Public Health Classics

This section looks back to some ground-breaking contributions to public health, adding a commentary on their significance from a modern-day perspective. To complement the theme of this month's *Bulletin*, Iain Milne and Iain Chalmers comment on James Lind's 1753 *Treatise of the scurvy*, an extract of which is reproduced in this section.

Documenting the evidence: the case of scurvy

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In 1753, James Lind, a Scottish naval surgeon and medical graduate of Edinburgh University, published a 450-page, threepart *Treatise of the scurvy* (1). At that time, scurvy was killing thousands of people every year and was responsible for many more deaths of sailors in the Royal Navy than enemy action. Believing that one of the reasons there was so much confusion about the diagnosis, prevention and cure of scurvy was that "no physician conversant with this disease at sea had undertaken to throw light upon the subject", Lind set about filling this gap, with a clearly stated commitment to base his work on "observable facts" rather than on the theories that dominated medical decision-making at that time.

Lind's *Treatise* is a classic for two main reasons: it is one of the earliest accounts so far identified of a prospectively organized controlled clinical trial, comparing six commonly used treatments for scurvy, and it is a systematic review of what had previously been published on the diagnosis, prognosis, prevention and treatment of scurvy.

While serving in the Channel Fleet aboard HMS Salisbury in 1747, Lind reports having selected 12 sailors who were all at a clinically similar stage of scurvy, had the same basic diet, and were accommodated in the same part of the ship. He allocated two each to six of the many different treatments for scurvy then in use: a quart of cider daily; 25 gutts of elixir vitriol three times a day; two spoonfuls of vinegar three times a day; half a pint of seawater daily; a concoction of nutmeg, mustard and garlic three times a day; and two oranges and a lemon daily. "The most sudden and visible good effects", Lind reported, "were perceived from the use of oranges and lemons; one of those who had taken them being at the end of six days fit for duty ... The other was the best recovered of any in his condition; and being now deemed pretty well, was appointed nurse to the rest of the sick." Although Lind does not provide any information on how he allocated the sailors to the six treatments he compared, he is rightly celebrated for having taken care to compare like with like: his report shows his awareness of the need to guard against selection bias, noting that potential confounding factors - clinical condition, basic diet and environment — had been held constant.

Although Lind is remembered for his controlled trial, his account of it fills only four pages in the book: the rest of it reports what had been published on the diagnosis, prognosis, prevention and treatment of scurvy. Lind's systematic review of the literature deserves greater recognition, particularly now that there is wide acceptance of the principle that decisions in health care and health policy should be informed by up-to-date, systematic reviews of reliable, relevant research.

The year after Lind conducted his clinical experiment at sea, he left the Navy and returned to Enlightenment Edinburgh, where he graduated in medicine at the University, obtained a licence to practise, and became a fellow (and subsequently treasurer) of the Royal College of Physicians of Edinburgh. It was during this time, when his home was most probably an apartment in Paterson's Court off Edinburgh's Royal Mile (2), that Lind did the research that he reported in his *Treatise*.

In the preface, Lind makes clear that he prefers observations to theory, stating bluntly: "before the subject could be set in clear and proper light, it was necessary to remove a great deal of rubbish". Before critically appraising his predecessors' results and conclusions, he had to identify potentially relevant material. How did he succeed in bringing together almost all the available writings on scurvy? In Part III of his treatise he first provides an overview of "passages in ancient authors" before dealing with more recent writers in the "chronological view" of his *Bibliotheca Scorbutica*.

In the Appendix, Lind sets out the steps he took to identify potentially relevant material. He emphasizes the difficulties: "It has been no easy matter to obtain knowledge of the many writings on this distemper. There have been collections made from time to time, of the several authors on the plague, venereal disease, etc., but no such have been compiled of writers on the scurvy. There was here little assistance to be obtained from medical bibliothecae."

Of the medical literature consulted by Lind 126 years before the publication of the first printed *Index medicus*, one of the secondary sources was Martin Lipen's 1679 *Bibliotheca realis medica* (3), which contained 29 writings on scurvy, and another was the bibliography compiled by Albert von Haller in 1751 (4).

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"The indefatigable Dr Haller published in his notes illustrating Boerhaave's *Methodus* the titles of almost all medical writings now extant, no less than 30 000 volumes", writes Lind. "But it were to be wished, that so good a judge had distinguished such books that (not being able to maintain their character) are now out of print, are occasional pamphlets or trifling academical orations, from writings of greater value."

Lind's search identified 54 books meriting critical appraisal. He then wrote abstracts summarizing his incisive views of the chosen books. For example, he considers the writings of Eugalenus, 1604 (5), to be untrustworthy: "This book must have been published by the author in a very loose immethodical dress; as it has undergone several corrections by different editors; and the order of the whole is still very inaccurate."

Ever aware of continuity, Lind comments that Felix Platerus, 1608 (6), "seems not to have seen Eugalenus' book, or at least has copied nothing from it for he still delivers the same description of the scurvy ... He recommends for prevention, as also cure, a confection of mustard-seed and honey; likewise the juice of oranges."

Lind writes that the observations of Petrus Forestus, 1634 (7), "although extremely tedious, are valuable for the many truly scorbutic cases they contained". Lind's contemporary, Samuel Sutton, 1649 (8), gets gentler treatment: "The learned author very justly describes the most essential symptoms of the scurvy. He imagines the air even more than any other agent concerned in bringing on this calamity. He observes, that the disease is cured by vegetables. But as the design of this discourse is principally to demonstrate the usefulness of Sutton's machine, he particularly insists upon the advantage that might reasonably be expected from it."

The listing of many of the authors and their affiliations in a chronological index emphasizes just how far back Lind went — and, indeed, was able to go — in his search for potentially relevant material. Many of his sources were over 100 years old. His thoroughness is particularly noteworthy at a time when dependence on computerized databases means that important information published only a few decades ago may be overlooked, which can have tragic consequences. A young woman volunteer recently died in a research project partly because important information published during the 1950s had been overlooked (9). It is also worth considering the implications of the medium — paper — used to record Lind's sources. The Royal College of Physicians of Edinburgh still has entirely usable copies of 31 of the 54 sources identified by Lind, 19 of which were already in its collection during his Edinburgh stay. It remains to be seen whether the digital records of the 21st century will survive so well (*10*).

The least satisfactory feature of Lind's Treatise is that he leaves his readers confused about his recommendations. Some passages suggest that he is very clear about the implications of his review, for example when he writes: "Some new preservative against the scurvy might in this treatise have been recommended; several indeed might have been proposed, and with great show of probability of their success; and their novelty might perhaps have procured them a favourable reception in the world. But these (citrus) fruits have this peculiar advantage above anything that can be proposed for trial, that their experienced virtues have stood the test of nearly 200 years." The number of times each of the six purported treatments compared in the experiment is mentioned in his book should leave little doubt about his preferences: 117 mentions of orange(s) or lemon(s), 29 of vinegar, 29 of vitriol, 19 of seawater, 16 of cyder/cider, and 2 of nutmeg. In spite of these apparently clear indications of Lind's conclusions, however, his readers are left wondering whether he regards fruit and vegetables as relatively more important than fresh air - one of the other factors that he cites as crucially important in preventing and treating scurvy. This is probably one of the reasons that it took so long for oranges and lemons to be widely recognized as antiscorbutics.

Although Lind's *Treatise* was published in three editions in English (1753, 1757 and 1772), two in French (1756 and 1783) and one each in Italian (1766) and German (1775), it was not until a year after Lind's death in 1794 that the Admiralty issued a general order sanctioning the provision of lemon juice in the navy on a far more generous scale than previously. The effects of the Admiralty's order were dramatic: within two years scurvy had more or less disappeared from the Royal Navy. Today there are a variety of reasons why research evidence has little or no impact on policy and practice. It seems likely that similar problems also existed in the years after the publication of Lind's classic work.

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Ex Libris & Bibliotheca TREATISE Ex Libris OF THE College Roge medic. Edin for rgeal. CURVY. IN THREE PARTS. An inquiry into the Nature, Caufes, egu and Cure, of that Difeafe. POLCON. Together with A Critical and Chronological View of what has been published on the subject. By JAMES LIND, M. D. Fellow of the Royal College of Phyficians in Edinburgh. EDINBURGH: Printed by SANDS, MURRAY, and COCHRAM FOF A. KINCAID & A. DONALDSON. MDCCLIIL

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PREFACE.

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weceffary, in order to obviate prejudices at the time they might naturally arife, and to inforce the argument.

As to the contents of the book in general:

In the first part, I have endeavoured, by a connected courfe of reasoning in the several chapters, to establish what is there advanced, upon the clearest evidence, confirmed by some of the best authorities; and have laid astic all fistems and theories of this malady which were found to be disovved by nature and fast. Where I have been necessary led, in this disarceable part of the work, to criticise the fontiments of eminent and learned authors, I have not done it with a malignant view of depreciating their labours, or their names; but from a regard to truth, and to the work, do the most judicious, be a fulficient apology for the liberties I have assored.

Dies diem docet.

The principal chapters of the fecond part, containing a defoription of this difeafe, its caufes, the means of preventing and curing it, are also b 2 founded

4.15 Huxham. Alfon. Part III. for thirty years, alrogether upon falt beef, bacon, and coarfe puddings, unlefs upon a high holiday, when they are fornetimes regaled with a bit of frefh meat, and yet continue perfectly healthy and fhong. So that the difference between thole people and feamen lies only in this, that the latter have not the benefit of fo much ex- ercife, and live in a molif air, by which the tone of their these is allowed and and and the tone of	1750. An effer on frever, see. By Dr John Huxham. Appendix, A method for preferving the bealth of feamen in long crulps and vorges. The thinks the fourty at fea owing to bad providens, bad water, bad beer, Sr. The pericions effects of which will be confiderably augmented by living in a moily, that annofphere, and breathing the foul air betwirt decks. The molt effectual way of correcting this alcalefcent a crimony in the blood, is by vegetable and mineral acids and for that pupole the particularly recommends evden, of which each failor flould have at leaft a pint a-day. 3752. A differtation on guide-line and line-water, By Dr Ch. Alfon. The Defen in puriod have at leaft a pint a-day, concepting this alcalefcent a crimony for the ufe of matiners. He attributes the good effects of line-water in puried fourvies, and fome other differed of the as to its penetrating, detergent, and function for the under the anticipatic which his paper chiefly for the ufe of matiners. He attributes the good effects of line-water in puried fourvies, and fome other differed of the use of the secondard for the published this paper chiefly for the ufe of matiners. He attributes the good effects of line-water in puried fourvies, and fome other differed of the use of the use of the use of the use of the other differed of water, or infects by the problem of the function of water, or infects by the problem of the function of the vater in puried fourvies, and fome other differed of water, or infects by the different of the effects of the use of the other is produced, which is profected of water, and this may be ufed, not only for termon drink by the different of water; and this may be ufed, not only for common drink by the different, and this may be ufed, not only for termon drink by the different, and this may be ufed, not only for common drink by the different, and this may be ufed, not only for common drink by the different, and this may be ufed, not only the leadily; but allo by bolining, and exponds it to the sit for a flort time,	Iweed
xii PREFACE. founded upon attefted facts and obfervations, with- out fuffering the illuftons of theory to influence and pervert the judgment. For, that things certain may precede what is uncertain, the theory, and the inferences from it, are placed at the latter end.	In the third part, where I have given an a- bridgment of what has been written upon the fub- jeft by the mole celebrated medical authors, and others, I have alronys endeavoured to express their fentiments with as much clearnels and con- cifenels as I could. I have indeed through the whole aimed at perfpiculty rather than elegance of diffion, as mole proper in a book of feience. To know a difede, and to cure it, being the two things mole effential to be learned; I have there- fore transferibed the fymptoms and cure of the feur- vy from those authors, where they do not entirely copy from each other.	

Addington. Chap. II.

flweet and wholfome water. When lime-water, by flanding expoted for fome time to the air, has thrown up all its crufts, none of the qualities of lime-water remain in it. From the notable quality he found in quick-lime to prevent water from corrupting, he often thought, that fome of it put in the flnp?s well would effectually prevent the corruption of the water there, and confequently the putrid fleams or foul air arifing from thence. All thefe experiments are fafe, eafy, and attended with no expence. An ellay on the fea-feuroy: wherein is propoled an eafy 1753. method of curing that diffemper at fea, and of preferving water feveet for any cruife or wyage. By Dr Anthony

age, \mathfrak{S}_{ℓ} . The cure propoled at fea, is to be begun, if there be any marks of fulnels, by blood-letting. This is repatient is afterwards to be put under a courfe of gentle without any reflriction to the habit of the patient, gives us the greatest expectations from a moderate and protracted course of purging in the foury; and Hoffman (peaks to the fame purpole. But where there are marks of virulence in the fearvy, it will be loft labour to rely on fimple fea-water, unaffifted with any other antiputrid medicine. So if, in conjunction with that water, we make a prudent ufe of the fpirit of fea-falt, we fhall but felin our hopes of a cure. This is the putrifying quality of rock and bay fait, when they have been taken in fuch large quantities as to occalion Sennertus, and Bruceus, as allo Eugalenus. In order to leffen the quantity of redundant blood flill more, the that fafe and effectual corrector, which will counteract The defcription of the difeafe is borrowed from Cackburn, Boerbaave, Hoffman, Eagalenus, Lord Anfen's voythe fourvy. Twenty drops of this fpirit taken every day, $\frac{3}{3}$ K $\frac{1}{2}$ commended upon the authority of Hoffman, Boerbaave, and daily purgation, with fea-water. Bostbaave, dom be difappointed Addington.

A P P E N D I X.

perly) upon account fubject (a). Another, viz. and has given by mildake inferted twice in his lift; and has given a place in it to *70f. Stubendorflus* an editor of *Euvern a cimon Paulli*, *7ob. Langius, Arnold. Wrickar-*Herricus a Bra, is claffed among them (though impro-perly) upon account of a letter written to Foreflus, upon a very different fubject(a). Another, viz. Albertus, blifthed ann. 1583, viz. Echthius, Wierus, and Lan-gius; and this book, containing those feven authors, is the only collection ever published of writers on the feurdeferving of it. He has befides mcluded in it three a-cademical diffutations. The indefatigable Dr Haller from medical bibliothece. Lipenius, in his Bibliotheca nine writings on this fubject, of which eight are acadefura medica, published in the year 1686, cnumerates notice of in the Bibliotbeca, though perhaps they are not of the many writings on this diffemper. There have been collections made from time to time, of the feveral authors on the plague, venereal difeafe, $\mathcal{C}_{\ell,i}$, but no fuch have been compiled of writers on the feuryy together with Ronfleus, and the authors which he had pu-There was here as little affiftance to be obtained realis medica, published ann. 1679, reckons up twentymical difcourfes or difputations. Mercklin, in his Cynotwenty-four authors on the fcurvy. Of thefe, one, viz, published ann. 1751, in his notes illustrating Boerbaave's T has been no eafy matter to obtain a knowledge reprinted the writings of Solomon Albertus and Martini, Sennertus, ann. 1624, when he wrote his own treatife, all medica Methodus Judii medici, the titles of almoft (a) Vid. Forefit obferes, medicinal. lib. 20. obf. 12. vy.

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