

Sir David Bruce and the Saga of Brucellosis

David Vassallo

Introduction

I am indebted to my late father, Dr Luis Adrian Vassallo (1933–1994),¹ consultant physician from Malta, who was fascinated by the saga of brucellosis. His enthusiasm for its history, his inspiring lectures, and his shrewd insights into the personalities involved enkindled in me a similar interest. The story is so full of unexpected events, coincidences, controversy and insights into the capriciousness of human nature that it well merits description as a saga. This Chapter is based largely on my father's unpublished notes and his Sydenham lecture 'The Saga of Brucellosis', delivered posthumously on his behalf to the Worshipful Society of Apothecaries, London on 6 November 1995, and later published in part in *The Lancet*.²



Sir David Bruce. (RAMC Muniments Collection, Wellcome Library, reproduced with permission)

- 1 D. J. Vassallo. L A Vassallo. (Obituary), *British Medical Journal* 309, (1994), p.1578.
- 2 D. J. Vassallo, 'The Saga of Brucellosis: Controversy over Credit for Linking Malta Fever with Goats' Milk' in *The Lancet*, 348 (1996), pp.804–808.

Brucellosis and the Island of Malta

Brucellosis, a chronic and debilitating feverish illness previously known as Malta, Mediterranean or Undulant Fever, has almost certainly plagued peoples of the Mediterranean littoral and further afield from beyond time immemorial. Its causative organism was discovered in Malta in 1887 by Surgeon Captain David Bruce (1855–1931), then a young medical officer in the British Army, though it would be another 18 years before the mode of transmission was elucidated.

British troops first arrived in Malta in 1798 during the Napoleonic Wars, helping the Maltese oust the French invaders. The British remained by invitation of the Maltese, with the Royal Navy stationing its Mediterranean Fleet in Malta's majestic Grand Harbour. Malta's strategic importance increased after the Suez Canal opened in 1869. Bruce arrived there in 1884, at the height of Empire.



Dr Luis Adrian Vassallo, May 1994.
(Photo: author's copy)

The Young Bruce

David Bruce was born on 29 May 1855 in Bendigo, Australia to Scottish parents; engineer David Bruce from Airth and his wife Jane Russell Hamilton from Stirling, who had emigrated to Australia in the 1850 gold rush. When he was five years old the family returned to Stirling, where he developed a lifelong interest in natural history.³ He entered Edinburgh University as a zoology student, transferred to medicine and graduated with distinction in 1881. Soon he became keenly interested in the scientific side of medicine, wanting to follow in the footsteps of Pasteur, Koch and Lister, but did not have sufficient funds. He therefore entered general practice in Reigate, Surrey

3 David Bruce, Lecture to medical students, Aberdeen University, 1922.

in 1881 as assistant to a Dr Stone. There he fell in love with Mary Elizabeth Sisson Steele, daughter of his partner's predecessor.⁴

Mary Elizabeth Steele was born in 1849. She was the sixth of nine children of the much-respected Reigate general practitioner, Dr John Sisson Steele, who was also a fine artist and Mary inherited his talent for accurate drawing and sketching. She would put this talent to good use assisting her future husband in the laboratory, producing thousands of drawings of microscopic organisms, many preserved in the RAMC Muniments Collection.⁵

Planning to marry, but without private means, Bruce decided to transfer to the Army:

But as I still hankered after the scientific side of medicine I conceived the idea of going into the Army Medical Service where I would get my bread and butter, and at least there would be plenty of leisure. This I did in 1883 and early in the following year found myself stationed in Malta. There was no doubt about the leisure. The day's work could be done as a rule in about half an hour...⁶

Bruce was commissioned as Surgeon Captain in the Army Medical Department on 4 August 1883,⁷ having gained first place in the entrance examination and then finishing in first place in the passing out examination at the Army Medical College, Netley that same year.⁸ He could now marry Mary, which he did on 8 December 1883. On 10 March 1884 they arrived in Malta on the troopship HMS *Malabar* for his five-year tour of duty (1884–1888). Bruce was appointed medical officer in charge of the Station Hospital (previously the Sacra Infermeria of the Knights of St John) in Valletta, where he encountered the first of hundreds of Malta Fever patients.

This mysterious illness was wreaking havoc amongst the soldiers and sailors of the Malta Garrison. Bruce was familiar with the first paper on this illness published in 1863 by a British military surgeon, Assistant Surgeon Jeffrey Allen Marston. Marston gave an accurate description of the illness in troops invalided to Malta during the Crimean War, calling it “Mediterranean Remittent (or) Gastric Remittent Fever”. Marston poignantly depicted his own sufferings, noting the irregular type of fever, the languor and weariness, the muscle and joint pains, the gastro-intestinal symptoms

4 Ethelwald E. Vella, ‘Major-General Sir David Bruce, K.C.B.’ in *Journal of the Royal Army Medical Corps*, 119 (3) (1973), pp.131–144.

5 RAMC Muniments Collection – Archives and manuscripts related to Sir David Bruce and Lady Bruce <https://wellcomecollection.org/works/srsccksk> (accessed 31 May 2024)

6 Bruce. Lecture to medical students.

7 Anonymous, ‘Obituary, Sir David Bruce’ in *Obituary notices of Fellows of the Royal Society*, 1, (1932), pp.79–85.

8 J. E. Noble, ‘The David Bruce Laboratories 25th anniversary’ in *Journal of the Royal Army Medical Corps* 113, (1967), pp.208–212; A. Hamerton, ‘Obituary – Major-General Sir David Bruce’ in *Transactions of the Royal Society of Tropical Medicine & Hygiene*, 25, (1931–1932), pp.305–312.



The Sacra Infermeria. (Station Hospital), Valletta (Photo: David Vassallo)



Malta Fever patient. (Photo: David Bruce, RAMC Muniments Collection, Wellcome Library, reproduced with permission)

and the long duration of illness: 'The patient is prone to relapses, and the disorder is followed by a protracted convalescence – very frequently also by rheumatism of some form or other.'⁹

The Bruces arrived in Malta at the dawn of the golden age of microbiology. Only four years previously Alphonse Laveran, a French army surgeon in Algeria, had discovered malaria parasites in the red blood cells of man, though the way in which this great scourge of mankind was transmitted was still a mystery.

The year 1884 was also when Dr Robert Koch in Berlin proved that cholera was due to a specific micro-organism, and just two years since Koch had revealed to the world the identity of the tuberculosis bacterium, the 'Captain of the Men of Death', responsible then for the deaths of one in seven human beings.

Bruce resolved to find the cause of Malta Fever. The challenges he faced were peculiar to a peacetime garrison:

But on the other hand there was no encouragement or assistance of any kind for research work. There was no laboratory, not even a microscope in the hospital. In fact, in those days your brother officers almost looked on it as a crime if you presumed to do anything outside your strict duty. So I had to set up a laboratory and provide myself with microscope and other apparatus.... Before long I was at work trying to find out the nature of Malta Fever.¹⁰

Bruce was initially sceptical about Koch's findings:

It is difficult to put prejudice aside and I can well remember in the year 1882 the scepticism with which I first heard of the new discovery, that consumption was caused by a minute vegetable parasite. It was with difficulty then that I brought myself to take up the study of Malta Fever by the new methods, but at last by the help of a neighbouring tin-smith I found myself in possession of the necessary bacteriological apparatus and started work...¹¹

Bruce closely followed the methods of Koch and Gaffky, whose techniques first became readily available in English translation in the book *Microparasites in Disease* published in 1886, two years after he arrived in Malta. He acknowledged this in his 1888 article.¹²

Bruce made the first important breakthrough on Boxing Day 1886, by fulfilling the first of Koch's postulates. He identified numerous micrococci in the spleen at the post mortem examination of a young soldier, 20 year old Private John Riddall,

9 J. A. Marston, Report on Fever (Malta), *Army Medical Department Medical Report for 1861*. 3, (London: 1863), pp.520–521.

10 Bruce. Lecture to medical students.

11 Bruce. Lecture to medical students.

12 David Bruce, 'The Micrococcus of Malta Fever' in *Practitioner*, 40, (1888), pp.241–249.



Private Hugh Dixon's grave, Pieta Military Cemetery, Malta. (Photo: David Vassallo)

2nd Battalion, King's Own Yorkshire Light Infantry, who died of Malta Fever in the Forrest Hospital, Spinola, on 26 December. Private Riddall was buried in Pieta Military Cemetery.

Bruce fulfilled the second of Koch's postulates in July 1887 when he successfully cultivated the *Micrococcus* in vitro, from the spleen of another young soldier who died of this illness. The unfortunate soldier whose death hereby earned him a place in medical history was 25 year old Private Hugh Dixon, 1st Battalion The Black Watch (Royal Highlanders), who died on the twelfth day of his illness, on 6 July 1887. He too was buried at Pieta.

Bruce was aided by the Maltese Government analyst, Dr Joseph Caruana Scicluna.¹³ They are commemorated together on a plaque outside the Sacra Infermeria.

Bruce fulfilled the last of Koch's postulates in August 1887 by successfully infecting a monkey with the *Micrococcus* and cultivating the organism from its spleen. He published his findings in *The Practitioner* in 1887 and 1888. Bruce had discovered the causative organism of Malta Fever, later naming it *Micrococcus Melitensis* from the Roman name for Malta.

The Bruces left Malta at the end of 1888. In 1889 Bruce was appointed Assistant Professor of Pathology at the Army Medical School, Netley, near Southampton.

Matthew Louis Hughes

On Christmas Day, 1891, a bright young doctor who had graduated top of the class at Netley, Surgeon Captain Matthew Louis Hughes (1867–1899), arrived in Malta for a six-year tour of duty.¹⁴ He was the great-grandson of one of Nelson's admirals, Sir Thomas Louis, and was therefore known as Louis Hughes.

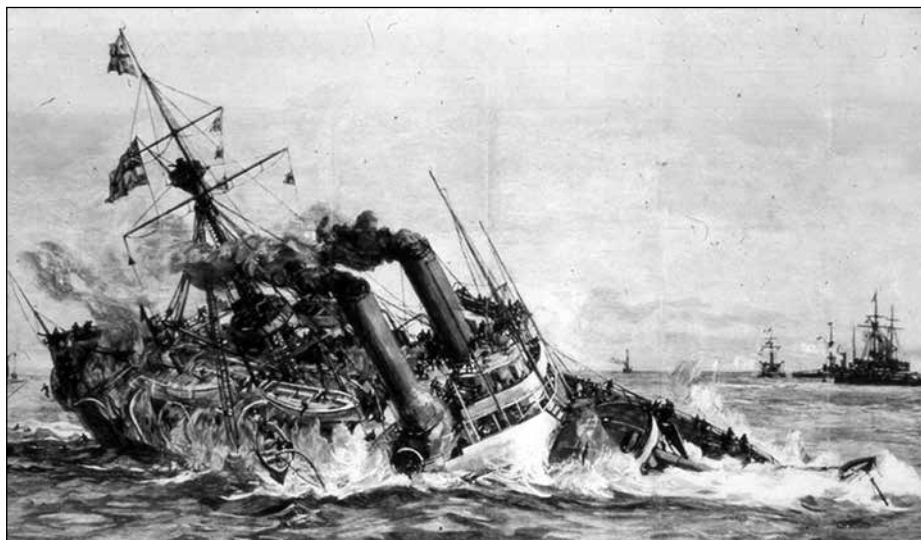
The Loss of HMS *Victoria*

Two years later, on 22 June 1893, the Royal Navy suffered its greatest peacetime disaster: the collision during annual manoeuvres in calm seas off Syria between two of Her Majesty's finest battleships, the *Victoria* and the *Camperdown*, flagships of the First and Second Divisions of the Mediterranean Fleet.

This disaster resulted in the loss of the *Victoria* and most of her crew, including the Fleet's Commander-in-Chief, Britain's most renowned naval officer, Vice Admiral Sir George Tryon. The disaster resulted from Tryon's enigmatic order for the two Divisions of the Fleet to reverse course by turning inwards towards one another.

13 David Bruce, Note on the Discovery of a Micro-organism in Malta Fever. *Practitioner*, 39, (1887), pp.161–170.

14 G. W. G. Hughes and M. H. Hughes. 'Matthew Louis Hughes and Undulant Fever' in *Journal of the Royal Army Medical Corps*, 115, (1969), pp.199–203.



The loss of HMS *Victoria*, 22 June 1893. (Reproduced from *The Graphic*, 8 July 1893, with permission from The British Library)

In attempting to explain the disaster, the highly respected Admiral Sir Geoffrey Phipps Hornby speculated that Tryon was suffering from Mediterranean Fever:

We know Sir George had been suffering very lately from fever; and I happen to have had painful evidence of how virulent Mediterranean Fever has been in the last two years. I have no doubt he was so suffering, and gave his orders in complete forgetfulness.¹⁵

This allegation was firmly refuted by Tryon's Fleet Surgeon, Mr Herbert Ellis, at the court-martial in Malta.

But was Malta Fever the culprit after all, the real villain of the piece? The other main protagonist, Rear Admiral Albert Markham, commanding *Camperdown*, had in February been struck down with Malta Fever, only returning from a prolonged convalescence to rejoin the Fleet four weeks before the fatal collision. Is it possible that Markham's slow reaction and erroneous interpretation of Tryon's signal were due to the after-effects of Malta Fever?¹⁶

15 G. P. Hornby, 'The Loss of the *Victoria*' in *United Service Magazine*, August 1893; 128: pp.1109–1113.

16 D. J. Vassallo, 'The Centenary of the Sinking of the Mediterranean Fleet flagship, HMS *Victoria*. What was the role of Malta Fever?' in *Journal of the Royal Navy Medical Service*, 79, (1993), pp.91–99.

Rightly or wrongly, in the perceived opinion of the time, the loss of the Royal Navy's mightiest battleship and its most famous officer became inextricably linked to the mysterious microbe of Malta Fever.

This drew worldwide attention to the havoc this illness was causing to the Mediterranean garrison, and it thereby played a catalytic role in the saga of brucellosis, ultimately leading to the setting up of the Mediterranean Fever Commission.

In the meantime, this controversy spurred Louis Hughes, overseeing the fever wards in Malta, to determine the mode of transmission. The prevailing opinion was that the cause was sewage pollution of subsoil by leakage from broken cesspits.

Hughes, Undulant Fever and Goat's Milk

In 1896, Louis Hughes and his wife caught Malta Fever and were invalided home to Wales. His prolonged convalescence gave him the opportunity to write up his research, published in 1897 in an important monograph entitled *Mediterranean, Malta or Undulant Fever*.¹⁷ Completed when Hughes was only 30 years old, this book firmly established his reputation.

Hughes coined the term 'undulant fever' because of the undulating character of the temperature, and because he disapproved of a limiting geographical term like 'Malta Fever'.

It was Bruce who had originally described the tendency of the fever to assume an 'undulatory course'. Ironically, Bruce hated the name given by Hughes, 'We trust that such a ridiculous term as 'undulant fever' will never come into general use.'¹⁸

However, in one important respect, Hughes went badly astray: he completely ruled out the possibility of milk being the vehicle of infection. He had 'met with no fact that would favour a causal connection between milk supply and this fever.'¹⁹

Ironically, Hughes came tantalisingly close to the solution, but failed to make the vital connection, in fact advocating goats' milk as treatment:

In the countries where this fever occurs, **goats' milk is always obtainable**, cows' milk being less commonly used. As goats can generally be brought to the patient's house, or to the hospital, and there milked under supervision, their milk is to be preferred to the more doubtful cows' milk... [author's emphasis]²⁰

17 M. L. Hughes, *Mediterranean, Malta or Undulant Fever*, (London: Macmillan, 1897).

18 D. Bruce, 'Malta Fever Part II (Editorial)' in *Journal of the Royal Army Medical Corps*, June 1904, pp.731–736.

19 Hughes, *Mediterranean, Malta or Undulant Fever*, p.52.

20 Hughes, *Mediterranean, Malta or Undulant Fever*, p.91.



Maltese goatherd providing fresh milk. (Painting by Chevalier Edward Caruana Dingli, 1876-1950. Reproduced with permission of Perfecta Advertising Ltd)

His clearly documented case histories show that all his visiting relatives, his wife and himself fell severely ill with fever. The leaking drain in their backyard only reinforced his belief in the sewage theory.

One wonders whether Louis' enthusiasm for goats' milk may not have had a bearing on the severity and prolonged nature of their illness; his lasted 310 days:

Milk, as fresh and pure as possible, should form the chief part of the patient's diet... As a general rule three pints of good milk is sufficient for a very severe case, every 24 hours. This may be increased in amount in less severe cases until a maximum of five pints is reached.²¹

One may imagine how meticulously Louis would have followed his own advice and served his nearest and dearest with five pints daily of fresh goats' milk obtained directly from their trusted milkman.

Despite the undoubted excellence of his book, Hughes' ideas on the place of milk in the management of Undulant Fever not only almost killed him and his stepsister, but they also delayed for years the discovery of how the disease was spread. No medical

21 Hughes, *Mediterranean, Malta or Undulant Fever*, p.190.

worker, after reading Hughes' authoritative statements, could possibly suspect the humble Maltese goat.

Louis Hughes died tragically, aged 32, at the Battle of Colenso on 15 December 1899 during the attempt to relieve the siege of Ladysmith in the Second Boer War. Coincidentally, only 15 miles north, besieged within Ladysmith itself, were David and Mary Bruce. Bruce was in charge of No.1 Stationary Hospital, running an improvised operating theatre, while Mary worked as his theatre sister. The newly created Royal Army Medical Corps (RAMC, formed 23 June 1898) was receiving its baptism of fire.

Laboratory diagnosis

Simultaneously with Hughes publishing his book, a major advance occurred in laboratory diagnosis. In 1897 Almroth Wright, Professor of Pathology at Netley, and Surgeon Major David Semple, Assistant Professor, successfully applied Widal's Agglutination Test to the testing of serum of Malta Fever patients, readily distinguishing it from typhoid fever, malaria and other illnesses.

The Widal test was promulgated in Malta by Caruana Scicluna and Zammit at the Public Health Department, though significantly their colleagues refused to use it. Local doctors were notoriously resistant to change and very suspicious of the public health authorities. They reacted similarly to Zammit's advocating the boiling of milk during an outbreak of gastroenteritis due to coliform contamination. The doctors objected on the grounds that 'To boil is to spoil.' Such ingrained beliefs bedevilled attempts to control Malta Fever.

Wright's modification of the Widal test was adopted by the British Army in Malta in 1900, and then by the Navy. It soon confirmed the clinical impression that Undulant Fever prevailed far beyond the Mediterranean basin, though it was not until 1902 that reliable statistics could be collected. In 1905 Zammit would apply this test to goats' milk, when it became known as Zammit's test.

Malaria and Malta

1897 was to be remembered for another momentous discovery: a surgeon with the Indian Army Medical Service, Ronald Ross, discovered malaria parasites in mosquitoes. Zammit enthusiastically corresponded with Ross, wondering whether Malta Fever might also be transmitted by mosquitoes. Zammit carried out extensive field-work without finding the *Micrococcus*, but in 1902 still contended that Malta Fever might be transmitted by insects.

The Origins of the Mediterranean Fever Commission

When David Bruce returned to England from South Africa, Zammit appraised him of his suspicions regarding mosquitoes. Bruce, elected a Fellow of the Royal Society while besieged in Ladysmith, brought this to the attention of the Royal Society.

As a result of Bruce's intervention, Sir Michael Foster, Secretary of the Royal Society, wrote on 2 December 1902 to the Under Secretary of State for the Colonies, requesting the Government's intercession with the Government of Malta on behalf of Dr Zammit. He advocated the creation of a formal investigation, to examine the possibility 'that Malta Fever is conveyed by means of a mosquito or other insect.'

The British Government, no longer distracted by war in South Africa, was increasingly concerned at the cost entailed by the equivalent of a regiment of infantry being ill at any one time with Malta Fever. The Royal Society's timely involvement culminated in the formation of the Mediterranean Fever Commission on 16 May 1904.

Bruce, Malta Fever and the Journal of the RAMC

It is pertinent to explore the relationship between Bruce, Malta Fever and the new *Journal of the RAMC* (hereafter *The Journal*), and to examine this journal's role as an all-important propaganda weapon in the war against this disease.

The Journal was founded in 1903, soon after the call from the Royal Society to investigate Malta Fever. Bruce, arguably the most famous officer in the newly created RAMC, was appointed editor in early 1904. He forthrightly converted *The Journal* into the mouthpiece through which each stage of the epic fight against this illness was broadcast to the world, commencing with his extensive editorial of April 1904 devoted to Malta Fever.²²

He thundered out a challenge to the Government and the RAMC, 'There can be little doubt that it is in the investigation of disease with a view to its prevention that our foremost duty lies.'²³

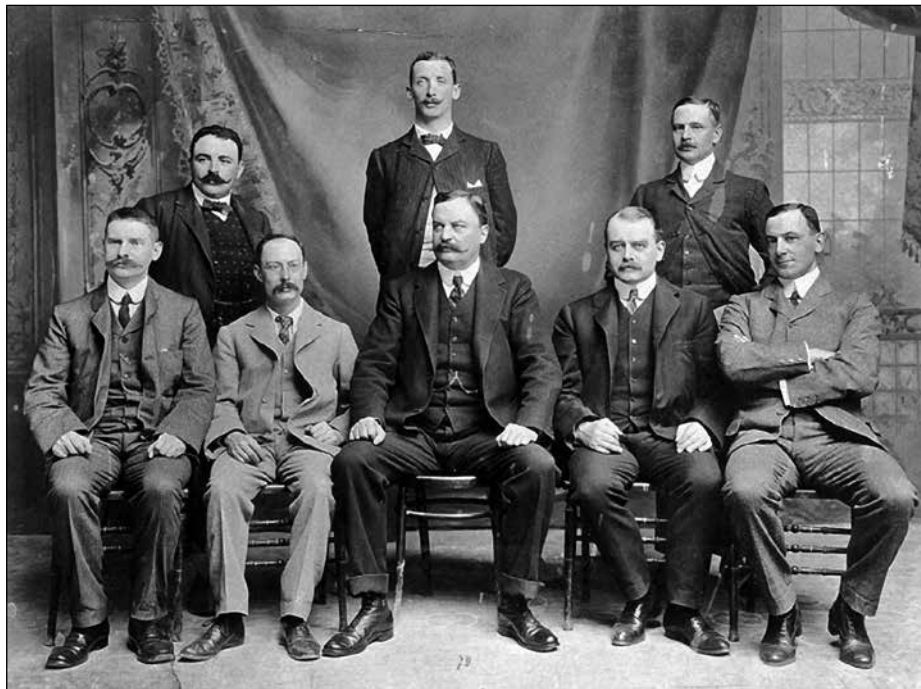
His April editorial carried blueprints for the necessary experiments. He would follow these almost to the letter when his efforts were rewarded by his appointment as Chairman of the Advisory Committee of the Royal Society supervising the MFC, on 16 May 1904. Subsequently, *The Journal* under his editorship would reprint all seven volumes of MFC Reports, ensuring their widest possible distribution, and their ready availability even today.

22 David Bruce, 'Malta Fever. Editorial' in *Journal of the Royal Army Medical Corps*, 2, (1904), pp.485–502.

23 David Bruce, 'Malta Fever. Editorial' in *Journal of the Royal Army Medical Corps* 2, (1904), pp.603–605.

The Mediterranean Fever Commission

The working members represented the Army, the Navy and the Civil Government, and initially consisted of Colonel David Bruce RAMC as president, Major William Heaton Horrocks, sanitary officer from Gibraltar, Staff Surgeon Ernest Shaw RN from HMS *Vulcan*, and Dr Temi Zammit, Board of Health, Malta. They were joined on 30 June by Dr Ralph Johnstone, an epidemiologist on loan from the Local Government Board.



Mediterranean Fever Commission, 1904. (RAMC Muniments Collection, Wellcome Library. Copyrighted work available under Creative Commons by-nc 2.0 UK)

Late in 1904 they were joined by Captain James Crawford Kennedy RAMC (in charge of the Acute Fever Wards at the Station Hospital), and by Staff Surgeon Gilmour RN (Bighi Hospital). Later members included Lieutenant Colonel A. M. Davies RAMC, Dr J. W. H. Eyre (Bacteriologist to Guy's Hospital), Majors J. G. McNaught, T. McCulloch and J. C. Weir RAMC, Staff Surgeon F. H. A. Clayton RN, and Fleet Surgeon P. W. Bassett-Smith RN.

Bruce chose the Board of Health rooftop laboratory in Castellania Palace, Valletta, as the best location for the Commission. A plaque within this Palace (now the Ministry

of Health) commemorates this association.²⁴ The roof was utilised for experiments on monkeys. Bruce returned to England in mid-July.

The first discovery of significance was made by Horrocks. He isolated the organism in the urine of infected patients, notifying Bruce by telegram on 22 July 1904. Soon another discovery was heralded. One can sense the suppressed excitement in Zammit's first letter to Bruce on 26 August:

Today I find that one of my monkeys has developed a temperature, and has a blood reaction up to 1 in 300. The monkey had been bitten by two [mosquitoes] which had fed two days previously on a patient affected with Mediterranean Fever at the Civil Hospital.²⁵

Zammit felt he was on the brink of an epochal discovery to rival that of Ross. Horrocks now started working on mosquitoes, writing to Bruce on 5 September: 'If I can confirm Zammit's results I think the work may be considered practically finished It seems to me the story is now pretty plain.'

However, the enigma was not to be solved so easily. On 23 September Horrocks reported: 'All the mosquito experiments have failed.'

Monkey Shortage

By far the greatest difficulty for the Commission was finding monkeys for experiments. They had to be imported at great expense from Calcutta and Ceylon, with consignments arriving irregularly and depleted by monkeys dying en route. It was also unfortunate that their chosen species, *Macacus Rhesus*, proved relatively resistant to infection, leading to erroneous conclusions when extrapolating results to man.

The monkeys were housed individually in cramped cages. In early September, two monkeys accidentally developed Mediterranean Fever, apparently from their immediate neighbours, causing Horrocks to write: 'These two results will invalidate monkey experiments on the terrace for some time to come.'²⁶ Horrocks had to kill off the infected monkeys, disinfect the roof, and segregate the few remaining monkeys.

24 Paul Cassar, *Sir Temi Zammit's Laboratory* (Malta: Department of Information, 1980).

25 The author's father obtained this and other quotes taken from correspondence between the members of the Mediterranean Fever Commission, from photocopies supplied by the Royal Society in the 1960s or early 70s. This correspondence is now held at the Wellcome Library (within the Contemporary Medical Archives Collection, CMAC WT1/RST files). For simplicity, quotations from these Letters are simply referenced by date and author in the body of this article.

26 Letter; Horrocks to Bruce, 8 September 1904.

Zammit's choice of Maltese Goats

Constrained to experimenting on the few monkeys at the Station Hospital, and encouraged by coincidentally discovering malaria transmission by mosquitoes in Malta on 13 September, Zammit looked for an alternative. His attention turned to the ubiquitous Maltese goat.

He obtained a goat on 15 September, confirmed that its blood reacted negatively for agglutinins, and commenced feeding experiments, buying another goat in December. Over subsequent months, he intermittently examined their blood, milk and urine, but was distracted by other duties. He was a gifted amateur archaeologist and was setting up the Malta Museum, which would be inaugurated on 25 May 1905. He was also lecturing in chemistry at the University of Malta and had applied for the Professorial post, being appointed in June 1905.

Nonetheless, during the winter of 1904/1905, realisation slowly dawned. While his two goats remained well, their serum converted from negative to a persistently positive reaction, leading Zammit to revise his previous belief in mosquito transmission of Malta Fever. By the time of the last positive agglutination test on 29 April he had formulated a new hypothesis: 'These two experiments led me to the belief that goats are susceptible to Malta Fever, and that the disease may be spread to human beings by goats.'²⁷

Zammit would probably not have paid attention to goats had the supply of monkeys been plentiful. He waited until Bruce arrived in Malta (28 May 1905) so that he could personally communicate his serendipitous findings. This was the tipping point for the Commission. Bruce recorded this important meeting for posterity: 'Zammit informed the Chairman that the goat was in his opinion the transmitter of the disease...'²⁸

Bruce's spirits must truly have been raised by this promising news, for only two weeks beforehand Staff Surgeon Shaw in Bighi Hospital had informed him that the Admiralty had ordered him to cease all animal experiments on Navy property, fearing the strong Anti-Vivisection movement in London.

Bruce was galvanised, as is evident from the MFC's records. The position at the beginning of June 1905 and the start of the new fever season looked much more promising. It remained to be seen if Zammit's new hypothesis could be proven.

27 T. Zammit. A Preliminary Note on the Susceptibility of Goats to Malta Fever. *Proceedings of the Royal Society*, 76B, (1905), pp.377–378. (Reprinted in: *Journal of the Royal Army Medical Corps*, 5, (1905), pp.341–342).

28 D. Bruce. Introduction. *Reports of Mediterranean Fever Commission*, Part III (London: Harrison & Sons, 1905), August: pp.3–4.

The Goats' Milk Discovery

Bruce left Malta on 12 June 1905. On the same day Zammit bought six goats from two different herds and took them to the Lazzaretto. On 14 June, he examined their blood. With mounting excitement, he discovered that the blood in five out of the six goats reacted strongly to the *Micrococcus Melitensis* in the specific agglutination test, indicating that they were naturally infected. He obtained identical results the next day. Horrocks and Shaw confirmed Zammit's findings.

At Caruana Scicluna's suggestion, Zammit had brought milk from each goat for examination. It was agreed that Zammit would investigate the bloods, and Horrocks the milk. Zammit reported the findings to Bruce by letter on 30 June:

for the lazaretto I found that not less than five reacted to M.M. I informed Horrocks of the fact and passed him some milk for examination. He found the coccus in this milk and I found it abundant in the blood of the same goat. This is not bad for a beginning and hope to make good progress along the way.

Zammit sent his pithy, seminal report to the Royal Society, concluding that though the organism had caused no symptoms it must have lived and multiplied in the tissues.²⁹

Controversy

The news of the discoveries of 14–15 June was first communicated to Bruce by Horrocks as Acting Chairman, whose letter of 20 June, intentionally or not, made it appear that the main credit was due to himself. Bruce was certainly given this impression. It was only when he received letters from Zammit dated 30 June and from Shaw dated 5 July that he became aware of the facts.

Nonetheless, the chase was on and Bruce's hunting instincts were to go for the kill:

I was much excited by your letter this morning.... If this discovery in regard to the milk turns out to be true, it ought to make all your fortunes, it will be one of the most remarkable discoveries of recent times, and if the goat is the only transmitter of the disease we will be able to cut all their throats and throw them into the sea and "Bust the fever."³⁰

The Maltese goatherds soon divined his intentions: 'I am afraid there is a combination of the owners of the goats against us; they are getting very suspicious and refuse to allow the goats to be touched...'³¹

29 Zammit. A Preliminary Note on the Susceptibility of Goats to Malta Fever. pp.377–378.

30 Letter, Bruce to Davies, 28 June 1905.

31 Letter, Horrocks to Bruce, 5 July 1905.

Zammit sidestepped obstacles by successfully adapting the agglutination test for milk, enabling widespread testing in villages and towns. The milkmen were happy to sell goats' milk, a much easier process than bleeding their goats. The results corroborated Zammit's suspicions, revealing that up to half of the 20,000 goats in Malta were infected and that a tenth were excreting the organism in their milk.³²

The Pied Piper

Just as victory seemed assured, there was another twist to this tale. Lieutenant Colonel A. M. Davies, replacing Johnstone as epidemiologist in 1905, threw the cold water of doubt on the newly perceived importance of goats' milk in the causation of Malta Fever. My father described him as the pied piper who would lead the Commission astray.

Davies was pre-occupied with the soldiers' insanitary and poorly-ventilated barracks, and indeed his recommendations led to a marked improvement. He would eventually become the Army's Professor of Hygiene.

Within three weeks of Horrocks' intimation to Bruce that 'There may be something in the goat question.' Davies had investigated the milk supply for the 2nd Battalion of the Essex Regiment (who had suffered considerably from Mediterranean Fever at Lower St Elmo), and the Royal Garrison Artillery (who had suffered only slightly at Upper St Elmo). The findings perplexed him:

I can ascertain no series of facts pointing with any clearness to milk-transmission as an important mode of spread among troops or families. Practically all the troops drink either boiled or condensed milk and the great majority of families do the same...³³

It would be many months before realisation dawned on Davies, 'with Maltese cooks, possessed of profound faith in the virtues of goats' milk, we cannot be certain that effective sterilisation had been carried out.'

It was not just the local doctors who believed 'To boil is to spoil'.

Distractions

By the end of August 1905, the expert opinion of Davies dismissing the goats' milk theory created so much doubt that the Commission was led to waste time investigating alternative hypotheses. Thus, the incidental finding in September of micrococci in the blood of a mosquito that had fed on an infected monkey resulted in

32 J. C. Kennedy, 'Notes from Malta' in *Journal of the Royal Army Medical Corps*, 5, (1905), p.44.

33 Letter, Davies to Director General, 17 September 1905.

Horrocks and Kennedy setting themselves the tedious, and ultimately fruitless, task of dissecting 1,000 mosquitoes. This occupied six weeks.

Zammit's contention that infected goats' milk might be the mode of transmission was hotly disputed by Royal Navy Surgeons Edward H. Ross (brother of Ronald Ross) and G. Murray Levick aboard the cruiser HMS *Lancaster*, investigating mosquitoes around the Mediterranean.³⁴ They claimed to have drunk such milk without coming to harm.³⁵ Edward Ross, as a sailor, could not see how the ordinary 'Jack Tar' could possibly catch Malta Fever other than from biting insects when in harbour: 'The British sailor does not, as a rule, when he goes ashore at night on the spree, drink MILK.'

Bruce was exasperated by these delays and distractions:

Can't you fellows give us a "tip" as to how this fever is spread? I thought the milk was going to explain everything, but neither Davies, Horrocks or any of you seem to think much of the milk...³⁶

S.S. *Joshua Nicholson*

A fortuitous epidemic of brucellosis aboard ship stemmed the tide of scepticism. The merchant vessel S.S. *Joshua Nicholson*, trading between Antwerp and Egypt, anchored in Malta for one day in August 1905 to take on board 65 Milch goats bound for Washington. En route back to Antwerp, many of the ship's crew drank fresh goats' milk, and within weeks several were struck down with Malta Fever.

The first intimation of this was published in early 1906 as a short letter to Bruce from Dr N. Armand Ruffer, Maritime Quarantine Officer in Egypt.³⁷ Further details soon followed and Bruce expounded on this epidemic in two editorials.³⁸ This was clear proof of the connection of Malta Fever in man with the Maltese goat.

Royal Naval Hospital Bighi

Further positive epidemiological evidence was forthcoming when Shaw showed that a third of the Malta Fever cases in the Mediterranean Fleet occurred among staff

34 E. H. Ross, Levick G. Murray, 'Experiments on the transmission of Mediterranean Fever' in *Journal of the Royal Army Medical Corps*, 5, (1905), pp.240–247. E. H. Ross, Levick G. Murray, 'Notes on some of the Blood-sucking insects of the Mediterranean littoral' in *Journal of the Royal Army Medical Corps*, 5, (1905), pp.385–390.

35 E.H. Ross, Levick G. Murray, 'Dissemination of Malta Fever by Goats' Milk. (Correspondence)' in *Journal of the Royal Army Medical Corps*, 5, (1905), p.662.

36 Letter, Bruce to Shaw, 25 January 1906.

37 Armand N. Ruffer, 'The possible infection of man with *Micrococcus Melitensis* by goats' milk. (Correspondence)' in *Journal of the Royal Army Medical Corps*, 6, (1906), p.113.

38 D. Bruce. Editorial. *Journal of the Royal Army Medical Corps*, 6, (1906), pp.65–167; D. Bruce. Malta Fever (Editorial). *Journal of the Royal Army Medical Corps*, 6, (1906), pp.330–352.

and patients at Bighi hospital. He discovered that the herds of goats supplying this hospital were heavily infected with the *Micrococcus*.³⁹

Negative epidemiological evidence was also forthcoming. Dr Caruana Scicluna showed that none of the 200 inmates of an Institution run by nuns had suffered from Malta Fever for many years. Examination of the Institution's goats revealed them to be uninfected. Similarly, there had been no cases of Malta Fever in the overcrowded, insanitary Civil Prison for over nine years – this was ascribed to the prisoners not being allowed milk in any form.

Affirmative Action

Bruce returned to Malta in April 1906. With three new epidemiologists on the Commission, and all the accumulated evidence before him, Bruce could finally write categorically to the Lieutenant Governor on 1 May, two days before leaving Malta:

In conclusion, I beg to record my opinion that the infection of man with Mediterranean Fever by means of goats' milk is one of the most important factors in the spread of this disease ... and that I think the time has come when measures to remove this danger to the Public Health should forthwith be undertaken.

The Governor responded robustly with an Order to the Garrison on 12 May:

Stop goats' milk to troops; interim arrangements: use condensed tinned milk...

The milkmen, their livelihood threatened, rose up in protest, pasting placards listing their grievances, signed 'The Vexed Maltese Milkman', and went on strike, between 15 and 30 May 1906. This resulted in the troops converting wholesale to tinned condensed milk. When the milkmen ended their strike, the troops would no longer buy their milk; their actions inadvertently made it easier for the military authorities to institute the necessary public health measures, reinforced by military discipline. This included the orders:

Goats' Milk prohibited by Army (Garrison Orders, June 1906)
Prohibition of use of unboiled goats' milk (C-in-C's General Order to the Fleet, August 1906)

39 E.A. Shaw. III. 'Mediterranean Fever in goats, cows, and other animals. Reports of the MFC', 1906, Pt. IV, 16–26 (reprinted in: *Journal of the Royal Army Medical Corps*, 2, (1907), 1). E.A. Shaw. III. Further Observations on goats, cats, rats, and ambulatory cases in connection with Mediterranean Fever. Reports of the MFC, 1906, Pt. V, 37–41.

Success at last

Bruce was able to appraise Sir Archibald Geikie FRS, Secretary of Royal Society, on 8 October 1906:

Whether *post hoc* or *propter hoc*, it is too early to say, but during July, August and September of this year, there were only 15 cases of Malta Fever admitted to hospital against 258 cases for the corresponding three months of 1905 I think it is very probable that we have made a hit in preventive medicine, to the glory of God and the honour of our country...

Bruce had ended his May 1904 editorial with this exhortation:

One thing appears perfectly clear, at least to our mind, and that is that no stone should be left unturned, no amount of labour thought too much, to enable us to gain a knowledge of the natural history of Malta Fever, and so in time to prevent the occurrence of so many cases of this plague among our soldiers and sailors in the Mediterranean.⁴⁰

His efforts had been vindicated.

Bibliography

Manuscripts

RAMC Muniments Collection – Archives and manuscripts related to Sir David Bruce and Lady Bruce <https://wellcomecollection.org/works/srsccksk> (accessed 31 May 2024)

Books

Hughes, M. L., *Mediterranean, Malta or Undulant Fever* (London: Macmillan, 1897)

Journal articles

Anonymous, 'Obituary, Sir David Bruce' in *Obituary Notices of Fellows of the Royal Society*, 1 (1932), 79–85

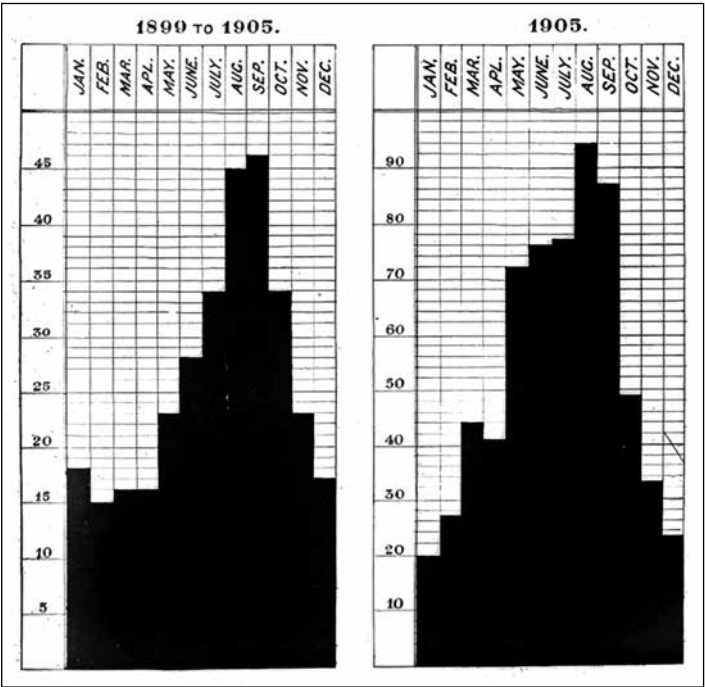
Bruce, D., 'Note on the Discovery of a Micro-organism in Malta Fever' in *Practitioner*, 39 (1887) pp.161–170

Bruce, D., 'The Micrococcus of Malta Fever' in *Practitioner*, 40 (1888), pp.241–249

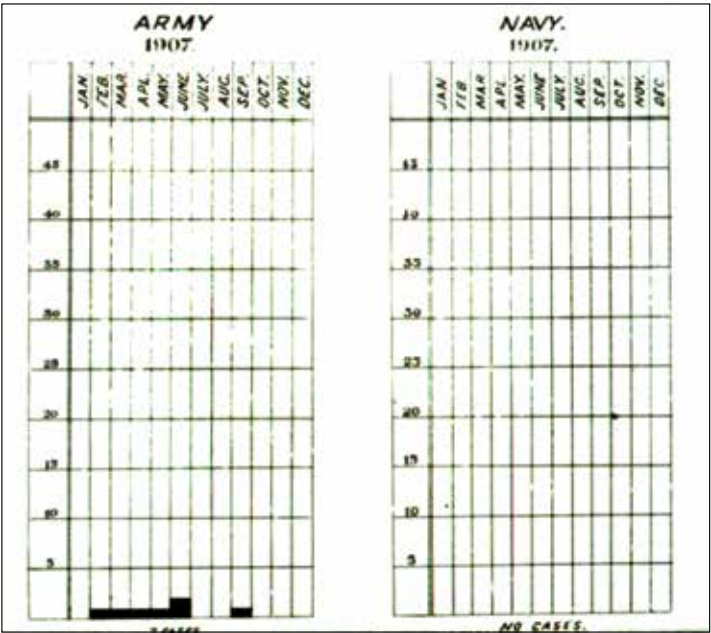
Bruce, D., 'Malta Fever. Editorial' in *Journal of the Royal Army Medical Corps*, 2 (1940), pp.485–502

40 D. Bruce. Malta Fever. Editorial, *Journal of the Royal Army Medical Corps*, 2, (1904), pp.603–605.

Prevalence of
Malta Fever in
the Garrison,
1899–1905.
(Chart by David
Bruce, RAMC
Muniments
Collection,
Wellcome Library)



Prevalence of
Malta Fever in the
Garrison, 1907.
(Chart by David
Bruce, RAMC
Muniments
Collection,
Wellcome Library)



- Bruce, D., 'Malta Fever. Editorial' in *Journal of the Royal Army Medical Corps*, 2 (1904) pp.603–605
- Bruce D. 'Malta Fever Part II. Editorial' in *Journal of the Royal Army Medical Corps*, 2 (1904), pp.731–736
- Bruce, D., Editorial. *Journal of the Royal Army Medical Corps*, 6 (1906), pp.165–167
- Bruce, D., 'Malta Fever' (Editorial) in *Journal of the Royal Army Medical Corps*, 6 (1906), pp.330–352
- Hamerton, A. E., 'Obituary, Major-General Sir David Bruce' in *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 25 (1931–1932), pp.305–312
- Hornby, G. P., 'The Loss of the Victoria' in *United Service Magazine*, August 1893, 128, pp.1109–1113
- Hughes, G. W. G., Hughes, M. H., 'Matthew Louis Hughes and Undulant Fever' in *Journal of the Royal Army Medical Corps* 115 (1969), pp.199–203
- Kennedy, J. C., 'Notes from Malta' in *Journal of the Royal Army Medical Corps*, 5 (1905), p.44
- Marston, J. A., 'Report on Fever (Malta)' in *Army Medical Department Medical Report for 1861*, 3 (1863), pp.520–521
- Noble, J. E., 'The David Bruce Laboratories 25th anniversary' in *Journal of the Royal Army Medical Corps* 113 (1967), pp.208–212
- Ross E. H., Murray Levick G., 'Experiments on the transmission of Mediterranean Fever' in *Journal of the Royal Army Medical Corps* 5 (1905), pp.240–247
- Ross E. H., Murray, Levick G., 'Notes on some of the Blood-sucking insects of the Mediterranean littoral' in *Journal of the Royal Army Medical Corps*, 5 (1905), pp.85–390
- Ross, E. H., Murray Levick G., 'Dissemination of Malta Fever by Goats' Milk' in *Journal of the Royal Army Medical Corps*, 5 (1905), p.62
- Ruffer, Armand N., 'The Possible Infection of Man with Micrococcus Melitensis by Goats' Milk' in *Journal of the Royal Army Medical Corps*, 6 (1906), p.113
- Vassallo, D. J., 'The Centenary of the Sinking of the Mediterranean Fleet Flagship, HMS *Victoria*. What was the role of Malta Fever?' in *Journal of the Royal Navy Medical Service*, 79 (1993), pp.91–99
- Vassallo D. J., 'L. A. Vassallo, (Obituary)' in *British Medical Journal*, 309 (1994), p.1578
- Vassallo D. J., 'The Saga of Brucellosis: controversy over credit for linking Malta Fever with goats' milk' in *The Lancet* 348 (1996), pp.804–808
- Vella, E. E., 'Major-General Sir David Bruce, K.C.B.' in *Journal of the Royal Army Medical Corps* 119 (3) (1973), pp.131–144
- Zammit, T. A., 'Preliminary Note on the Susceptibility of Goats to Malta Fever' in *Proceedings of the Royal Society*, 76B (1905), pp.377–378. Reprinted in: *Journal of the Royal Army Medical Corps* 5 (1905), pp.341–342

Publications

Cassar, Paul, *Sir Temi Zammit's Laboratory* (Malta: Department of Information, 1980)

Reports

Bruce, D., Introduction. Reports of Mediterranean Fever Commission, Part III (London: Harrison & Sons, 1905 August 3–4)

Shaw, E. A. III, 'Mediterranean Fever in goats, cows, and other animals.' Reports of the MFC 1906, Pt. IV, 16–26 (reprinted in: *Journal of the Royal Army Medical Corps*, 2 (1907), pp.1–12)

Shaw, E. A. III, 'Further Observations on goats, cats, rats, and ambulatory cases in connection with Mediterranean Fever' Reports of the MFC, 1906, Pt. V, 37–41.

Lectures

Bruce, David, Lecture to medical students, Aberdeen University, 1922