

James Lind's *Treatise of the Scurvy* (1753)

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Lind is revered as the first doctor to conduct systematic clinical trials of potential cures for scurvy—trials in which oranges and lemons came out as decisive winners. The following paper argues that our modern understanding of scurvy and vitamin C has hindered our understanding of Lind's own conception of his work and of the place within it of his clinical trials. Lind conceived of scurvy not as a disease of dietary deficiency, but of faulty digestion. In the full context of his *Treatise of the Scurvy*, and of his own medical practice, the seeming decisiveness of the trials fades, to be replaced by a sense of Lind's bafflement at the nature of the disease to which he had devoted his career.

with regular doses of lemon juice? Conservatism or niggardliness are not good explanations. A reliable cure for scurvy would have doubled the overall efficiency of the fleet: no admiral is likely to have turned away the chances of an improvement on that scale. And again, if Lind's conclusions were persuasive, surely his own clinical practice would have been transformed by them: we might confidently expect him, when he became the director of the Navy's largest hospital, Haslar, to have routinely dosed the thousands of scurried seamen who came ashore with exactly the remedy that had been so efficacious in his *Salisbury* experiments. But he did not. Oranges and lemons certainly became part of his repertoire of treatments, but they did not take automatic pride of place, rendering every other measure obsolete.

The chief concern of traditional histories of medicine has been "who got the right answer first?" Guided by our certainties about what has turned out to be the truth, we arrange the past into a parade of heroes and heroines who were clever enough, or inspired enough, or lucky enough to have erected the medical monuments that line the road that leads to us. James Lind (1716–94) has an established place in the parade. The standard account of Lind's work runs as follows. His search for a cure for scurvy culminated in a set of clinical trials of potential cures for the disorder. Lind's trials, which he called "experiments", are held to be the very first systematic clinical trials of any sort. Not surprisingly, they lack the absolute rigour of modern trials, but they are persuasive. In May 1747, while working as a naval surgeon at sea on *HMS Salisbury*, Lind isolated six pairs of scurried seamen and gave to each pair a remedy that various medical authorities had canvassed. Five pairs of the seamen were prescribed vinegar, mustard and garlic purges, elixir of vitriol, and other potential remedies. These seamen remained scurried. For the remaining pair, Lind prescribed oranges and lemons. The pair quickly recovered. Citrus fruits were the convincing winners in the trial. Lind included a report of his experiments in his *Treatise of the Scurvy*, which was published in Edinburgh in 1753. Thus he raised his decisive monument on the route to our understanding of the disease that regularly disabled ships' crews in the age of Britain's maritime expansion.

The mystery that clings to Lind's *Treatise* is the consequence of our knowing about vitamin C. Knowing, beyond all doubt, that scurvy is a disease of vitamin deficiency and that it responds quickly to remedies based on fruit and vegetables that contain vitamin C, we assume that Lind, who knew nothing of vitamins (he had been dead a hundred years before they were discovered) was none the less trying to establish that there is a constituent in vegetables and fruit—especially citrus fruits—that is uniquely efficacious in curing scurvy. Our assumption is mistaken. Lind did not conceive of scurvy as fundamentally a dietary disorder at all. He believed that it was a digestive disorder. Once his theories of how the body works, and of what goes wrong when it is assailed by scurvy, are grasped, his experiments on the *Salisbury's* seamen have to be reinterpreted. They did not mean to Lind what they inescapably mean for us, and the rather insignificant place that he gave them in his *Treatise* indicates that he did not see them as the compelling conclusion to his research into scurvy. The Admiralty, along with plenty of naval doctors and the redoubtable Captain Cook were not being obtuse when they overlooked the potential significance of Lind's experiments: Lind overlooked it himself.

Lind's monumental *Treatise*, however, is a rather mysterious text. If its conclusions about the efficacy of oranges and lemons were as persuasive as my summary of the standard account makes them look, why did the Admiralty, which had a powerful reason for wanting a cure for scurvy, wait for another 42 years before issuing seamen

The clearest section of the *Treatise* is the chapter in which he sets out what he calls his own "theory of the disease" (chapter VI). Scurvy is, he says, essentially a disease of faulty digestion and excretion. The digestive system, according to Lind, operates optimally when people live in generally warm and dry conditions, and eat a reasonably varied diet. Under such conditions, he asserts, the digestive system breaks down food into the small particles necessary for the renovation of the body, and, eventually, for excretion. The mode of excretion is important. Lind was impressed by the work of the Paduan physician, Sanctorius, who had calculated that over half of the body's waste products are evacuated by what

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Lind calls “insensible perspiration” through the pores of the skin. According to this theory, if food is imperfectly digested, and if, as a consequence, its waste products cannot be insensibly perspired, it will putrefy the body. In Lind’s words, because insensible perspiration is:

“...the last and most elaborated action of animal digestion, the body is hereby freed from what is consequently the most subtle [*sic*] and putrescent of the animal humours. And it is certain these excrementitious humours naturally destined for this evacuation, when retained long in the body, are capable of acquiring the most poisonous and noxious qualities, and a very high degree of putrefaction” (first edition, p 203).

Lind goes on to apply this theory to outbreaks of scurvy at sea. On long voyages, and especially when the weather is wet and close, the digestive system of an otherwise perfectly healthy seaman is hard pressed to cope with the normally perfectly adequate diet of unleavened bread and heavily salted meat. The stomach cannot break the sea diet down into small, digestible particles. At the same time, the pores of the skin are tending to close up in response to the poor weather, thus further jeopardising healthy excretion-by-perspiration. The symptoms of scurvy then appear—stinking breath, bleeding gums, ulcers on the skin. The imperfectly digested, unexcretable food is starting to putrefy the body.

According to Lind, therapy should be designed to reverse the environmental conditions that produced the disorder. Sufferers need to be given fresh air, dry conditions, and exercise. There is nothing wrong, he says, with the seaman’s regular diet:

“...it appears, I think, very plainly, that such hard dry food as a ship’s provisions, or the sea-diet, is extremely wholesome [*sic*]; and that no better nourishment could be well contrived for labouring people, or any person in perfect health, using proper exercise in a dry pure air; and that, in such circumstances, seamen will live upon it for several years without inconvenience” (p 92).

What part, then, do oranges and lemons play in the relief of scurvy? As a practising naval surgeon, Lind knew that it was simply unrealistic to recommend that scurvied members of a crew should be transferred to warm, dry lodgings. There were obviously no such places on a crowded warship on a long voyage. What *could* be recommended, however, were medicines designed to restore the digestive system to its optimal condition, and much of Lind’s book is given over to a discussion of the preparations that are likely to do this. This is where oranges and lemons come in. He was not original in proposing that citrus fruits in particular, and greenstuff in general, are likely to be useful. He was perfectly ready to acknowledge long traditions, both in medicine and in the habits of the common people, of combatting scurvy with fruit and greenstuff: the *Treatise* dutifully cites many authorities who had made the connection. But for Lind, it is not the case that oranges and lemons have, in high concentrations, a constituent that is present, in lower concentrations, in other fruit and vegetables. It is true, he argues, that fruit and vegetables are generally tenderer and less oily than meat, but “*there is no other particular virtue in which they all agree*”. On the contrary, it is the *diversity* among vegetables that strikes him. They have “various qualities”, and the best scurvy remedies “are furnished from a composition of different plants, most eminent for the properties required” (pp 220–1; my italics). And since it is the diverse properties of vegetables that interest him, he never observes a category that the modern reader is inclined to take for granted. Lind does not group into a single, significant category all fruits and vegetables. In surveying the effects of greens, (cooked and uncooked), root vegetables, fruit in general, citrus fruits in particular, fruit *juice* (fresh or preserved), wild

herbs, he is *not* trying to isolate a single, common constituent. What he is trying to do is to define the special contributions to the relief of scurvy made by different sorts of vegetables. Furthermore, in his surveys, when he moves into considerations of foodstuffs like milk, wine, beer and bread, he conveys no sense of having shifted into altogether different types of food. Lind’s categories, in short, are not our categories. So, when he set up his experiment on his 12 scurvied patients, he was predisposed to believe, along with plenty of other authorities, that oranges and lemons might be useful in an emergency, when general environmental conditions could not be expected to improve, but he was not predisposed to see them as a medium bearing an agent that was the one and only remedy for the patients’ condition.

Consequently, the chapter in which he wrote up the *Salisbury* experiment reaches no rhetorical climax. On the contrary, Lind moves steadily on, leaving his experiment further and further behind and launching into all sorts of other recommendations, many of which are environmental rather than dietary in nature. He favoured the installation of a machine that simulated the action of riding a horse, for example, and he makes recommendations about fumigation, ventilation, and drinking water.

In later editions of the *Treatise*, the potential significance of the *Salisbury* experiments receded yet further, and he became more convinced that scurvy is a protean disorder that is not susceptible to a single, decisive curative agent:

“...as there is not in nature to be found, an universal remedy for any one distemper, in all its complicated stages, and for the various symptoms that attend it, so in the scurvy, deviations from the general method of cure become often necessary, according as particular symptoms of distress present themselves” (third edition, London, 1772).

In this third and final edition, which incorporated his experience of attending literally thousands of scurvied patients at Haslar hospital, he opened with a disarming admission of defeat:

“I have ..... put my hand to a work, which in all probability I shall not further enlarge; being perswaded [*sic*] I can carry my researches no further, without launching into a field of conjecture and uncertainty. A work, indeed, more perfect, and remedies more absolutely certain, might perhaps have been expected from an inspection of several thousand scorbutic patients, from a perusal of every book published on the subject, and from an extensive correspondence with most parts of the world, whereby a knowledge must have been obtained of every remarkable occurrence of the disease; but, though a few partial facts and observations may, for a little, flatter our hopes of greater success, yet more enlarged experience must ever evince the fallacy of all positive assertions in the healing art” (pp v–vi).

No wonder, then, that their Lordships at the Admiralty did not immediately order supplies of lemon juice to be issued to the fleet.

In the case of scurvy, the search for who-got-the-right-answer-first leads inescapably to Lind. By plucking out the five paragraphs from his 358 page *Treatise* that describe his experiments on the *Salisbury*, and by reading them by the light of our modern understanding of scurvy, we can make Lind look very modern, both in his use of clinical trials, and in his having found a way of curing his patients. But when those five paragraphs are set in their full context, Lind emerges as a man who was thoroughly bounded by 18th century conceptions of the body, and who, by his own heroic admission, spent over 20 years in never fully comprehending the disorder to which he had devoted his career.