other air as before. Thus by continuing the fire for some time in any of the lower apartments, the foul air is in a measure driven out, and the fresh admitted. This is not all: I apprehend that the acid steams of the wood, in burning, act here as an antiseptic on the corrupted air that remains.

An officer of distinguished rank, another of Captain Cook's experienced friends, mentioned to me a common and just observation in the fleet; which was, that all the old twenty-gun ships were remarkably less sickly than those of the same size of a modern construction. This, he said, was a circumstance he could not otherwise account for, than that, by the former having their *galley* [their kitchen] in the fore-part of the orlop, the chimney vented so ill, that it was sure to fill every part with smoke whenever the wind was a-stern: this was a nuisance for the time, but, as he thought, abundantly compensated by the extraordinary good health of the several crews. Possibly the heat of those fire-places was also beneficial, by drying and ventilating those ships more when they were below, than they can do now they are placed upon the upper deck under the fore-castle.

But the most obvious use of the portable fires was their drying up the moisture, and especially in those places where there was the least circulation of air. This humidity, composed of the perspirable matter of a multitude of men, and often of animals (kept for a live-stock) and of the steams of the bilge-water from the well, where the corruption is the greatest; this moisture, I say, being

one of the main sources of sea-diseases, was therefore more particularly attended to, in order to its removal. The fires were the powerful instrument for that purpose; and whilst they burnt, some men were employed in rubbing hard, with canvass or oakum, every part of the inside of the ship that was damp and accessible. But the advantage of fire appears no where so manifest as in cleansing the well; for this being in the lowest part of the hold, the whole leakage runs into it, whether of the ship itself, or of the casks of spoilt meats or corrupted water. The mephitic vapours from this sink alone have often been the cause of instantaneous death to those who have unwarily approached to clean it; and not to one only, but to several successively, when they have gone down to succour their unfortunate companions: yet this very place has not only been rendered safe but sweet, by means of an iron pot filled with fire and let down to burn in it.

When from the circumstances of the weather this salutary operation could not take place, the ship was fumigated with gun-powder, as described in the Paper; though that smoke could have no effect in drying, but only in correcting the corruption of the air, by means of the acid spirits from the sulphur and nitre, aided perhaps by some species of an aërial fluid, then disengaged from them, to

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counteract

counteract putrefaction. But as these purifications by gun-powder, as well as by burning tar and other resinous substances, are sufficiently known, I shall not insist longer on them here.

Among the several means of sweetening or renewing the air, we should expect to hear of Dr. HALES's *ventilator*: I must confess it was my expectation; and therefore, persuaded as I was of the excellence of the invention, it was not without much regret that I saw so good an opportunity lost of giving the same favourable impression of it to the public. If a degree of success, exceeding our most sanguine hopes, is not sufficient for justifying the omission of a measure, deemed to be one of the most essential for attaining an end, I would plead in favour of our worthy brother, that by a humiliating fatality, so often accompanying the most useful discoveries, the credit of this ventilator is yet far from being firmly established in the navy. What wonder then if Captain Cook, being so much otherwise taken up, should not have had time to examine it, and therefore avoided the encumbering of his ship with an *apparatus* he had possibly never seen used, and of which he had at best received but a doubtful character? Nor was he altogether unprovided with a machine for ventilation. He had the *wind-sails*, though he
hath

hath not mentioned them in his Paper; and he told me that he had found them at times most serviceable, and particularly between the Tropics. They have the merit of taking up little room, they require no labour in working, and the contrivance is so simple that they can fail in no hands: but their powers are small, in comparison with those of the ventilator; they cannot be put up in hard gales of wind, and they are of no efficacy in dead calms when a refreshment of the air is most wanted. Should there be any objection to the employing both?

Such were the measures taken by our sagacious navigator for procuring a purity of air. It remains only to see in what manner he supplied pure water; another article of so great moment, that the thirsty voyager, upon his salt and putrid diet, with a short allowance of this element and that in a corrupted state, must account a plentiful provision of fresh and sweet water to be indeed *the best of things*.

Captain Cook was not without an *apparatus* for distilling sea-water; and though he could not obtain nearly so much as was expected from the invention yet he sometimes availed himself of it; but for the most of his voyage he was otherwise provided. Within the Southern Tropic, in the Pacific Ocean, he found so many islands, and those so well stored with
springs,

springs, that as I have hinted before he never was without a sufficiency of water for every necessary purpose. But not satisfied with plenty, he would have the sweetest; and therefore, whenever an opportunity offered, he emptied what he had taken in but a few days before, and filled his casks anew. But was he not above four months in his passage from the Cape of Good-Hope to New-Zeeland, in the frozen zone of the South, without once seeing land? and did he not actually complete his circumnavigation, in that high latitude, without the benefit of a single fountain? Here was indeed *a wonder of the deep!* I may call it the romance of his voyage! Those very shoals, fields, and floating mountains of ice, among which he steered his perilous course, and which presented such terrifying prospects of destruction; those, I say, were the very means of his support, by supplying him abundantly with what he most wanted. It had been said that those stupendous masses of ice, called *mountains*, melted into fresh water; though CRANTZ, the relator of that paradox, doth not imagine they originate from the sea; but that they are first formed in the great rivers of the North, and being carried down into the ocean are afterwards increased to that enormous height by the snow that falls upon them*. But that all frozen sea-water would

* Hist. of Greenland, b. I. ch. ii. § 11, 12.

thaw into fresh, had either never been asserted, or had met with little credit. This is certain, that Captain Cook expected no such transmutation, and therefore was agreeably surprized to find he had one difficulty less to encounter; that of preserving the health of his men so long on salt provisions, with a scanty allowance of corrupted water, or what he could procure by distillation. The melted ice of the sea was not only sweet but soft, and so wholesome as to shew, among numerous other instances, the fallacy of human reason unsupported by experiments: an ancient of great authority had assigned, from theory, bad qualities to melted snow; and from that period to the present times, this prejudice had not been quite removed.

In this circumnavigation, amidst fleets and falls of snow, fogs, and much moist weather, the *Resolution* enjoyed the same good state of health she had done in the temperate and torrid zones. It appears only from the journal of the surgeon, that towards the end of the first course* some of the crew began to complain of the scurvy; but the disease made little progress, except in one who had become early an invalid from another cause. The other disorders were likewise inconsiderable, such as common colds, slight diarrhoeas, and intermittents, as they readily

* *Viz.* the voyage between the Cape of Good-Hope and New-Zeeland.

yielded to the bark: there were also a few fevers of a continued form, but which by timely care never rose to an alarming height. Much commendation is therefore due to the attention and abilities of Mr. PATTEN, the surgeon of the *Resolution*, for having so well seconded his Captain in the discharge of his duty. For it must be allowed, that in despite of the best regulations and the best provisions, there will always be among a numerous crew, during a long voyage, some casualties more or less productive of sickness; and that unless there be an intelligent medical assistant on board, many under the wisest commander will perish that otherwise might have been saved.

THESE, GENTLEMEN, are the reflections I had to lay before you on this interesting subject; and if I have encroached on your time, you will recollect that much of my discourse hath been employed in explaining some things but just mentioned by Captain Cook, and in adding the materials which I had procured partly from himself, and partly, since his departure, from those intelligent friends he alludes to in his Paper. This was my plan; which if I have executed to your satisfaction,

faction, your thanks are due to those gentlemen who, on your account, so cheerfully communicated to me their observations.

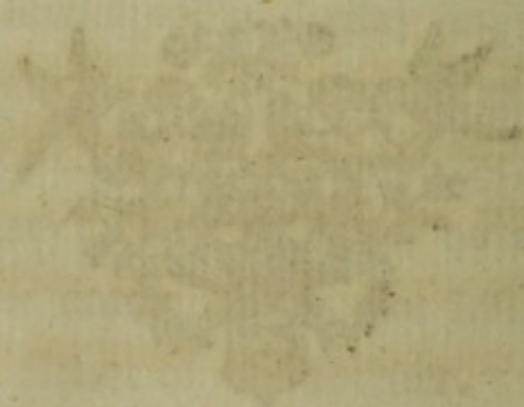
As to your acknowledgments to Captain Cook, and your high opinion of his deserts, you now testify them by the honourable distinction suggested to you by your Council, in presenting him with this medal: for I need not gather your suffrages, since the attention with which you have favoured me hath abundantly expressed your approbation. My satisfaction therefore had been complete, had he himself been present to receive the honours you now confer upon him. But you are apprized that our brave and indefatigable Brother is at this instant far distant from us; anticipating, I may say, your wonted request on these occasions, by continuing his labours, for the advancement of Natural Knowledge, and for the honour of this Society; since you may be assured, that the object of his new enterprize is not less great; perhaps still greater than either of the former.

Allow me then, GENTLEMEN, to deliver this medal, with his unperishing name engraven upon it, into the hands of one who will be happy to receive that trust, and to know that this respectable Body never more cordially

nor more meritoriously bestowed that faithful symbol of their esteem and affection. For if Rome decreed the *civic crown* to him who saved the life of a single citizen; what wreaths are due to that Man, who, having himself saved many, perpetuates now in your Transactions the means by which Britain may henceforth preserve numbers of her intrepid sons, her *Mariners*; who, braving every danger, have so liberally contributed to the fame, to the opulence, and to the maritime empire, of their Country!



of more moderate views, followed the liberal system of
 their efforts and exertions. For if Rome decreed the
 due crown to him who saved the life of a single citizen;
 her rewards are due to that Man, who, having himself
 saved many, perpetrated now in your Transactions the
 same by which Britain may hereafter preserve num-
 bers of her intruding Sons, her Masters; who, having
 very danger, have so liberally contributed to the same,
 the pleasure, and to the humane empire, of their
 country.



A Copy of Captain Cook's Paper referred to in the foregoing Discourse.

The Method taken for preserving the Health of the Crew of His Majesty's Ship the Resolution during her late Voyage round the World. By Captain James Cook, Fellow of the Royal Society.

Read at the SOCIETY, March 7, 1776.

TO SIR JOHN PRINGLE, BART. P. R. S.

S I R,

Mile-end,
March 5, 1776.

AS many gentlemen have expressed some surprize at the uncommon good state of health which the crew of the *Resolution*, under my command, experienced during her late voyage; I take the liberty to communicate to you the methods that were taken to obtain that end. Much was owing to the extraordinary attention given by the Admiralty, in causing such articles to be put on board, as either by experience or conjecture were judged to tend most to preserve the health of seamen. I shall not trespass upon your time in mentioning all those articles, but confine myself to such as were found the most useful.

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We had on board a large quantity of Malt, of which was made sweet-wort, and given (not only to those men who had manifest symptoms of the scurvy, but to such also as were, from circumstances, judged to be most liable to that disorder) from one or two or three pints in the day to each man, or in such proportion as the surgeon thought necessary; which sometimes amounted to three quarts in the twenty-four hours. This is without doubt one of the best antiscorbutic sea-medicines yet found out; and if given in time will, with proper attention to other things, I am persuaded, prevent the scurvy from making any great progress for a considerable time: but I am not altogether of opinion, that it will cure it in an advanced state at sea.

Sour-Krout, of which we had also a large provision, is not only a wholesome vegetable food, but, in my judgment, highly antiscorbutic, and spoils not by keeping. A pound of it was served to each man, when at sea, twice a week, or oftener when it was thought necessary.

Portable-Soup, or broth, was another essential article, of which we had likewise a liberal supply. An ounce of this to each man, or such other proportion as was thought necessary, was boiled with their pease three days in the week; and when we were in places where fresh vegetables could be procured, it was boiled, with them and with wheat

or oatmeal, every morning for breakfast, and also with dried pease and fresh vegetables for dinner. It enabled us to make several nourishing and wholesome messes, and was the means of making the people eat a greater quantity of greens than they would have done otherwise.

Further, we were provided with Rob of lemons and oranges; which the surgeon found useful in several cases.

Amongst other articles of victualling we were furnished with sugar in the room of oil, and with wheat instead of much oatmeal, and were certainly gainers by the exchange. Sugar, I imagine, is a very good antiscorbutic; whereas oil, such at least as is usually given to the navy, I apprehend has the contrary effect. But the introduction of the most salutary articles, either as provision or medicines, will generally prove unsuccessful, unless supported by certain rules of living.

On this principle, many years experience, together with some hints I had from Sir HUGH PALLISER, the Captains CAMPBELL, WALLIS, and other intelligent officers, enabled me to lay down a plan whereby all was to be conducted. The crew were at three watches, except upon some extraordinary occasions. By this means they were

not so much exposed to the weather as if they had been at watch and watch; and they had generally dry cloaths to shift themselves when they happened to get wet. Care was also taken to expose them as little as possible. Proper methods were employed to keep their persons, hammocks, bedding, cloaths, &c. constantly clean and dry. Equal pains were taken to keep the ship clean and dry between decks. Once or twice a week she was aired with fires; and when this could not be done, she was smoaked with gunpowder moistened with vinegar or water. I had also frequently a fire made in an iron pot at the bottom of the well, which greatly purified the air in the lower parts of the ship. To this and cleanliness, as well in the ship as amongst the people, too great attention cannot be paid; the least neglect occasions a putrid offensive smell below, which nothing but fires will remove; and if these be not used in time, those smells will be attended with bad consequences. Proper care was taken of the ship's coppers, so that they were kept constantly clean. The fat, which boiled out of the salt beef and pork, I never suffered to be given to the people, as is customary; being of opinion that it promotes the scurvy. I never failed to take in water wherever it was to be procured, even when we did not seem to want it;

because I look upon fresh water from the shore to be much more wholesome than that which has been kept some time on board. Of this essential article we were never at an allowance, but had always abundance for every necessary purpose. I am convinced that with plenty of fresh water, and a close attention to cleanliness, a ship's company will seldom be much afflicted with the scurvy, though they should not be provided with any of the antiscorbutics before mentioned. We came to few places where either the art of man or nature did not afford some sort of refreshment or other, either of the animal or vegetable kind. It was my first care to procure what could be met with of either by every means in my power, and to oblige our people to make use thereof, both by my example and authority; but the benefits arising from such refreshments soon became so obvious, that I had little occasion to employ either the one or the other.

These, SIR, were the methods, under the care of Providence, by which the *Resolution* performed a voyage of three years and eighteen days, through all the climates from 52° North to 71° South, with the loss of one man only by disease, and who died of a complicated and lingering illness, without any mixture of scurvy. Two others

others were unfortunately drowned, and one killed by a fall; so that of the whole number with which I set out from England I lost only four.

I have the honour to be, SIR, &c.

Extract of a Letter from Captain COOK to Sir JOHN PRINGLE, Bart. dated Plymouth Sound, July 7, 1776.

I entirely agree with you, that the dearth of the Rob of lemons and of oranges will hinder them from being furnished in large quantities, but I do not think this so necessary; for though they may assist other things, I have no great opinion of them alone. Nor have I a higher opinion of vinegar: my people had it very sparingly during the late voyage; and towards the latter part, none at all; and yet we experienced no ill effects from the want of it. The custom of washing the inside of the ship with vinegar I seldom observed, thinking, that fire and smoke answered the purpose much better.

