Clinical Medicine 2019 Vol 19, No 1: 22–5

Five centuries of medical contributions from the Royal Navy

Authors: Kristian Houlberg,[A] Jane Wickenden[B] and Dennis Freshwater[C]

ABSTRACT

Royal Naval ships' companies, isolated by hundreds of miles of sea with contacts to the outside world tightly regulated, provided perfect environments to study the epidemiology of disease. In 1747, James Lind organised one of the earliest clinical trials, demonstrating that scurvy could be treated by lemon juice. A century later, Alexander Bryson proved the value of careful epidemiological data collection and observation of infectious diseases encountered on the West Africa station. In the 20th century, Royal Navy physicians were at the cutting edge of vaccine research and antibiotic production. Nuclear submarines placed naval physicians at the forefront of nuclear medicine and environmental safety. The development of new aircraft carriers has driven a renewed interest in aviation medicine. This article reviews the contributions that Royal Navy physicians have made to medicine over the centuries, detailing some of the better known as well as some almost forgotten, but still remarkable, achievements.

KEYWORDS: Lind, Bryson, Royal Naval Medical School, Royal Navy, history

Introduction

The Royal College of Physicians (RCP) celebrated its 500th anniversary in 2018 and, for much of its history, members of the RCP have either sailed or worked closely with the Royal Navy. The role of physicians in the Royal Navy was officially recognised by the creation of the Sick and Hurt Board in the mid-17th century.[1] With that, and with the establishment of naval hospitals in the 18th century, the Royal Navy created one of the first free and comprehensive healthcare systems in the world. Over time, the Navy has attracted many outstanding physicians: some, exposed to the horrors of the slave trade, became leading advocates of abolition; others became leading lights in the world of natural history and exploration. This article concentrates on the contributions of Royal Navy physicians to the field of medicine, giving historical perspective.

Authors: [A]consultant nephrologist and physician, University Hospitals Plymouth, Plymouth, UK; [B]historic collections librarian, the Institute of Naval Medicine, Alverstoke, UK; [C]consultant hepatologist and physician, Queen Elizabeth Hospital Birmingham, Birmingham, UK

Fig 1. Sir George Chalmers' portrait of James Lind, painted in 1783. By kind permission of John Hepner.

Eighteenth century

Any discussion on the contributions of naval medicine must consider James Lind (Fig 1), who, on a plaque at Edinburgh University, is referred to as 'The Hippocrates of naval medicine'. He was born in Edinburgh in 1716 and, after completing a surgical apprenticeship, joined the Royal Navy in 1738 as a surgeon's mate serving around Iberia, Africa and the Mediterranean. He joined HMS *Salisbury* (a 50-gun ship) as surgeon in 1746 and, aboard her, he carried out his first observations on scurvy (Fig 2). On 20 May 1747, HMS *Salisbury* was patrolling the Bay of Biscay, 8 weeks after leaving port. At this stage, one-tenth of the crew had scurvy.[2] The cause of the disease was unknown at this time, but several treatments purported to have merit. John Woodall, an East India Company naval surgeon, had written the first comprehensive clinical account of scurvy in 1617, recommending the use of 'Lemmons, Limes, Tamarinds, Oringes' for its prevention and cure.[3]

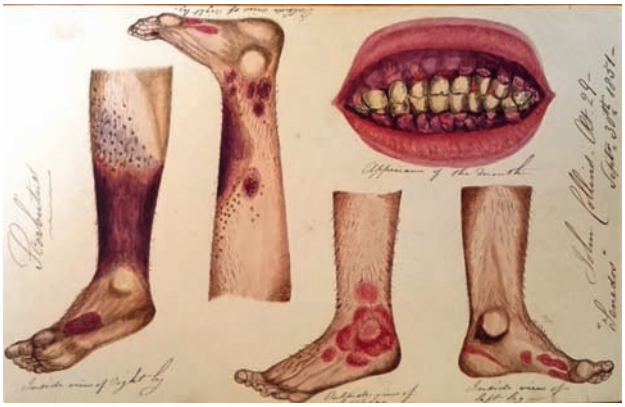

Fig 2. Watercolour of scurvy, 1851. INM Historic Collections.

Lind picked 12 men for a six-way comparison of cider, elixir of vitriol, vinegar, sea water, oranges and lemons, and a purgative mixture. He gave no reason for the choice of treatments, although he thought that scurvy was due to putrefaction of the body, which could be counteracted by acids. He reports selecting sailors 'as similar as I could have them', being accommodated in the same quarters and having the same basic diet. By the end of the month, the men assigned citrus fruit were almost recovered. One had returned to duty; the second helped nurse the others.[2]

HMS *Salisbury* arrived off Plymouth on 17 June 1746, ending both the experiment and James Lind's ship service. He retired from the Royal Navy, and graduated as a Doctor of Medicine from Edinburgh University in 1748, subsequently being elected a fellow of the Royal College of Physicians of Edinburgh in 1750 and treasurer in 1756. In 1753, he published the book for which he is most famous, *A treatise of the scurvy. In three parts. Containing an inquiry into the nature, causes and cure, of that disease. Together with a critical and chronological view of what has been published on the subject.*

The *treatise* is often considered a long, difficult and contradictory read,[4] but is also, and rightfully, considered important to the history of medicine for several reasons. Firstly, the description of Lind's experiment aboard HMS *Salisbury* is a very early example of a prospective controlled trial or 'fair test'. By selecting patients accommodated in the same area of the ship, with the same basic diet, Lind demonstrated his awareness not only of the need to guard against selection bias, but also to hold potential confounding factors constant.[4]

Furthermore, the *treatise* contains what we would now describe as a systematic review, detailing previous work on the subject. Lind describes his use of the *Bibliotheca Realis Medica* (1679) published by Martin Lipen and Albert Haller's *Bibliography* (1751) to identify relevant material. He found 54 books meriting consideration, and in the *treatise* wrote abstracts of each book. He described his search strategy for relevant material and observed bluntly that 'before the subject could be set in clear and proper light, it was necessary to remove a great deal of rubbish'. Lind was hampered by the knowledge of his time but, somewhat bizarrely, despite his own experimental evidence stopped short of calling citrus fruit a cure for scurvy. However, he did comment that 'These fruits have this peculiar advantage above anything that can be proposed for trial, that their experienced virtues have stood the test of near 200 years.'

It is well documented that the Admiralty did not issue an order to supply the Navy with lemon juice until 1795. The cause of this delay is not entirely clear, however, there appears to be little evidence that Lind ever clearly recommended the use of lemon juice to the Admiralty.[4] Sir Gilbert Blane, commissioner for sick and wounded from 1795–1802, pushed through reforms, such as the official Admiralty issue of lemon juice.[5] Thanks to his work, and that of Dr Thomas Trotter, between 1795 and 1806 the Navy's sick-list was reduced by one-half as scurvy was eliminated,[5] a crucial factor in Lord Nelson's victory at the battle of Trafalgar in 1805.

In 1758, Lind was appointed as chief physician to the Royal Hospital Haslar in Gosport (Fig 3). There, he published further books, including two papers on fevers and infection in 1763. In this, Lind again performed what we would now recognise as a systematic review,[6] also using statistical returns from Haslar and from ships across the world to document the epidemiology and correlates of fevers (crowding, dirt, semi-starvation), and the contagious nature of jail-fevers, hospital-fevers and ship-fevers, showing that they were actually identical.

James Lind retired from Haslar in 1783 and died in Gosport in 1794, having contributed one of the earliest examples of a prospective controlled trial (whether it was *the first* is hotly contested), early examples of systematic reviews and a very early example of operational epidemiology.

Nineteenth century

Alexander Bryson, born in 1802 and less well-known than Lind, was also from Scotland. He was awarded a Doctor of Medicine from Glasgow University in 1827 and joined the Royal Navy that year. Following a posting to Haslar, he spent several years overseas, initially at the Royal Naval Hospital Jamaica, then with four ships of the West Africa station.

Although the slave trade was abolished in Britain in 1807, and illegal in most nations, it continued on a wider scale illicitly until 1865. The Royal Navy in the West Africa station was tasked with its suppression. It is almost impossible today to comprehend how arduous life was, and how devastating disease could be, for the

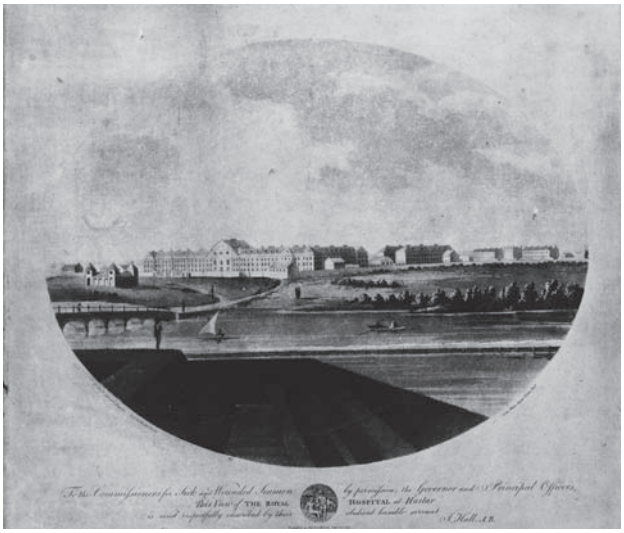

Fig 3. The Royal Hospital Haslar, engraved in 1799 by J Hall.

sailors aboard these ships off the coast of West Africa, sometimes for years at a time. HMS *Eclair* is a prime example.[7] She arrived off Freetown on anti-slavery patrol in February 1845; in April the first case of yellow fever occurred. She sailed for home in July; by the time she reached Boa Vista in the Cape Verde islands in August, she had lost 16 men to fever. A month later she sailed for Madeira; 39 of her crew had died, including the assistant surgeon. At Madeira they were refused permission to land; the ship's captain and the remaining medical staff had also died. A further 17 crewmen died before they reached England. The principal medical officer of Haslar Hospital was willing to take the crew ashore, but the superintendent-general of quarantine insisted that the ship proceed to the quarantine station at Stangate Creek in the Medway, where she arrived on 2 October. The next day, five more men died, and assistant surgeon Sidney Bernard, who had joined the ship at Madeira, himself fell ill; he died on 9 October 1845. More than 60 officers and men, nearly half the crew, died aboard HMS *Eclair* in only a few months.

Bryson, having had extensive experience of the West Africa station, described it as 'the most disagreeable, arduous and unhealthy service that falls to the lot of British officers and seamen'. His most important work, *Report on the climate and diseases of the African station*,[8] carefully details which activities in which locations posed a greater risk of contracting disease. The book, available via the internet today, is a fascinating read from scientific, medical and historical perspectives; it meticulously analyses almost every possible variant as Bryson and his colleagues tried to understand the nature of the fevers that they were combating.

Bryson's conclusions that 'if boat services were in some degree restricted; if prize crews were not permitted to land at Sierra Leone and if all vessels contracting epidemic diseases were to leave the station and proceed to a colder climate, the ratio of mortality would be reduced by at least nearly one half'[8] are more than borne out by the figures. In 1829, 202 out of 792 men on the station died; in 1847, Bryson's book was published; in 1854, 10 out of 992 men on the station died.

In 1862 Bryson published *On the recent introduction of yellow fever into Port Royal, Jamaica*.[9] The report details the tragic consequences of a yellow fever outbreak, describing how the disease reached the ships and was transmitted in a contagious manner. Unfortunately, the Admiralty still officially adhered to the 'miasmatic' theories of the Navy's chief medical adviser from the 18th century, Dr Richard Mead. Bryson's frustration at the authorities and their failure to understand the nature of yellow fever is palpable over 150 years later.

Captain Owen of the *Leven*, which had lost 60 men to malaria in 1823, first noted, 'In the course of our experience, the first attacked with the fever were always those who suffered most from mosquitoes,'[10] but it was not until 1881 that Carlos Finlay correctly proposed mosquitos as the vector for yellow fever,[11] and 1897 that Ronald Ross identified the *Anopheles* mosquito as the vector for malaria.[12]

Bryson was promoted to deputy inspector-general of naval hospitals in 1854. His duties consisted chiefly of preparing the statistical reports on the health of the Navy, which were first published in 1856 and appeared annually until 1935. Bryson was gazetted as honorary physician to her majesty in 1859, and in the same year re-edited the *Manual of medicine and medical statistics for the Admiralty: manual of scientific enquiry*. He was promoted to director general of medical department from January 1864 until retirement in April 1869, and died on 12 December 1869.

Twentieth century

The beginning of the 20th century saw huge changes in the challenges faced by the Royal Naval Medical Service, with the development of the Submarine Service and the Naval Air Service.

The Royal Naval Medical School (RNMS) was founded at the Royal Naval College Greenwich in 1912. Infectious diseases remained the principal preoccupation of Royal Naval physicians, and the two main professorships were bacteriology and hygiene.[13] During World War One, staff researched and produced vaccines and sera against typhoid, cholera, influenza and gas gangrene. Successes included, in 1916, the first TAB vaccine against typhoid, paratyphoid A and paratyphoid B.[13]

Sheldon Dudley (later surgeon vice-admiral and medical director general (Navy)) was born in Lisbon in 1884, qualified in medicine from St Thomas' Hospital in 1906 and immediately entered the Royal Navy, serving during World War One as senior medical officer of the Royal Naval air station Dunkirk. In 1923, he was appointed professor of pathology at the RNMS. Working closely with the boys of the Royal Hospital School nearby, he was author or co-author of three special reports to the Medical Research Council: *The Schick test, diphtheria and scarlet fever: a study in epidemiology* (1923); *The spread of droplet infection in semi-isolated communities* (1926); and *Active immunization against diphtheria: its effects on the distribution of antitoxic immunity and case and carrier infection* (1934). His work contributed much to the success of a national campaign for diphtheria immunisation in 1932.

Cases of pulmonary tuberculosis (TB) in the Mediterranean fleet during the latter half of the 19th century were estimated at 8 per 1000 per annum (with a case fatality of 25%). This rate declined steadily in the years leading up to World War One, largely due to earlier diagnosis by periodical medical examinations and weighings of the men.[14] But the case rate remained unchanged at just over 2 per 1000 in the years from 1921 to 1934, twice that reported in the Army and Royal Air Force. Dudley attributed the on-going scourge of TB aboard warships to the unavoidable overcrowding. A policy of mass miniature radiography was adopted by the Royal Navy in 1941, aiming to image every Royal Navy sailor's chest every 3 years to catch cases earlier, before they could become a risk to their mess-mates.[14] Unfortunately, the effectiveness or otherwise of this policy, which was an example of an early screening programme, is not known.

On the outbreak of World War Two, the RNMS moved from Greenwich to Clevedon in Somerset. The core of its activities was the operation of what has been claimed as the first fully-operational mass production penicillin factory in the world,[15] supplying freeze-dried penicillin powder, with instructions for its reconstitution, to all three Armed Forces and a few civilian establishments (Fig 4). When no suitable equipment was available, naval personnel designed their own and had it built in the naval base at Devonport.[14]

Twenty first century

Naval medicine continues to progress, building on the past. With the development of nuclear submarines, the RNMS expanded its

Fig 4. The Royal Navy makes its own penicillin. 15 August 1944, Royal Naval Medical School, Clevedon, Somerset. ©IWM–A25174.

clinical research into nuclear submarine atmospheres in the 1950s and 1960s. Recently the new aircraft carriers HMS *Queen Elizabeth* and HMS *Prince of Wales*, the largest ships ever to enter service with the Royal Navy, represent a return to fixed-wing flight and have renewed interest in aviation medicine.

There has been a renewed focus on humanitarian operations in the last decade: the Philippines after typhoon Haiyan in 2013, the Ebola crisis in Sierra Leone in 2014 and the United Nations Mission in South Sudan in 2018. This focus has been reflected in the *Journal of the Royal Naval Medical Service* (*JRNMS*) as the Royal Navy continues to contribute to medical knowledge in ever-changing circumstances. The *JRNMS* was first produced in 1915, and still publishes original research and reviews, focusing on the highlights of best practice in the unique field of maritime military medicine in the 21st century. ■

References

1 Keevil JJ. *Medicine and the Navy 1200–1900: vol 2. 1649–1714*. Edinburgh: Livingstone, 1958:19–20.
2 Sutton G. *James Lind aboard* Salisbury. JLL Bulletin: Commentaries on the history of treatment evaluation, 2004. www.jameslindlibrary.org/articles/james-lind-aboard-Salisbury [Accessed 2 September 2018].
3 Woodall J. *The surgions mate, or, A treatise discouering faithfully and plainely the due contents of the surgions chest*. London: Edward Griffin, 1617:183–4.
4 Milne I. *Who was James Lind, and what exactly did he achieve?* The James Lind Library, 2012. www.jameslindlibrary.org/articles/who-was-james-lind-and-what-exactly-did-he-achieve [Accessed 2 September 2018].
5 Lloyd C, Coulter JLS. *Medicine and the Navy 1200–1900: vol 3. 1714–1815*. Edinburgh: Livingstone, 1961:320–6.
6 Tröhler U. *James Lind at Haslar Hospital 1758–1754: a methodological theorist*. The James Lind Library, 2003. www.jameslindlibrary.org/articles/james-lind-at-haslar-hospital-1758-1774-a-methodological-theorist [Accessed 2 September 2018].
7 Wickenden J. Doing it by the book: what the libraries of the Royal Naval Hospitals can tell us about naval medicine in the nineteenth century. *J R Nav Med Serv* 2007;93:109–14.
8 Bryson A. *Report on the climate and principal diseases of the African station*. London: Clowes, 1847.
9 Bryson A. On the recent introduction of yellow fever into Port Royal, Jamaica. *Trans Epidemiol Soc Lond* 1862;1(Pt 2):181–7.
10 Owen WFW. *Narrative of voyages to explore the shores of Africa, Arabia, and Madagascar: performed in HM Ships Leven and Barracouta: Vol. 1*. London: Richard Bentley, 1833:224.
11 Finlay C; translated by Matas R. The mosquito hypothetically considered as an agent in the transmission of yellow fever poison. *New Orleans Medical and Surgical Journal* 1881;9:601–16.
12 Ross R. On some peculiar pigmented cells found in two mosquitos fed on malarial blood. *Br Med J* 1897;2:1786–8.
13 Dickinson H. *Wisdom and war: the Royal Naval College Greenwich 1873–1998*. London: Routledge, 2016.
14 Dudley SF. Pulmonary tuberculosis in the Royal Navy and the use of mass miniature radiography in its control. *J Roy Soc Med* 1941;34:401–6.
15 Girling R, Hale G. Number Five Elton Road. In Campbell R (ed), *Clevedon: places and faces*. Kibworth Beauchamp (Northants): Matador, 2010:63–78.

Address for correspondence: Dr Kristian Houlberg, Renal Medicine, University Hospitals Plymouth, Derriford, Plymouth, PL6 8DH, UK.
Email: kris.houlberg@nhs.net