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THE HISTORY OF ANAESTHESIA SOCIETY PROCEEDINGS

Volume 42

Proceedings of the Summer Scientific Meeting

The Metropole Hotel, Llandrindod Wells, Wales

25th and 26th June 2010

Contents of Volume 42

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We are saddened to report the deaths of the following members of the Society: Dr Barbara Collier, Dr R Jayaweera, Dr Ed Charlton, Dr R Gabriel.

HISTORY OF ANAESTHESIA SOCIETY

2010 Summer Scientific Meeting, The Metropole Hotel, Llandrindod Wells

25-26 June 2010

Organizers: Dr Adrian Kuipers and Dr Barrie Fischer

The Organizers are very grateful for the assistance of Mrs Frankie Wakeford and staff of the Metropole Hotel, as well as Marion Kuipers and Lorna Fischer.

The Society would like to thank the following for generous support:

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HISTORY OF ANAESTHESIA SOCIETY

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For more information visit the website: www.histansoc.org.uk

EDITORIAL

About seventy delegates attended the summer meeting in picturesque Llandrindod Wells. Adrian Kuipers had made a good choice in the Metropole Hotel where his organisation was excellent. The scientific programme arranged by Barrie Fischer provided a variety of topics, always stimulating. Sunshine prevailed on both days!

There were six papers on the Friday morning and another six in the afternoon – the latter included three presentations by trainees, which were well received. As usual the trainees were awarded copies of Duncum's *The Development of Inhalation Anaesthesia* and one year's free membership of the Society. After the twelfth presentation, the AGM was smoothly conducted by President Tony Wildsmith. I had the privilege of reading the citation for the investiture of Prof J Roger Maltby as an Honorary Member. To conclude the AGM, the Presidential Medal passed to the new President, Dr C Neil Adams.

On Saturday morning there were another five interesting papers from members, four focussing on equipment. To conclude before lunch, Dr Colin Hughes delivered the guest lecture on the development of Llandrindod Wells as a spa town. This was an informative and entertaining account – well illustrated with many photographs.

Alistair G McKenzie
Hon Editor

FUTURE EVENTS

2010 9 October. HAS Autumn Meeting, Newmarket
Contact: Dr Kenneth Macleod (kenmacleod@doctors.org.uk)

2011 3-4 June. HAS Summer Meeting, Edinburgh (part of the JY Simpson Bicentenary Celebrations)
Contact: Dr Alistair McKenzie (mckenzie_alistair@hotmail.com)

For more information visit the website: www.histansoc.org.uk

Speakers at Llandrindod Wells

Dr D Zuck

Dr H Connor

Dr I McLellan

Dr D Wilkinson

Dr P Featherstone

Dr AG McKenzie

Dr Birte Feix

Dr Aditi Modi

Mr AP Bacon

Dr S Duttagupta

Prof JAW Wildsmith

Dr G Hamlin

Dr M Stratling

Prof JR Maltby

Dr Christine Ball

Prof Sir MK Sykes

Dr P Magee

Dr CPF Hughes

Members and guests attending Llandrindod Wells meeting

Dr Catherine Adam	Leven
Dr Neil Adams	Bury St Edmunds
Mr Andrew Bacon	Rochester, USA
Prof Douglas Bacon	Rochester, USA
Dr Christine Ball	Hampton, Australia
Dr Moyna Barton	London
Dr Edward Bick	Cheltenham
Dr Colin Birt	Rochford
Dr John Blizzard	Chelmsford
Dr Elizabeth Bradshaw	London
Dr G Burton	Bristol
Dr Anthony Clover	Shrewsbury
Dr Henry Connor	Hereford
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Dr Birte Feix	Cambridge
Dr Ann Ferguson	Broadstairs
Dr Barrie Fischer	Ombersley
Dr Anne Florence	Warrington
Dr Veera Gopakumar	Walsall
Dr Paul Goulden	Dewsbury
Dr Geoff Hall-Davies	Redditch
Dr G Hamlin	Blackburn
Dr Helen Hannah	Chippenham
Dr Eric Holmes	Colby
Dr Jean Horton	Cambridge
Brig I Houghton	London
Dr Graham Housam	Llandrindod Wells
Dr Michael Inman	Yelverton
Dr R Johnstone	Ulverston
Dr Adrian Kuipers	Near Shrewsbury
Dr R Laishley	London
Dr Peter Lloyd Jones	Cardiff
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Dr Ken Macleod	Huntingdon
Dr Alistair McKenzie	Edinburgh
Dr Colin McLaren	W/ Bassett
Dr Ian McLellan	Dorset
Dr Patrick Magee	Bath
Prof Roger Maltby	Jasper, Canada
Dr Aditi Modi	Wymondham
Dr Peter Morris	Holmes Chapel
Dr J Mulvein	Bristol
Dr Angela Murray	Sefton Vlg
Dr D Nightingale	Liverpool
Dr Abina O'Callaghan	London
Dr Roger Packham	Poole
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Dr Jeanne Seager	Rhuddlan
Dr P Shah	Stockport
Dr Meinolfus Stratling	Penarth
Prof Sir Keith Sykes	Devon
Dr Alistair Trench	Dunblane
Dr Yoav Tzabar	Carlisle
Dr M van Wijhe	Delden, Nethlds
Dr Barbara Weaver	Winscombe
Prof Tony Wildsmith	Dundee
Dr David Wilkinson	B/Stortford
Mrs Patricia Willis	London
Dr Raymond Wise	B/Forum
Dr Chris Woollam	Norwich
Dr Edward Young	Reading
Dr David Zuck	London

Guest Lecturer:
Dr Colin Hughes, Llandrindod Wells

THE WESTMINSTER MEDICAL SOCIETY 1809-1850

Dr D Zuck
Past President HAS, London

The Westminster Medical Society is of particular interest to anaesthetists, because it was at its meetings in the early months of 1847 that John Snow laid down the basic principles of the science and art of inhalation anaesthesia; but it is of considerable importance in its own right, as one of the only three medical societies in existence in London in its time - the others being the Medical Society of London and its breakaway, the Medical and Chirurgical Society. For more than forty years it provided a well-regarded and influential forum for the discussion of a wide range of medical problems. There are several misconceptions about the Society, especially in its later days, which I hope this account will correct.

Primary Sources

The records of the Westminster Medical Society were originally held by the Medical Society of London, with which it amalgamated in 1850. What remains of them is now in the care of the Archives Department of the Wellcome Library. They consist of Attendance Books, Minute Books of Committee Meetings, and Minute Books of General Meetings, and I am grateful to archivist Helen Wakely, for making them available to me. [1] They are hand-written and not always easy to read, and there are a number of volumes missing, so to fill the gaps I have used the reports of the Society's meetings published in *The Lancet.* The *London Medical Gazette,* possibly regarding it as already moribund, announced in 1840 that it did not intend to continue to report the Society's meetings routinely; but in any case *The Lancet* provided better coverage, reporting not only the papers but also the discussion that followed, which is valuable for revealing the depth of knowledge or ignorance, and prejudices and conceits, of the members. [2] Because these reports of clinical meetings are readily accessible in medical reference libraries, the main focus of this paper is on the mechanics and problems of running a homeless medical society in early Victorian London (Figure 1).

The First Thirty Years

The Society was founded in 1809 by Benjamin Brodie and C. Mansfield Clarke, as an adjunct to the Hunterian or Great Windmill Street Medical School, [3] which they owned, probably inspired by the long-established Scottish student society, the Royal Medical Society of Edinburgh, [4] and the Guy's Physical Society. [5]

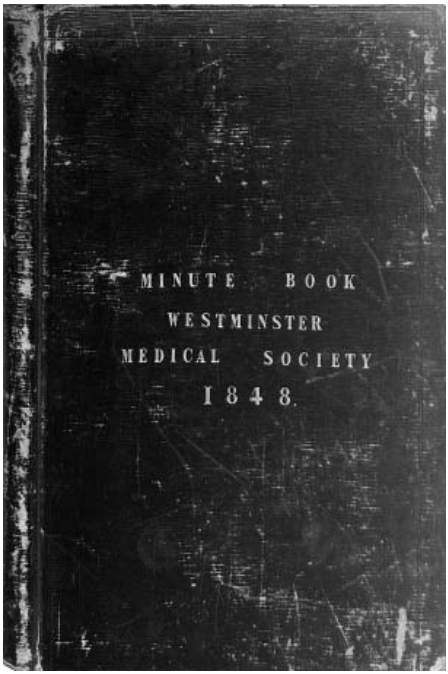

Fig. 1 WMS Minute Book 1848 (Medical Society of London)

The earliest archive is the Minute Book of General Meetings between 7th December 1811 and 6 May 1815, and it contains some familiar and distinguished names. Among those occupying the Chair were W.T. Brande, who succeeded Humphry Davy as professor of chemistry at the Royal Institution in 1813, Charles Bell, and Peter Mark Roget, of the eponymous Thesaurus. On 17th October 1812 the distinguished Swedish chemist Dr Berzelius was elected a corresponding member, which gives an idea of the Society's view of its own stature.

Membership and Finances

Students at the Hunterian School could be nominated for life-time membership. The fee was one guinea, and as the Society had the use of the facilities of the Hunterian School its expenses were not great, so no annual subscription was required. A balance of income and expenditure was recorded every February in the Minute Books during the 1830s. The sum in hand fluctuated between some

£30 and £50, the main income coming from new members. In 1836 only six new members were admitted, and cash in hand amounted to £17-17-8. The following year new members brought in £17-17-0 and the Society enjoyed a balance of £47-3-11. Rent of £31-12-0 was paid for the use of the premises, and £4-15-11 for stationery, postage, and the porter's gratuity. In 1836 an attempt by a minority to establish the independence of the Society from the Hunterian School by moving the venue of meetings to the vicinity of London University as being 'of easier access to the mass of students' was defeated.[6]

Reports of Meetings [7]

The Lancet commenced publication at the beginning of 1823. It is an indication of the changing attitude towards work and leisure during the C19th that originally the publication day was Sunday. A recurring grumble that WMS attendance had fallen off soon made its first appearance, in a letter from a Member. 'Our Society has for many years ranked high in the Metropolis; let not its members see it fall for the want of support.' But attendance usually fell off in January because of the weather; the following Saturday 'there was a full attendance of the members.' As was and always will be the case, lack of interest in the subject, dreary presentations, and the tendency of some members to monopolise the proceedings, were reasons for poor attendance.

The Lancet's reporters were not welcomed by medical teachers or societies during its early years; teachers especially were not happy to see their lectures available gratis in print, but by 1826, when the journal began to report the WMS meetings regularly, the reporters signed in openly, and appeared to be welcome[8].

The Meetings

The Society met at 8 o'clock on Saturday evenings. Generally meetings took the form of one or more case reports, followed by a discussion. Topics I have picked at random included iritis; hydrophobia; descriptions of new apparatus; an outbreak of influenza and the problems of treating it; icterus, fatal on the third day, in a female patent with no obstructive cause found at postmortem; the classification of skin diseases; the preservation of health in warm climates, and the contageousness of dysentery. Before the meeting started, pathological specimens or new items of apparatus could be 'laid on the table,' for examination by members. Speakers were required to submit their proposed subjects, which were peer-reviewed. On 20 April 1839, for example, Mr. Costello requested the Committee to sanction a paper on 'Physical Love.' Sadly, ' the Committee did not deem it prudent to grant Mr. Costello's request.'

In 1832 a succession of meetings were devoted to the outbreak of cholera that had started in Newcastle and spread south. In the words of the Lancet's reporter on 7 April, 'If it be true that "hope deferred maketh the heart sick," there must be not a few "sick hearts" at the museum in Windmill Street. Every Saturday brings with it an expectation that the CHOLERA discussion will lose its claims to eternity; yet every Saturday it again stalks forward... This evening the gaunt visitor was present as usual; he had, however, a very thin audience, his "ravages" having, it seems, terribly decimated the members, who have ... forsaken the field of battle to avoid the flying arguments.'

This particular meeting reveals the relationship between the Society and the reporters. The Hon. Secretary having been called away unexpectedly before he had had time to prepare the minutes of the previous meeting, he had suggested to his deputy, Mr. Greenwood, that the minutes might be taken from the Lancet's report. This provoked much adverse comment. It also appears that the Hon. Secretary expected to receive 'proof sheets' from journals carrying the Society report before publication. *The Lancet's* detailed account of this incident occupied the best part of half a page, but in the Minute Book it reads as follows: 'Mr. Greenwood rose to reply but owing to cries of Chair! and Order! His explanation was not heard sufficiently distinct (sic) to be noted down.' Comparison of the Minutes with the published reports shows that correspondence between the two was not always exact, the journal's generally being fuller. Where they coincide closely it is likely that the Minutes have been cribbed from the Reporter's account.

The Anatomy Petition

A notable event in the history of the Society, indicative of the importance with which it was regarded, or regarded itself, was the presentation of the Anatomy Petition to the House of Commons. This related to a Bill introduced as a reaction to the illicit and sometimes murderous activities of the suppliers of cadavers to the teachers of anatomy. The proposals in the Bill, in the view of the Society's members, were unnecessarily bureaucratic and restrictive, limiting the teaching of anatomy to the medical schools associated with hospitals, and requiring complex registration and the purchase of an expensive certificate for each individual dissection. This did nothing to increase public safety, and would create a closed shop in the teaching of anatomy, outlawing the very valuable private medical schools such as the Hunterian.

The Society set up a sub-committee, and adopted and submitted its proposal that public safety would be enhanced by making the sale of cadavers illegal. It also suggested that dissection, as the final component of the sentence of

execution for murder, was stigmatised in the eyes of the public by associating it with criminality. In the words of one member, 'medical men should not be *the finishers of the law*.' If it were intended to appeal to the public for the voluntary donation of their bodies, then the practice of dissection must be dissociated from execution.' The discussion of the Petition, which was effective in modifying the Bill, was more fully reported in *The Lancet* than in the Society's Minute Book. The arguments for and against the Act are dissected in Ruth Richardson's classic. [9]

The Society also initiated enquiries into the danger of carbon monoxide poisoning from stoves in closed spaces, and of arsenic poisoning from cheap stearin candles, to which John Snow contributed his expertise in analytical chemistry; but fear of libel action by the manufacturers played a part in inhibiting the Society from publishing a public warning. Nevertheless Professor Brande, at the conclusion of his lecture on the chemistry of fatty substances and the constituents of candles at the Royal Institution on 26 January 1838, was able to claim that in consequence of the exertions of the Westminster Medical Society, no manufacturer in London now used arsenic in the manufacture of candles. [10]

Closure of the Hunterian School – finding a New Home

The Hunterian School closed after the 1837-8 session, John Snow being among its last students, so the Society had to find a new home. [11] Where medical societies might meet in the early 19th century is an interesting but unexplored question. The Westminster Society met for a while at the Hunterian Museum of the Royal College of Surgeons in Lincoln's Inn Fields, but the accommodation was described as cold and cheerless on a winter's night, and sufficiently dreary in appearance as to prevent all but the staunchest of the friends of the Society from attending. The problem was finance; the funds of the Society were insufficient to meet the current running expenses. Since its founding thirty years earlier some 1200 members had joined, so it had been able to run like an inverted 'pyramid' scheme, funded by the admission fees, and not needing to charge an annual subscription; but the nature of the Society had changed. Because of life-time membership it was no longer a students' society; the majority of the members, as could be told from the nature of the meetings, had graduated and were in practice. They desired to rent more comfortable rooms, render the Society more useful, and raise its respectability in every way, so at a Special General Meeting held on Saturday 14 April 1839 it was proposed to break with precedent and raise an annual contribution from London members of ten shillings and sixpence; and the admission fee was to be increased to two guineas. [12]

The minutes of the committee meeting on 16 July 1839 record that several pairs of members undertook to investigate accommodation in a house in Sackville Street, in Blenheim Street School, and in the Westminster Dispensatory. Other places considered were the Literary Institution in Leicester Square, and the Egyptian Hall, Piccadilly, but this would be very expensive. Failing all these, it was resolved to place an advert in *The Times* newspaper in the name of an old established Medical Society seeking two rooms, one able to hold 100 persons with lighting, heating, and seats provided. Since the average attendance rarely exceeded twenty members the provision for one hundred seems optimistic.

Whether as a result of the advertisement is not clear, but at the committee meeting on 6 August the proposal to rent accommodation at Exeter Hall was carried unanimously. [13] It was agreed to rent Room No. 6 for six months for a fee of 25 guineas, the only extras being 5 shillings per night for gas light and one shilling for fire when wanted. An extra room for half an hour before the meeting could be available without charge. It was also decided to place announcements of the start of the new session in The Times, the Morning Herald, Morning Chronicle, Athenaeum Literary Gazette, The Lancet, and the Medical Gazette; also to print 250 cards with details of the session's programme, to be laid on the table for the benefit of members, and to issue personal invitations to a number of the leaders of the profession.

The beneficial effect of these measures, which were repeated in successive years, were seen in *The Lancet's* report of the first meeting of the new session, 'which was held on Saturday 19 October 1839 in the Society's new rooms in Exeter Hall. The well-founded objections which existed to the Hunterian Museum, as a place of meeting, prevented many of the old members of the Society from attending … The meeting room in Exeter Hall, on the contrary, possesses an air of comfort, and is so well warmed and lighted, that no such objection can be raised against it. ... The Westminster Medical Society numbers about 1200 members, among whom will be found the names of many distinguished men. With a little industry, its proceedings will bear comparison with those of any similar institution.'

But finance continued to be a problem. On 30 November 1839 the appointment of a Collector to pursue subscriptions was discussed, and on 11 April 1840 William Beamish was appointed, having agreed to provide a guarantor for a surety of £100, on a commission of 5% of the sums collected. He was supplied with a list of defaulters, but after some small initial successes, and the alienation of some members, this appointment appears to have lapsed.

The condition of the Society at the beginning of each Session can be gathered from the presidential address. In October 1840 the President congratulated members on the prosperous condition of the funds. In 1841 there was a full attendance; but the following year the President, Dr Golding Bird, reported difficulties due to the apathy of members. This, he said, was one of the oldest institutions of its kind, but many senior members had left, and the Society needed new blood. He called for more exertion to prevent this being the last session of the Society. To increase attendances it was decided to meet fortnightly instead of weekly, and to continue the session into May and June, as some of the other societies did.

Meanwhile, following the migration of the affluent classes, the centre of gravity of the medical profession was moving west also, from Finsbury Square to Harley Street, so Exeter Hall was too far east for many members. [14] At the Committee meeting on 1 April 1843 it was decided to look for different accommodation, and on 15 April it was reported that the Committee Room at 32 Sackville Street, owned or managed by a Mr. Skinner, could accommodate WMS meetings at a cost of one pound, provided that 'the room shall not be occupied beyond half past ten o'clock at night.' On 1 July it was decided that the place of meeting be changed from Exeter Hall to 32 Sackville Street.
Consequently *The Lancet's* report of the first meeting of the 1843/4 session stated, rather grandly, that it was held in the Society's rooms at 32 Sackville Street, and the President's opening address provides a valuable indication of the ethos of the Society. After mentioning its prosperity and the advantages of the new meeting place, he continued: 'This society is essentially a practical one; our object, in assembling together, is simply to increase our stock of knowledge by listening to the narration of cases, or essays on any professional subject of interest … Without assuming the appearance of a debating society, we meet to discuss freely, yet without acerbity, the relative value of the facts presented to us, and the deductions drawn from them, and I think few will be found who will not at once admit that they have reaped much advantage occasionally from these discussions … One of the most valuable contributions to these meetings has been the occasional exhibition of specimens of morbid anatomy with a history of the case attached to them … Another … is the varied experiences which may be made available by members in their varied pursuits in the different branches of the profession … and another, of considerable value to professional men, is the opportunity afforded us of meeting together, and cultivating friendly feelings …' Mr. Snow then read a paper on a fatal case of poisoning with carbonate of lead. So clearly it was a society of practitioners seeking to widen their knowledge, and their ability to treat their patients, by the exchange of experiences.

During the following months the Committee was concerned with the revision of its Laws and the collection of subscriptions. In March 1843 a new Collector, a Mr. Jacques, was appointed, but before letting him loose all members in arrears were written to individually. However, on 1 February 1845 there was only 18/6 in the Treasurer's hands, and rent was owing for the current session. On March 11 it was decided to raise the annual subscription to one guinea, payable on the anniversary of election to the Society, and rather than being a deterrent, *The Lancet* reported that at the beginning of the 1845/6 session there was a full attendance of members. But although the Collector was able to hand over ten guineas the financial problems continued, to the extent that on October 10 1846 the Committee received a letter from Mr. Skinner refusing to allow the Society to meet in the Sackville Street house until the balance of £25-4-0 was paid to him. To keep the Society going the committee members resolved to dip into their own pockets and make up the difference between what the Collector was able to obtain from outstanding subscriptions, and the amount due, by a whip round among themselves.

At this point an offer was received from Dr Richard King, Secretary of the Ethnological Society, of rooms at 27 Sackville Street, including lighting, fire, and attendance, for 15/- a meeting, which it was speedily resolved to accept.[15] So the Society was on the move again, meeting in the rooms of the Ethnological Society, 29 Sackville Street (as *The Lancet* erroneously reported). ' The attendance of members was numerous, and the greatly increased comfort and accommodation offered at the new place of meeting gave great satisfaction to the members present. Dr. Snow read a paper on alkaline urine and phosphatic calculi.'

Measures introduced in October 1846 reveal the surprisingly amateurish way in which the Society's finances had been managed; it was resolved to appoint a Finance Committee; in December 1847 to keep an Income and Expenditure Account Book; and in 1848 the Treasurer was asked to lay the Book on the table at each meeting.

By 1847 the Society had moved again, following Dr King and the Ethnological Society to 17 Savile Row (Figure 2), on the same terms as in Sackville Street; it was agreed to use two rooms which plans of the building suggest were on the ground floor.[16]

Fig. 2 17 Savile Row, London W1

Enhancing the Society's Status

Towards the end of the 1847 session the Society embarked on a complete revision of its constitution. The changes were discussed at meetings of the Committee on April 6 and 13 1848. The result was that henceforth ' The Society shall consist of the President, four Vice-Presidents, a Treasurer, two Honorary Secretaries, and Fellows. The Fellows shall consist of two classes, viz. Honorary and Ordinary.' It was resolved also that, in Law 3 and elsewhere ' the Committee be called in future the Council.' With this change of nomenclature it was putting itself on a par with the Royal Colleges. It was also decided that the Society should publish its Proceedings. At the end of the session the Society's finances were in a healthy state. After paying its expenses of £58-19-11 it was left with £44-7-5 cash in hand.

The beneficial effects of the constitutional changes were soon seen. On October 16 1848, ‘ The Society commenced its meetings for the session this evening. The rooms in Savile-row were completely crowded, reminding us of the Society in its most palmy days. About sixty fellows and visitors were present. The President, on taking the chair, gave an inaugural address on the state of the Society, which was in every way prosperous.’ He traced the Society from its origin in John Hunter’s drawing-room in 1773 down to the present time, remarking on its alternating phases of prosperity and adversity, and discussing their various causes. He enumerated the various public services the Society had rendered the profession, particularly alluding to the Anatomy Act, and its influence on measures adopted by government during the time of the cholera, and observed that during the last session the most philosophical (meaning scientific) treatise on ether had emanated from the pen of one of their secretaries. All this was recorded in detail in *The Lancet*. In the Society’s Minute Book it was summarized in one sentence! The Society continued to flourish. The attendance book shows an average turnout in the mid-30s.

And finally, on Saturday 6th October 1849, the commencement of the last session of the WMS as a separate entity, ‘ The rooms of the Society were crowded this evening – the first of the session – with fellows and visitors. The increasing prosperity of this useful institution may be judged by the fact that three new members were admitted, and seventeen proposals for new members were read from the chair.’ Hence it was a Society whose fortunes had fluctuated, being kept afloat in bad times by the loyalty of a small core of devoted members, but it was ending the decade of the 1840s on a wave of success and prosperity, much different from the misleading account given in the *‘Autobiographical Recollections of the Medical Profession’* of J.F. Clarke, a long-time reporter and sub-editor of *The Lancet*.[17] ‘ When I joined the Society it was well attended, the papers were valuable, and the discussions animated and interesting. But when the Hunterian school broke up the Society began to decline: expenses increased, while income diminished. The Society at various times held its meetings in Sackville Street, Savile Row, and Exeter Hall. It was all but defunct at the latter place. I have been present on several occasions when the only persons present were the President, Mr. (now Sir) John Fisher, Dr. Sayer, and myself. But on the amalgamation things of course took a turn, and the Society has been flourishing in connexion with the ‘London’ ever since’.

John Snow’s Contribution

In the General Minute Book covering the period 4 January 1834 to 31 March 1838 it is recorded that on 28 October 1837 Mr. Snow was one of three

applicants balloted and admitted as an ordinary member of the Society.[18] He first signed in to a meeting on 25th November 1837, after which his signature appears regularly. He missed very few meetings during the whole of his life. John Snow was one of the pillars of the WMS during its years in the wilderness. He first attended a Committee meeting on April 20th 1839, but in what capacity is not indicated. He was next present as an elected member of the Committee on November 9th of that year, and was re-elected annually for the next ten. Apart from a spell of absence during 1845, when according to Richardson he was convalescing from a renal disorder, he was a fairly regular and reliable attender. He first took the chair, in the absence of the Chairman, on 1st July 1843, again on 2nd November 1844, and several times during 1846. He was appointed one of the two honorary secretaries in 1847, and, as already mentioned, the President complimented him in his inaugural address. It is noteworthy that although Snow wrote in his own hand the minutes of the meeting on 18 January 1847, at which he first put forward his views on the requisites for the safe administration of ether, that part of the report, uniquely, was cut out and glued in from *The Lancet*.

At the beginning of the 1848 session he was elected one of the four vice-presidents, and on November 19th he chaired a very sticky meeting at which were discussed the many problems created by the previous Hon. Sec., Mr. Chance. At a previous committee meeting, which he had not attended, he had been censured and voted out of office, but at his request it was agreed that the minute should be cancelled and he be allowed to resign voluntarily, on the face-saving grounds that he was moving to the country. At the end of the meeting it was 'Resolved unanimously that the best thanks of the Committee be presented to Dr. Snow for his impartial conduct while in the chair this evening.' In this connection it should be remembered that John Snow was still only in his early 30s, and is accurately represented by the Barker portrait of 1847, not by the much better known photograph taken ten years later.[19] Further evidence that his quality was recognised was his appointment as one of the three representatives delegated to negotiate the proposed amalgamation with the Medical Society of London. These were his administrative contributions, but also, of course, he read a number of important papers, and contributed to discussions.[20]

Richardson reports John Snow's own expression of the importance of the WMS to him in his clinical life. [21] ' I have often heard him say, both privately and publicly, that, upon this early connexion with the "Westminster Medical," his continuance in London depended, and all his succeeding scientific success.'

Other Stalwart Supporters

For some twelve years the Westminster Medical Society, struggling against financial and accommodation problems, was kept going by the esprit de corps of a nucleus of devoted members. Even in the darkest days the Committee Minutes give no indication that the winding up of the Society was ever conceived. Among the most active were:

- William Dingle Chowne (1791-1870), who often hosted committee meetings in his home. He was the most senior; his qualifications were MRCS 1813; MD Edin 1827; MRCP 1833. He was on the staff of Charing Cross Hospital, specialising in diseases of women and children. He was a Fellow of the Medical Society of London, had been its Orator in 1841, and succeeded Snow as President in 1856.
- Golding Bird MD, FRS, had been a fellow student of John Snow at the Hunterian School. He became a physician on the staff at Guys, and lived at 48 Russell Square, which in the 1980s became the first home of the Royal College of Anaesthetists. He was the MSL Orator in 1847.
- Francis Hird MRCS 1836; FRCS (Hon) 1843; was Chowne's junior colleague at Charing Cross Hospital. He, also, was a Fellow of the MSL, was its Orator in 1848 and 1850, and succeeded Chowne as President in 1857. These men must have been part of Snow's social circle, and obviously held him in some considerable regard.

Amalgamation with the Medical Society of London

There was considerable cross-membership between the WMS and the Medical Society of London (MSL), so it was probably no surprise that on 10 January 1850 the Committee received and considered a letter from William Smiles MD, 3 Bolt Court, Hon. Secretary of the MSL, proposing its amalgamation with the Westminster Medical Society. The attraction would be a permanent home, with a library, and a reading room. The MSL's premises in Bolt Court, off Fleet Street, gifted conditionally by its founder John Coakley Lettsom, was even farther east than Exeter Hall, and the MSL was experiencing a fall-off of attendance and membership. The WMS Committee elected a deputation of three members, Mr. Hird, Dr. Chowne, and Dr. Snow, to enter into discussion with the MSL.

Mr. Hird and Dr. Snow reported on 24 January on behalf of the deputation, 'that the Medical Society of London stated that that Society could not alter its name on account of the title by which its property is held, that the Council of that Society was willing to come to Savile Row or the immediate neighbourhood in the event of their union with the Westminster Med. Society, and to have a reading room and accommodation for their library. The deputation of the

Medical Society of London expressed their desire to unite with the Westminster Medical Society. They estimated the value of their property at £2000, and stated that the number of their paying members was about 75.' The deputation's proposal that the report be adopted was passed unanimously, and subsidiary reports paving the way for amalgamation were also passed.

Far from being moribund, as Clarke claimed, the WMS was by far the larger and more prosperous of the two societies. The attendance book shows a steady increase from a low of 3 and an average of a dozen during the early 1840s, to a peak of 70 and an average of 60 at each meeting towards the end of the decade; and it brought with it a dowry of some £60, and an annual income from subscriptions of £157-10-0. The Society held its last meeting on 18th May 1850; seventy members were present, and the final entry in the Minute Book reads, 'The Society then broke up.'

The Lancet's Farewell

'We cannot allow the Westminster Medical Society to merge into "things that were" without an epitaph.' [22] The editorialist summarized the early history of the Society, its difficulties after the closure of the Great Windmill Street School, and personality problems which were eventually resolved when ' it became important that one of the officials of the Society should retire ... From this period a new life seems to have been imparted to the Society ... and members began to pour in. For the last two or three sessions of its existence the success of the Westminster Medical Society was beyond anything in the history of scientific medical associations. When the Society dissolved, on the 18th of May, 275 fellows were on the books.'

There followed a summary of the Society's influence on health policy, during the cholera of 1832, its submission during the debate on the Anatomy Act that did much to 'do away with the public prejudices respecting that important measure,' and on other occasions too the WMS contributed its influence in favour of changes connected with the public health. 'It bore, in fact, more resemblance to the Academie de Medicine, of Paris, than did any other British institution. It was always considered more of a debating society that a publishing one; but within the last year or two, the proceedings, which were published in a pamphlet form, showed that the Society took a high position among the scientific bodies of the metropolis.'

But however justified all this praise was, Wakley, for it must have been he, had an axe to grind, and he proceeded to compare the Royal Medical and Chirurgical Society very unfavourably with the WMS. For some years past it

had given great offence by its arbitrary rejection of papers, by cliquism and favouritism. 'Under these circumstances, an (*sic*) union between the Westminster and London Medical Societies was determined on. The first had numbers, the second had a library and considerable property .... and such a union promises to be both prosperous and happy.'

Medical Society of London - A New Beginning

The new joint Society took a lease of what had been the gallery of an art dealer at 33 George Street, off Hanover Square, for £100 per annum, and fitted it out;[23] and as The Lancet reported on Saturday, October 12, 1850, 'The first meeting of this Society, since its amalgamation with the Westminster Medical Society, was held this evening, at the new rooms in George-street, Hanover-square.' [24] The committee who had managed the amalgamation had succeeded in making what had been a picture gallery into a suitably worthy meeting place for the oldest metropolitan medical society in every particular but one. It was too small. 'When we state the fact, that on this evening nearly fifty fellows and visitors were unable to obtain admission, the room of meeting and the library being both so crowded, that every space where the President could be seen, or a speaker heard, was occupied ... Many of the most eminent members of the profession were present ...' and twenty seven new applicants for membership were to be ballotted for in the usual way at the next meeting. There are 140 signatures in the MSL Attendance Book!

The rest is of the story belongs to the Medical Society of London, of which John Snow was elected Vice-President and Orator in 1853, and President in 1855. [25]

Acknowledgements

I am grateful to Helen Wakely, Archivist, The Wellcome Library, for providing access to the records while they were still being catalogued; to Commander Roger Ireland, MBE, Registrar, Medical Society of London, for permission to quote from the minute and attendance books; and, as always, to Professor Peter Vinten-Johansen for continually identifying new stones to upturn, just when I thought I had finished.

Notes and References

1. The Westminster Medical Society's records are included in the Medical Society of London's archive, which has the prefix SA/MSL. There is one book of Committee minutes, SA/MSL/K/1/1/1; six books of minutes of the Society's public meetings, SA/MSL/K/1/2/1 to 6; and three attendance books,

SA/MSL/K/1/3/1 to 3. Fortunately the surviving Committee minute book covers the most interesting period, 1839-1850.

2. *London Medical Gazette* 1840-41; 27: 175. 'It is not our intention to report the proceedings unless on extraordinary occasions.'

3. For relevant topological information about London during the first half of the 19th Century see: Zuck, D. John Snow's London – the Blessed Chloroform Lecture 2008. *Proceedings, History of Anaesthesia Society* 2008; 39:109-127.

4. Power, D. *British Medical Societies*. London, Medical Press and Circular 1939; and Jenkinson, J. *Scottish Medical Societies 1731-1939, their History and Records.* Edinburgh University Press, 1993, 219-220. The Royal Medical Society was founded in Edinburgh in1737 as an association of students. Power's supposedly comprehensive review does not include the Westminster Medical Society.

5. Wall, J.R. The Guy's Hospital Physical Society 1771-1852. *Guy's Hospital Reports 1974;* 123: 159-170. Founded in 1784; see also Burch, D. *Digging up the Dead.* London, Vintage Books, 2008, an excellent biography of Sir Astley Cooper.

6. *The Lancet* 1836-7; i: 232, 260,280.

7. To avoid overloading the list of references, sufficient indication is given in the text to allow the reader to locate *The Lancet's* reports.

8. Wakley's biographer, Samuel Squire Sprigge, writes about the very interesting but unexplored subject of *The Lancet's* reporters. ' The meetings of the medical societies, again, were reported at the length that their importance warrented – a proceeding that the officials of the societies objected to as an infringement of copyright.' Sprigge, S.S. *The Life and Times of Thomas Wakley. London,* Longmans Green & Co. 1897, 81. Since the WMS did not publish its transactions there seems to have been no objection to the presence of reporters.

Wakley, in his evidence at the libel action brought by Bransby Cooper, said that 'In the discharge of my duty as a journalist, I am under the necessity of employing a great number of reporters; they are widely distributed, - they take note of the cases as they are admitted into the various hospitals, and carefully describe all particulars connected with them. The reporters I have employed, as far as I have been capable of judging, have been men of honourable character, and they have executed their duties in a very honourable and accurate manner.' The identity of one only is known, James Lambert, a recently qualified surgeon, evidently also skilled at shorthand, who had reported from the Middlesex and

St. Thomas's Hospitals, and had been banned from both for the tone of his reports. He was attacked by Sir James Scarlett, acting for the plaintiff, as 'a hireling, instigated by malice to write untruths.' Wakley riposted that Scarlett was himself as hireling, as were they all. Wakley, T. *A Report of the Trial of Cooper v Wakley for an Alleged Libel ...* London, Office of *The Lancet*, 1829, 15. (Available on the Web by searching for Cooper v Wakley – a most entertaining and instructive verbatim account.)

9. Richardson, R. *Death, Dissection, and the Destitute*. Harmondsworth, Penguin Books, 1989, 144, 236.

10. *The Literary Gazette and Journal of Belles Lettres* 1838;22: 72-73.

11. The *Survey of London* (Vol. 31, Chap. 3) states erroneously that the School closed at the end of 1831, and this has been copied elsewhere. The *Survey* cites two references, Peachey and Thomson. Peachey, at the end of a history of the School, says, ' ... on completion of the spring course of lectures in 1831, the doors of William Hunter's Theatre of Anatomy were closed. Its career, like that of its founder, had extended over sixty-four years.' (Peachey, G.C. *A memoir of William and John Hunter*. Plymouth, Brenden, 1924, 124). Note that this refers only to the ' Theatre of Anatomy,' not to the School. There is ample evidence, from its adverts in the journals and John Snow's studentship among much else, that the School did not close, nor did the teaching of anatomy cease, until the end of the 1837-1838 session. The John Thomson reference is to his two volume *Life of William Cullen, MD,* London, Blackwood, 1859. 739-742.

12. It is difficult to provide equivalent present-day values, and contemporaneous information is scarce, but in 1876 a good middle class general practice brought an income of £500 a year, while a prestigious one run by a practitioner with higher qualifications would bring an income of £1100. Among the upper echelon of London consultants, Benjamin Brodie earned between £15,000 and £21,000 a year during the period 1824 to 1846. Peterson, M.J. *The Medical Profession in Mid-Victorian London.* Berkeley. University of California Press, 1978, 206-215.

13. Exeter Hall, now almost completely forgotten, was built in 1829, on the site now occupied by the Strand Palace Hotel. It had a large hall, soon enlarged further to cope with public demand, and a number of smaller meeting rooms. It was the Albert Hall of its day, a popular venue for concerts and public meetings, religious and political. Information about it can be found on the Web.

14. The Royal College of Physicians had moved as early as 1828.

15. Richard King trained at Guy's and St. Thomas's, and from 1833 to 1835 was surgeon and naturalist on an Arctic expedition sponsored by the Royal Navy. He corresponded with Thomas Hodgkin, who had a great interest in the conditions of the aboriginal inhabitants. Hodgkin and King were founder members of the Aborigines Protection Society, and of the Ethnological Society, set up to study the natives of the territories being taken over by the ever-expanding British Empire. Kass, A.M. and Kass, E.H. *Perfecting the World – The Life and Times of Dr. Thomas Hodgkin 1798-1866.* Boston. Harcourt Brace Johanovich, 1988, 258-279, 393, 455.

16. I am grateful to Peter Vinten-Johansen for a copy of the plan of the ground floor as it appears in the Survey of London.

17. Clarke JF. *Autobiographical Recollections of the Medical Profession*. London: Churchill, 1874; 239-240.

18. It has been suggested that Dr. John Epps introduced John Snow to a meeting on 8 April 1837 as his guest, but there is no evidence for this in the Attendance Book. A scrawled entry on 15 April opposite that of Dr. Epps could be Snow's name, but it is certainly not his signature.

19. Zuck D. Snow, Empson, and the Barkers of Bath. *Anaesthesia* 2001; **56**: 227-230

20. Snow's main communications to the WMS were on neonatal asphyxia and resuscitation, paracentesis of the thorax, the capillary circulation, alkaline urine and calculus formation, lead poisoning, cholera, and ether and chloroform anaesthesia.

21. Richardson, B.W. The Life of John Snow, M.D. in *Snow, J. On Chloroform and Other Anaesthetics,* London, Churchill, 1958, viii – ix.

22. *The Lancet* 1850; i: 668-669.

23. Some information about the mechanics of the move will be found in Hunting, P. *The Medical Society of London 1773-2003. London, MSL, 2003,* 170-173. In addition to its books the WMS brought its teacups and saucers, so for the first time refreshments became available at meetings of the MSL.

24. *The Lancet* 1850; ii: 456-458.

25. In the words of the MSL's historian, '... for a few incandescent years Snow was the most active and inspiring Fellow of the Society ...' Hunting, P. *op. cit.* 195. There are 96 signatures in the MSL Attendance Book on the occasion of his Oration.

BENJAMIN WARD RICHARDSON AND HIS CONTRIBUTION TO ANAESTHESIA *

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BW Richardson (1828-96) was a physician, scientist, sanitarian, biographer, playwright and poet, who practised as an anaesthetist, discovered fourteen general anaesthetics and introduced the ether spray as a local anaesthetic. He also experimented with the use of electricity and vacuums to produce anaesthesia.

Only two of his general anaesthetics were used regularly by other doctors; methylene bichloride being favoured by Spencer Wells and methylene ether by Lawson Tait. Of greater importance than the anaesthetics themselves was the manner of their discovery. Building on Snow's pioneering work, Richardson's systematic and quantitative studies of hydrocarbon compounds enabled him to develop relationships between chemical constitution, biological activity and toxicity. From a knowledge of the chemical composition, specific gravity, boiling point and vapour density of a compound, Richardson claimed that he could predict whether it was or was not an anaesthetic and, if it was, how much would be needed to produce anaesthesia, how quickly anaesthesia would be produced and how long would be required for recovery. These claims were over-ambitious but Richardson's work ensured that the study of anaesthetic agents made a major contribution to the emerging discipline of experimental pharmacology. He was on much less certain ground when discussing agents other than hydrocarbons and always maintained that the anaesthetic action of nitrous oxide was due to hypoxia.

Richardson designed mouthpieces, masks and inhalers. In 1870, having personally collected data on 35162 cases of chloroform administration in 14 hospitals, he published the first reliable mortality rate attributable to chloroform (1 in 3197). He also published research on resuscitation, a biography of John Snow and a history of the origins of anaesthesia.

* Abstract only

CHARLES T JACKSON MD
Robin Hood or Sheriff of Nottingham?

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There is a prevalent view that Charles Jackson tried to inappropriately take the credit for the first public demonstration of Ether anaesthesia from William Morton. This was supported by the tale of his involvement with Samuel Morse and the introduction of the telegraph. Later, it was reported that Jackson spent the last years of his life in an asylum due to psychiatric disease resulting from the ether controversy. As a result of purchasing a copy of Jackson's book, *A Manual of Etherization*, my interest was aroused in this man. Researching further showed that he was not an unstable individual but a well regarded scientist.[1] It became apparent that the prevalent view had come to be accepted from a point in the 19th Century and like other historical figures, this view became popularised. This paper will revisit the issues and although no new facts are introduced a different view will be taken of what occurred and the controversy discussed. The paper brings a different interpretation of the issues. How such a situation could occur with claim and counterclaim by an unqualified dentist (who had also dropped out of medical school) and a well regarded doctor, geologist and chemist will also be considered. This includes comment on whether this would have occurred if the demonstration had been in the UK.

Agreed Facts

Charles Jackson discovered that ether caused unconsciousness in the early 1840's. [2] William Morton was a student of Jackson's for chemistry tuition whilst a medical student at Harvard Medical School. Ether was discussed in their meetings. In the late summer of 1846 Morton approached Jackson concerning the bags that could be used for inhalation of ether. [3]

Disputed Facts

Charles Jackson claimed he suggested to Morton that ether be used to prevent the pain of surgical operations.

As such Jackson claimed that on the 16th October 1846 Morton was acting as Jackson's agent rather than in his own right. Jackson had requested Morton to ask Dr J.C. Warren to try ether for a surgical operation. [4]

Morton disputed this latter request, but accepted that Jackson '--- should be named as a joint discoverer in the patent'.[5] This would enhance the publicity of the demonstration. This surely indicates Jackson's academic scientific standing.

The Patent

This formed a one part of the controversy between Morton and Jackson. The original application was in their joint names but Jackson gave up his right to it. It was stated by Gay that he only agreed to have his name added in order to show he was a 'discoverer' of anaesthesia. Jackson believed that as a scientist his duty was '--- to give his discovery without restriction to the world.' [6]
Pressure mounted from doctors and dentists to reveal the nature of the anaesthetic. Jackson by withdrawing from the patent application may have judged public opinion well and so maintained the high moral ground leaving Morton in the mire.

Jackson's Status

In the USA, Jackson was regarded as scientist with a particular interest in geology and chemistry as well being a doctor; he took part in the geological survey of New Hampshire, Maine and Michigan. He also was the United States Geologist on Lake Superior. [7] He was considered to have tried to take the credit for the invention of the telegraph from Samuel Morse. This was an issue which left Jackson being regarded as generally contentious. The probability is that the original concept was Jackson's but it was Morse's interest and expertise which produced the end result. It is of interest that Jackson and Morse met and discussed the possibility of the telegraph during a transatlantic voyage after Jackson had been studying electricity in Paris. [8] His contentious battle with Morse has been reviewed by Wolfe and Patterson. [9]

In Europe, Jackson was an honoured scientist. He had studied in Paris and was a Fellow of the Geological Society of France, Chevalier de la Legion d' Honneur, Caviliere dell SS Maurizio e Lazzaro, Ritter des Rothen Adler and Knight of the Turkish Order of the Medjidieh.[10] These latter relate to the discovery of ether anaesthesia.

Jackson related as much to European science as that of the USA. He dedicated his book to the perpetual Secretary of the Imperial Academy of Sciences in Paris. [11]

In the books by supporters Jackson is always referred to with the title Dr whereas Morton is referred to as Mr by Gay [12] (Jackson supporter) but as Dr by

Rice [13] (Morton supporter). The use of Mr indicates the feeling about the difference in their academic/professional status at this time.

Dental Surgery circa 1840-1860

USA

In the USA dental surgery had advanced so that it was a leading centre. [14] The Baltimore College of Dental Surgery was founded in 1840, as was the American Society of Dental Surgeons. The previous year, the American Journal of Dental Science appeared. The impression is therefore of a developing and active profession which seems to have been well rewarded. Morton's practice turnover was $20000 per annum [15] and although costs took 50% of this, he still had a good income.

England

In England dentistry lagged behind the USA so that the professional and academic advances did not take place for a further decade and a half. If it had proceeded at the same rate there might have been public controversy involving James Robinson and the first anaesthetic in England. There was continuing rivalry between dentists and doctors concerning anaesthesia into the 20th century. The situation of one dentist, Robert Marston has been previously described [16] involving argument nationally and locally with anaesthetists.

Jackson's Insanity

Jackson spent the last seven years of his life in the McLean Asylum and was considered to be insane. His disease however, came on suddenly; he collapsed[17] and may have had a stroke. He recovered but never spoke intelligibly again. Patterson has conjectured about the cause. [18] It had become popular legend that he was insane due to the ether controversy. [19] At the time insanity was poorly defined as a medical condition. There was dissent between neurologists and psychiatrists about it [20] and the probability is that he was suffering from the sequelae of a stroke. Summaries of his condition during his hospital stay showed he was cooperative although aphasic and also refuted that he was an alcoholic. [21]

Conclusions

Jackson was an able and well respected scientist who had graduated from medical school. The respect for Jackson was international, particularly in Europe. The fact that he was supported in his claims concerning the

demonstration of anaesthesia by Europeans, especially the French may have counted against him in the USA.

Jackson certainly advised Morton on some aspects of the use of ether but it is not certain as to whether he realised the potential of preventing the pain of surgery and thereby asked Morton to be his agent on the 16th October 1846. Is it possible that after the Wells debacle that Jackson distanced himself from a possible embarrassment?

The controversy would not have occurred if the first demonstration had been in the UK as the medical profession would have backed the doctor over the unqualified dentist. Dentistry had not developed in the UK to the level of acceptance by doctors of dentists being professionals.

Jackson's admission to a lunatic asylum can be explained by him having an acute neurological disease rather than pre-existing psychiatric disease.

Charles T. Jackson was more Robin Hood than Sheriff of Nottingham as he appeared to have acted for the good of the population rather than himself over the demonstration of ether anaesthesia.

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2. *ibid*.; 18
3. Rice NP. *Trials of a Public Benefactor*. New York: Pudney and Russell, 1859; 60
4. Jackson CT *op.cit.*; 48
5. Report to the House of Representatives of the US of America (No. 114), 1849; 19
6. Gay M. *A Statement of the Claims of Charles T. Jackson, M.D. to the Discovery of the Applicability of Sulphuric Ether to the Prevention of Pain in Surgical Operations*. Boston: David Clapp, 1847; 20-21
7. Jackson CT *op.cit.*; 24
8. Porter R, Ogilvie M (Eds.) The Hutchinson Dictionary of Scientific Biography Vol. II (3rd Ed.). Morse, Samuel Finley Breese (1791-1872). Oxford: Helicon Publishing Ltd., 2000
9. Wolfe RJ, Patterson R. *Charles Thomas Jackson – The Head Behind the Hands*. Novato (California): History of Science.Com, 2007
10. Jackson CT *op.cit.*; frontispiece
11. *ibid.*
12. Gay M *op.cit.*
13. Rice NP *op.cit.*

14. www.britannica.com/EBchecked/topic/158069/dentistry/274268/History-of-dentistry
15. Rice NP *op.cit.*; 51-52
16. McLellan I. A Leicester Dentist – Robert Marston. *The History of Anaesthesia Society Proceedings* 1988; **4**: 7-9
17. Patterson R. Dr Charles Thomas Jackson's aphasia. *Journal of Medical Biography* 1997; **5**: 229
18. *ibid.*; 228-31
19. *ibid.*; 228
20. *ibid.*; 230
21. *ibid.*

ELECTRICAL ANAESTHESIA; IS IT TIME TO TRY AGAIN? *

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Jaques-Arsène d'Arsonval may have been the first to experiment on the effects of high frequency electrotherapy, which induced an anaesthesia-like state, in 1892. Subsequent work by Leduc in the first decade of the 20th century on both animals and man showed the possibilities of electro-narcosis as an alternative to chemically induced anaesthesia. The challenges of apnoea, cardiac arrest and convulsions in animal models and the horrific "locked in" syndrome in human subjects appears to have dissuaded many researchers in this field but by no means all!

The next impetus for research appears to have been the development of electroconvulsive therapy for psychological illness. Originally this therapy involved no muscle relaxants (as they were not available), little if any oxygen therapy, and occasional use of barbiturates prior to the administration of the shock. The electro-narcosis induced probably owed as much to hypoxia as to the electrical discharge, as severe cyanosis and cardiac arrest were often noted during and after treatment. The post-shock state of unconsciousness was shown to also create a state of analgesia (or lack of response to pain at least) and a great deal of animal experimentation followed in the 1920-40s.

There was a resurgence of interest in the technique in the mid 1950s after a series of papers in the American literature demonstrated that some form of narcosis was possible in patients although again the side effects on the cardiovascular system seemed prohibitory. Adjuvant drugs such as muscle relaxants and sedatives were mandatory! Rumours of an electro-narcosis society behind the Iron Curtain abounded and in 1960 *Anesthesiology* published a translation of a Russian paper which suggested that human surgery was possible in this manner.

More interest emerged in the 1960s after more US case reports which utilised succinylcholine, barbiturates and IPPV through a tracheal tube to minimise side effects. An International Symposium on electrical therapy and electroanesthesia in Austria in 1966 attracted over 200 participants including Clutton-Brock from Bristol whose work on animals was well known.
The concept appears to have disappeared from modern research consideration and should perhaps be re-explored.

* Abstract only

AN ILLEGITIMATE RELATION: THE HISTORY OF HYPNOSIS AND MESMERISM IN ANAESTHETIC PRACTICE

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Introduction

Almost 154 years since Oliver Wendell Holmes first coined the term *'anesthesia'* (meaning "without perception"),[1] members of our profession continue to spend much of their working lives attempting to ensure the absence of feeling or sensation in patients undergoing surgical procedures. Whilst millions of pounds have been spent developing pharmacological agents to assist in this endeavour, it is known that in certain individuals, these effects can be elicited by suggestion alone. Hypnosis has evolved conceptually from 'animal magnetism' or mesmerism, and has been defined as the induction of a subjective state in which alterations of memory or perception can be elicited by suggestion;[2] its use (in a variety of guises) is amongst the oldest and darkest of the medical arts. This essay begins by tracing the origins of hypnosis and its employment as a means of healing, before focusing on the controversial work of Franz Anton Mesmer in the late 1700s. Though Mesmer failed to consider the use of his technique as a means of rendering patients insensible for surgery, those who followed did, and the history relating to the employment of hypnosis for this purpose is outlined alongside the reactions of both the medical and lay communities. Contrary to popular belief, the use of 'hypno-anaesthesia' did not end following Morton's successful public demonstration of ether, and its continued, though contentious use in a variety of clinical applications relevant to the anaesthetist are summarised along with the results of studies which have sought to shed light on its mechanism of action. Finally it considers the reasons for which hypnosis still resides on the fringe of scientific respectability – an illegitimate relation.

The origins of hypnosis

Since early history, man has attempted to bring about healing by suggestion following the induction of an altered state of consciousness. These processes have long been believed to be governed by supernatural or divine powers and the combination of mystery, folklore, fear and wonder which surround them still pervades our psyche today. The ancient Egyptians utilised Temples of Sleep which claimed to heal the sick by means of incantation and religious ritual and in ancient Greece, shrines such as the Temple of Aesculapius at Epidaurus were synonymous with mystical healing in dream states.[3] The use of such techniques

continued into the middle ages and beyond, with countless reports of miraculous cures effected by magical objects and people alike. In 1666 Valentine Greatrakes a faith healer from County Waterford in Ireland known as 'The Stroker' toured England claiming to cure by the laying on of hands and in the mid 1700s the Austrian priest Johann Gassner gained a certain degree of celebrity when he attempted to cure disease by means of exorcism.[4] Their work was however to be overshadowed by that of a German physician who is often referred to as the founding father of clinical hypnosis – Franz Anton Mesmer.

Franz Anton Mesmer

Born in the village of Iznang, on the shore of Lake Constance in 1734, Mesmer studied at the Universities of Dillingen and Ingolstadt before entering the University of Vienna to study medicine in 1759.[5] During this time he developed an interest in the work of Paracelsus who in 1530 had postulated that the planetary bodies exert an effect upon the health of mankind,[6] and Athanasius Kircher, a German priest who suggested that men could influence each other through magnetic forces.[6] In 1766 Mesmer published his dissertation '*De planetarum influxu in corpus humanum*' in which he hypothesised that in accordance with the principles of Paracelsus and Kircher, there was a invisible magnetic fluid of celestial origin which surrounded and extended through people and the flow of this 'animal magnetism' could be manipulated by man.[7] By the early 1770s Mesmer had begun attempting to cure disease caused by 'magnetic imbalance' using specially shaped iron plates he obtained from Father Maximilian Hell, director of the astronomical observatory at the University of Vienna, who had himself experimented with the use of magnetic forces for healing purposes.[5] Mesmer's methods were elaborate and involved the production of a trance-like state which would progress to a 'therapeutic crisis' after which the patient might collapse, convulse or fall into a deep sleep.[7] Reports of his work precipitated both shock and fascination amongst Vienna's medical and lay communities and whilst he claimed to have successfully treated conditions as diverse as urinary retention and paralysis, Mesmer was forced to leave Vienna in 1777 following a widely publicised failure to cure an 18-year old girl of blindness.[6] Mesmer moved to Paris where despite his inability to gain approval for his doctrines from either the Parisian Royal Academy of Sciences or Royal Society of Medicine, he set up a successful practice, aided in part by Marie Antoinette who appears to have been sympathetic to his cause.[5] In 1779 Mesmer published *Mémoire sur la découverte du magnétisme animal* in which he outlined 27 propositions governing his practice[8] and over the course of the next four years enrolled paying students including Charles d'Eslon and Armand-Jacques de Chastenet, the Marquis de Puységur to learn the intricacies of his practice. Much to the disgust of the established medical profession,

'mesmerism' became the treatment of choice for Europe's 'idle rich', and in particular, its women.[6] Indeed so great was the demand for treatment that Mesmer began using a 'Baquet' or trough filled with water and iron filings, around which stood rows of patients each holding an iron rod connected to the trough and tied to each other by cords. Theatrics such as dim lighting, perfumes and soft music added to the air of mystery and there are many reports of Mesmer, wearing a coat of lilac silk walking amongst his patients in the company of his handsome and youthful assistants.[5,6] Some patients apparently convulsed, others were thrown into a state of semi-stupor in which they were submissive to the master and others still became affectionate and embraced one another.[6]

An investigation of this work was perhaps inevitable and on the 12th March 1784 Louis XVI appointed a commission to undertake this task. Amongst its members were the American ambassador Benjamin Franklin, the chemist Antoine Lavoisier, the astronomer Jean Sylvian Bailly and the physician Joseph-Ignace Guillotin.[7] Since Mesmer refused to cooperate with the investigation, the commission studied his student Charles d'Eslon and on 11th August 1784 presented a report refuting the existence of magnetic fluids and concluding the effects of treatments to be imagined and potentially harmful to patients.[7] The Government was so impressed by these dangers that it took steps to make the report as widely public as possible, distributing more than 20,000 copies in France.[6] Whilst Louis XVI and Marie Antoinette were both to lose their heads to the invention of Joseph-Ignace Guillotin within the next 10 years, Mesmer kept his, but left France with his reputation indelibly tarnished. He led the rest of his life in relative obscurity and died in Switzerland in 1815.

The continued spread of mesmerism

The Commission of 1784 was not however the end for 'mesmerism', and its practice continued to spread throughout pockets of Europe via Mesmer's 'disciples' such as the Marquis de Puységur, who's research in the late 1700s lead him to give the first description of its ability to induce a state of sleep known as artificial somnambulism.[9] The existence of such a state yielded the first suggestion that mesmerism could be utilised to render patients insensible for surgical operations, and it was merely a matter of time before someone attempted to carry this work to its natural conclusion.

The first cases of surgery under mesmeric insensibility

Whilst the 1792 publication '*General and Particular Principles of Animal Electricity and Magnetism'* by Dr. John Bell, 'Professor of Animal Magnetism'

and member of the Philosophical Harmonic Society of Paris contains what is likely to be the first printed record of the use of mesmeric insensibility for minor surgery,[10] no details of the operation or mesmeric procedure are included. A further report in the literature from 1797 is equally limited[11] and whilst additional accounts were published sporadically in the early 1800s, including that relating to unspecified surgery performed on a mesmerised patient by Joseph Recamier in 1821,[12] procedural detail is sparse and often absent in these articles, especially those published in the English language.[11] In fact the first clearly recorded surgical procedure performed under mesmerism dates from 12th April 1829 and involves a 64-year old Parisian woman by the name of Madame Plantin who underwent a right mastectomy by surgeon Jules Cloquet, having been rendered in a state of magnetic sleep by her personal doctor, Pierre-Jean Chapelain.[11] Whilst Cloquet presented an account of the case to the French Royal Academy of Medicine on 16th April 1829 and a committee was appointed to investigate mesmeric insensibility further, its findings were never published publically, amidst claims of fakery on the part of Plantin.[11] Though further reports relating to the use of mesmerism in the alleviation of pain and in surgery followed, the wider medical community remained dismissive and suspicious of its practice. More than 50 years since its introduction, 'animal magnetism' had failed to achieve scientific respectability and mesmerism subsequently evolved to be the principal preserve of travelling showmen, entertainers and charlatans. However, in 1837 another individual would attempt to wield this phenomenon in the arena of clinical medicine - the eminent British physician John Elliotson.

John Elliotson

Born on 24th October 1791, John Elliotson was the eldest son of a Southwark druggist.[13] He graduated from Edinburgh medical school aged 19 and subsequently studied at Jesus College Cambridge before being elected assistant physician to St Thomas' hospital in 1817, and physician to the hospital in 1823.[13] Amongst the leading clinicians of his day Elliotson was appointed Professor of Medicine at the University of London in 1832 and sat as president of the Medical and Chirurgical Society between 1833-1835.[13]

It appears Elliotson was rapidly seduced by mesmerism after witnessing public displays and lecturers by travelling magnetisers such as Richard Chenevix and Jean Dupotet de Sennevoy who toured the London hospitals in the early 1830s;[6] by 1836, he had begun to experiment with mesmerism privately and in April 1837 embarked on a series of sensational, though controversial experiments at the University College Hospital. These public displays were witnessed in person by the likes of Charles Dickens and reported widely by the medical and lay press alike. *The Lancet* carried many such articles, often penned by its

editor Thomas Wakley who was amongst Elliotson's foremost critics. Uneasiness grew over these spectacles and in June 1838 the medical committee prohibited public demonstrations at the College Hospital, though they permitted Elliotson to continue his experiments in private.[13] By December 1838 however, growing unease amongst the majority of his colleagues led the committee to ban the use of mesmerism all together, whereupon Elliotson resigned, resenting any interference or dictation with his modes of practice.[13] Though ostracised from the medical community, Elliotson soon founded the London Mesmeric Infirmary in Weymouth Street and in 1843 established a quarterly journal devoted to the advancement of phrenology and mesmerism – *The Zoist – a Journal of Cerebral Physiology and Mesmerism, and their Application to Human Welfare*.[6] Published from April 1843 to December 1855 this carried numerous reports of surgical operations without pain in the mesmeric state from around the world, including a large case series from another British doctor - James Esdaile.

James Esdaile

Born on 6th February 1808 in Montrose Angus, Scotland, James Esdaile studied at Edinburgh University before being appointed Medical Officer for the British East India Company in 1831.[14] Esdaile was posted to Calcutta and in 1838 took charge of Hooghly hospital. On 4th April 1845 he performed his first surgical procedure under mesmerism; the patient was a convict described as a 'hog dealer' with bilateral hydrocoeles.[14] By his own admission, Esdaile had never seen a mesmeric act, and recorded the following in his memoires: [14]
"Seeing him (the patient) suffering in this way, I turned to the native sub-assistant surgeon, a student of the medical college, and asked if he had ever seen mesmerism. He said that he had seen it tried at the medical college, but without effect. Upon which I remarked ' I have a great mind to try it on this man, but as I never saw it practised, and know it only from reading, I shall probably not succeed.'"

Esdaile was however successful, but found the act of mesmerising his patients exhausting – often magnetising them for eight hours a day for ten or twelve days prior to the operation.[14] This work was soon delegated and within a year he reported 70 successful cases. In 1846 Esdaile's work came to the attention of the Deputy Governor of Bengal, who appointed a committee of to investigate his claims. Following a report in October 1846 which stated 'complete insensibility to pain was attained by mesmerism in the most severe operations and its influence in reducing the shock of the operation is decidedly favourable'[14] ten beds were set aside at the Calcutta Native Hospital for Esdaile's use and in November 1846 a mesmeric hospital was opened. By 1847

he had performed 261 successful operations under mesmerism when news of inhalational anaesthesia finally arrived in India. Interestingly Esdaile quickly changed to using ether, writing:[14]
"All mesmerists will rejoice at having been the means of bringing light one truth more, especially as it will free them from the drudgery required to induce mesmeric insensibility to pain, which, although most striking, is the least important branch of the subject. It is only of late that the application of mesmerism to surgery has been prominently brought forward, principally with the view of affording an ocular demonstration of this great vital agent."

James Braid and the birth of hypnotism

At the same time Elliotson and Esdaile were employing mesmerism in clinical practice, others were questioning the nature of this phenomenon. One such individual was James Braid, who happened to be present at a public demonstration of mesmerism in Manchester on 13 November 1841 given by the travelling Swiss magnetiser Charles Lafontaine.[6] Though initially sceptical, Braid concluded the effects he witnessed were genuine but due to increased suggestibility rather than magnetic forces, and coined the term 'hypnosis' from the Greek *hypnos* meaning sleep.[15] He further attempted to explain Mesmerism from a physiological and psychological perspective in his 1843 publication *Neurypnology*[15] which many believe to be the foundation of modern hypnotic theory. Following Braid's death in 1860, interest in hypnotism shifted from Britain to France, where research began to grow and by the late 1870s there existed two major schools of hypnosis– one in Paris headed by Jean-Martin Charcot at the Salpêtrière Hospital, the other in Nancy lead by Ambroise August Liébeault and Professor Hippolyte-Marie Bernheim.[3]

Hypnosis in anaesthesia

Though the textbooks of anaesthesia suggest that the employment of hypnosis in anaesthetic practice died out with the widespread implementation of inhalational anaesthesia – the 'Yankee dodge' that beat 'mesmerism hollow'[16] - historical research proves this to be untrue. Indeed the late 1800s saw yet another revival of interest regarding the use hypnosis in our specialty; a paper read at the Royal Academy of Medicine in Ireland in April 1888 noted that hypnotic anaesthesia 'might be of value in cases where heart or lung troubles precluded the use of ordinary anaesthetics'[17] and a letter to the *British Medical Journal* soon after suggested 'a systematic trial of hypnotism as a means of anaesthesia would show that it is suitable for a large number of cases...and if this was found to be so, the reports of deaths from chloroform and ether which almost every week reproach us in the *British Medical Journal*, might diminish.'[18]

On 28th March 1890 in excess of 60 'leading' medical men and dental surgeons of Leeds and district assembled to witness a series of seven surgical and dental operations performed under the influence of hypnosis.[19] Cases included dental extractions, excision of a bony growth, a tonsillectomy and the removal of a cyst ' the size of a horse bean' from the nose of a young woman who, on coming round by order protested "that the operation had not yet been commenced"'.[19] Whilst at the conclusion of the meeting it was remarked that 'the time has now come when we shall have to recognise hypnotism as a necessary part of our study', interest in hypno-anaesthesia once again waned during the early 1900s, and it would be almost 50 years before its next resurgence.

The anaesthetic applications of hypnosis in recent history

In 1946, two doctors working with limited pharmacological resources in a prisoner-of-war hospital near Singapore during the Japanese occupation described 29 surgical and dental operations successfully performed under hypnosis.[20] This report appears to have rekindled the debate on hypno-anaesthesia, and a leading article in the *British Medical Journal* in 1947 was to conclude that 'the time may be due for thorough review of the subject of hypnosis in relation to surgery' and this 'might best be undertaken by a surgeon or better still, an anaesthetist collaborating with a psychiatrist.'[21] There followed a series of pleas for the therapeutic effects of hypnosis to be formally investigated and recognised as a reasonable form of treatment in selected cases and in 1953 the Psychological Medicine Group Committee of the British Medical Association appointed a subcommittee for this purpose. Its report was published in 1955 and stated that 'there is a place for hypnotism in the production of anaesthesia or analgesia for surgery and dental operations'[22] and further recommended that a description of hypnosis be given to medical undergraduates and instruction in its clinical use be provided to all postgraduate psychiatric trainees and possibly trainee anaesthetists.[22] Whilst these recommendations went largely un-noticed, reports of hypno-anaesthesia from this period include its successful use during dental extractions,[23] burns dressings changes,[24] as a means of labour analgesia[25-27] and an account in *Anaesthesia* of its implementation during a bilateral breast reduction procedure.[28]

In 1956 Laurence Goldie, Registrar at the Maudsley Hospital described a study he had performed over a one month period involving patients presenting to the casualty department with injuries requiring anaesthesia to permit their definitive treatment.[29] Unlike previous studies which had hand-picked subjects known to be susceptible to hypnotic suggestion, Goldie hoped to determine the practical use of hypnosis in untrained and unselected patients and evaluate its function as a substitute for conventional methods of anaesthesia. His unwitting subjects

ranged from 3 ½ to 57 years of age and underwent a variety of procedures including fracture reduction, wound suturing, removal of foreign bodies and the incision and drainage of abscesses. Whilst Goldie reported success in the vast majority of cases and concluded that hypnosis represented a simple and valuable tool, his paper met with a mixed response in the medical press – some imagined a panacea where 'every house surgeon could succeed with the manoeuvre'; [30] others painted a dimmer view:[31]

"I have been trying to imagine the state of affairs which would exist if we took literally Dr Goldie's suggestions. A series of highly trained psychiatrists would be on duty throughout the 24 hours to take patients as they arrived into a quiet, darkened side-room where suitable forms of suggestion would be offered. Some would emerge to enter the channel for those angrily refusing such a demand for the surrender of their will... others would be wheeled, or preferably walk with a trance-like step, to the rooms where their treatment could be applied without pain or protest. They would return to the little room to be instructed to wake up and forget all that had transpired. A final suggestion would be offered that no question of legal action regarding the absence of consent or the blank in their memory would ever enter their minds."

By the end of the decade there were even calls for the foundation of hypno-anaesthesia clinics in larger hospitals where patients awaiting routine surgery might be invited to attend pre-operatively and participate in group sessions aimed at preventing post-operative pain and complications by means of hypnotic suggestion.[32]

Like so much in the history of hypnosis before it, little transpired from this work and in the United Kingdom, the implementation of hypnosis in anaesthetic practice remained largely confined to a handful of interested individuals who gradually gathered to form specialist groups such the British Society of Medical and Dental Hypnosis. In recent years those interested in this field have moved to view hypnosis as a complementary technique to general anaesthesia and found it of value in patients having procedures under conscious sedation, where it has been shown to provide reductions in anxiety and post-operative pain.[9]

Recent investigations into the mechanisms of hypnosis

Whilst the clinical work outlined above provides evidence to suggest that hypnosis might be of value in anaesthesia, there remains a huge void in the understanding of the underlying physiological mechanisms by which it might act. Studies utilising modern methods of brain imaging such as Positron Emission Tomography and functional Magnetic Resonance Imaging have gone

some way to ameliorate this - demonstrating specific alterations in cerebral metabolic activity and perfusion following hypnosis.[9]

Why has hypnosis failed to enter mainstream anaesthetic practice

Despite this growing body of scientific and clinical evidence for its legitimacy, hypnosis has failed to integrate itself into mainstream anaesthetic practice. As this essay demonstrates, interest in its use has been briefly revived in virtually every decade since Mesmer's introduction of 'animal magnetism' in 1770, only to fail spectacularly or evoke heavy criticism. Whilst the sense of mystery and folklore which have forever surrounded this phenomenon may be partly implicated in this, much of hypnotisms failure to achieve respectability can be attributed to its unregulated application by lay practitioners. Ranging from amateur scientists to entertainers and charlatans, these individuals have accompanied hypnosis in one form or another from its very beginning and whilst calls to bring hypnosis under medical control can be traced as far back as the early 1800s, they have failed to be implemented.

Conclusions

More than 200 years since the first documented use of mesmeric insensibility for surgery, hypnosis has failed to achieve a significant impact in our specialty and whilst it seems unlikely that this position will change significantly, this story is however amongst the most colourful and controversial of those that comprise the history of anaesthesia.

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ANAESTHETIC AND OTHER TREATMENTS OF SHELL SHOCK IN WORLD WAR I *

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Shell shock or neurasthenia was a major problem for medical services in the First World War and its aftermath. As early as December 1914 it affected 7-10% of the officers and 3-4% of other ranks in the British Expeditionary Force. One of the first to publish on shell shock was Dr Charles Myers in February 1915, when practising at a War Hospital in France As a result he was appointed by the War Office. In the summer 'forward psychiatry' was begun by French doctors, who tried treatment with electric shock. Some British doctors tried treatment with general anaesthesia - ether and chloroform; others preferred application of faradic current. In June 1916 the War Office recognised shell shock as a genuine war injury.

Four British 'forward psychiatric units' were set up in 1917. One of these was commanded by Maj William Brown, who favoured modified Freudian methods (early CBT). The USA sent Dr TW Salmon to investigate, and his report was responsible for the introduction of *selection* and of psychiatrists into the USA military.

Hospitals for shell shocked soldiers were also set up in Britain: Maghull MH near Liverpool, Seale Hayne MH in Devon, RVMH at Netley (Hants), and (for officers) Craiglockhart War Hospital in Edinburgh. The War Poets Wilfred Owen and Siegfried Sassoon were at CWH in 1917. William Brown became CO of CWH in 1918. Patients diagnosed to have more serious psychiatric conditions were transferred from CWH to the Royal Edinburgh Asylum – a summary of these cases will be presented.

Gradually, towards the end of 1918 anaesthetic and electrical treatments of shell shock fell out of favour. The efficacy of 'forward psychiatry' in WWI was acclaimed and also disputed!

* Abstract only

THE DRÄGERHEFTE
– a tool for customer loyalty by Dräger

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Introduction

This paper will discuss the customer magazine "Drägerheft" (English: Dräger Review) from 1912 to the present day and give some background of the history of Dräger. The Drägerheft is probably a so far underused and not very well known historical resource. The paper will give an eclectic account of the material covered in the Drägerheft. More generally, the history of advertising in anaesthesia appears to be not extensively covered in the literature so far, possibly because access to original material proves difficult; the author would like to make a small contribution to this wider topic.

The history of Dräger

Dräger was founded as Dräger und Gerling in 1889 in Lübeck, Germany. From 1893 Johann Heinrich Dräger was the sole proprietor, since when the Company has always been managed by members of the Dräger family. The company provides products in medical and safety technologies.

The Company started out selling equipment and new technology. Since the mid 19th century it was possible to store gases at high pressure in cylinders but the controlled flow from the cylinders was a problem. Johann Heinrich Dräger and his son Bernhard constructed the Lubeca valve, a type of pressure-reducing valve which resulted in their first patent and was initially used in a beer tap system using compressed carbon dioxide.


Sichere Existenz.

Der „Bierfass-Automat" stellt das einzige Biersyphonsystem dar, das in nahezu vierjährigem, praktischem Gebrauch sich in jeder Beziehung voll bewährt hat. Energischen jungen Leuten, die über einiges Kapital verfügen, wird die Gelegenheit geboten, sich durch die Erwerbung der Licenz für Erfurt und Umgegend eine sichere und angenehme Existenz zu schaffen. Beste Referenzen stehen ernsten Interessenten zur Verfügung.

Deutsche Bierfass-Automat-Gesellschaft G. m. b. H., Lübeck.

Fig. 1 Advertisement for beer tap system, 1889

One of the early pieces of advertising by Dräger was on the beer tap system in the Erfurter Allgemeiner Anzeiger of 22nd December 1899 (see Figure 1).

The pressure-reducing valve as well as the development of a high pressure manometer (the Finimeter) to measure the pressure and thus content of gas cylinders made the use of oxygen in a controlled fashion possible and could be regarded as the origin of Dräger's involvement in "Technology for life" but also had other applications, for example in welding or in the development of breathing apparatus for mining rescue teams, fire services or submarine sailors.

In 1902 German Reich patent number 154338 was granted to the drip feed device, the basis of the Roth-Dräger anaesthetic apparatus which allowed accurate delivery of chloroform or ether in oxygen.

In the 1906 mining disaster of Courrière the few miners that survived were rescued by teams equipped with Dräger respiratory apparatus, which was also successfully used in various later mining disasters; in fact in the US, mine rescue workers were even known as Drägermen.

In 1907 the Pulmotor respirator was one of Dräger's first 'best sellers', an oxygen driven respirator that created a cycle of positive and negative pressure. It was the start of a long series of ventilator developments at Dräger including the development of the iron lung during the 1947 polio epidemic, ventilators for anaesthetic machines such as the Spiromat, the first oxylog transport ventilator in 1978 and the Evita series of modern intensive care ventilators.

Mechanisms of carbon dioxide absorption are another recurrent theme of Dräger's developments. In 1907 Dräger developed a soda lime cartridge and its air purification system was instrumental for the survival of submariners in the sinking of the U3 submarine in 1911. It was also used in the development of the first circle system in anaesthesia in 1926 as well as closed circle breathing systems for miners.

Dräger's long history in anaesthesia started with the Roth-Dräger Apparatus in 1902, followed in 1912 by the Dräger Kombi, an apparatus that combined mixed anaesthesia with chloroform and ether and positive pressure ventilation. Model A in 1926 was the first anaesthetic apparatus with circle system, developed at a time when the use of nitrous oxide (which was very expensive) became popular in anaesthesia.

In 1952 Dräger launched the Romulus anaesthetic machine (as well as its twin brother Remus for the US market) which was fitted with monitoring and drawers and a desk. A series of further developments (all named after Roman emperors – Octavian, Tiberius, Sulla) followed and in 1988 Cicero was Dräger's first electronically regulated integrated anaesthesia workstation. 2002 saw a change to Greek mythology and the advent of Zeus, an anaesthesia workstation that could be fully integrated into the IT network of the hospital.

Dräger also developed systems for pipeline supply of gases and vacuum to hospitals, filters for operating theatres and other pieces of systems technology including devices for the measurement of gases and other substances.

The Drägerheft

The first Drägerheft (Figure 2) was published in July 1912 as a means of communication with the public by the Dräger company. Heinrich and Bernhard Dräger were the first editors.

Nummer 1. Periodische Mitteilungen. Juli 1912.

Inhalt: Zum Geleit. — Der Dräger-Taucher-Apparat. Illustriert. — Aus unserer Arbeit am Dräger-Sauerstoff-Rettungs-Apparat. Illustriert. — Dräger-Sauerstoff-Rettungs-Apparate im Bergbau. — Besuch der Senate der Freien Städte Hamburg, Bremen und Lübeck auf dem Drägerwerk. Illustriert. — Rettungs- und Wiederbelebungs-Apparate in der Praxis. — Patentmitteilungen. — Geschäftliche Mitteilungen.

Zum Geleit. Die wachsende Verbreitung unserer Sauerstoff-Apparate, die fast alle im Dienste zur Erhaltung von Menschenleben, zur Sicherung von Gut und Erwerbsmöglichkeit stehen, hat uns die Verpflichtung auferlegt, von unserer Werkstättenarbeit und von ihren Ergebnissen in der Öffentlichkeit zu reden. Der Weg, auf dem dies in sachlicher Form geschehen soll, ist durch die Herausgabe dieser Zeitschrift gekennzeichnet. Sie soll zunächst nur nach eintretender Notwendigkeit erscheinen. Wir erhoffen für diese Blätter in allen Interessentenkreisen eine freundliche Aufnahme.

Das Drägerwerk, Lübeck.
Heinr. und Bernh. Dräger.

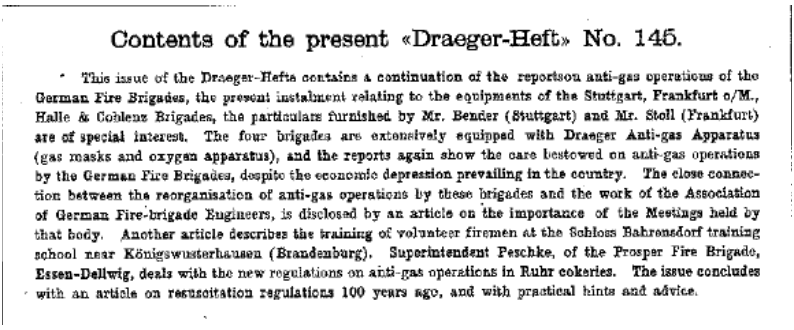
Fig. 2 The first Drägerheft (1912)

The intention was to publish the Drägerheft at "as needed" frequency, but in the first decade it was published every two months, and recently, every three to four months.

The preface to the first leaflet reads "The increasing distribution of our oxygen apparatus of which almost all are in service to save lives, secure property and sources of income, has given us the obligation to publicly talk about our workshops and their results. The way in which this should happen objectively is indicated by the publication of this leaflet. For the time being, it should only be published when necessary. We hope these leaflets will receive a friendly reception amongst interested parties. "

The first issue contained articles on a portable diving apparatus (including some research on the effect of oxygen consumption and carbon dioxide production under water pressure) and the new tubing seal for the helmet of the rescue apparatus which was adaptable to a variety of shapes of faces. It also reported on the visit of the Senates of the free cities of Hamburg, Bremen and Lübeck at the factory which included a guided tour and a demonstration of equipment. On the last page, it included the German translation of a Russian article on the use of Dräger apparatus after an explosion in the mine "Italianka", comments on the Pulmotor in practice and lists of patents and business notices.

Initially, the issues were about 8 to 12 pages long and contained a mixture of material similar to the first Drägerheft. Later issues were published in English (1959), French (1974-2000; again scheduled for November 2010) and Spanish (since June 2010); below is an example from issue 145, 1930 (Figure 3).



Contents of the present «Draeger-Heft» No. 145.

This issue of the Draeger-Hefte contains a continuation of the reportson anti-gas operations of the German Fire Brigades, the present instalment relating to the equipments of the Stuttgart, Frankfurt o/M., Halle & Coblenz Brigades, the particulars furnished by Mr. Bender (Stuttgart) and Mr. Stoll (Frankfurt) are of special interest. The four brigades are extensively equipped with Draeger Anti-gas Apparatus (gas masks and oxygen apparatus), and the reports again show the care bestowed on anti-gas operations by the German Fire Brigades, despite the economic depression prevailing in the country. The close connection between the reorganisation of anti-gas operations by these brigades and the work of the Association of German Fire-brigade Engineers, is disclosed by an article on the importance of the Meetings held by that body. Another article describes the training of volunteer firemen at the Schloss Bahrensdorf training school near Königswusterhausen (Brandenburg). Superintendent Peschke, of the Prosper Fire Brigade, Essen-Dellwig, deals with the new regulations on anti-gas operations in Ruhr cokeries. The issue concludes with an article on resuscitation regulations 100 years ago, and with practical hints and advice.

Fig. 3 Drägerheft 145, published in 1930

The Drägerheft also reflects contemporary history through the years. For example, during the First World War notices of military honours and letters from the front were published; below is an example from 1915 (Figure 4). There was also an emphasis on rescue equipment for submarines and protective equipment such as respiratory protection masks.

Mit dem Eisernen Kreuz II. Klasse
ausgezeichnet und zum Unteroffizier befördert:
Gefreiter **Johann Warncke**
im 20. Füsilier-Regiment, 2. Bataillon
Metalldreher im Drägerwerk seit 21. November 1913.

Befördert:
Leutnant **K. Mühlenpfordt**
Ritter des Eisernen Kreuzes
Professor, künstlerischer Beauftragter des Drägerwerkes
zum Oberleutnant im Inf.-Regt. Nr. 171.

Feldpostbriefe der Unseren.
Mit Originalhandzeichnungen und Photogrammen.

Brief des Professors K. Mühlenpfordt an Heinr. Dräger.

M....., d. 15. Dez. 1914.

Lieber Vater Dräger!

Ich hatte mir schon längst vorgenommen und Dir auch schon längst versprochen, über einige „Alkoholika" aus dem Kriege zu schreiben. Wenn ich das so lange aufgeschoben

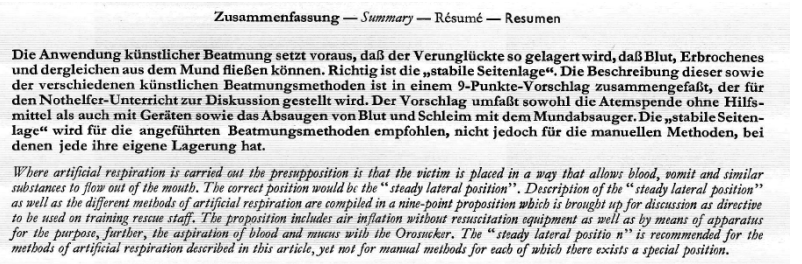
260

Fig. 4 First World War notice in Drägerheft of 1915

Dräger maintained a remarkably international outlook in Germany during World War II; for example issue 213 in 1943 contained reports about the fire services of Antwerp and Stockholm (as well as showing Generalfeldmarschall Rommel wearing a Dräger life vest on the title page). In 1940 Dräger published an edition aimed at export following an international conference (V. Internationaler Rettungskongress) in Zurich in July 1939. There was a short break in publication of the Drägerheft beginning in the later years of the Second World War. The first post-war issue was published in 1949.

Later editions resembled more a magazine than a leaflet and also contained scientific articles, for example on resuscitation. They also included literature reviews, question and answer advice pages, obituaries and tributes to long-serving employees.

The following is a summary of an article on pre-hospital resuscitation published in the Drägerheft 243 in 1961 (Figure 5).



Zusammenfassung — *Summary* — Résumé — Resumen

Die Anwendung künstlicher Beatmung setzt voraus, daß der Verunglückte so gelagert wird, daß Blut, Erbrochenes und dergleichen aus dem Mund fließen können. Richtig ist die „stabile Seitenlage". Die Beschreibung dieser sowie der verschiedenen künstlichen Beatmungsmethoden ist in einem 9-Punkte-Vorschlag zusammengefaßt, der für den Nothelfer-Unterricht zur Diskussion gestellt wird. Der Vorschlag umfaßt sowohl die Atemspende ohne Hilfsmittel als auch mit Geräten sowie das Absaugen von Blut und Schleim mit dem Mundabsauger. Die „stabile Seitenlage" wird für die angeführten Beatmungsmethoden empfohlen, nicht jedoch für die manuellen Methoden, bei denen jede ihre eigene Lagerung hat.

Where artificial respiration is carried out the presupposition is that the victim is placed in a way that allows blood, vomit and similar substances to flow out of the mouth. The correct position would be the "steady lateral position". Description of the "steady lateral position" as well as the different methods of artificial respiration are compiled in a nine-point proposition which is brought up for discussion as directive to be used on training rescue staff. The proposition includes air inflation without resuscitation equipment as well as by means of apparatus for the purpose, further, the aspiration of blood and mucus with the Orosucker. The "steady lateral positio n" is recommended for the methods of artificial respiration described in this article, yet not for manual methods for each of which there exists a special position.

Fig. 5 Drägerheft 243, published in 1961

Dräger also published special review magazines, for example on medical apparatus in 1928 (not available for review for this paper) as well as a second review in 1970 detailing the history of their anaesthetic machines (Figure 6).

Fig. 6 Drägerheft, published in 1970

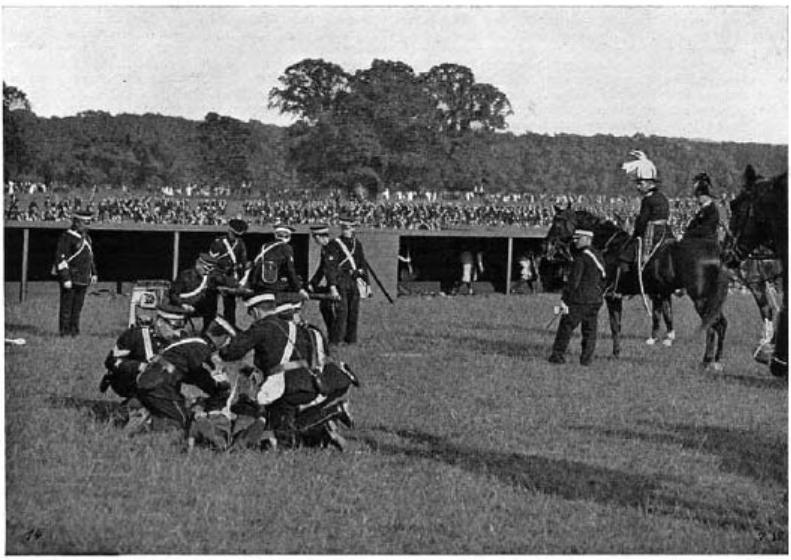
Other special editions dealt with breathing apparatus for fire services or diving equipment. Further publications include a roughly annual Dräger Review in English (which was started in July1959) as well as the Pulmotor news.

Dräger Review 96, published in 2008, contained an article on "People who perform" (with Dräger equipment) which amongst others featured an anaesthetist at the Prague Military Hospital (Figure 7).

Fig. 7 Dräger Review, published in 2008

Some further examples

An example of the early international outlook of both the Dräger Company and its customer magazine is the feature in Drägerheft 2 on a revue of St John's ambulance service and the mining rescue service in Windsor Park in 1912 – see Figure 8.



Bergmännische Rettungsleute mit Sauerstoff-Rettungs-Apparaten und Wiederbelebungs-Apparat „Pulmotor" üben vor dem König von England im Windsor Schloß-Park. 22. Juni 1912.

Fig. 8 Rescue drill at Windsor Park (1912) – published in Drägerheft 2

Drägerheft 8 (1915) featured the Roth-Dräger anaesthetic apparatus as well as the Roth-Dräger-König mixed anaesthesia apparatus – see Figure 9.

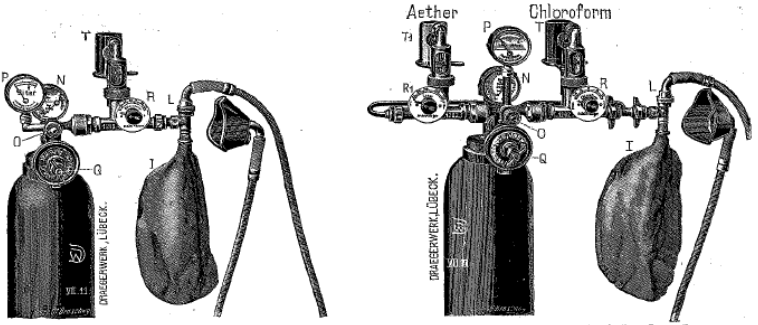


Fig. 2. **Einfacher Hand-Apparat** Prof. Dr. Roth-Dräger

Fig. 3. **Hand-Doppel-Apparat** Prof. Dr. Roth-Dräger zur Mischnarkose nach Prof. Krönig.

Sauerstoff-Narkose-Apparate zur Mischnarkose.

Fig. 9 Apparatus featured in Drägerheft 8, published in 1915

The leaflet also mentioned the experience of doctors in the use of the apparatus, containing comments on the possibility of precise dosage of anaesthetic agent, the maintenance of anaesthesia and emergence as well as the construction of the apparatus. For example, Professor Kehr wrote "Anaesthesia has lost its terror. No patient became cyanotic…No single disturbance interrupted the smooth course of the operation. It takes away many concerns and has many advantages". See Figure 10.

Sauerstoff-Narkose-Apparate Prof Dr. Roth-Dräger Prof. Krönig-Dräger in der Praxis. Aus einem Teil der Eingänge.

Genaue Dosierung des Chloroforms

Einen Hauptvorteil der Methode des Chloroformierens mit genannten Apparaten sehe ich in der genauen und sicheren Dosierbarkeit des Chloroforms.
Dr. Roth, Oberarzt am Allgemeinen Krankenhaus in Lübeck.

Eine „bombensichere" Maschine, die fast absolut eine Überdosierung ausschließt.
Bruno Busse „Die allgem. Narkose" Berl. Klin. Wochenschr. 06, Nr. 54

Es ist kaum auf eine andere Weise möglich, so regelmäßig das Narkotikum zuzuführen, wie mit dem Apparat, der weder ermüdet, noch der Operation zuschaut.
Aus Prof. L. u. Dr. T. Landau's Frauenkl. i. Berl. v. Bernh. Rosenthal

Verlauf der Narkose

Die Narkose hat ihre Schrecken verloren. Kein Patient ist mehr cyanotisch geworden ..... Keine einzige Störung hat den glatten Verlauf der Operation aufgehalten. Er nimmt manche Sorge und schafft viele Vorteile.
Prof. Kehr, Halberstadt. 25. VI. 03

Bei den Sauerstoff-Chloroform-Narkosen war die Sorge um den Narkotisierten nicht sehr groß. Wenn er einschlief, war die Narkose in der Regel richtig, dabei der Puls kräftiger und die Gesichtsfarbe rosiger, als sie bei bloßer Chloroform-narkose zu sein pflegt. **Prof. Dr. Czerny, Heidelberg 1904**

Die Patienten schlafen fast ausnahmslos ohne jede Excitation. Zwischenfälle während der Narkose haben wir bei den 400 Fällen nur zweimal gesehen, d. h., zwei Patienten wurden leicht asphyktisch. Sofort wurden die Narkotika ausgeschaltet und unter Zuführung von reinem Sauerstoff und Vorziehen des Unterkiefers verschwand die Asphyxie bald.
Aus Prof. L. u. Dr. Th. Landau's Frauenkl. in Berl. v. Bernh. Rosenthal

In England hat sich die Methode ebenfalls gut bewährt. Der Apparat gibt eine recht gute Narkose, gewöhnlich ohne eine Krampfperiode oder Atemnot. Der Operierende kann die Dosierung vollständig kontrollieren und mit einem Fingerdruck die Menge der anästesierenden Dämpfe verringern oder vergrößern. **Prof. Buxton, Brit. Med. Journal 07**

Die Gesichtsfarbe veränderte sich nicht. Die Reizung der Bronchien scheint viel geringer.
Dr. Lucas, Championnière, Ac. de Médicine, 31. I. 08

Es sei lobend darauf hingewiesen, wie schnell selbst beginnende Asphyxie und Pulsarythemie durch Absperrung der tropfenden Anästhetika und alleinige Verabfolgung von Sauerstoffgas gehoben werden.
Bruno Busse „Die allg. Narkose", Berlin Klin. Wochenschr. 08. Nr. 38

Der Puls läßt niemals eine Depression erkennen. Die Atmung ist durchaus ruhig und regelmäßig. Die Pupillen bleiben zusammengezogen. **Med. Fakultät zu Bukarest 1906**

Das Erwachen

Das Erwachen erfolgt sehr schnell und vollständig; Erbrechen tritt verhältnismäßig sehr selten beim Erwachen ein, jedoch niemals während der Anästhesie.
Med. Fakultät zu Bukarest 06

Das Wecken erfolgt unendlich viel leichter. Erbrechen tritt viel seltener ein.
Dr. Lucas Championnière, Ab. de Med. 31. I. 05

Die Patienten wachen sehr schnell aus der Narkose wieder auf, da die Menge des eingeatmeten Narkotikums, wie oben gezeigt, gering ist und der am Schluß der Operation zugeführte reine Sauerstoff die Ausscheidung von Aether und Chloroform begünstigt. Auch jeder Brechreiz fehlt in fast allen Fällen.
Aus Prof. L. u. Dr. Th. Landau's Frauenkl. in Berl. v. Bernh. Rosenthal

Konstruktion des Apparates

Der Narkotiseur wird wesentlich entlastet, er behält beide Hände frei für das Vorziehen des Unterkiefers und kann der Herztätigkeit und der Atmung des Patienten größere Aufmerksamkeit schenken.
Prof. Kionka u. Prof. Krönig, Arch. f. kl. Chir., B. 75, H. 1.

Wir haben uns an den exakt und sicher arbeitenden Apparat so gewöhnt, daß wir ihn durch keine der früher geübten Methoden des Chloroformierens ersetzen möchten.
Dr. Fritz Windrath, Med. Blätter, Wien, 4. IV. 03

Nr. 8. Februar 1913. 63

Fig. 10 Doctors' comments in Drägerheft 8, published in 1915

The 2nd edition aimed at export (205) was published in April/June 1940 following an international conference (V. internationale Rettungskongress in Zürich 1939). It attempted to address scientific questions arising from presentations by English and American physiologists opposed to the artificial ventilation of patients poisoned by gas, after asphyxiation, drowning or electrocution (Figure 11).

Die vorliegende zweite Exportausgabe der Draeger-Hefte bemüht sich wiederum um einige wissenschaftliche Fragen, die durch die Beratungen des V. Internationalen Rettungskongresses (Zürich, Juli 1939) der Beurteilung unserer Fachkreise entgegengebracht wurden. In Vorträgen englischer und US-amerikanischer Physiologen zeigte sich wiederum eine Ablehnung der künstlichen Beatmung Gasvergifteter, Erstickender, Ertrinkender, durch elektrischen Schlag Verunglückter, wie sie durch die seit dem Jahre 1908 in der Rettungsarbeit international gebrauchten Sauerstoff-Wiederbelebungsmaschine „Pulmotor" herbeigeführt wird und segensreich blieb. Die Kritik

Fig. 11 Extract from Drägerheft 205, published in 1940

Drägerheft issues 280/281/282 in 1970 included an historical review of its medical equipment starting with the American silver medal (Fig.12) for the Roth-Dräger anaesthetic apparatus and the gold medal (Fig. 13) for respiratory apparatus.

Fig. 12 Diploma for silver medal, awarded in 1904 – Dräger Review, 1970

Fig. 13 Diploma for gold medal, awarded in 1904 – Dräger Review, 1970

It featured accounts of Dräger's anaesthetic equipment, oxygen therapy, ventilators and central gas supply for hospital.
Dräger's development of ventilators started with the Pulmotor in 1907 (Fig. 14).

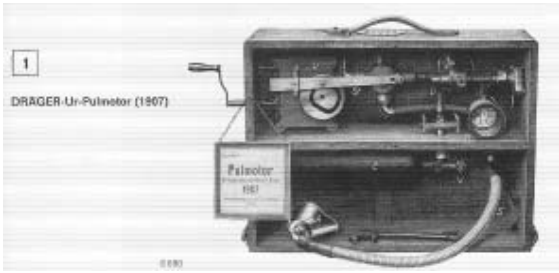


Fig. 14 The original Dräger Pulmotor (1907) – Dräger Review, 1970

The review issue also contained an example of Dräger breathing apparatus and the Pulmotor used in the training of the Croydon fire brigade in 1913 (Fig. 15).

Fig. 15 Pulmotor drill by Croydon fire brigade (1913) - Dräger Review, 1970

Romulus was one of the earlier anaesthetic machines developed by Dräger that incorporated many features we now take for granted (Figure 16).

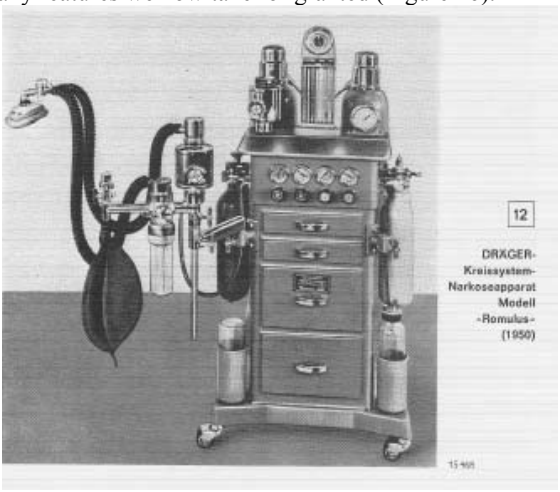


Fig. 16 Romulus anaesthetic machine (1952) - Dräger Review 51 (1970)

In more recent years, the Drägerheft continued to address a variety of issues. Issue 352 (1992) included an article on a fire evacuation exercise in the University Hospital Freiburg featuring the Brandfluchthaube (masks to prevent smoke inhalation) for staff and patients – see Figure 17.

Fig. 17 Fire evacuation, featured in Drägerheft 352 (1992)

Drägerheft 380 (2007) included a review on submarine escape devices from 1914 to the present day, starting with the Tauchretter. Below is an example from 1975 (Figure 18).

Fig. 18 Submarine escape device, shown in Drägerheft 380 (2007)

Summary

This paper has drawn attention to the Drägerheft, a probably underused resource in the research of the history of anaesthesia. It has also made a small contribution to the history of advertising in anaesthesia, a subject apparently not researched very well so far, possibly because the discovery of and access to the material proves difficult.

Acknowledgements

I would like to thank Wolfgang Fülber, Archivist within Dräger, and Claudia Rohn, Corporate Communications from Dräger, for their support and access to the material (Drägerheft and other advertising leaflets) used in this article as well as the Drägerwerk AG & Co. KGaA for the permission to reproduce the material in this article.

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Sonderdruck MT1 aus den Drägerheften 280/281/282, Dräger-Medizingeräte im Wandel der Zeiten
Drägerheft 352, September 1992
Drägerheft 380, August 2007
Dräger Review 96, November 2008

‘SURVIVAL OF THE SLICKEST’

Evolution of formal training in anaesthesia including major reforms in the UK

Dr Aditi Modi
SpR Anaesthetics, West Suffolk Hospital

In the mid-nineteenth century two new practices would change what it meant to have a surgical operation. Anaesthesia and subsequently the use of antisepsis were emerging. In the United Kingdom, in 1846, William Squire and Robert Liston of University College Hospital, London, successfully demonstrated the use of ether inhalation to induce analgesia and insensibility in a patient undergoing thigh amputation.[1] But this new discipline would evolve beyond the art of administering a vapour to a patient until they lost consciousness, to today’s specialist field demanding comprehensive knowledge of physical and physiological sciences in addition to good clinical acumen. There would be an increasing need to see such practitioners properly trained, and such training had to evolve with the practice of anaesthesia itself.

An Amateur Stepchild to an Independent Professional

Scientific discoveries in the nineteenth century gave medical practice a new momentum, but for many decades anaesthesia remained a stepchild of surgery and responsibility for its administration fell to the lowest ranking member of the operative team. This could be a medical student, or even a porter and their training was on-the spot! The disastrous consequences of improperly administered chloroform (like sudden death from cardio-respiratory arrest), surfaced during America’s Civil War (1861-1865); highlighting the need for a specialist practice based on the understanding of basic sciences. [2]

In England, in 1892, J. Frederick W. Silk- anaesthetist to Guy’s Hospital; pleaded for ‘systematic teaching’ in anaesthesia; emphasizing that improvements in surgical techniques would have to be paralleled by those in anaesthetic skills.[3] In 1898, an editorial in the Journal of the American Medical Association, commented that only competent men should administer anaesthetics in order to get rid of the ‘indifferent’ anaesthetist’.[4]

Back in the U.K., D.W. Buxton (anaesthetist in University College Hospital), proposed the involvement of final year medical students in fifty anaesthetisations, for it would be their expertise or ignorance which would make the difference between a successful or disastrous anaesthetic.[5] Sir Frederick Hewitt took the next step by lobbying parliament to legislate against any form of

anaesthetic administration by non-medical personnel including dental practitioners.[6] Finally, in 1912, the General Medical Council was compelled to include the 'bona-fide' study of anaesthetics as the last (16th) subject in the medical curriculum; the study of mental disease and hygiene preceding it! [7] It is interesting to note that in this era, Sir Ivan Magill upon graduating from Queen's University-Belfast in 1913, had been issued with a certificate stating that he had administered one anaesthetic during his medical training; and this was considered to be adequate instruction! [8]

Across the Atlantic, in 1910, Abraham Flexner's report criticising the state of American medical education was published. Flexner, an educational theorist, was chosen by the Carnegie Foundation President, Henry Pritchett, to survey medical education. To tackle the heterogeneity of educational experiences, he recommended that medical schools be regulated by a university system wherein students were taught a standardized curriculum.[9]

Amidst all these attempts to improvise medical training, the world was to face its first total war. World War I (1914-1918) left Europe economically devastated, but America flourishing with new ideas.

In 1927, Americans were dancing to the tunes of *Jazz* and the first Oscar had been given to the film *Wings*. The first transatlantic telephone call had been made from New York to London, and the newly introduced Model A Ford was unveiled. It was at this time that Ralph Waters was invited to Madison, by Chief of Surgery-Erwin Schmidt, to establish an academic anaesthesia program at the University of Wisconsin medical school.[10]

Creation of the 'Water babies'

The first training programme that Waters designed in Wisconsin was of three years duration, post-internship; of which one year was dedicated for research. The 'person specification' was fairly competitive; because Waters preferred residents that had already been in general practice, believing they would be more committed to the speciality. Interviews were in an objective conversation, often even on a weekend. Once appointed, supervision was direct for the first three months, a situation which we all are familiar with today! Regular teaching consisted of two weekly meetings; one named 'morbidity and mortality case discussion', and the other 'literature review'. Departmental social events consisted of 'ping-pong matches' or 'tea' at the Waters' residence. Waters' devotion was such that he often even volunteered to be 'on-call' on New Year's Eve on behalf of his residents! [10, 11]

On the face of it then, not much seems to have changed over the last century. Committed individuals are desirable, interviews are objective, initial competencies take around three months to be signed off, clinical governance and journal club meetings are a consistent feature and departments do get together and socialise once in a while.

Waters thus began a legacy of excellence and his 'academic triad', comprising the integration of clinical anaesthesia, teaching and research; became the perfect example to base the creation of anaesthesia departments' world-wide. Among his trained graduates was Dr Emory Rovenstine, who in 1935 left Wisconsin to develop a department of Anaesthesia at Bellevue Hospital of New York. Others included Torsten Gordh, who became the first consultant anaesthetist in Sweden; and Barindra Sircar who took up the first similar post in Mumbai, India. [10]

In Great Britain in the 1930s, there were some teaching hospitals in London and other main cities with a small number of resident anaesthetists; but in smaller hospitals, anaesthesia was being provided by general practitioners. Dr John Elam, a general practitioner of that time, commented that- 'it is absurd that a practitioner having no knowledge of anaesthesia can be licensed to kill'.[12] Unfortunately, the competition surrounding private practice created a barrier for teaching anaesthetics at a postgraduate level. There were no organised training programmes and the only means of learning was by accepting poorly paid resident posts, and private study. During this time, two British anaesthetists (W. Stanley Sykes and Sir Robert Macintosh) had visited Madison, the 'Mecca of anaesthetists'. They were immensely impressed by the efficient running of Waters' academic department and endeavoured to incorporate his training model in the U.K.[13, 14]

1932 saw the beginning of a new era for anaesthesia in Britain. The Association of Anaesthetists was founded with the perseverance of Henry Walter Featherstone[15, 16]. Subsequently, a Diploma in Anaesthetics (D.A.) was introduced and it brought with it the requirement of minimal formal training in recognised hospital posts of at least one year duration. The criteria for sitting the examination also included possession of a registered U.K. medical qualification, or a foreign medical degree acceptable in the U.K. In addition, candidates had to produce certified evidence of having 'personally' administered 1000 anaesthetics. The examination, which would be held twice a year in May and November, was to include a written paper and a viva. The fee for the award of this Diploma was six guineas (£6.30). [17]

It is interesting to note that the Diploma (without an examination) would be granted to any practising anaesthetist who had held a post in a teaching hospital for a period of ten years. Unfortunately, some dignitaries like Sir Robert Macintosh, did not qualify for this exemption, and therefore received the D.A. only by success at the examination in 1939.[16, 17, 18, 19]

The guidance available to future candidates sitting the examination included questions from the previous paper published in the 'British Journal of Anaesthesia'- (first issue in 1923). 'Current Researches in Anaesthesia and Analgesia' published in the preceding year, and books written by C. F. Hadfield, Blomfield were also available for perusal.

The Association Council went on to disapprove of the administration of anaesthesia by non-medically qualified personnel but there continued to be a few instances particularly in Addenbrooke's Hospital, Cambridge, where, until the nineteen fifties, nurses were still being employed as anaesthetists.[20]

Inauguration of the Nuffield Department of Anaesthetics in 1937, with Sir Robert Macintosh as its first professor, opened the doors for further advances in research and training opportunities. Five junior residents, at a salary of £100 per year, were to assist the professor in his research projects.[21]
Almost parallel developments were ongoing in USA and Canada where national qualifications in anaesthesia were introduced in 1938 and 1942 respectively.

World War II

From September 1939 to 1945, Britain mobilised its entire population to fight the Axis powers. The Emergency Medical Services scheme came into existence at the outbreak of the war, resulting in amalgamation of voluntary and municipal civilian hospitals. The rising demand for anaesthetic services had to be met with an increasing supply of practitioners capable of working as anaesthetists.[16, 22]

Sir Robert Macintosh started 2-week short revision courses for anaesthetists, held twice a year in Oxford. In addition to refresher courses, 'Nuffield Dominion Scholarships', enabling overseas doctors to benefit from specialist training in England, were initiated. [22, 23] This was the beginning of an era of international exchanges in medical specialities.

Another key event was the formation of the Goodenough Committee by the government in 1942, with a vision for the future of medical education. Representing the Association of Anaesthetists, Dr R.J. Minnitt, contributed towards the committee's proposals by suggesting that students were to be

granted training facilities in the form of lectures in one term and teaching of practical skills in the other.[16, 24]

In the United States, a committee chaired by Ralph Waters, arranged twelve-week courses in anaesthesia for medical officers in the army. Study of available literature including the journal of 'Anesthesiology' (first published in 1940), was encouraged. Thousands of physicians were trained by virtue of these courses and a substantial growth of the speciality and its members became inevitable.[25] In Canada, Dr Harold Griffith organized a teaching programme in anaesthesia for physicians in the armed forces, and this then led him to develop the McGill Diploma course in anaesthesia for resident staff.[26]

By the end of the Second World War, the importance of structured training in anaesthesia had finally dawned on the medical profession across the world.

Post World War II

From early computers to nuclear power, inter-continental air-travel and travel to the moon; developments in World War II have changed the world in which we live.

In 1945, an innovative teaching method was introduced at a meeting at the Royal College of Surgeons by the anaesthetic department of Westminster hospital; a film titled 'How not to do it' (although whether this was intended for the surgeons or anaesthetists, one cannot be sure!). The first issue of 'Anaesthesia' journal was published in 1946, and that of J Alfred Lee's 'Synopsis of Anaesthesia' came out in 1947.

1948 became a year to remember in the history of both academic anaesthesia and the medical profession in Great Britain. The D.A. was upgraded to a two-part examination in order to ensure equal status and remuneration for anaesthetists joining the newly established NHS. Part 1- (a test on basic sciences), could be taken by house officers who had completed a minimum of six months in anaesthesia and part 2 could be attempted after completing a year in a full-time post; on the knowledge of anaesthesia and perioperative care. With the introduction of the clinical examination on a live patient, this two-part D.A. was re-named as the diploma of the Fellow of the Faculty of Anaesthetists of the Royal College of Surgeons (FFARCS) in 1953. This format continued up until 1985, after which a three-part examination was introduced.[16]

Anaesthesia was the first specialty to develop vocational training courses to help achieve success in the examination. Dr. T.C. Gray, (reader in Anaesthesia for the University of Liverpool), set up the first three-term course in 1948; with lectures on relevant applied sciences spread evenly throughout the three terms. He embedded the concept of 'protected teaching time' and convinced surgeons to accept trainee anaesthetists in their theatres; both of which require constant reinforcement today! [27]

Responsibility for the examination was handed over to the College of Anaesthetists in 1988 (hence then called Fellowship of the College) and finally to the Royal College of Anaesthetists with the new title of Fellowship of the Royal College of Anaesthetists (FRCA) in 1992. The two-part FRCA (Primary and Final) has been introduced since 1997.

The ''*Good Old Days*''

In the U.K., Anaesthesia as a speciality has always been in the vanguard when reforming training programmes. In 1968, the Royal Commission on Medical Education, made recommendations for structured training in the light of national needs and resources.[28] Sir Alexander Todd, who authored this report, had won a Nobel Prize for his research in organic chemistry in 1957. The Royal Colleges were to oversee the postgraduate programmes; the first three years would be spent in 'General Professional Training' (GPT) with the acquisition of FFARCS, followed by three in 'Higher Specialist Training', leading to accreditation as a specialist. In this era, anaesthetic training was comprehensive due in part to working up to 100 hours per week. Trainees were supervised for 35% of their theatre time during GPT.[22] Part-time trainees would be working up to 48 hours per week! Perhaps one of the better aspects of the older system when compared to today's training was the Senior Registrar grade, where trainees could consolidate their skills in preparation for the Consultant post. Though it lacked a quantitative tool for assessing performance, there was the ability to halt promotion of an unsuitable trainee based on professional judgement. In the rest of Europe, specialist recognition was being granted after only three years of training.

The Junior Anaesthetists' Group (now known as the Group of Anaesthetists in Training) was established in 1967. This august organization has since been involved in the training and social needs of registrars. [16]

Medical training has never been immune to politics. The Calman report of 1993 called for streamlining of postgraduate training and the Royal College of

Anaesthetists took the lead in implementing a seamless, seven-year duration, competency based training programme with a definitive end-point by the award of the 'Certificate of Completion of Specialist Training'. 'The New Deal', a contract negotiated by the British Medical Association in 1991, to limit the number of weekly worked hours to 56, came hand-in hand with the Calman report.[29] See Figure 1.

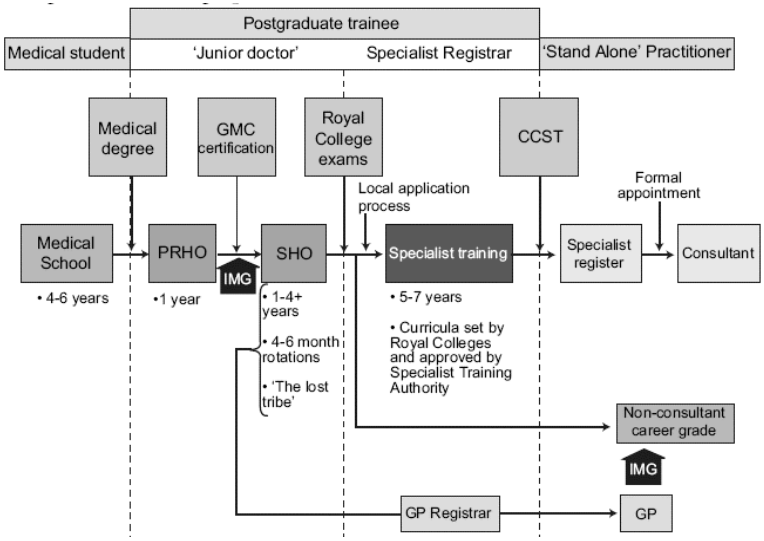

Fig. 1 The Calman Reform

So where are we today? The author's identity badge reads 'Speciality Registrar (ST)' as opposed to 'Specialist Registrar (SpR)'; reflecting a major reform as the result of structural re-organisation of training by the Modernising Medical Careers (MMC) team in 2007.[29] See Figure 2.

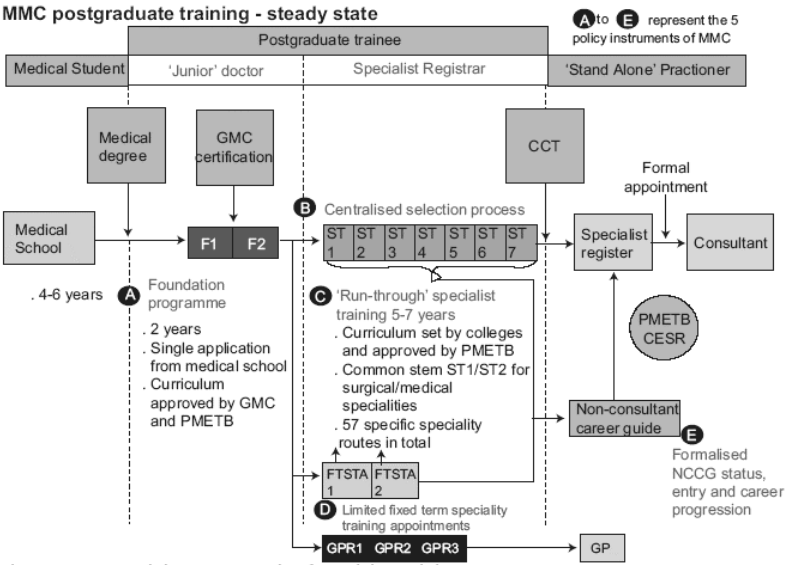

Fig. 2 Training flow-diagram by MMC team

Now, with the advent of the European Working Time Directive, rotas are stringent and political pressures on service delivery will mount again. The onus is on us to ensure we achieve **confidence** in addition to **competence**.

Evolution in medical training as in the natural world hopefully brings out a better design, but, without the knowledge of the past, one cannot have a vision for the future.

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GREAT ASPIRATIONS

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Aspiration, the "the inspiratory sucking into the airways of fluid or foreign body as of vomitus"[1], has been a recognized danger since the times of the ancient Greeks. One of the first recorded deaths due to this phenomenon was the Greek poet Anacreon, who, in 475 B.C., purportedly died after inhaling a grape seed. The lethality of aspiration was such that the father of medicine, Hippocrates, cautioned his followers in 400 B.C. that "'for drinking to provoke a slight cough, or for swallowing to become forced, is bad"'[2]. Despite Hippocrates' best efforts, aspiration continued to strike down notable figures throughout the historical record.

John Hunter 1781

While its lethality was well established, little was known concerning the mechanics of aspiration until 1781, when John Hunter was called to the stand during the trial of Captain John Donellan for the murder of Sir Theodosius Boughton. Presenting the results of his experiments with cats, Hunter declared that "'It is in the mouth of everybody that a little brandy will kill a cat. I have made the experiment; in all those cases where it kills the cat, it kills the cat by getting into her lungs, not her stomach"'[2], indicating that the lungs were the targeted organ of injury.

Death of Hannah Greener 1848

Brandy, Hunter's killer of cats, also provides the first tentative link between aspiration and anaesthesia, because of its involvement in the first death under chloroform. On January 28th, 1848, Hannah Greener, a healthy 15-year-old girl, went under the knife a second time for the removal of a toenail. She had already undergone a similar operation several months previous while under the influence of diethyl ether; however she complained that the ether "made her head bad for two or three days" [3] afterwards. This caused a switch to chloroform, the anaesthetic properties of which had been discovered less than a year previously.[4] Unfortunately for Miss Greener, this change may very well have brought about her death.

Dr. Thomas Meggison, who oversaw the operation and also administered the anaesthetic to Miss Greener, described the operation at the behest of the coroner, stating:

> "I seated her in a chair, and put a teaspoon of chloroform into a tablecloth, and held it to her nose. After she had drawn her breath twice, she pulled my hand down. I told her to draw her breath naturally, which she did, and in about a half a minute I observed muscles of the arm become rigid, and her breathing a little quickened, but not stertorous. I had my hand on her pulse, which was natural, until the muscles became rigid. It then appeared somewhat weaker- not altered in frequency. I then told Mr. Lloyd, my assistant, to begin the operation, which he did, and took the nail off. When the semicircular incision was made, she gave a struggle or jerk, which I thought was from the chloroform not having taken sufficient effect. I did not apply any more. Her eyes were closed, and I opened them, and they remained open. Her mouth was open and her lips and face blanched. When I opened her eyes, they were congested. I called for water when I saw her face blanched, and I dashed some of it on her face. It had no effect. I then gave her some brandy, a little of which she swallowed with difficulty. I then laid her on the floor and attempted to bleed her in the arm and jugular vein, but only obtained about a spoonful. She was dead, I believe, at the time I attempted to bleed her. The last time I felt her pulse was immediately previously to the blanched appearance coming on, and when she gave a jerk. The time would not have been more than 3 min from her first inhaling the chloroform till her death." [5]

Being the first death while under the influence of chloroform, Miss Greener's demise naturally engendered a major controversy, most of which was centred around two giants of the British medical community, Dr. James Young Simpson and Dr. John Snow.

Dr. Simpson, who had ascertained the anaesthetic properties of chloroform, argued that Miss Greener's death was caused by the aspiration of the water and brandy given in an effort to revive her, rather than the intrinsic action of chloroform on the lungs, as was initially supposed. In support of his theory, Dr. Simpson emphasized the "post mortem finding of pink froth in the lungs", arguing that this was an indication that aspiration had occurred. [4]

Contrary to Dr. Simpson, Dr. Snow believed that Miss Greener's death was brought about by the "action of the chloroform on the nervous centres having extended so far as to put a stop to respiration".[4] He accentuated the speed with which chloroform could transport a patient from consciousness to blissful unawareness, far faster than could be achieved with diethyl ether, arguing that Miss Greener was spirited to what he deemed the "fifth degree of narcotism", the final and deepest level of narcotism in which the patients "respiratory movements are more or less paralyzed" far too quickly via an overdose of

chloroform, resulting in her death. However, Dr. Snow was also developing a vaporizer during this time that would "administer known quantities of chloroform to a patient" and it is beyond a doubt that "Hannah Greener's death was used to promote Snow's ideas of increased patient safety by more careful titration of anaesthetic depth using inhalers".[4]

While the British medical community would eventually side with Dr. Snow, his interpretation of the events surrounding Miss Greener's death is easily dismissible. Dr. Meggison only administered a teaspoonful of chloroform through a tablecloth to a healthy patient who had previously experienced anaesthesia with no apparent difficulty. Furthermore Miss Greener moved when the incision was made, indicating, that if anything, she was "light" rather than "heavy" in terms of anaesthetic. [4]

First reported deaths from aspiration under anaesthesia 1853-62

The tentative link forged between aspiration and anaesthesia by Miss Greeener's death was solidified in 1853, during the Burmese War. A soldier suffered a gunshot wound "through the upper part of the thigh" in which "secondary haemorrhage had repeatedly occurred". The man, who had recently eaten his dinner, was anesthetized using chloroform while the surgeon endeavoured to tie off the femoral artery. During the course of the operation, the patient "became sick and vomited", dying shortly thereafter. During the autopsy the "trachea was found filled with vomited matters" [6], making this the first reported death resulting from aspiration while under the influence of anaesthesia.

While the patient had died in 1853, it was not until 1862 that this case was reported. This was one year after Dr. Sansom had reported the first fifty-one cases of death under the influence of chloroform. Out of the fifty-one cases, two could be directly attributed to aspiration, while in an additional eight cases "cessation of breathing" occurred, possible caused by occult aspiration. [7]

Winternitz 1920

The mechanics of aspiration were well known at this point, however little was known about aspiration pneumonia, which develops "secondary to the presence in the airways of fluid, blood, saliva, or gastric contents". [8] This remained true even after 1920, when Winternitz et al published the results of their experiments with rabbits. After noting the similarities between "the lesions of influenzal pneumonia and those produced by the inhalation of pulmonary irritating gases" they devised a series of experiments based on the observation that "many of the war gases, particularly those which act as pulmonary irritants, contain free

chlorine or liberate it when they are decomposed". [9] Testing this theory, Winternitz *et al* administered hydrochloric acid to rabbits via intrabronchial insufflation, finding that 0.1 to 0.25 percent hydrochloric acid solutions produced "an inflammatory process which resembles that encountered in influenza and after the inhalation of toxic gas. [9] Unfortunately, they did not extrapolate their findings to aspiration pneumonia.

Amberson 1937

It was not until 1937, when Dr. J. Burns Amberson published his paper *Aspiration Bronchopneumonia*, that the ability of gastric contents to irritate the pulmonary process was emphasized. He also underlined the disparity in effects caused by the aspiration of different materials, noting that gastric contents would lead "to more intense bronchopulmonary inflammation" while the "the aspiration of clean water during swimming or swallowing seldom is harmful".[10] However it is his description of an obstetrics case in which aspiration occurred during and following the use of ether anaesthesia that is most notable, as it was the first time that anyone had reported such an event. [11]

Hall 1937-40

That same year, Dr. Charles C. Hall, witnessed the death of one of his patients thirteen days after she aspirated while under anaesthetic for a low forceps extraction of her unborn child. Her death inspired Dr. Hall to search for similar cases throughout the medical literature available to him. Finding none, he compiled a report of 15 cases in which aspiration occurred, 14 of them obstetric, from colleges in his immediate area. The report, published in 1940, called attention to the seriousness of this phenomenon, as five out of the fifteen patients had died "while several other patients required prolonged hospitalization".[12] Additionally he quantified the two different types of aspirate, noting that in the case of solid material "death may result rapidly from the obstruction of the air passages" while the aspiration of liquid material "seems to set up a chemical pneumonitis". [12]

The year 1940 marked another advance in the understanding of aspiration and aspiration pneumonia. Irons and Apfelbach published their findings concerning the intrabrachial instillation of stomach contents into the lungs of dogs. They found that, upon installing the stomach contents into the lungs, the characteristic changes associated with aspiration pneumonia occurred, leading them to declare that hydrochloric acid was the vehicle by which this change occurred. [12]

Mendelson 1946

Despite these advances, it was not until Dr. Curtis Mendelson published his landmark 1946 paper that all of these factors were put together. Examining the records of 44,016 obstetrics patients from 1932 to 1945, Mendelson found 66 instances in which aspiration occurred. In a surprising number of these cases, aspiration was mistaken for other conditions, highlighting the need for a comprehensive study of the phenomenon.

Mendelson divided these 66 cases between those who aspirated solid material, those who aspirated liquid material, and those in which aspiration was only recognized later. Of the five who aspirated solid material, two died, however all "exhibited the classical picture of massive collapse with cyanosis, tachycardia, dyspnoea, evidence of mediastinal shift, and consolidation".[13] Of the 40 who aspirated liquid material, none died, though all developed "cyanosis, tachycardia, and dyspnea…as in the obstructive cases, but there was no massive atelectasis or medisatinal shift". [13]

Turning to the laboratory, Mendelson was able to reproduce his findings in rabbits. Interestingly he determined that in cases in which solid food was aspirated, the acidity of the food did not matter, as the same results were obtained. Additionally, he reaffirmed the findings of Irons and Apfelbach, that hydrochloric acid was the agent that produced the classic symptoms of aspiration pneumonia. He also noted that intratracheally introduced neutralized liquid vomitus had the same effect as distilled water or normal saline, producing "a brief phase of laboured respirations and cyanosis" which resolved itself in a few hours time. [13]

From these observations and his own practical experience, Mendelson came up with several suggested changes, both in equipment and in practice. He recommended the use of "clear anaesthetic masks, tilt-able delivery table[s], suction, laryngoscope, and bronchoscope", alkalizing or emptying the contents of the stomach, and the "wider use of local anaesthetic where indicated and feasible".[13] Many of these practices are still in use today.

Weiss 1949

Three years after Mendelson, Dr. William Weiss investigated the occurrence of regurgitation and aspiration in the operating room. Following 112 major cases Weiss discovered that regurgitation occurred with alarming frequency, in 29 out of the 112 cases. Of these 29 occurrences, 76 percent of them resulted in the

aspiration of gastric contents. In light of these results, Weiss recommended that "light anaesthesia with the pharyngeal reflexes not abolished might be avoided"; also preoperative emptying of the stomach and decompressed bowel, and "pharyngeal suction of accumulating material" if drainage tubes must be withdrawn while the patient is still under the influence of anaesthesia. [14]

Sellick manoeuvre 1961

For the anaesthetist, the next significant development pertaining to the treatment of aspiration was the Sellick manoeuvre, first described in 1961 by Dr. Brian Sellick. Designed to control the "regurgitation of gastric or oesophageal contents…until intubation with a cuffed endotracheal tube is complete" and also to keep the stomach from inflating during the use of positive pressure ventilation, the manoeuvre accomplishes this by temporarily occluding the "upper end of the oesophagus by backward pressure of the cricoid cartilage against the bodies of the cervical vertebrae".[15] This process represents the last innovative breakthrough in the prophylactic treatment of aspiration within the realm of anaesthesia to the present day.

Conclusion

Despite the numerous advances in the understanding of aspiration and aspiration pneumonia, it remains an important killer of women having general anaesthesia for caesarean section. Jimi Hendrix and some other 'rock stars' also shared the same fate as these women, struck down by this insidious phenomenon. Research continues to minimize the effects of aspiration and to prevent its occurrence.

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CAUSALGIA: AN HISTORICAL PERSPECTIVE

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An affliction of war

Causalgia is an uncommon but distressing condition that can follow peripheral nerve injury.[1] [2] It is not surprising that this condition has been reported mostly during times of war, with firearm induced damage to nerves.[2] [3] Hassantash *et al*[3] from a search of MEDLINE for the period of 1966-2000 reported 109 articles, to which they added one of their own, making it a total of 110; 1528 cases were reported, in total. The etiological factor in 67% of cases was high-velocity missile injuries. To this can be added reports of seven and six patients, by Cohen *et al* [4] and Verdolin *et al* [5], respectively, from the war in Iraq.

A war presents a paradox; on the one hand, men strive to find better and more efficient ways to kill each other, while on the other, equally vigorous attempts are made, behind the lines, to preserve life.[6] The large number of wounded provide an extensive schoolroom for the surgeon [6] and a vast experimental laboratory for the study of nervous system lesions. [7] One product of this is the contribution to the current knowledge of causalgia.

Early consonant reports

Sir Percival Pott, the eighteenth century English surgeon, after whom fracture of the ankle and of the tibia and tuberculosis of the spine, are named, mentioned "certain painful afflictions of the nerves", in connection with injuries of the extremities. [8] However, the first formal report of this condition came from the English naval surgeon Alexander Denmark, in 1813. [9] Denmark joined the Royal navy on 5th October 1795, as Acting Surgeon's Second Mate, gained promotion within a year and passed a formal examination on the 2nd February 1797. [10] He was promoted to the rank of Physician to the Mediterranean Fleet in 1810, followed by his final appointment at the Royal Naval Hospital, Haslar, at Gosport, Hampshire. It admitted soldiers wounded in the Peninsular War; the siege of the Spanish town of Badajoz by the British took place between 16th March and 6th April, 1812 and Denmark came to care for a Henry Croft, a young soldier injured on the last day of the siege. [9] Croft had been shot in his upper arm and had "*developed excessive pain, which the largest opiates could not assuage...the little sleep he had was disturbed by frightful dreams and starting*". Denmark rightly diagnosed involvement of the radial nerve and offered resection of the injured section of the nerve but the patient opted for an

amputation which was carried out, with success. Denmark did not comment on the pathophysiology or name the condition. While at the Haslar, Denmark worked with Thomas Wilson, who subsequently served as Surgeon Superintendent on ships on the Australian convict run. [10] Wilson was shipwrecked in 1829 and managed to reach the settlement of Albany; during his stay, he led an expedition and discovered a river which he named after Denmark. Later on, a town established near the Denmark River was named after him.

The next report of this intriguing condition, by John Hamilton, appeared in 1838.[11] Hamilton dealt with several patients with accidental nerve injury, and observed that they developed severe pain in the injured part, frequently associated with tenderness and swelling and constitutional symptoms, which he referred to as "those commonly called nervous and hysterical". He suggested that these symptoms were most frequently observed in nervous and hysterical women, though not always. He opined that a local inflammation was set up in the wounded nerve and that a morbid impression was then conveyed to the brain and spinal marrow, thence re-acting on the nervous system. James Paget, in his paper of 1864 [12], described a young male with total paralysis of the left arm following an accident and who complained of intense pain. Paget stated that cases of neuralgia in the absence of injury to the brain or spinal cord were rare and that he could not offer any explanation for the occurrence of pain and the associated trophic changes in the limb.

The American Civil War

The American Civil War (1861-1865) was the next phase of development of knowledge of this disease. During this war, approximately 620,000 men lost their lives and 144,000 were wounded; of the latter, 108,000 were victims of the infamous "Minié Ball".[6] Prior to the development of the Minié Ball, rifles were not used commonly in combat due to difficulty in loading. The ammunition used was of the same diameter as the rifle bore and therefore had to be forced in, to engage the groove of the rifle. The Minié Ball, designed by Captain Claude-Etienne Minié in 1848, had a conical cavity at the base which expanded on firing. The bullet could therefore be of a diameter smaller than the rifle bore, allowing it to be dropped in quickly and the rifle to be loaded more frequently. The Minié Ball was adopted by both sides during the war and improved the range and accuracy of the rifle significantly [13 14] and necessarily lead to more injuries. In face of such accurate fire, soldiers hid behind cover, so that they escaped injuries to their trunk but not to their extremities.[6] Missiles can damage nerves by direct impact, shock wave and by cavitations.[15] When tissue is struck by a missile, energy is transferred, accelerating the tissue particles ; the outward movement of the accelerating particles and the elasticity of the tissues produces

a cavity along the track, which subjects nerves to a rapid and violent deformation, stretching and tearing them and causing significant damage.[16 26 28-31] Of equal importance is the fact that a soft-point bullet, such as used in the Civil War, fragments on impact, which is a critical factor in the increased tissue destruction caused by such a bullet. [17 27]

Silas Weir Mitchell and the term "causalgia"

No description of causalgia can be complete without the mention of Silas Weir Mitchell, the noted American physician and neurologist. Silas Mitchell was the son of a physician and was rather slow in deciding on a vocation.[18] He graduated from Jefferson Medical College in 1849 and studied for a year in England and France.[13] Returning to Philadelphia, Mitchell continued his experiments in physiology, studying snake poisons and established himself as a physician as well[19].During the war, Philadelphia became second only to Washington in concentration of hospitals for the Union Army and Mitchell was one of the first civilians to volunteer to serve as a physician at the Christian Street Hospital. Mitchell transferred to the Filbert Street Hospital in 1862, and was joined by GR Morehouse and WW Keen; Hammond subsequently became the chief of army medicine and Mitchell prevailed upon him to open a hospital, at Turner's Lane, for the treatment of patients of nerve injury. Keen took charge of detecting malingerers, Hammond concentrated on epileptics and Mitchell studied patients with damage to peripheral nerves caused by gunshot injuries. The trio published the book *Gunshot Wounds and Other Injuries of Nerves* in 1864, followed by *Injuries of Nerves and Their Consequences* in 1872, which Mitchell wrote by himself. The original description of a patient of Causalgia was vivid and precise,[20 21] and probably remains unchanged to some extent.

Its intensity (pain) varies from the most trivial burning to a state of torture. The part itself is not alone subject to an intense burning sensation, but becomes exquisitely hyperaesthetic. As the pain increases...the temper changes and grows irritable. The sleep is restless, and the constitutional condition, reacting on the wounded limb, exasperates the hyperaesthetic state, so that rattling of a newspaper, another's step across the ward, the vibration caused by a military band... gives rise to increase of pain. At last the patient grows hysterical. He walks carefully, carries the limb tenderly with the sound hand, he is tremulous, nervous and has all kinds of expedients to lessen the pain. Perhaps few persons who are not physicians can realize the influence which long-continued and unendurable pain may have upon both body and mind. (Italics and paraphrasing: author of article).

Mitchell however did not name the condition; his friend, Robley Dunglison, a British physician who emigrated to the USA, to take up a professorship at the

University of Virginia [22] coined the term from the Greek words *kausos* (heat) and *algos* (pain). Mitchell used this term in his second book.

Spread of Mitchell's ideas

Mitchell's ideas did not remain confined to the USA but reached Europe through a French translation of *Injuries etc*. Koehler and Lanska, in a review of Mitchell's influence on European studies of peripheral nerve injuries during WWI [23], mention works by Tinel, Athanassio-Benisty, Purves-Stewart, Evans, Carter, Foerster and Oppenheim. Tinel discovered a sign that could be related to regeneration of a nerve. Athanassio-Benisty, working at the Pitie-Salpetriere Hospital, provided an extensive description of Causalgia and authored two books on the treatment of nerve injuries.

A contemporary of Mitchell was Jean JE Letievant, who worked at the Lyon Medical School between 1861 and 1884 and published *The Treatise of Nervous Section*, in which he discussed neurotomy as a treatment for neuralgia.[8] [24] Letievant stated that there were three sites fundamental to production of pain, namely, the peripheral nerve, the spinal cord and the sensorium and concentrated on the periphery, the only site surgically accessible at that time. He introduced the concept of esthesiography or sensory topography and was one of the first to carry out surgical repair of a nerve, though James Learmonth, the Scottish surgeon, is often credited with this honour.[25]

Pathophysiology

The evolution of this disease is comprised of the understanding of the pathophysiology and treatment; a description of the history of this condition needs a discussion of both. Stopford [27] in his study of 1917 implicated interference of vasomotor control in pain genesis but doubted the role of a periarterial sympathetic plexus, supporting instead the view that arteries received sympathetic fibres at irregular intervals down the limb from fairly constant nerve trunks. The role of neuritis of the peri-arterial sympathetic plexus in causalgia was put forward by the French surgeon Rene Leriche.[32] A landmark study was conducted by HS Carter, who published, in 1922, his observations based upon examination of three thousand cases of peripheral nerve injury[32], twenty-three of whom developed causalgia. Carter worked at the Second Northern General Hospital, Leeds, which was housed at the site of the Teachers Training College at Beckett's Park, Leeds; this hospital treated 57, 200 soldiers between 1914-1918 and returned to educational use after WWI but was reconverted into a military hospital during WWII, to treat the Dunkirk evacuees.[33]

Carter supported Stopford's views regarding the pathology and made the interesting observation that the disease seemed to be commoner in the French.

Kwan, in 1935, commented upon the fact that the sympathetic system may influence the excitability of the extra-sympathetic, as suggested by Dragonesco and Kreindler [35] and that causalgia was probably caused by a state of sensory hypertony. Kwan worked at the Peiping Union Medical College, which was set up in 1921, occupied by the Japanese after Pearl Harbour and nationalized in 1951. This institution was funded by the Rockefeller Foundation with a grant of forty-five million dollars, an amount representing the largest single donation for a project outside the USA.[36] Support for Leriches' hypothesis [32] came from Hommans, who commented that the sympathetic system was certainly involved in the genesis of the pain and that peri-arterial sympathectomy worked in well localized causalgia.[37] Doupe, Cullen and Chance, in 1944, postulated that neighbouring axons may sometimes fuse, especially during regeneration following an injury and those sensory fibres could be activated by the sympathetic, following such a union. They stated that oedema and ischemia of the extremity, as present in these patients, could lead to de-myelination of the nerves and abnormal fusion.[8 31 38 47-49] This group worked at the Winwick Hospital which was set up by the Lancashire Asylum Board in 1902, at the Winwick Rectory Estate, near Warrington; it was rechristened the Lord Derby Hospital during the WWI and treated 56,000 soldiers. The hospital resumed its original function after the war and closed in 1997. [39]

Granit and co-workers [40], in a series of animal experiments, found that at the site of a nerve injury, an "artificial synapse" seemed to be set up, with considerable interaction amongst the fibres and the occurrence of spontaneous discharge; this behaviour could explain the genesis of causalgia. A similar explanation was given by Barnes [30] and Sunderland [31], who postulated the setting up of synapses between afferent sensory and sympathetic fibres. Lewis hypothesized the existence of a class of fibres which he named "nocifensor"; these fibres could detect an injury, and the action potentials carried, anti-dromically, to other nerves, causing hyperalgesia.[41 46] These fibres have recently been identified as a class of C-mechanically insensitive, afferent fibres.[42] Speigel and Milowsky quoted Fuchs as stating that causalgia was the result of irritation of the peripheral sympathetic plexus, which in turn led to sensitization of the thalamus and production of pain by non-nociceptive stimuli.[43] Mayfield and Devine refuted the role of alteration of blood flow in causalgia, as their patients exhibited both vasodilatation and vasoconstriction.[44] De Takats spoke of a similar state of sensory irritation, at peripheral, spinal and cortical level; the lesion became more and more intractable the higher it ascended.[45 49] Sunderland and Kelly opined that causalgic pain, even if localized, indicated a disturbance

at the central level.[28] Gerard stated that an abnormal, dynamic state of the cord neurones was produced by overactivity due to setting up of artificial synapses at the periphery and to underactivity, due to the loss of the normal inhibitory influence of large fibre transmission, on small fibre traffic.[29] The latter concept was explored later on, in greater details, by Melzack and Wall.

Roberts, in a review article [50], highlighted the concept of Sympathetically Mediated Pain (SMP), which was due to sympathetic efferent induced tonic activity of peripheral mechanoreceptors leading to sensitization of Wide Dynamic Range neurones in the spinal cord. This mechanism was acknowledged by Baron and his group [51 52] and Siddall *et al* [53] extended the concept by stating that in the presence of injury, abnormal links were set up between sympathetic efferent and large diameter afferents in the spinal cord. The most recent articles state that the pathophysiology of causalgia (and reflex sympathetic dystrophy, RSD) still remains controversial but that neuroplastic changes within the CNS, including cortical reorganization, certainly take place.[54-57] It can be said that there has been a shift, over the years, to view causalgia as a central nervous system disease.[54]

Treatment

The treatment of causalgia underwent remarkable changes over the years. Hamilton [11] tried tonics, arsenic, mercury and leech application, while Paget [12] advocated electrical stimulation and Swedish exercise. Mitchell [21] advised application of leeches over the injured nerve, for the treatment of pain; he used blistering with Granvilles Lotion and shampooing, reserving morphine injection for the refractory cases. Leriche, in 1913, recommended interruption of the sympathetic supply of the extremities by periarterial sympathectomy [43] but this procedure did not prove to be effective. [1 27 32 34 35 43]

Since causalgia originated from a nerve injury, many earlier workers concentrated on repair of the nerve and neurolysis, as forms of treatment. Denmark was probably the first to suggest exploration of the injured nerve [9], as did Letievant.[8 24] Jean Sicard, the French neurologist who gained fame during WWI as the "Healer of pain", due to his work on mechanisms of and treatment of pain[58], described in 1916 [43], successful treatment of 21 cases of causalgia by injection of the involved nerve with 60% alcohol. Later reports suggested combining neurolysis with injection of the nerve.[1] Carter [32] and Platt[59] commented on the efficacy of end-to-end suture of the injured nerve. Stopford [27] advised excision of the divided portion of the nerve and secondary suture. However, neurolysis was described as ineffective by later workers. [3 30 60]

A landmark in the treatment of causalgia was the introduction of sympathetic ganglionectomy by Spurling[34], based on the success of Adson and Brown in treating Reynaud's Disease, another vasospastic condition of the limbs. This procedure, preceded by diagnostic blocks, became the mainstay in the treatment of the condition, and remained so, till recently; success was reported by several workers.[2 3 28 30 35 37 38 43-45 47 48 50 60] Schumaker [61] went so far as to say "*I can think of no results more immediate and spectacular in the entire practice of medicine*", while commenting on the efficacy of sympathetic block. In the same vein, Jebara and Saade [2] commented "*One of the outstanding surgical lessons learned during WWII was that the interruption of the appropriate sympathetic nerve fibres is almost invariably effective in the treatment of causalgia".* Another landmark was the introduction of guanethidine block by Hannington-Kiff in 1974. [62 63]

SMP vs SIP

The role of the sympathetic nervous system in generation of pain still remains controversial.[51 57 64] It is now recognized that patients can be clearly divided, on the basis of response to sympathetic blockade, into positive (*Sympathetically Mediated Pain*, SMP) and negative (*Sympathetically Independent Pain*, SIP) responders.[52] In any patient, the two may co-exist.[65] In addition, it is also recognized that evidence regarding the efficacy of sympathetic blocks is still lacking. [66 67]

New terminology

The term "causalgia" was itself replaced by CRPS TypeII, following an international workshop in 1993,[65] which concluded that since the pathology of causalgia and RSD remained unclear, classification would be based upon a descriptive method rather than on pathophysiology.

Current management

Regarding the treatment, Livingston, in 1948 [68] remarked*" The course of treatment is much like the progress of a chess game; the physician makes a move and the response of his patient will determine his subsequent move"*. He emphasized on early treatment of the pain and preservation of function to be the two cornerstones of treatment. More than half a century later, an updated pathway drawn up by Stanton-Hicks and colleagues, mentions similar goals. The emphasis is on rehabilitation and the addition of psychological treatment. [69]

An exciting development in the treatment of causalgia was the introduction of long-term stimulation of the dorsal column by Shealy *et al*, in 1967; this is now well established and of proven efficacy. [5 70-72]

Conclusion

In conclusion, this article has attempted to trace the history of a condition, the understanding and the treatment of which still remain incomplete but which will continue to affect humans, due to the regrettable but inevitable occurrence of wars.

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AN UNSUNG *LOCAL* HERO

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Local anaesthesia by chemical means: JY Simpson

The term 'local' anaesthesia was first used in a paper by James Young Simpson and published in *The Lancet* of 8th July, 1848. [1] In the paper Simpson described some ancient references to local methods of pain relief, gave an account of his unsuccessful attempts to produce local anaesthesia by topical application, primarily of chloroform, and provided a striking appreciation of the potential benefit of local (compared to general) anaesthesia:
"If a man, for instance, could have his hand so obtunded that he could see, but not feel, the performance of amputation upon his own fingers, the practice of anaesthesia in surgery would, in all likelihood, advance and progress even still more rapidly than it has done."

Local anaesthesia by freezing: J Arnott

In the next issue of *The Lancet*, a letter appeared from a Dr James Arnott, an Aberdeen and London trained physician working in Brighton, making a number of comments on Simpson's paper [2]:
"The Lancet for July 8th contains an interesting paper."
"Unfortunately, however his paper does not hold out much hope of success from any of the local means with which he has experimented."
"Eight months ago, I proposed…to substitute local means for producing insensibility during surgical operations. One of the two measures then suggested I have proved to be effectual. I allude to the benumbing effect of cold."

These observations refer to a pamphlet which Arnott had published the previous year on the anti-inflammatory effects of various physical methods of treatment. [3] He was stretching his case because his suggestion of a surgical indication was made in a passing reference in a footnote, but the suggestion was there. Simpson appears to have ignored Arnott's letter because no subsequent comment from him has been found. However, this is perhaps not surprising given that Arnott suggested that cold might be appropriate for minor operations:
"..in which ether and chloroform have been so much and often so improperly used.."
A further letter,[4] in *The Lancet* a few weeks later, described cold as:
"..a safer mode than any .. of producing insensibility in surgical operations"

Not comments to endear him to the great man, although Simpson continued his interest in topical analgesia (using carbonic acid).

Being so ignored did not deter Arnott who found readier listeners when he visited Paris in 1850,[5] his technique then acquiring the name 'congelation', congélation being the French for freezing. He continued with his work, and there are a number of accounts of the successful surgical use of his method in the UK,[5] although his primary interest remained in the therapeutic use of cold for inflammatory and malignant lesions. His apparatus was displayed at the Great Exhibition in 1851, but the pamphlet describing it makes no reference to any anaesthetic application. [6] His definitive contribution on that subject was perhaps his 1854 pamphlet,[7] notable for its advocacy of cold for avoiding deaths due to chloroform and the length of its title which was long even by Arnott's standards! [3 6]

Arnott eclipsed

It is interesting to speculate why Arnott's method was not more widely used, and why he and it are so little known in anaesthetic circles today. The apparatus looked cumbersome,[8] requiring an ice/water/salt mixture to be infused through a pig's bladder placed over the target site, and success probably needed considerable persistence. The medical profession has always preferred pharmacological to physical treatments, and was probably much embroiled in the ether versus chloroform debate at the time. Finally, Richardson's ether spray, introduced in 1866, was much more practical, and his reputation has perhaps overshadowed Arnott's. As a result the latter, while venerated as the pioneer of cryotherapy,[9] is virtually unknown as a pioneer of local anaesthesia, surely an unjust situation?

Acknowledgements

Arnott's pamphlets are not easy to obtain: I would like to thank the National Library of Scotland for providing access to references 3 and 7, and Glasgow University Library for number 6.

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THE KING THERMANESTER VAPORIZER – manufactured by C.J. Birtcher

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The apparatus and instructions

The King Thermanester (K.T.) came into my possession many years ago, and like most things was forgotten gathering dust. Rediscovered a couple of years ago I decided to see if I could find out more about it. After all the instructions claim " Over 100,000 anaesthetics have been administered by several thousand physicians and it is used in over 30 Foreign Countries". [1]

Fig. 1 King Thermanester vaporizer

The vaporizer (Figure 1) does not look as if it has ever been used. In 1939 it cost £8/5/0, $39.75, an exchange rate of $4.80 to the pound. Manufactured largely from bakelite with chromed brass the machine has a glass ether reservoir with a needle valve to control the drip rate onto heated copper gauze. The instructions advise the water jacket must be pre heated then filled with boiling water. There is a variable air bypass to the face mask which is made of rubber. The instructions say a more rapid induction can be facilitated by unclipping the ether reservoir and squirting ethyl chloride onto the copper gauze. "King Thermanester" is cast into the bakelite, and C. J. Birtcher's transfer as manufacturer is on the water jacket and box lid.

Research into the vaporizer has not really yielded much further information.

The manufacturers

Google yielded nothing on King Thermanester, but was a little more helpful with C. J. Birtcher. There were two Birtcher brothers with the same initials in Los Angeles (L.A.) One was involved in real estate; the company still exists as Birtcher Anderson. The other brother set up Birtcher Medical Inc. in 1936. [2] This company was involved in the manufacture of various electrosurgical instruments. In 1992 there was a long legal battle with Valleylab over a patent infringement. [3] Around then the company made some very poor acquisition decisions and went from one of the top 100 listed companies around L.A. with profits of $1.6m in 1991 to a final takeover in March 1995 with loss of 100 of the 120 jobs. [3] Birtcher medical equipment is still widely advertised in the second hand market in the U. S. There is no mention in anything I have found of the manufacture of this or any other vaporizer or indeed any anaesthetic equipment.

Los Angeles street gazettes give the address of Birtcher Inc. as 1001 North Main Street, in 1938 and 1939. The company had moved to 5087 Huntingdon Drive by the next available gazette in 1943. [4]

Search for answers

The Wood library was contacted. I copied photographs of the instrument and instructions to them. The reply was interesting. I had more information than they did. They have two K.T.s. They had less paperwork than I had, and no idea that it had been exported. The letter ended with a question: "Have you got the stand as we have never seen one?"

The Thackray Museum in Leeds was contacted but they too were unable to help, and had no record of the K.T. in their archives.

I wrote to 1001 North Main Street but got no reply. Later looking on Google earth this area is now warehouses and parking.

Conclusion

In Conclusion this is a vaporizer which appears to be well made and claims to be well used and multi- national in its usage. It was made by a company which seems to have done it as a one off and did not pursue the production of anaesthetic equipment.
Was it really as popular as advertised?

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WELSH MINING-RESCUE SERVICES, EARLY RESPIRATORS * AND TECHNOLOGY TRANSFER – - a review of crucial contributions to the development of modern anaesthesia technology

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Background and Aims: As part of a large research project we carried out a review of the history of early respirators (mid 1800s – 1918), particularly in the field of (mining) rescue technology. Our findings allow an international re-assessment of technologies, which pioneered later developments in the field of anaesthesia.
Material and Methods: Systematic historic analysis. (Inter)National historic sources were largely obtained by exclusive access to the Archives of the firm Draeger, based in Luebeck, Germany ("Dräger", est. 1889), one of the leading international producers of respirators, ventilators, anaesthesia- and rescue technology since about 1902.
Results: We provide an extensive international survey on early respirators, developed between the mid 1800s and the end of the First World War. These are systematised chronologically, nationally and according to underlying main principles. Rare photographic evidence, blueprints, patents etc. are included. Preliminary assessments on the specific importance of several devices are proposed, conflicting and unresolved claims concerning historic priority etc. are discussed.
Conclusions: Our findings provide further evidence that inhaled oxygen as a therapeutic (or prophylactic) agent had its´ first internationally really significant breakthrough in the field of rescue technology. These also illustrate that the most important technical principles of modern anaesthesia devices (e.g. oxygen supplementation; gas-supply storage by compression into cylinders; filtration, absorption and CO2-elimination; the closed circuit with its gas-flow directing and airway pressure reducing valve technology) were first pioneered in respirators. Noteworthy contributions to the early history of this "Technology Transfer" are highlighted and put into an international chronological context. Examples of particularly noteworthy British and Welsh contributions are specifically highlighted. Interestingly, most of these contributions did initially not originate from the input of physicians, but from non-medical professionals: unsung and forgotten firemen, miners, engineers, health and safety experts, labour charities, military officers etc. Re-discovering these roots provides opportunity to acknowledge the considerable inter- and trans-disciplinary influence on the development of modern anaesthesia and medical technology.
***** Abstract only

LEECH PHARYNGEAL BULB GASWAY

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Beverley Leech was one of Canada's pioneer anaesthetists in the years between the First and Second World Wars. He was born in Brandon, Manitoba in 1898 and graduated in medicine from McGill University, Montreal in 1925, three years junior to Harold Griffith with whom he had a collegial lifelong friendship.[1] He settled in Regina, Saskatchewan and was director of anaesthesia at Regina General Hospital from 1929 until 1956.[2] He was contemporary with Griffith in Montreal, Waters in Madison, Wisconsin and Magill and Macintosh in the United Kingdom

Waters introduced cyclopropane into clinical anaesthesia in 1933.[3] Griffith visited Madison to see it in use[4] and was immediately convinced of its superiority over all other forms of general anaesthesia. Leech followed Griffith's lead and they later documented their combined experience of more than 8,000 cyclopropane anaesthetics.[5] Its favorable qualities included rapid, smooth induction, potency that allowed high oxygen concentration with good abdominal relaxation, and less postoperative vomiting and discomfort than with other agents. But it was explosive and more expensive than other agents so, to be both safe and affordable, it had to be administered in closed circuit.

Leech considered deep ether anaesthesia to be necessary for unhurried laryngoscopy and passage of the tube that required "skill and dexterity born of experience".[6] He and Griffith recommended that every anaesthetist who contemplated the use of cyclopropane should first practise tracheal intubation, but only use it when there was a clear indication.[7,8] Leech recommended the autopsy room first for recognizing the laryngoscopic appearance and landmarks of the pharynx and larynx, then practising on edentulous etherized patients during recovery after the operation was completed.[7] Griffith recommended practice at every opportunity under ether anaesthesia, both during and after an operation.[8]

Leech was disappointed that, for practical reasons, he could not provide the benefit of cyclopropane to large numbers of patients undergoing dental, ophthalmic, ear, nose, throat and other head and neck procedures. The face mask interfered with the surgical field while tracheal intubation, either oral or blind nasal, was too time-consuming. Cyclopropane induction alone was too

evanescent for unhurried laryngoscopy while the time taken for intubation under deep ether was not acceptable for lists of short cases. He circumvented the problem by designing a supraglottic airway that enabled closed circuit cyclopropane to be maintained without either intubation or face mask.

Pharyngeal bulb gasway

He began in 1935 by making wax casts of the pharynx of male and female cadavers of various ages and statures. These served as models for the reusable soft rubber bulb fitted over the distal quarter of a modified metal oropharyngeal Connell airway to provide an airtight fit in the pharynx.[7]

Figure 1 shows a normal Connell airway on the left and Leech's modified version in the centre. The distal orifice was expanded and had two metal loops to prevent occlusion by the patient's epiglottis. The flanges half way round the curved portion assured correct positioning of the rubber bulb. The proximal end of the airway was threaded and circular for attachment of an L-shaped swivel connector that allowed the fresh gas tube to be swung in any direction for the convenience of the surgeon or anaesthetist.

Fig. 1 Leech pharyngeal bulb gasway. Stages of development (L to R): Connell oropharyngeal airway, Leech's modified Connell airway, Leech pharyngeal bulb gasway.

Leech applied for a patent on 30th December 1936 and United States Patent 2,099,127 Pharyngeal Bulb Gasway was granted on 16th November 16, 1937 to Beverley C. Leech, Regina, Saskatchewan, Canada, assignor to the Foregger Co., Inc., a corporation of New York".[9] The Foregger Company Catalog No 7 (probably 1937) advertised the gasway with the L-shaped connector at an introductory price of $10, and replacement rubber plug for $2. Later versions of the gasway had a simple L-shaped connector, or a flexible curved connector that Leech preferred. Both models were shown in Foregger Catalog No. 8 in 1942. (Figure 2). Only one size of bulb was ever produced because Leech found that this gave [7] "remarkable uniformity of satisfaction" for "both sexes in cases ranging all the way from a small girl of sixteen years to a large man of seventy".

Fig. 2 Leech pharyngeal bulb gasway: L-shaped and flexible curved connectors. The Foregger Company Inc., catalogue No. 8, 1942. Wood Library-Museum of Anesthesiology, with permission.

In preparation for induction of anaesthesia, the parts of the gasway were fitted together. The rubber bulb, which was sterilised between cases, was slipped over the distal end and generously lubricated with Vaseline. Anaesthesia was induced with cyclopropane until the jaw muscles relaxed. The tongue was then pulled forward with Allis forceps to allow the bulky gasway to be passed along the roof of the mouth to the back of the tongue. When the tongue was released, the bulb provided an airtight fit as the pharyngeal tissues relaxed round it. The fresh gas tube was connected to the swivel adaptor and anaesthesia continued as with tracheal intubation. [7]

Discussion

Reviews of the history of supraglottic airways include the Leech pharyngeal bulb gasway but fail to mention the specific reason for its invention.[9-11] Leech's objective was to enable closed circuit cyclopropane to be used for head and neck surgery without the need for time-consuming tracheal intubation under deep ether. His pharyngeal bulb gasway had a useful life span of approximately twenty years of the cyclopropane era from the late 1930s to the mid-1950s.

When Griffith began using cyclopropane in 1933 he intubated the trachea routinely for head and neck surgery and usually for upper abdominal operations, long bowel resections, kidney operations, awkward positioning, gross obesity or fear of respiratory obstruction.[12] He did not specify whether he induced anaesthesia with cyclopropane alone or a combination of drugs. When the pharyngeal bulb gasway became available in 1937, however, he promoted its use:

"When there is obstruction of breathing from a tongue that is hard to control, the rubber Guedel airway may be introduced, or better still the 'pharyngeal bulb gasway' designed by Dr. Beverley Leech. I have used this simple device in hundreds of cases with great satisfaction, and it allows also the use of cyclopropane by closed circuit for teeth extractions and other operations where a mask would be in the way." [13]

In 1957 Leech received an inquiry from an American anesthesiologist about the pharyngeal bulb gasway. He prefaced his response with the comment, "I appreciate your inquiry re the Leech gasway, and I am glad that you still find some use for it. I rarely use it myself any more, – since rapid acting relaxants have made intubation so simple."[14] Leech's comment implies that the introduction of curare in 1942 had little effect on airway management. Griffith

and Johnson's first curare case record shows the anaesthetic as "cyclopropane" and the technique as "mask and airway".[15] Their purpose in using curare was to provide the surgeon with excellent muscle relaxation under light inhalation anesthesia and they did not mention whether intubation was performed in any of the 25 patients.[16] The same was true in Cullen's 131 patients in 1943.[17] Gray and Halton in 1946 did not mention tracheal intubation in their report at the Royal Society of Medicine of 1,049 cases.[18] In the ensuing discussion, Organe suggested that tracheal intubation was not called for because curare made it so easy to maintain a clear airway. Gillespie mentioned curare's possible usefulness for endoscopies in the 1948 edition of Endotracheal Anaesthesia, but made no mention in relation to tracheal intubation. [19] The main factor that made the Leech pharyngeal bulb gasway obsolete was almost certainly the introduction of suxamethonium. In 1953 Foldes described its use in 317 patients and concluded that its rapid onset and short duration of action made it the agent of choice for intubation, especially when relaxation afterwards would be maintained with inhalational anaesthesia, [20] as in the range of head and neck surgery that Leech described.

Leech was well known in Canada and the United States and addressed important issues at national and international meetings, and in published papers. Those on the organization and management of a department of anesthesia for a 200 to 400 bed hospital in 1934,[21] and the design of a crash cart with necessary drugs and equipment for operating theatre in 1939[22] were far ahead of their time. He became a Fellow of the International College of Anesthesiologists in the USA in 1936; Honorary Member of the Section of Anaesthetics, Royal Society of Medicine in 1942; and was elected Fellow of the Faculty of Anaesthetists of the Royal College of Surgeons in 1950.

When Leech died from a stroke in 1960, Griffith paid tribute to his leadership role in anaesthesia, "Bev Leech was one of the historic names in anaesthesia. At a time when few others were interested, he was a leader in the fields of teaching, research, and medical organization and economics."[1] His pharyngeal pharyngeal bulb gasway was a useful device in the cyclopropane era, especially for head and neck surgery, when closed circuit administration was essential for safety and economic reasons tracheal and intubation was a time-consuming challenge.

Acknowledgment

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JOSEPH CLOVER AND THE COBRA *
A tale of snake envenomation and attempted resuscitation with bellows in London, 1852

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"April 20th Sent in an application for a clinical clerkship under Dr Williams & Dr Taylor. Went in the Evenᵍ to tea at Mr Beasely's and met there a Gent who had long resided in Calcutta. He mentioned that Elephants have the power of splashᵍ themselves over with water (out of the trunk) in hot weather – that the value of a moderate sized one & of greatest use is abˡ £80."

Joseph Clover, Miscellaneous Journal. 1846.(1)

Ether and chloroform were not the only wondrous new things exciting Victorian England. Travellers returning from exotic lands brought tales of extraordinary creatures, plants and insects which fascinated scientists and enlivened dinner conversations. A number of learned men, among them Stamford Raffles and Humphry Davy, gathered together to form the London Zoological Society in 1826. Two years later the Zoological Gardens in Regent's Park was established to allow members of the society to study animals at their leisure. Eventually, in 1847, it opened to the paying public allowing the curious population to observe these strange creatures from far away places.

The Industrial Revolution had seen the creation of many new job opportunities but probably none more curious than that of zoo keeper. There were, of course, no recognised qualifications and applicants presumably had to be adventurous and creative. Edward Horatio Girling had previously been employed as a guard on the Eastern Counties Railway, another new source of employment, but in 1851 went in search of new adventures and was appointed "Head Keeper of the Serpent Room". (2) He was instructed in the care of the snakes by Mr D.W. Mitchell, the secretary of the Zoological Society, and employed for one guinea a week. But, as it was later discovered, Girling had a fondness for gin. His wife stated "He used to break out at times, but not while he was at his work. He went to it at 6 in the morning and returned at 6 in the evening. When he was intoxicated she had kept him at home in the morning until he was fit to go. He

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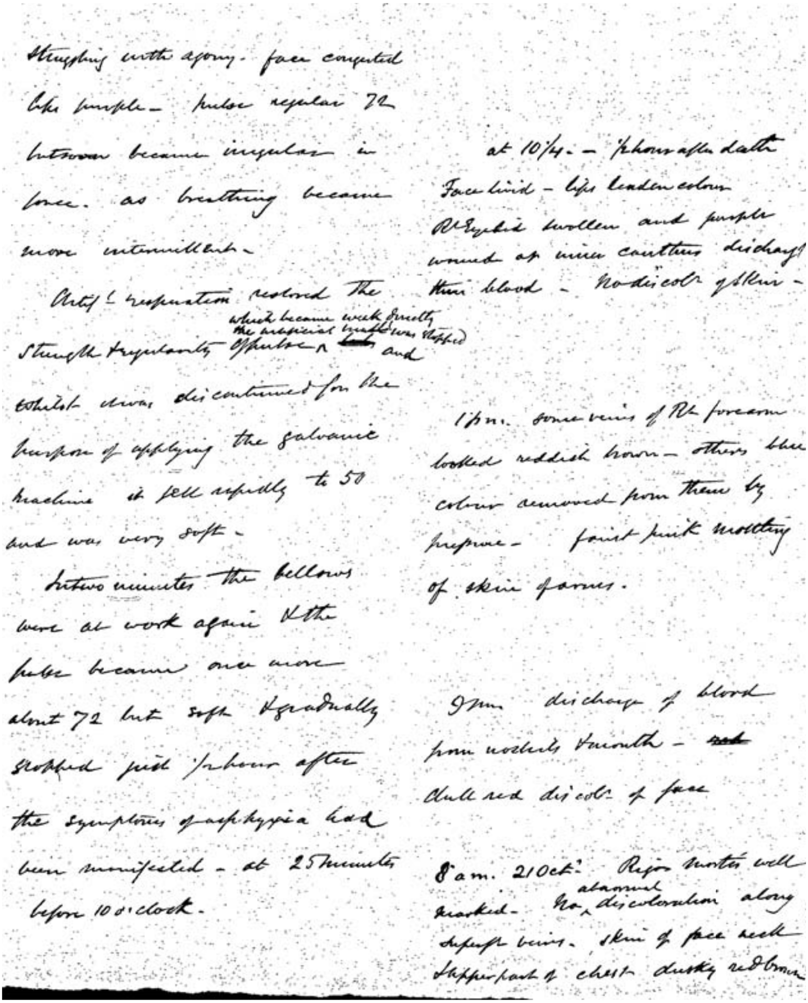
had never been suspended from his work…" Others told a different story and suspected he had been drunk at work in the past but they had not reported it, not wanting to cost the man his job.

On the night of the 19th of October, 1852, Girling was out drinking with a friend who was moving to Australia. Together with Edward Stewart, a temporary employee of the Zoo, they stayed up all night, having three pints of beer at the friend's house before moving to a pub in Shoe-lane where they drank quarters of gin until eight in the morning. From there it was straight to work where Edward Stewart, presumably still inebriated from the night before, was occupied in the relative safety of the humming-bird enclosure. But once he had gathered up a basket of sparrows for the snake house he went there to find Girling in "an excited state." Girling, emboldened by gin, had walked past the railing in the reptile house and proceeded to lift out a Morocco snake from its glass fronted cage. Despite the protests of his
friend he draped this snake around the unfortunate Stewart crying "I am inspired!". His friend bent down protesting that the snake would bite him at any moment, Girling relented and put the snake back where it belonged. Stewart went about his work only to hear his friend cry "Now for the cobra" – a statement which must have chilled him into instant sobriety. Unable to stop his friend he watched horrified as Girling took hold of the snake and put it under his waistcoat. The snake coiled around Girling's waist, came out the front and, as Girling took hold of its body, struck him in the middle of his face. Stewart fled in search of help and Girling managed to return the cobra to the safety of its cage and wash his bleeding face before being bundled into a cab and taken to University College Hospital (UCH).

About forty minutes after the accident Girling staggered into the hospital unable to speak or swallow and pointing to his throat. At the hospital a number of doctors went straight to work, trying to keep him alive –among them Joseph Clover, then the resident medical officer, and George Burder, the house surgeon. Girling was rapidly assessed in the casualty department and was then "transferred to the ward, undressed and placed in bed"(3) His condition deteriorated rapidly as he lost consciousness and his breathing became laboured. As his respiration ceased, artificial respiration was commenced with bellows with some improvement in the condition of the patient. Galvanic current was also applied with little effect but the respiratory resuscitation was effective for about half an hour, at which point the pulse weakened and ceased. Death was declared about 90 minutes after the accident.

Clover made the following notes about the presentation in his personal casebook:


struggling with agony - face congested
like purple - pulse regular 72
between became irregular in
force. as breathing became
more intermittent -
Artif. respiration restored the
strength & regularity of pulse which became weak directly the artificial breath was stopped and
whilst it was discontinued for the
purpose of applying the galvanic
machine it fell rapidly to 50
and was very soft -
In two minutes the bellows
were at work again & the
pulse became once more
about 72 but soft & gradually
stopped just 1/2 hour after
the symptoms of asphyxia had
been manifested - at 25 minutes
before 10 o'clock -

at 10 3/4 - 1/2 hour after death
Face livid - lips leaden colour
Rt Eyelid swollen and purple
wound at inner canthus discharg[ing]
thin blood - No discolr of skin -

1 p.m. some veins of Rt forearm
looked reddish brown - others blue
colour removed from them by
pressure - faint pink mottling
of skin forms.

9 p.m. discharge of blood
from nostrils & mouth - ~~red~~
dull red discolr of face

8 a.m. 21 Oct. Rigor mortis well
marked - No abnormal discoloration along
superf. veins. skin of face neck
& upper part of chest dusky red brown

Fig 1. Clover's notes on the case (4)

"Struggling with agony – face congested lips purple – pulse regular 72 but soon became irregular in force as breathing became intermittent.
Artif[l] respiration restored the strength & regularity which became weak directly the artificial breathg was stopped and whilst it was discontinued for the purpose of applying the galvanic machine it fell rapidly to 50 and was very soft.
In two minutes the bellows were at work again & the pulse became once more about 72 but soft & gradually stopped just ½ hour after the symptoms of asphyxia had been manifested – at 25 minutes before 10 o'clock" (4)

Burder, as the house surgeon responsible for the reporting, made more detailed notes, preparing for the inquest and the inevitable public scrutiny. But the observations did not stop there, Clover's notes continued:

"At 10 ¼ - ½ hour after death. Face livid – lips leaden colour. Rt eyelid swollen and purple wound at inner canthus discharged thin blood – no discol[n] of skin.

1pm. Some veins of Rt forearm looked reddish brown – others blue colour removed from them by purpose – faint pink mottling of skin & arms.

9pm discharge of blood from nostrils & mouth – dull red discol[n] of face

8am. 21 Octr. Rigor mortis well marked. No abnormal discoloration along superfl veins. Skin of face neck & upper part of chest dusky red brown purple discol[n] of front part of body except where pressure had been face generally rather swollen Rt eyelid resumed its natural size and little darker than the rest of the face."

They knew little about this venom and its effects on the body and this case presented a unique opportunity. "…the attention of the profession has been attracted by the hope of gathering facts which might lead to better knowledge of the nature of the venom, and possibly conduce to the discovery of an antidote". (5) This was Victorian medicine, very little in the way of specific medicines and treatments, but constantly documenting and searching for clues, describing the smallest changes in a patient's condition (even after death) in the hope that it may yield information leading to an eventual cure.

Clover was not the only one visiting the body and taking notes. Burder also made intermittent notes during the following day and the post mortem was eventually conducted on the afternoon of the 21st October. Experiments were conducted with the dead man's blood and Mr Marshall (assistant surgeon to UCH) "tried the blood in the dead-house with hydrochloric acid, and found that some vapours of ammonia were evolved."(5) A mouse was also injected with

some of the blood but "did not experience any ill effects."(5) The blood itself was noted to be dark, alkaline and fluid and emitting an unusual odour.

On the 22nd October the body was on view again, this time before the jury and the wife of the deceased at the inquest. Thomas Wakley, editor of the Lancet, was the coroner presiding over the proceedings and, after viewing the body, the entire court departed for Regent's Park to view the scene of the accident. The cobra, displayed in its glass case, took refuge "from the gaze of the respectable jury in a small water tank with which the compartment is provided" (2)

The post mortem revealed nothing unexpected and Burder reported that death was due to asphyxia. There was no argument from the coroner about the cause of death or the hospital treatment and his only criticism was to suggest that someone at the scene of the incident should have applied suction to the wound. Had he been there, he stated, he would have not hesitated to do so – a safe enough proclamation from where he was sitting. The jury, suitably instructed by Mr Wakley returned the only sensible verdict "…that the deceased had lost his life by the bite of a serpent known as the cobra de capella, when in a state of intoxication, and in consequence of his own rashness and indiscretion." (2)

What is intriguing is that this patient was resuscitated, albeit unsuccessfully, with artificial ventilation using bellows. The Royal Humane Society, established in 1774, advocated the use of bellows for resuscitation after drowning from about 1776 onwards.(6) Instrument makers were quick to develop sets which came with a variety of airways and tracheal tubes. Charles Kite, aware that tracheal intubation was difficult in unskilled hands, developed a nasal airway which was included in his resuscitation set and was used with cricoid pressure. In 1827 Leroy reported a survey of resuscitation practices and animal experiments demonstrating that over-distension of the lungs could rupture the alveoli and that modern resuscitation practices were producing worse results than before the introduction of bellows.(7) The acceptance of his work in France led to the technique being abandoned and by 1832 The Royal Humane Society in Britain had also abandoned the use of bellows and resorted to warming and rubbing their drowned patients.

Hospital resuscitation practices are less well described and this case would suggest that, in London at least, resuscitation with bellows continued to be performed in the 1850s. Joseph Clover's papers reveal another case of resuscitation with bellows at UCH in 1848 in a patient who had ingested a fatal dose of prussic acid:

"June 2nd, 1848. The stomach pump was now used but very considerable difficulty was experienced in getting it down the gullet beyond the extent of 6 or 8 inches (leading me to suppose that it might have gone down the trachea). Warm water & ammonia were used to wash out the stomach …Galvanism was used from the spine to the sternum. Artificial respn …by bellows (Two persons should be engaged in pushing the abdomen and thorax & the larynx shall be pressed back against the vertebra). He died in about ½ hour." (8)

These notes were made by Clover shortly after he completed his medical degree and just before he took up the post of resident medical officer. His notes in brackets suggest that this was a technique that was regularly practised at the hospital and had some protocols attached to it. They also suggest that it was not a technique Clover had used before because he usually only noted new or interesting experiences. Exactly the same technique was described at the inquest in the resuscitation of Mr Girling 4 years later at the same hospital

"The bellows for artificial respiration were now brought into play, the nozzle for the instrument being introduced into the nostril, the pharynx closed by pressure upon the larynx, and the expulsion of in the injected air being aided by firm rhythmical pressure upon the chest and abdomen".(9)

It would seem that bellows were standard equipment for resuscitation at University College Hospital at this time: "preparations were made without delay for the employment of artificial respiration. Probably within a minute after the man was in bed the apparatus was in readiness."(3)

The bellows were not used two years later when, on the 11th October 1854, the shoemaker George Sands, was given chloroform for the insertion of a urinary catheter. The surgeon, Mr Erichsen, noticed that the patient's respiratory rate had slowed alarmingly and " …desisting from the use of the catheter, he immediately commenced dashing the patient's chest and face with water."(10) He then dragged the tongue forward with his finger and performed mouth to mouth resuscitation. Resuscitation seems to have proceeded for about five minutes and the galvanic apparatus was found and applied – but there is no mention of bellows, either they were not readily available or the protocols at the hospital had changed.

There is a recorded case of the use of bellows for resuscitation after chloroform - this time across the river at St Thomas's Hospital. John Shorter, a 48 year old porter was having a toe nail removed under chloroform on October 10th 1849 when he abruptly ceased breathing. Once again he was doused in cold water, his

chest was rubbed and ammonia applied to his nose. He struggled for a while but then became still and pulseless.

"Immediately after the appearance of these symptoms, artificial respiration was commenced by depressing the ribs with the hands and then allowing them to rise again until the proper apparatus was brought, when respiration was kept up by means of the trachea tube and bellows, and oxygen gas introduced into the lungs by the same means. Galvanism was also applied through the heart and diaphragm, but all signs of life ceased about six or seven minutes after the commencement of inhalation." (10)

From 1856 Marshall Hall's method of resuscitation became popular, followed a few years later by the Sylvester method. All the reports of death following chloroform that Snow collected after 1856 contain reference to the Marshall Hall method and there are no further references to bellows. In Clover's casebooks there are references to both the Sylvester and Marshall Hall methods and, once again, no further references to bellows. It would seem that, despite the Royal Humane Society withdrawing their endorsement of bellows for resuscitation in 1832, they either continued to be used in some London hospitals until at least 1854 or were reintroduced during that time.

Acknowledgements

I would like to thank Michael Palmer, the archivist to the Zoological Society of London, for the information he provided and for his prompt responses to my emails.

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THE DEVELOPMENT OF THE PENSTAR ANAESTHETIC MACHINE 1980-86

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Background

The stimulus for the development of a new anaesthetic machine was the author's move from the Royal Postgraduate Medical School (RPMS) at Hammersmith Hospital, London, to the Nuffield Chair of Anaesthetics at Oxford in June 1980. At the RPMS, I had studied the performance of anaesthetic breathing systems,[1] designed an anaesthetic machine based on the East-Radcliffe ventilator,[2] and cooperated with manufacturers on the design and testing of ventilators and humidifiers. [3] During this period I also served on the AAGBI Safety Committee and on British and International Standards committees. This work made me aware of the deficiencies of much of the anaesthetic equipment at that time, and brought me into close contact with engineers concerned with the development of new anaesthetic apparatus, including Ray Sugg, Technical Director of Penlon Ltd, of Abingdon, near Oxford.

The Nuffield Department of Anaesthetics (NDA) had nurtured the development of a wide range of anaesthetic equipment since its foundation in 1937. [4] Some 2,700 Oxford vaporisers were manufactured in the Morris Motor works at Cowley and distributed to the Services during the Second World War,[5] and the Macintosh laryngoscope was produced by technicians from the NDA who founded the Longworth Instrument Company in 1943. This company became Penlon Ltd; they subsequently manufactured various items of equipment developed in the NDA that included the EMO vaporiser,[4] the Oxford miniature vaporiser,[5] the Penlon A-P ventilator [6] and the Oxford ventilator.[7]

The development

Recognising the wealth of expertise available in the department, and with the support of Dr Clive Hahn (then a University Lecturer in Anaesthetics and, later, Professor of Anaesthetic Science), I approached Ray Sugg and Tony Hillier (then Chief Executive of Penlon Ltd), to see if they were interested in producing an anaesthetic machine based on entirely new principles. They were enthusiastic and agreed to go ahead providing that adequate finance could be found to support the project.

I knew that Geoff Cooper, an engineer working in the Anesthetic Department in the Massachusetts General Hospital, Boston, USA, who had developed a major interest in patient safety,[8] had produced a new machine that eliminated some of the dangers associated with older machines,[9] and I also knew that some European manufacturers were beginning to take an interest in the problem. Clive Hahn had joined the Nuffield Department in 1967 and had not only developed a major interest in clinical measurement, but had also started to investigate methods of assessing lung function by the analysis of the expired gases during the inhalation of sinusoidally-varying concentrations of inert gases. He and his colleagues had started to use rapidly oscillating valves to produce the changing pattern of inspired gas concentrations and they realised that, with suitable microprocessor control, such valves might be used to control gas and vapour concentrations in the new machine. It was hoped that the use of such a system would eliminate the costly machining and other disadvantages of conventional flowmeters and vaporisers, and that the provision of microprocessor control and monitoring of other machine functions could eliminate malfunctions that had caused deaths in the past.

With these ideas in mind, and the information from recently published analyses of anaesthetic machine function and design,[10 11] we proceeded to draw up a design for the new machine.[12] The plan was that the design and development work on the various components of the system and the microprocessor control would be based in the NDA while staff at Penlon would take care of the overall design of the machine and the production of components and prototypes. A Microprocessor Development Grant was obtained from the Department of Industry and additional financial support was received from the Department of Health and Social Security. We appointed Roy Jackson, a software engineer, to work full time on the development of the microprocessor systems. Clive Hahn and a recently appointed NDA physicist, Eileen Palayiwa, concentrated on the development of the gas mixing, vaporisation and gas analysis modules, and a number of research fellows and technicians helped with other aspects of the development. Dr Lyn Davies, the Senior NDA electronics engineer, supervised the NDA side of the electronics and software development of the machine. Ray Sugg created a similar design and development team in Abingdon, and brought in an outside consultant to design the control panel and general image of the machine.

Work on the machine started in 1981 and by 1983 a prototype had been built and demonstrated to potential purchasers in the USA –see Figure 1. During this visit it became apparent that American anaesthetists were employing circle CO_2 absorption breathing systems with low fresh gas flows while UK anaesthetists

were increasingly using Mapleson D (Bain) systems. I realized that it was necessary to increase the flexibility of the machine and on the overnight flight

Fig. 1 Ray Sugg with Penstar prototype in 1983

back to the UK sketched out a completely new breathing system assembly that enabled the operator to select circle, non-rebreathing or Mapleson A or D systems by the touch of a switch. Many other modifications to the original design were made in response to rigorous testing of components and their interactions with each other. For example, Eileen Palayiwa, who undertook much of the development work on the flow control valves [13] and vaporizer systems,[14] discovered that nitrous oxide was surprisingly soluble in the volatile

agents,[15] so the vaporizer system had to be redesigned to reduce errors in the delivered vapour concentration due to this effect. Another problem was that, at this time, there were few rapid gas analyzers available commercially, though the design team knew that rapid response multi-gas analyzers were being developed. The NDA-Penlon team remembered that in the 1940's the NDA physicist Dr H.G. Epstein had used a two-metre long Rayleigh refractometer to calibrate the Oxford vaporizer and had later used it to calibrate other vaporisers that were developed in the department, so it was decided to develop an analyser based on a commercially available compact interferometer designed to detect dangerous gases in mines. Since the interferometer had a slow response and could not differentiate between nitrous oxide and the inhalational anaesthetic agents when they were both present in the refractometer cell, sequential sampling of the fresh gas flow at each stage of the gas and vapour mixing process was utilised. The refractometer technique proved to be very reliable, but the development of an automated analyser was extremely time-consuming and involved collaboration between many workers. [16 -18]

One of the major aspects of the development was the necessity to ensure that all the components performed within given limits of accuracy, and that their interaction with each other did not introduce a new and unanticipated hazard. The microprocessor system not only controlled delivery of the set gas flows, gas and vapour concentrations, and the ventilator performance, but also checked that the set parameters were bring delivered within specific limits. There were many other safety features that ensured that the operator could not use the machine in an unsafe mode. To cite but two, the Mapleson A system could only be selected if ventilation was spontaneous and the fresh gas flow rate was adequate, and there were several independent mechanisms to prevent the administration of a hypoxic gas mixture. See Figures 2 and 3.

The development of the microprocessor control systems provided a major challenge for Roy Jackson because he had to modify his system continually to incorporate design changes and new developments; he had also to ensure that the system was not affected by fluctuations in the electrical supply, by electrical interference and by other hazards associated with the operating theatre environment. There were very complex interactions between the various components of the machine and their microprocessor systems, and safety could only achieved by developing new techniques of fault analysis. This was a long and tedious process involving the development of many novel techniques.

By 1986, the design was considered satisfactory and six machines were built for clinical trials. The intention was to trial these in selected centres in the UK and overseas. I had just started to introduce the first machine into the Oxford operating theatres in 1987 when disaster struck. The NDA team learnt that

Penlon had been taken over by another commercial group who had decided that the project was not in its interest (its very design conflicted with its other commercial products) and that all further development was to stop.

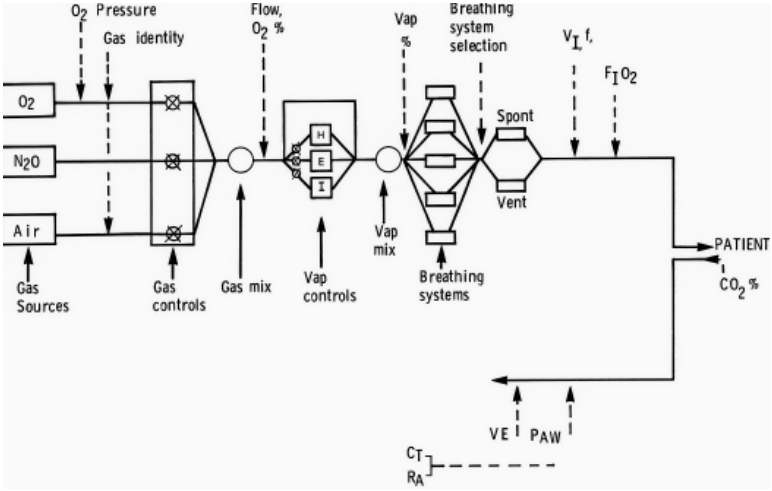

Fig. 2 Penstar design showing monitoring sites for O_2, inspiratory flow & frequency, expiratory CO_2, flow & volume; also airway pressure from which were derived total thoracic compliance (CT) and airway resistance (RA)

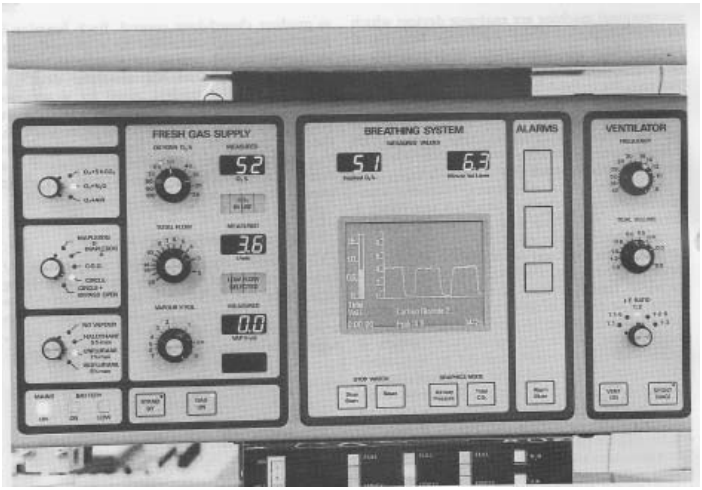

Fig. 3 Penstar panel

The aftermath

All the members of the development team were devastated by the news, and for those in Penlon the decision had a major impact on their lives. Those in the academic environment, who were not dependent on the development for their future sustenance, were able to redirect their energies into other research projects, while Roy Jackson was able to utilise his talents and experience in other fields of endeavour. The project had provided the NDA team with many intellectual challenges, had utilised its resources to the full, and had provided material for seven papers,[12-18] Eileen Palayiwa's Ph.D. and Roy Jackson's M.Phil. theses,[19 20] and a number of presentations. While I was still in post I could not bear to order the destruction of the prototype, and neither could my successor, Professor Pierre Foëx. For twenty years, it resided in the NDA basement store. However, the closure and demolition of the Radcliffe infirmary site in 2008 led to its transfer to the Association of Anaesthetists Heritage Centre and stimulated me to retell the story of the development of the machine. We all found that the intellectual challenges provided by this project expanded our horizons, and although we were disappointed by the outcome, felt that time spent on the project had not been wasted.

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THE COXETER PORTABLE ANAESTHETIC MACHINE

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Description

This presentation concerns a portable table top anaesthetic machine made by Coxeter, probably in the 1930's. Shown in Figure 1, it consists of a jar (a vaporizer) for chloroform and a jar for ether, both marked in drams (1 dr ≈ 3.5 ml), and both connected in series by a 'backbar'. Each jar has a switch associated with it on the backbar to vary the output from that jar, although in contrast to modern practice, there seems to be no mechanism to prevent simultaneous use of both agents. On the input side to the backbar, on the left of the picture, is a manually operated bulb with a one way valve, for squeezing air into the jar to aid air flow through the system and aid vaporization of the liquid agents. This is in series with another bulb which is more flexible, primarily for smoothing the air flow from the manually squeezed bulb, but also for visualising any downstream respiratory effort by the patient, which makes it a bit like a reservoir bag. The output conduit from the backbar consists of a tube which goes to a vacuum insulated flask, shown on the right at the rear of the picture in Figure 1, which is intended to be filled with water to warm the mixture of air and volatile agent, which may have cooled following the vaporization process. The vapour thence goes via another long, rather narrow tube to an air breathing patient to the right from the picture.

Design

The rationale for the design of this apparatus is simplicity and portability for use in a non-hospital surgical environment. No piped or cylinder gases are required, and it is assumed that the patient will breathe air spontaneously. The narrowness of bore of the tubing leading to and from the backbar is remarkable by modern standards, and supports the notion that the majority of the patient's spontaneous ventilation consists of air and takes place outwith this device and its vapour output. The pressurising bulb squeezes relatively small amounts of air through the system to the patient compared to the patient's likely minute ventilation, even with respiratory depression caused by the anaesthetic agent. Nevertheless a component of the patient's respiratory pressure waveform is visible as far back as the reservoir bag on the input side, which therefore acts as a visual respiratory monitor. The switching devices for each jar, shown on the backbar in Figure 1, do not seem to prevent the simultaneous use of both agents, but this may be deliberate, since there was at one time a vogue for using both agents

Fig. 1 The Coxeter portable anaesthetic machine

Fig. 2a The backbar and vaporizing mechanisms, side view, agent jars removed

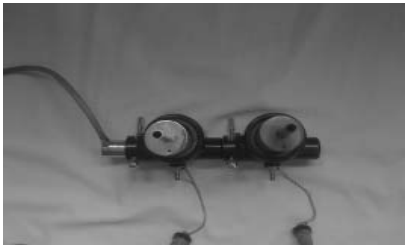

Fig. 2b View from the bottom, agent jars removed

simultaneously. The air inlet from the backbar into each jar, the vaporization mechanism referred to in Figure 2, is designed so that a portion is directed into the air and vapour containing space above the liquid agent, and another portion is directed through metallic tubing to near the bottom of the jar, designed to ensure a jet of air bubbles through the liquid agent. Figure 2a shows these devices from the side with the jars removed, and Figure 2b shows them from the bottom. The air goes from the backbar through the wide section in which there

is a small hole to allow air to flow into the air space above the liquid agent, and the remainder of the air issues from the narrow tube into the liquid agent. The metallic tubing in the chloroform jar is made of stainless steel, while that of the ether jar is made of copper;
copper ions act as a preservative for ether. The ether jar also sits in a small container, which can be filled with warm water to ensure its vapour pressure does not fall. The backbar outlet goes into the vacuum flask, also filled with warm water, in a long U shaped tube to ensure good thermal exposure and warming of the vapour mixture.

Use of chloroform and ether together

It is of interest to dwell on the physico-chemical properties of chloroform and ether in relation to each other and in relation to more familiar agents, such as desflurane and sevoflurane, in order to remind ourselves of the rationale for their use; these are shown in Table 1.

Agent	**Mol. Wt.**	**SVP @ 20ºC. (mm Hg)**	**Boiling Pt. (ºC)**	**Blood/gas solubility**	**Oil/gas solubility**	**MAC (Vol. %)**
Chloroform	119	170	61	8.4	265	0.7
Ether	74	440	36.5	12.1	65	1.9
Nitrous oxide	44	39000	- 89	0.47	1.4	105
Sevoflurane	200	157	58.5	0.69	53	2.0
Desflurane	168	660	23.5	0.4	19	6.0

Table 1 Physico-chemical properties of chloroform, ether and other agents

Ether is a remarkably volatile agent, with a high saturated vapour pressure (SVP) and a low boiling point, rather akin to desflurane. Chloroform is rather less volatile, with a lower SVP and higher boiling point, rather like sevoflurane.
The bood-gas solubilities of both agents are at least an order of magnitude greater than those of the two modern agents, which means that by modern standards, the onset of anaesthesia is slow, with chloroform having the slightly faster onset. Ether and sevoflurane have similar oil-gas solubilities, with correspondingly similar MAC values and potencies. Chloroform, on the other hand, has a much higher oil-gas solubility, with a correspondingly lower MAC, and with a potency correspondingly greater than either desflurane or

sevoflurane. The popularity of chloroform after its introduction was presumably due to its potency, although this came with added potential hazards of respiratory and cardiac depression. The contrasting properties of ether and chloroform thus explain why they were often available together on an anaesthetic backbar.

History of the Coxeter portable machine

In researching the subject matter for this device, which came into the author's possession through family connections, almost no information was available on its history. It appears to resemble the Shipway apparatus, shown in Figure 3, which has similar structural (and presumably functional) characteristics. These include the backbar, chloroform and ether vaporisers in series, warming baths for the vaporisers, and a thermos flask for warming the vapour-air mixture at the output.

Fig. 3 The Shipway apparatus

Acknowledgements

I am grateful to the following people for providing me with additional information and resource on the Coxeter portable anaesthetic machine and similar devices: Mrs Patricia Willis of the AAGBI Heritage Centre, Professor Sir Keith Sykes, Dr David Zuck, Dr David Wilkinson, Dr Michael Ward.

LLANDRINDOD WELLS: the development of a spa

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Early settlement

Llandrindod Wells is a fairly modern creation. The name *Llandrindod* means 'the church of the Trinity' and this name is derived from what is known locally as 'the Old Church', which stands proudly on its hill-top location about one mile south-east of the modern town. This old parish church dates from about the thirteenth century.

Llandrindod Old Church – 'the church of the Trinity'

Llandrindod did not exist as a settlement at the time the church was built. The church would have served a very scattered and very sparsely populated rural farming community. However, there is evidence of much earlier human existence in the surrounding area. There are many hill-top locations which show the remains of prehistoric settlement but, most importantly, there is evidence of Roman occupation in the area.

At Castell Collen, one mile north-west of the present town, there are the remains of a large and important fort. To the south of the town, there are the remains of numerous Roman practice camps. Earthworks at Llyn Gwyn (four miles north-west of Llandrindod) are claimed by some to be the site of the baths of the Roman garrison of nearby Caer Fagu. The Romans would certainly have had their bath houses at the local forts, but they also may have been aware of the curative properties of the local waters. Marjorie Sykes states that Llandrindod's mineral springs had been known for many centuries. The Romans, who were quick to discover such health-giving waters wherever they went, had a station nearby called *Balnae Silures*.

However, knowledge of the local springs fell into oblivion and Llandrindod continued to be unknown and undeveloped. In fact, it was nearby Cefnllys that developed into a medieval borough. Even when the county of Radnorshire was created by the Acts of Union of England and Wales between 1536 and 1543, Llandrindod did not exist as a settlement.

Castle Bank at Cefnllys. A medieval castle stood at the top right of the ridge and the medieval borough of Cefnllys stood between the church on the left, and the bottom of Castle Bank.

Discovering and exploiting the waters

About 1670, three springs were rediscovered. These were sulphur, saline and chalybeate springs and the area around present-day Llandrindod became know as 'Ye Wells'. The *Gentleman's Magazine* reported the extraordinary benefits that various persons had derived from taking the waters. As a consequence, visitors then came to drink the waters, but only in small numbers. Llandrindod was undeveloped and very remote.

In 1736, Mrs Jenkins, a resident of what was becoming known as the village of Llandrindod, rediscovered the saline spring as well as the sulphur spring at the site of what was to become the area's premier hotel, The Pump House Hotel. Mrs Jenkins became famous by claiming several important cures that she had achieved with the spring waters. This brought the area to the notice of a wider clientele and to subsequent prosperity.

A book entitled *A Journey to Llandrindod, in Radnorshire, with the Parson's Tale – A Poem* (1746) also helped to make the area better known. The author was apparently so grateful for having been restored to good health after taking the local waters that he wrote, "Let England boast Bath's crowded springs/Llandrindod happier Cambria sings…". The eighteenth century was a time when 'taking the waters' was very fashionable and felt to be beneficial for a whole range of ills.

In 1748, the area received a further boost when another poem, this time in the *Gentleman's Magazine*, also praised the Llandrindod waters. This led in 1749 to an enterprising speculator from Shrewsbury, Mr William Grosvenor, developing the area. Mr Grosvenor leased and built several houses and established a large and well-appointed hotel on the site of a farmhouse now known as Llandrindod Hall, just below the Old Parish Church. Grosvenor spared no expense in making his *Grand Hotel* attractive. People suffering from all kinds of ailments flocked to this newly-emerging spa as the local waters were considered to provide an infallible remedy for all kinds of sickness. The hotel could accommodate several hundred visitors. The season extended from Easter to November and the area was overcrowded with visitors.

However, there was a downside to this development. Plenty of provision was made for the amusement of the visitors. A racecourse was established and gambling and other vices flourished. Indeed, Llandrindod became the resort of a rather wild set whose debaucheries brought the little village spa (population less than 200) into disrepute. Gamesters and other undesirables came and it was said

that £70,000 was won and lost in a day at the gaming tables. In 1787, the hotel closed down on the expiry of the lease.

The establishment of the *Grand Hotel* had brought some bad publicity to the emerging spa of Llandrindod. However, just after the establishment of this hotel, the spa had received welcome positive publicity. In 1754, Dr Wessel Linden, an eminent German physician, visited Llandrindod and, in 1756, he wrote a treatise in grateful praise of the medicinal value of the springs in the area.

Dr Linden seemed to have been suffering from several diseases but, after a month's course of saline water, he found himself perfectly cured. In his publication, *A Treatise on the Three Medicinal Mineral Waters at Llandrindod in Radnorshire*, he wrote: "I have seen and made trials of several medicinal mineral waters in various parts of Europe, and have read of many more that have been tried by more able hand, but as yet I have not met with any of the same kind as those that surpass these at Llandrindod". The area received considerable publicity from such glowing praise but, still, visitors were slow to come 'to take the waters'.

It was not until the early nineteenth century that Llandrindod gained a fresh lease of life. In 1817, Dr Richard Williams of Guy's Hospital wrote a book entitled *An Analysis of the Medicinal Waters of Llandrindod.* This gave favourable publicity to the spa and, as a result, the Pump House Hotel was built. This was to become the premier hotel in the town. From about 1830, it boasted a double tariff: 'first class visitors' paid 42 shillings a week; 'second class visitors' paid thirty one shillings and sixpence; and the charge for servants was one guinea.

The spa at Llandrindod was now developing and a different kind of clientele was being attracted. For those visitors who could not afford to stay at the Pump House Hotel, the Llanerch Inn and the Rock House Inn were available as well as local farmhouses.

The Pump House Hotel (Courtesy of the Radnorshire Museum)

Taking the waters

Both the *Gentleman's Magazine* and Dr Wessel Linden had heaped praise on the benefits of the Llandrindod waters. Three different types of water had been discovered which were thought to have medicinal properties.

Saline water was served at the Pump House Hotel. The saline water was thought to be best drunk before 7 a.m. and, as a consequence, there would be long queues of visitors early in the morning, trying to drink as much water as possible before the early deadline. This early morning dose of saline was generally served hot, the water being heated by passing it through coiled pipes in hot water, in order to retain the gases. Saline water was regarded as a mild laxative, diuretic and alterative. It was believed to stimulate appetite and promote digestion and it was especially effective in getting rid of waste materials from the body! The Llandrindod saline water was awarded a bronze medal at the 1881 Balneological Exhibition at Frankfurt.

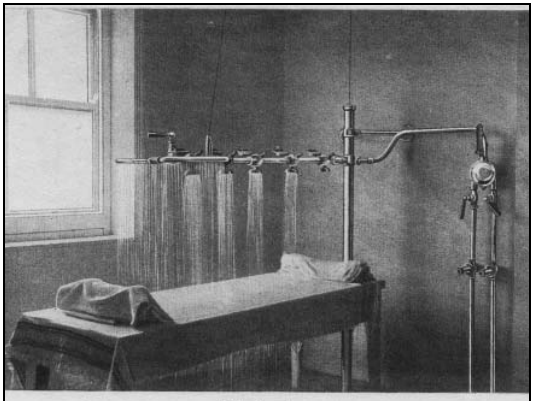
Sulphur water was served at the Rock Park Spa. It was also regarded as a mild laxative, as well as being diuretic and alterative. It was believed to have a selective action on the skin, mucous membranes and excretory organs. The Public Analyst of the City of Gloucester found the presence of radium in the water. It was believed that the sulphur water was best drunk in the afternoon and it was considered that the water should be consumed on the spot as it was thought by many to be ineffective if drunk ten to twelve yards away.

The chalybeate iron spring was also located at the Rock Park Spa. This water was essentially tonic and beneficial in cases of anaemia and debility and was drunk after meals. This chalybeate spring was popularly known as the 'Rock Spout' and was the only free spring. It was dedicated to the free use of the public by the lord of the manor, J. W. Gibson-Watt, a descendant of James Watt.

'The Cure' would take at least three weeks. Chronic cases of illness would take longer to cure, undoubtedly invigorated by the pure air, as Llandrindod is located on a plateau in the lee of the Cambrian Mountains, at a height of seven hundred feet above sea level. As well as drinking the waters at the times specified above, baths could be taken at suitable hours during the day and much time was spent in the open air, in games and in walking on the hills.

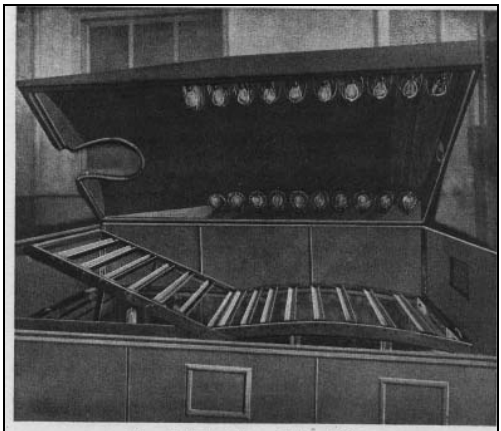
The 'Medical Notes' from a 1916 guide book to Llandrindod Wells stated:

"Although 'drinking the waters' is in itself of great use in most cases, in many conditions baths in some form, application of heat or light, or electric currents, or massage, are also necessary or desirable. These are provided at Llandrindod Wells in great variety; indeed, practically every form of spa treatment is administered, including immersion, reclining, circular, needle, Aix, Vichy, Scotch and spinal douches; Nauheim treatment; Plombières and Tivoli baths; the Tyrnauer and Dowsing hot-air electrical appliances, including high-frequency Schnee battery and X-ray apparatus. Massage and Swedish exercises are administered by English and Swedes, both at the various baths and in the rooms of patients".



Vichy Douche

Schnee 4-Cell Bath.



Electric Radiant Heat and Light Bath

Pictures courtesy of Mrs N. Baird-Murray

The development of the town

As Llandrindod became more widely known for its spa treatments and for its attractive setting in Mid Wales, the town was able at last to develop. A crucial element in the development of Llandrindod was the arrival of the London and North Western Railway (LNWR) in 1865. The area's isolation was ended and the town was linked by rail with the English Midlands and with London. Llandrindod now changed its image. It became Llandrindod *Wells*. This proved far more attractive to visitors to the area.

The development of Llandrindod Wells was greatly helped by the passage of an enclosure act about this time. The Swydd Neithon Enclosure Act released 3,220 acres of common land for building. Two enterprising entrepreneurs – Sir Richard Dansey Green-Price and Mr E. Middleton Evans – were principal landowners in the area and sold off numerous plots of land for building. From that time on, the growth of Llandrindod Wells as a spa was rapid and continuous and, by 1886, it had acquired the title of 'Queen of Welsh Watering Places'.

A late resident of Llandrindod Wells recalled the town's continued development:

"At the time when I was born, in 1891, the resident population was 784 and the number of dwelling houses 160. [By 1901, the resident population had risen to 1848 and the number of dwelling houses to 384.] My earliest recollections are of a very scattered place, with many unfinished roads. There were a great many plots of gorse-covered land, with notice-boards advertising building sites for sale. The town had a remarkably fresh, well-painted appearance. Everywhere one saw building in progress. But there was no serious effort to plan a proper layout: in the hurry to accommodate the increasing numbers of visitors, it became a sprawling place, lacking orderliness and compactness".

Numerous hotels were built in the town and others were considerably updated and expanded. The premier hotel of the town was the Pump House Hotel. It had evolved from the 1736 building first occupied by Mrs Jenkins through various phases until it was entirely rebuilt in 1888. It continued to offer saline and sulphur 'cures'. (The Pump Room still exists alongside the present Powys County Hall.) Sir Richard Dansey Green-Price had acquired the Rock Park Estate. He developed the Rock House Hotel on the 40 acre site, with its own 9-hole golf course and 7 miles of fishing on the River Ithon. The Rock House Hotel offered waters from a magnesium spring, a radium sulphur spring and a lithium sulphur spring. The Hotel Metropole itself evolved from Coleman's Hotel, to the Bridge Hotel and then it adopted its present name.

The Llandrindod 'Old Church' was no longer felt to be suitable as a parish church for a developing and aspiring spa town. In 1871, Holy Trinity Church was built out of local stone at a cost of £3,000. It was further enlarged in 1897 and again in 1902, at further cost, for an accommodation of 900, reflecting the development of the town and the aspirations of its people. Other nonconformist churches were built, often in outstanding architectural styles, in order to compete with the parish church. These ecclesiastical establishments catered to the 80,000 visitors a year who came to Llandrindod Wells when it was at the height of its popularity.

Llandrindod Wells Urban District Council was created in 1894 and the town acquired the buildings necessary for the effective running of an urban area. However, a very important building had already been constructed in 1880 – the Llandrindod Wells Cottage Hospital and Convalescent Home. Land for the site was given by Mr E. Middleton Evans and the cost of the original building (about £1,000) was raised by public conscription. Further extensions to the building were added in 1883 and again in 1895. Dr William Bowen-Davies was the first resident doctor in Llandrindod Wells, from 1872. He was instrumental in the creation and organisation of this important asset to the town, an asset which continues to provide invaluable service for the people of Llandrindod Wells.

Llandrindod Cottage Hospital, showing the original building of 1880 in the centre of the picture.

A new direction

Although the great British spa era had come to an end by 1914, Llandrindod Wells was a late developer compared with the English spas and the 1920s witnessed a boom period for the town, when 80,000 visitors a year came to Llandrindod Wells. However, with the outbreak of the Second World War in 1939, many of the prominent hotels in the town were taken over by the government for war hospitals and treatment centres.

Llandrindod Wells as a spa town was never the same again after the end of the war in 1945. Social habits had changed and old-fashioned spa holidays with their expensive 'cures' were no longer fashionable. The creation of the National Health Service in 1948, with its free treatment for all, sounded the final death-knell for spa towns like Llandrindod Wells.

Since the 1950s, Llandrindod Wells has moved in a new direction. It is now a conference centre, situated ideally in the centre of Wales and a sports championship centre for bowls and golf. Since the creation of the new county of Powys in 1974, it has been the administrative centre for this county's large and scattered rural county. Although Llandrindod Wells has changed direction, one building has not: the Hotel Metropole still offers modern-day 'spa facilities' and still caters for visitors from afar.

The Hotel Metropole

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PROFESSOR J ROGER MALTBY

Dr Alistair McKenzie
Hon Editor of the History of Anaesthesia Society

(Citation at the AGM of the HAS, Llandrindod Wells, 25 June 2010)

I have the honour of delivering this citation to mark the election of Professor J Roger Maltby as an Honorary Member of the History of Anaesthesia Society.

Roger was born and educated in England, graduating MB, BChir in 1961. After house jobs he went into general practice (1964-66) in England and Canada. Then he pursued specialist training in anaesthesia at Sheffield and Nottingham, obtaining the FFARCS in 1968. The following year he moved to Canada and soon settled into a career at the Foothills Hospital, University of Calgary.

Roger has published important papers on the history of anaesthesia since 1975. He became well known as an international presenter of note by his excellent deliveries at the First International Symposium on the History of Anaesthesia (ISHA) in Rotterdam, 1982, and at many other congresses and ISHAs.

I first met Professor Maltby at the Fourth ISHA held in Hamburg in 1997. Within five minutes I appreciated that here was a man with an excellent knowledge of the history of anaesthesia. Moreover, he was thirsty for more information and keen to engage with others in this quest. Over the years we struck up a friendly exchange of correspondence.

Roger has been a member of the History of Anaesthesia Society since its inception in 1986. He has presented quality papers at many meetings of the Society. Furthermore, he has been valued as a good listener to the presentations of others – someone who will pose the question that leads the researcher in the right direction. His efforts in travelling the long distance from Alberta, Canada to the UK are highly commendable.

In 2002 Roger produced his book *Notable Names in Anaesthesia*, which received the British Medical Association's 'Basics of Medicine' Book of the Year award, and also the David M Little award of the Wood Library-Museum. This book has become an important source of reference for historians.

In conclusion, I have great pleasure in announcing the investiture of Roger Maltby with the Honorary Membership of the History of Anaesthesia Society.

BOOK REVIEW

Visionaries and Dreamers – The story of the founding fathers of Anesthesiology in Israel. Gurman GM, in collaboration with Granot L. Beer-Sheva: Ben-Gurion University of the Negev Press, 2008 Paperback 228 pp. duplicated in Hebrew, plus illustrations, no index. Price US$ 16.43.

The National Health Service and the State of Israel have the same year of their creation, namely 1948. The NHS commemorated the 60th anniversary as a milestone in its history and it is appropriate that Dr Gurman is to be commended for choosing the occasion of the 60th anniversary of the State to produce an account of the history of anaesthesia in Israel with details and anecdotes of those anaesthetists he knew and who set up departments in the country. The book is in two parts – one in English and the other in Hebrew, which is intended to pay tribute to these founders and to remind the local population of the debt they owe them for setting up safe anaesthesia for all branches of major surgery and for caring for the injuries of warfare. The English reader however will find the title cumbersome and unattractive. This is not a translation of the Hebrew which comes from the Gemorrah, the commentary in the Talmud in section Bezah which states 'on the eve of the Sabath the Holy one blessed he gives to man an enlarged soul' which is intended to give added praise to the founders. However not intended is the continuation of the commentary which is 'and at the close of the Sabath it withdraws it from him'. The biblical story of the birth of Eve when the Lord God caused **a** deep sleep to fall on Adam to remove a rib, in Hebrew is tardemah and is the modern term for anaesthesia.

In the war of independence Israel acquired additional territory but lost access to mount Scopus where the Hadassah hospital was situated. The hospital was endowed by the organisation of that name and was its flagship. The hospital was relocated to an old building in Rehov (street) Strauss where conditions were primitive. There were doctors from all over the world with a larger contingent from South Africa. The neurosurgeon was American, the urologist was German and the Professor of Surgery was from New Zealand. The senior anaesthetist was Luise Wislicki who was the only anaesthetist who had been a consultant in mainland UK, but receives only scant mention in the book. She was initially responsible for seeing that all the operating lists were covered. She was joined in 1951 by Marc Chayen (pronounced 'chain' but in Israel he altered the pronunciation of the ch to that in Scottish loch, which in Hebrew though spelt differently is Charm). Chain lived up to his name.

It may be asked how do I know all this. In 1951 after completing one year in anaesthesia at Leicester Royal Infirmary I was on holiday in Israel and was curious to see what was the state of anaesthesia in Israel and visited a hospital in

Tel Aviv and the Hadassah in Rehov Strauss where I met Chayen, who asked me to do his locum as he needed to go to Haifa to obtain clearance for his goods from the UK. Here was I with only one year's experience working unsupervised. I was put up at a local boarding house and given free breakfast and lunch but had to fend for myself for the evening meal. It was a period of austerity and I received no pay. As a concession, if you were on night duty, you received an egg for breakfast!

Chayen found salary levels were low and he began to develop private practice in Tel Aviv and it was no surprise to find he left Jerusalem to work in Tel Aviv. On one occasion when he was about to set out for a private case the patient telephoned to say the operation was cancelled as he had consulted his Rabbi, who advised him that the operation should be postponed because the blood sugar was too high!

Terry Davidson and family moved to Israel in 1958 and in 1962 he became in charge of the new Hadassah hospital in western Jerusalem in Ein Kerem where Chagall designed the stained glass windows depicting the tribes in the synagogue. I was privileged to have a private viewing for giving a tutorial to the junior staff. Similarly Birkham took me to ancient ruins near Haifa (which could not be reached without a car) for the price of a lecture.

The book suffers from attempting to embellish the attributes of some of the anaesthetists and the author is unaware of the fact that the holding of the Fellowship in anaesthesia is not synonymous with being a consultant in the NHS. The experience of one of the anaesthetists working in a prestigious London Teaching Hospital is noted, but there is failure to mention that this was at senior house officer level. A claim that Chayen was the first to intubate patients would be contested.

There were limitations in the training of the staff but they made up for this with further education in the UK and the USA. I met Chayen in the canteen in one of the Boston Hospitals and he was also indebted to Alfred Lee under whose tutelage he learned most of his anaesthesia. Davidson paid me a visit at St.Marks Hospital to see the use of intrathecal diamorphine during surgery.

All the anaesthetists mentioned in the book made significant contributions to the development of anaesthesia in Israel. In particular Chayen, Davidson and Magora will be remembered for their contribution to the management of pain. Despite all their efforts anaesthesia fails to attract recruits and it would appear that the speciality is undervalued and underpaid.

Leon Kaufman

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