

THE CONQUEST OF SCURVY*

By C. C. LLOYD

SCURVY is now almost a forgotten disease, but it would be difficult to exaggerate its importance in the history of a maritime nation such as our own. To the historian of medical science it is equally interesting, because the various and extraordinary variety of theories concerning it reflect in themselves the intellectual climate of the past. By their repeated refusal to accept the conclusions of an experimental method by their pedantic reliance on *a priori* reasoning or antiquated prejudices the medical authorities of all countries delayed the conquest of this terrible disease long after a cure had been established by men who had practical experience of it. If anyone imagines that even in scientific knowledge progress is inevitable, let him remember that scurvy continued to be the curse of the sea and the hardship of explorers so recent as Scott and Shackleton a hundred years after it had been eliminated in the fleets of Nelson's day.

To explain its historical importance let me quote a few sentences from the *Treatise of the Scurvy* by Dr. James Lind, the book which should have killed the killer as far back as 1753. 'The subject of the following sheets is of great importance to this nation; the most powerful in her fleets, and the most flourishing in her commerce, of any in the world. Armies have been supposed to lose more men by sickness than by the sword. But this observation has been very much verified in our fleets and squadrons; where the scurvy alone, during the last war, proved a more destructive enemy and cut off more valuable lives, than the united efforts of French and Spanish arms. It has not only occasionally committed surprising ravages in the ships and fleets, but almost always affects the constitution of sailors.'

Meeting here in the noblest hospital ever built for the care of aged and infirm seamen, it is only right that I should stress this. If Lind was pointing to the losses caused by scurvy in the War of the Austrian Succession, one could almost say that we lost the American War of Independence thirty years later because his cure was not adopted by the Admiralty, though Lind himself was the head of the largest naval hospital in the world at Haslar, near Portsmouth. After a six weeks' cruise of the Channel Fleet in 1780, 2,400 cases of scurvy were landed there and a man had to be pretty far gone with a disease before the captain of a ship would allow him on shore.

If we turn from naval history to the story of the merchant ships of all nations making the long voyage to the East, the number of shipwrecks and the losses in men and cargoes due to scurvy are equally

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remarkable. As late as the decade of the Crimean War over 1,000 cases were treated in the Dreadnought Seamen's Hospital which you passed when you entered the College.

Since scurvy is a dietary deficiency disease it must have been common among the peasantry of medieval times, but it became the most notable of sea diseases when Europeans began to undertake long voyages on which the problem of the preservation of food became acute. Since salting was the only method known, foodstuffs such as fruit and vegetables containing a high percentage of vitamin C could not be carried on voyages lasting more than a week or two. Because these were lacking, scurvy soon made its appearance—nearly always among the crew rather than the officers, who were able to obtain a more varied diet.

Thus it is significant that the first recognizable description of the disease was made by Jacques Carrier on his voyage to Canada in 1535: 'The unknown sickness began to spread itself amongst us after the strangest sort that ever was heard or seen, insomuch that some did lose their strength and could not stand on their feet; then did their legs swell and their sinews shrank as black as any coal. Others had all their skins spotted with spots of blood of purple colour; then did it ascend from their ankles to their necks; their mouths became stinking, their gums so rotten that their teeth almost fell out.'

The natives cured Carrier's men with spruce beer and thus began a long, pleasant but misguided tradition that beer was an antiscorbutic. If not beer itself, which rapidly turned sour at sea, then malt, and we shall see how in the eighteenth century malt ousted the true specific, although modern analysis shows that it contains almost no ascorbic acid.

Throughout the Elizabethan period one can detect cases of scurvy among the narratives of the great explorers, though the description of the disease is often so vague as to be clinically useless. For one of the troubles about scurvy was that it affected different people in different ways. Nearly always it first manifested itself in the gums and teeth, but some recovered much more quickly than others and often, seemingly, by accident. Thus on the first English voyage to India it so happened that there were some bottles of lemon juice on board, so that there was little trouble on board Lancaster's ship compared with the catastrophic losses suffered by the Portuguese East Indiamen. As a result Sir Richard Hawkins notes soon afterwards: 'This is a wonderful secret of the power and wisdom of God that hath put so great and unknown virtue in this fruit to be a certain remedy for this infirmity.'

Would that his advice had been taken; or that of the intelligent surgeon of the East India Company, John Woodall, the author of the first manual of nautical medicine in 1617: 'The juice of the lemon is a precious medicine and well tried, so let it have the first place.'

The difficulty was that even if a cure was discovered, or even an accurate diagnosis made, no one could say what was the cause, beyond the fact that the disease was always associated with salt provisions. To say that the answer was a lemon was too easy for academic physicians enamoured with theories about the humours of the body, or the dangers of sea air. As long as the climatorial or atmospheric theory of causation was predominant—as it was by and large between 1650 and 1850—nothing was easier than to say that dirt, humidity, foul bilges, stinking water butts and such like were the causes. Even the great Captain Cook, who is so often erroneously thought to have conquered the disease, suffered from this delusion and failed to realize that it was the varied diet which he gave his men that made his voyages so remarkable, not only the cleanliness of his ship or the freshness of the water.

Lemons and oranges were hard to obtain in Britain or Holland in those days and even when they were distributed they do not seem to have been very popular. One of the outstanding characteristics of the British sailor is his conservatism about food. Cook had to flog two men before he could persuade them to eat fresh meat, and a century earlier Boteler complained that (unlike Popeye) seamen did not like their spinach. As he put it: 'Seamen are so besotted of their beef and pork that they had rather adventure all the calentures (fevers) and scurvies in the world than be weaned of their customary diet.'

As far as the Navy was concerned, matters came to a head with Anson's voyage round the world in 1740. This is the classic example of the incidence of scurvy and the effects of bad manning and worse victualling. Of the 500 old Chelsea pensioners sent to complete the complement at Portsmouth, only 259 arrived, the rest and the healthiest having deserted en route: not a single one of them survived the long passage round Cape Horn. Of the 1,955 men who embarked, 1,051 died in the course of the voyage, nearly all from scurvy. The principal medicines on board were Elixir of Vitriol (a compound of oil of vitriol, wine, cinnamon, ginger, etc.) and the Pill and Drop of Doctor Joshua Ward. This was a violent diuretic which killed far more than it cured, although it made the fortune of the quack who invented it. After his death his prescription was published: the pill consisted of balsam, wine and antimony.

In the narrative of Anson's voyage scurvy is described in these words: 'The common appearances are large discoloured spots, swelled legs, putrid gums and above all an extraordinary lassitude of the body, especially after any exercise whatsoever; this lassitude at last degenerates into a proneness to swoon and even die on the least exertion of strength. This disease is likewise attended with a strange degeneration of spirits, which shiverings, tremblings and a disposition to be seized with the most dreadful terrors on the slightest accident.'

The medical scandal of that voyage inspired a young naval surgeon in the Channel fleet to perform for the first time in history a controlled experiment in dietetics in the year 1746, publishing his results in 1753. Dr. James Lind, rightly called the father of naval medicine, took twelve men on board the *Salisbury* who were suffering from scurvy and gave two of them, in addition to the basic ship's ration of water gruel, mutton broth and boiled biscuit (owing to the state of their teeth they could not eat salt meat), a quart of cider daily; to another two, elixir of vitriol; to another two, vinegar; to another two, half a pint of salt water; to another two, a concoction of garlic, mustard, radish and balsam; to another two, two oranges and a lemon daily. In six days the latter reported fit for duty. Most of the rest died.

To give you an idea of these and other antiscorbutics which have at one time or another been proposed, may I quote a table of the comparative content in milligrammes of ascorbic acid in about 3 oz. of the fruits analysed? Such tables vary according to the freshness of the fruit and its quality, but this will serve as a rough guide.

Orange juice—	50
Lemon juice—	40
Lime juice—	20
Brussels sprouts—	30
Sauerkraut (Cook's favourite)—	10
Apples—	5
Beer or malt—	trace only
Blackcurrants—	180
Rosehip syrup—	200.

Lind thus laid it down in 1753 that the answer to the problem was a lemon or an orange. But it was not till 1795 that his disciples in the profession, Thomas Trotter and Sir Gilbert Blane, persuaded the Admiralty to make lemon juice a regulation issue after a crew had been on six weeks' salt provisions, and it was not until 1867 that the Merchant Navy act laid down similar regulations. The issue had, indeed, been laid down in a previous act, but merchant ship owners had evaded it by issuing adulterated juice or none at all.

What was the reason for this delay, which has been called 'one of the most foolish episodes in the whole history of medical science'? It was more than foolish. It was criminal and disastrous. Had not Blane insisted on lemon juice in 1795, the age of Nelson might well have proved as disastrous as the preceding age of Rodney.

To put it briefly. Lind was not an influential physician like Blane. His was only one of a score of remedies, and there was no authority to choose between them. Nor was his remedy infallible, because he made the mistake of heating the juice in order to preserve it, thereby destroying much of the vitamin content.

One of the many antiscorbutics suggested at that time was Dr. MacBride's idea of malt, made on the eve of Cook's voyage in 1768. Cook was instructed to experiment with this, but as he was on a hazardous voyage of exploration and half his men died of dysentery (though none from scurvy) after his discovery of Australia, he never had the opportunity for a controlled experiment. One instance, to our eyes, is clear enough. Sir Joseph Banks, who sailed on board the *Endeavour*, had taken the advice of another physician to carry bottles of lemon juice with him. Near Cape Horn the first symptoms of scurvy appeared—pimples on the gums. 'I flew to the bottled lemon', writes Banks, and all was well. Unfortunately his journal was not published until 1896, whereas Cook's came out immediately after the voyage. In the account of the second voyage Cook does indeed pay much attention to dietetic matters, but his conclusions regarding scurvy were erroneous and just before his last voyage, when he had received the Copley Gold Medal for the care of life at sea, he wrote a letter which had fatal consequences. He told Sir John Pringle, the famous army surgeon, 'I entirely agree with you that the dearthness of the rob (i.e. lemon juice) will hinder it from being furnished in large quantities. But I do not think this is necessary; I have no great opinion of them alone.' What he preferred was malt and fresh vegetables, but since the latter were out of the question, the navy entered the American War poorly equipped for its struggle against scurvy. Naturally, scurvy won and the losses were catastrophic. It was then that Blane made his first acquaintance with the disease and came to the simple conclusion that 50 lemons could save the life of one man in every fleet.

At the beginning of the long war with Revolutionary France he persuaded a benighted Admiralty to share this view, so that, as I have already said, Nelson's fleets never suffered acutely. The Mediterranean was the centre of the war for some time and the Wellcome Historical Medical Museum preserves his accounts for extensive purchase of Sicilian lemons. During the whole course of the war over 1½ million gallons of juice were consumed.

The Mediterranean ceased to be important in the nineteenth century, nor was it necessary to maintain large fleets at sea during the period of the Pax Britannica. Furthermore, the introduction of steam made sea passages shorter and the art of preserving food in cans developed apace after its first trial in the Navy in 1813. But what could happen when medical logistics broke down was notoriously illustrated during the Crimean War.

It was about this time that the Admiralty made an ill-advised replacement of Mediterranean lemon juice with West Indian lime juice, so that the latter came to be known as the principal antiscorbutic for the next hundred years. So much was it associated with British merchant ships that

it gave rise to the word 'limey' for an Englishman. It is not easy to say precisely why this change occurred. Partly, I suggest, because West Indian limes were cheaper; partly because of the botanical misnomer of the lime as *citrus medica acida*. Compared with a lemon or an orange, the one thing it is not is *medica*. As an antiscorbutic it is not much more effective than an apple.

This was proved by hard experience in the realm of polar exploration and not by the methods of chemical analysis then in use. The polar expeditions of the nineteenth century afforded almost clinical experiments in dietetics: cut off from normal supplies of food, it was often possible to prove whether ptomaine poisoning from the products of the early canning industry, or scurvy from the deprivation of vegetables was the cause of failure. Similarly, conditions of extreme cold often led to deterioration in the quality of the bottled juice. Circumstances such as these added rather than diminished the confusion in medical opinion about the subject, so that by 1900 knowledge of the causes and even the cure of the disease was back to the situation in which Woodall found himself in 1617: 'Truly the causes of this disease are so infinite and unsearchable as they far pass my capacity to search them all out.'

At least he spoke with more humility than the authors of a paper presented to the Royal Society on the eve of the Scott-Shackleton expeditions to the Antarctic: 'Neither lime juice nor fresh vegetables will either prevent scurvy or cure it; it is a disease produced through the eating of tainted food.'

No wonder Shackleton had to retire from his first expedition seriously ill with scurvy, as did others of Scott's party, which ultimately perished from a combination of exposure, exhaustion and scurvy. However, it was in that year that Sir Gowland Hopkins published his first paper on what he called 'the accessory food factors', which Sir Jack Drummond later called vitamins. Armed with this knowledge, the Lister Institute was able after the First World War to analyse foodstuffs issued to the army and navy and to discover from the records of the past, particularly those of polar expeditions, what had gone wrong. They did not have to go far back, because as recently as 1916 there were 1,100 cases of scurvy at the surrender at Kut-el-Amara.

As far as I know, the last description of a serious outbreak on board ship occurs in the story of the prisoners on board the German raider *Wolf* in 1917. As I wish to spare you further details about the more unpleasant symptoms of this disease, I will content myself with quoting a few sentences from the account left by a survivor: 'The prisoners began to go down in dozens with the disease. Many had been in the first stages of scurvy for some time—had been listless, sallow and sick. Now their teeth began to fall out, etc., etc. . . . None of us had seen scurvy before, and the old sea tales of this disease had seemed ridiculously exaggerated.'

But the foul symptoms of a serious outbreak of scurvy could never be overdrawn. This curse is an unholy combination of all the worst features of dysentery, syphilis and dropsy.'

The writer of those words might well have been living in the days of Commodore Anson, whose tragic voyage round the world is commemorated here at Greenwich by the two globes on the west gate. The varied diet normally enjoyed in the twentieth century, the great advances made in the science of the preservation of food, the progressively shorter passages attendant upon the evolution of the steam ship, and above all the biochemical discoveries associated with the name of Gowland Hopkins have enabled us to say at last that this ancient curse of the sea has been exorcised and that man has conquered scurvy.