The History of Anaesthesia Society
Summer 1995 Meeting

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Addendum. Vol 15, HAS Proceedings

Foot of p 75 should read ... "Long periods of boredom. Illness was common - notably gastro-enteritis, ear infections and prickly heat. VD, ..."

ERRATUM - VOL 17, Page 107, line 19.
The cardiovascular effects of dantrolene sodium in dogs.
The correct reference is Anaesthesia 1975; 30: 318-322
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Editorial

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EARLY GLASGOW ANAESTHESIA

Dr Betty Bradford
Retired Consultant Anaesthetist, Royal Infirmary, Glasgow

Glasgow was a medieval burgh, its cathedral dating from the 12th century, but the town itself did not come into prominence until after the Act of Union in 1707. Resulting from this, trade with the American colonies dramatically increased. Due to the wealth generated by the entrepreneurial skills of the tobacco lords, the city expanded, and there was diversification into iron, cotton and other industries. All of this was relevant to future medical developments, notably, the philanthropy of the rich merchants and the great increase in population. From 83,000 at the end of the 18th century, Glasgow’s population rose to 276,000 in 1847, due to industrial development, the Irish and Scottish potato famines and the continuing effect of the highland clearances. All were to have a considerable bearing on the future health of the city.

It is a city which has undergone a complete change in its ideas. Built on the proceeds of the tobacco trade, Glasgow is now bent on eliminating smoking. A century ago the old university in High Street was demolished to make way for the railway. In 1999 Glasgow is to be the City of Architecture and Design!

The Royal College of Physicians and Surgeons of Glasgow

Originally the Faculty of Physicians and Surgeons, the College was founded by Maister Peter Lowe in 1599 and came to its present site in 1862 when the previous building in St Enoch’s Square was demolished to make way for another railway station. One of the former owners was a Mr Wilson, an iron merchant, who would stand in his drawing room, now the Alexandra Room, and watch his ships loading and unloading down at the river. Several distinguished medical men passed through Glasgow University or the College on their way east or south - among them were William Cullen, credited with founding the Glasgow School of Medicine, the first to lecture in English, and who advocated the use of bellows in inflating the lungs of the drowned; Joseph Black, the discoverer of ‘fixed air’, and a young man who served his apprenticeship in Hamilton with Cullen, William Hunter. William’s younger brother, John, had experimented with a double-acting bellows in artificial respiration 20 years prior to the work of Cullen. James Watt, too, contributed to anaesthesia by designing containers for oxygen, hydrogen and carbon dioxide in conjunction with Thomas Beddoes. More recently, in the centenary year of the discovery of X-rays, mention must be made of John Macintyre who set up the first radiography department in Europe here at the Royal Infirmary and, in 1896, produced the first X-ray cinematograph film ever taken, still held in the College.

First anaesthetics

At our meeting in Edinburgh in 1989, Alan Macdonald described how in Glasgow, as in London, it was a dentist who first administered ether. This was J H H Lewellin, on 4 January 1847. Other dentists were quick to follow, including a Mr Buchanan who had been a student.
of Liston in London. There was at an early stage considerable local awareness of the complications of ether. A letter in the *Herald* on 22 January 1847 described the inhalation of ether vapour and air from a large bladder, this producing effects 'similar to the now famous laughing gas. Sometimes the patient will be unable to inhale the mixture into his lungs in consequence of the epiglottis shutting upon it; this being caused by too much ether and remedied by allowing some of the mixture to escape from the bladder and refilling by means of the bellows.' This property of ether was believed to have been discovered by a young assistant of Professor Gregory of the Andersonian University in 1839. The same article also cautioned against the use of a glass tube when experimenting with ether as the patient was very apt to crush it between his teeth.

On Saturday 13 February 1847 the *Courier* described four operations performed on 10 February in the Glasgow Royal Infirmary by Dr Lawrie:

'The first was a boy of about 7 years of age and no insensibility was produced and in his case the operation was successfully performed - the child crying all the time. Dr Lawrie, in addressing the students after it was completed, stated that he was not satisfied from this example that the ether could be successfully employed in the cases of young children, as it required a certain amount of intelligence and of resignation to its influence to enable it to have the desired effect. The second case was a woman who had an elbow tumour excised and while it was evident to all that insensitivity was produced, she declared that she was sensible all the time. The third and fourth cases of a fistula in ano and the excision of a tumour from the fourth left finger were both conducted on men and the patients did not exhibit the slightest degree of suffering.'

According to Sir Benjamin Ward Richardson, then a student in Glasgow, the day was not exactly as described in the local press:

'A large class of students was waiting in the lecture theatre at Anderson College for the midday lecture and the lecturer, Dr Moses Buchanan, one of the most punctual men in the world, was late. When he arrived he said that he had to convey a piece of news which marked a new era in surgical science, nothing less than the discovery of a method by which the most important operations could be performed while the patient undergoing the operation was asleep. They then all dashed off to the Royal Infirmary, to the operating theatre, which also served as a chapel on the Sundays, and present were Professor Lawrie, Andrew Buchanan, Moses Buchanan, Dr Fleming and Mr Anderson. Dr Fleming, with the house surgeon of the day for Dr Buchanan's ward, gave the anaesthetic ether from a sponge surrounded by a towel. The patient's name was Macleod and was, according to Sir Benjamin 'rather proud I fancy at being the first man in Scotland selected to enjoy the honour as well as the pleasure'. The patient was quiet during the operation and on wakening he affirmed with a broad grin that he felt 'just a wee bit fou'. Prior to going asleep the man recited a few lines from Burns and communicated a few secrets which he might just as well have kept to himself.'
Unfortunately, the ward records for this time are missing and the local press remains the principal source of information. But Dr (later Professor) Lawrie appears in both accounts and he is credited with giving the first anaesthetic in a hospital in the city. Dr Fleming, who may have been the anaesthetist on that day, went on to become a surgeon at the Royal Infirmary and President of the Faculty of Physicians and Surgeons on several occasions.

In another account, Sir Benjamin notes that the students of the time experimented on each other with ether. On one occasion at the Faculty Hall, one of the partially anaesthetised students boxed the ears of the President, to the amusement of all except the President and the committer of the act of violence.

Discussions on the merits of this new discovery continued in the press and at the Glasgow Medical Society. At the 24th meeting on 16 February 1847, during a discussion on the new remedy of inhalation of ether for the mitigation of painful operations, Dr Perry commented that it produced intoxication of a peculiar kind and during which it had the effect of bringing out the character of the individual. Despite its propensity to produce nausea and vomiting, he considered it a most important remedy. The first pain relief clinic in the city was also mentioned—two patients who suffered from severe pain had been relieved by its inhalation. Ether was also given in liquid form as well as being applied externally for pain relief.

'Dr Perry wished to caution anyone from using the remedy by candlelight as the vapour was very combustible. In one case he was applying it to a lady when a servant approached with a lighted candle to a distance of 4 to 6 feet when the vapour took fire and they were all enveloped in a blaze which fortunately was but instantaneous.'

Chloroform

Chloroform arrived in Glasgow one week after Dr Simpson's announcement. It was administered by Dr Mathew Wylie at the Royal Infirmary and, according to the Glasgow Herald, had proved 'more certain in its effect than ether, and more conveniently administered'.

Hannah Greener died on 28 January 1848, but Glasgow may have had a chloroform death just prior to this. At a meeting of the Glasgow Medical Society on 4 January 1848, Mr Lyon, then a surgeon at the Royal Infirmary, reported a case of amputation of the thigh. The man, on being conveyed back to the ward, was seized with convulsions and died the next day. Unlike some others, Mr Lyon did not believe that chloroform had a protecting influence in the shocked patient, and felt that it should be used with care if at all in such patients. He also advocated its use in the treatment of tetanus, making the patient more comfortable. He had used up to 110 pints of port wine in a previous case, so this could well be true.

Chloroform then became the anaesthetic of choice in Scotland. Stanley Sykes described it well when he said that the Scottish attitude was based on the idea that it was not possible to get drunk on too little whisky. However, discussions continued at the Glasgow Medical Society. On 2 April 1850 several of the members stated that they had given up chloroform
entirely. A Dr Adams thought that it should not be used in private practice, but in hospitals where good assistants and all necessary appliances were at hand. The unfailingly honest Mr Lyon reported yet another fatality where even galvanism had failed to produce the slightest manifestation of life. He also advocated that the administration of chloroform should be employed under the superintendence of an experienced assistant, whose whole duty should be that of administering the drug. Alas, little attention was to be paid to this pertinent observation.

The number of operations showed little change for the next few years until another Glasgow surgeon revolutionised surgical techniques. Following his appointment as Professor of Surgery at Glasgow University, succeeding Professor Lawrie, Joseph Lister was eventually given wards at the Royal Infirmary, in the new building and adjacent to the burial grounds of the cholera victims of 1849. Lister devoted his attention to the control of sepsis, while simultaneously taking an interest in anaesthetic developments. During his term in Glasgow, Lister contributed his chapter on anaesthesia in Holmes' *A System of Surgery.* Like his father-in-law, James Syme, Lister believed that every case for operation was a case for chloroform and regretted its lack of popularity elsewhere. He followed the Edinburgh method of administration - a towel folded six times with no precise amount of chloroform used. He emphasised the dangers of administering chloroform in the upright position, advocated the use of the conjunctival reflex in assessing the patient's readiness for surgery, advised omitting a meal prior to surgery and always accompanied the patient back to the ward.

Unlike Clover, he did not regard the patient's cardiovascular system to be of any moment, there was no need to feel the pulse 'in order that their attention may not be distracted from the respiration'. In the case of obstructed respiration, Lister advocated 'firm traction upon the tongue'. Regarding the administrator, Lister felt 'the notion that extensive experience is required for the administration of chloroform is quite erroneous'. Perhaps this philosophy was partly responsible for the attitude of the local surgeons who, for many years, controlled the teaching and administration of anaesthetics in the city. Despite his conclusion, Lister did comment that the administration of the anaesthetic was sometimes delegated to some unsuitable person, and advised the necessity for more vigilant care in its employment.

Certainly all did not run smoothly in every case, and comments such as 'narrow escape from death', 'very nearly succumbed under chloroform' and 'respiration ceased - tongue drawn out' can be found.

**William Macewen**

The next major contribution to anaesthesia in Glasgow came from another surgeon, William Macewen who, although a pupil of Lord Lister, emphasised training and the solemn responsibility of the operator more than his teacher. A leader in the change from antiseptic to aseptic surgery, he was also a pioneer in neuro, thoracic, orthopaedic and pulmonary surgery. Macewen came from Bute and had little money. As entrance to the hierarchical structure of the Royal Infirmary was not easy, he became Superintendent of the new fever hospital at
Belvidere. Whilst there, he began his outstanding contributions to anaesthesia, no doubt initiated by the incidence of laryngeal obstruction due to diphtheria. He used rubber or gum elastic catheters introduced into the trachea via the mouth as an alternative to tracheostomy. He practised this technique on cadavers and on himself, a manoeuvre he described as 'not a delectable experience'. In 1878 he read a paper to the Glasgow Pathological and Clinical Society - 'On the introduction of tubes into the larynx through the mouth instead of tracheotomy or laryngotomy in a case of oedema of the glottis'. This, and another case, with an account of the first successful use of the technique for the administration of an anaesthetic, were the subjects of an article in the *British Medical Journal* in 1880. Macewen used a brush mounted on a wire, which he pushed through the tube to remove tenacious mucus. For operations, he also advocated packing the pharynx with a sponge.

In his original paper of 1878, Macewen considered that death from chloroform sometimes resulted from the falling of the tongue over the larynx and that the introduction of the tube would prevent this. Later he designed flexo-metallic tubes of brass and stainless steel. Why these advances and observations lay dormant until the first world war remains a mystery.

Macewen did not confine his interests to the technical side of anaesthesia. He and the then chairman of the Royal Infirmary, a gentleman rather confusingly also called McEwen, insisted on better record keeping in surgical cases. Macewen was responsible for the introduction of formal teaching of anaesthetics in the student curriculum, making it a rule that students administered twelve anaesthetics and sat a written examination during their training. This, he felt, was of equal importance to the giving of twelve vaccinations, an essential requirement of the curriculum of the time. In 1879 he published an article on alcoholic coma and its distinction from coma from other causes. Macewen's contributions to anaesthesia, unlike his surgical achievements, have not perhaps received the recognition which they deserve.

**Appointment of hospital anaesthetists**

In the 1870s chloroform continued to be the anaesthetic of choice. Although few deaths were reported, there were several close calls and exhaustion, sudden death from liver complications, shock and spasm of the heart appear in the records. In 1882 concern was expressed at the number of deaths resulting from chloroform anaesthesia at Glasgow Royal Infirmary. The previously mentioned Mr McEwen, of the Board of Managers, suggested that a course of instruction be given to all residents before they could be certified to give anaesthetics. The following year, after a particularly acrimonious debate in the local press, a committee was formed and a questionnaire was sent to the leading hospitals in the United Kingdom requesting details of regulations regarding the teaching of anaesthetics, the administration of such anaesthetics and the qualifications of the administrators.

 Replies indicated that no formal regulations were in force in Scotland. Instructions were given in few hospitals and there were few specialists. In Perth, the anaesthetics were given on occasion by the Matron! Following this enquiry, training was formalised in the Royal
Infirmary but no appointment of an anaesthetist was made, nor was the information obtained from the enquiry more widely disseminated.  

Although chloroformists and anaesthetists were being appointed in other parts of the country, in Glasgow it was again the dentists who led the way. In 1878, Dr M Muir was appointed chloroformist to the Dental Hospital, Dr Thomas McKee was appointed to the Samaritan Hospital in 1885 and, in 1898, the Victoria Infirmary appointed a general practitioner, Dr Douglas Lamb, as anaesthetist at a salary of £30 per annum. Because of the variety of apparatus available at the time, a deputation went to London and "took advice from the most eminent authority on the subject - Dr Hewitt". Today's administrators would be happy to know that a 25% reduction on cost was obtained.

Some 20th century anaesthetists

The Royal Infirmary appointed its first anaesthetist in 1905, Dr A Laurie Watson, at a salary of £25 per annum. In 1909, Dr H Prescott Fairlie (1886-1937) was appointed, the first of several Scottish anaesthetists to make their mark nationally. A co-founder of the Scottish Society of Anaesthetists, he became President for the first time in 1925. He was in turn President of the Anaesthetic Section of the British Medical Association in 1931, President of the Section of Anaesthetics, Royal Society of Medicine in 1933 and was a member of the original editorial board of the British Journal of Anaesthesia in 1923. In 1919 he and J S Ross of Edinburgh - a fellow co-founder of the Scottish Society - produced Ross and Fairlie's Handbook of Anaesthetics, which in 1944 became the Textbook of Anaesthetics by Drs R J Minnitt and J G Gillies. Dr Fairlie wrote papers on a variety of anaesthetic topics and attempted to break the Scottish chloroform tradition. His interest in teaching and advancing the specialty made him the most distinguished and respected anaesthetist in Scotland at this time. In 1922, when the British Medical Association met in Glasgow, both he and Dr Lamb commented on how much influence the surgeons still had on the teaching of anaesthesia in the city.

In 1925 Dr W B Primrose joined the staff of the Royal Infirmary where he would serve for 33 years. During this time he developed an apparatus for closed circuit anaesthesia. In the Primrose apparatus, the 'Anaesthetor', a strong solution of caustic soda was used to extract carbon dioxide, and a constant supply of oxygen was conveyed directly to the patient's mouth. A special pharyngeal tube with an inflatable cuff was devised to prevent leakage and eliminate the ordinary facepiece. Dr Primrose was a President of the Scottish Society of Anaesthetists and also of the Glasgow and West of Scotland Society.

These latter two unassuming Scottish gentlemen provide the link to Professor Forrester and Dr Pinkerton who were, in their turn, to do so much to enhance the standing of our specialty.
Acknowledgments

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References

4. Macewen W. Clinical observations on the introduction of tubes into the larynx through the mouth instead of performing tracheotomy or laryngotomy. *British Medical Journal* 1880; 2: 122.
7. Board of Management Reports, Glasgow Royal Infirmary 1882-83. *Archives, Ruchill Hospital, Glasgow*.
HERBERT HARVEY PINKERTON

Professor A A Spence, University of Edinburgh

Herbert Harvey Pinkerton, MBChB, FRCP Glas, FFARCS, known universally as Tony, was born on 8 October 1901 into a comfortable middle-class background. His father, Peter, was a Principal Mathematics Master and Tony's earliest school education was at his father's school, George Watson's College in Edinburgh. Peter Pinkerton then moved to be Rector of the High School of Glasgow and most of Tony's school education was there. The High School was a well recognised privately financed boys' school which, with three or four other leading Glasgow schools, was the principal source of professionals in the west of Scotland. In later years it was sometimes asserted that Tony's influence among his peers in medicine had some connection with his origins as the 'headmaster's son', although I doubt if that was a major factor.

Tony went to Glasgow University in 1920 to study engineering. He used to boast a little of that start in another discipline before commencing medicine in 1921. By the time of graduation in 1926 he could claim an outstanding career as a medical undergraduate. He obtained Certificates of Merit in 21 subjects, Distinctions in professional examinations in 6 of these, a medical bursary on two occasions and prizes in physiological physics and pathology. He graduated MBChB with Honours and was awarded the Brunton Memorial Prize, which in Glasgow University marks the most distinguished student of the year. He was a member of the Students' Representative Council for four years, serving in relatively senior office in the last two. He was also a member of the committee of the Athletic Club, and Secretary and then Captain of the University Golf Club. He obtained a blue for golf, a sport in which he remained distinguished all his life.

He served as resident assistant at the Western Infirmary in various departments, with distinguished chiefs, the best known of whom was Sam Cameron in Gynaecology. It is notable that Tony was just in time to be an undergraduate in Sir William Macewen's class of surgery. He became a clinical tutor in the medical wards of Dr John Gracie at 26, and applied to be an extra dispensary physician to the Western Infirmary. The record is obscure but I do not think he was successful in that application. Instead, he moved to general practice at Busby, to the south-east of Glasgow and near the Hairmyres tuberculosis hospital.

As a student Dr Pinkerton had, of course, studied anaesthesia and as a resident doctor was involved in its administration. I have notes in his hand which recall that, in those days, the resident was unlikely to get through his six month appointment without at least one anaesthetic fatality and that many hospital records showed peaks of anaesthetic deaths which coincided with the half-yearly advent of new residents. One unfortunate contemporary of Tony's achieved no less than 17 deaths during his residency. These same notes recite, hardly surprisingly, the use of drop-bottles for ether or chloroform and the use of Shipway's apparatus and Clover's inhaler. At this time one of the three visiting anaesthetists to the Western Infirmary was Dr H P Fairlie, who was a founder member of many important
anaesthetic activities in the 1920s and early 30s. There are several quotations from Tony's notes which may be of interest:

'As a resident in gynaecology I only once saw a visiting anaesthetist and that on a special request of the chief who wished this particular patient to have a spinal anaesthetic. This she had and the anaesthetist left thereafter. I had the dubious satisfaction of dealing successfully with the subsequent ileus.'

'I used to take an impish delight in occasionally phoning visiting anaesthetists ostensibly to tell them of tomorrow's list, and so forcing them to ask me to deputise for them.'

When Pinkerton moved into general practice, the administration of anaesthesia was very much part of the expectations, particularly in respect of obstetrics. After seven years he abandoned general practice in favour of specialisation in anaesthesia:

'It was clear that hospitals would be increasing the numbers of their visiting anaesthetists (because of rapid developments in anaesthetics).'

'I was anxious to return to the hospital atmosphere, and I may have also been prompted by a chance remark of a friend in anaesthesia that it was a poor week in which you couldn't make £20 out of tonsils and adenoids alone. This was more than I was making in practice at that time.'

Pinkerton chose to engage in a period of postgraduate training in 1936. He spent two months with Dr John Challis of the London Hospital ('who worked me very hard'). On returning to Glasgow he was fortunate in securing an appointment as a visiting anaesthetist to the Western Infirmary with an honorarium of £100 per annum:

'Having a minimum of private work I was able to demonstrate the value to the Infirmary of having a visiting anaesthetist attending regularly and dependably at some operating sessions, as well as some emergency work.'

Establishing a Department

By 1946 there were eight visiting anaesthetists to the Western Infirmary. Of some, Pinkerton was frankly dismissive. He himself had secured a DA in 1938. Those who had the privilege of knowing Tony Pinkerton would recognise that he immediately thereafter regarded the DA as the minimum criterion for any satisfactory pursuit of the specialty. In 1946 many young doctors were demobilised and were offered postgraduate grants. Gordon Robson and one of my personal mentors, Hugh Wishart, were amongst that distinguished cohort.

With his feet well under the table at the Western Infirmary, Pinkerton's outstanding qualities as a pedagogue, undoubtedly inherited from his father, were crucially important to the
development of a school of anaesthesia. At that time there was no organised department of anaesthesia, although Pinkerton had obvious aspirations. He had become the clear academic leader, although acting without special pay or recognition, and obviously had initiated moves to encourage the Board of Management of the Western Infirmary to form a department. This overture was unsuccessful. By 1953 Pinkerton decided to relinquish as publicly as possible all responsibility for teaching and training. This led to a letter from nine trainees to the Board of Management expressing deep regret at what had happened, followed by an invitation to Pinkerton to re-submit his proposals. True to his style, Pinkerton refused to do any such thing but set a much wider agenda, part of which can be summed up in his letter of 23 November 1953 to the Medical Superintendent:

'I could only agree to reconsider the matter in the knowledge that the management and the affairs, as well as the arrangements for the training of at least the whole time anaesthetic staff were to be in my hands, and that the co-operation of the various departments would be available, especially for training and teaching purposes when required. This is clearly a wider and more ambitious scheme than has operated heretofore and accommodation (at least two rooms) and secretarial assistance would be required immediately for its management.

In addition, it has been recommended that two consultant anaesthetists should be appointed to the Ear, Nose and Throat Hospital and to the Eye Infirmary. As these are within our group it seems an excellent opportunity to incorporate such additional ability within a suitable department based on the Western Infirmary. Working regularly under the supervision of senior staff, our juniors would be in a position to deputise for their seniors during their absence.'

The result was an Anaesthetic Department, with Tony Pinkerton as its chief appointed in June 1954. His pressure for the University to appoint a Reader in Anaesthetics was not fully successful although he became joint Lecturer at the Western Infirmary. There were also clinical appointments to the tuberculosis hospital at Hairmyres, to the Samaritan Hospital for Women in the South Side of Glasgow, and to the Glasgow Dental Hospital.

Within these earlier years which I have tried to describe, albeit superficially, Pinkerton made consistent contributions to the literature in relation to cyclopropane, thiopentone and other intravenous anaesthetics. It is interesting that on several occasions authorship of papers was a joint exercise between the surgeon, who was the first author, and Tony who had obviously done the work. In clinical practice his special forte included thoracic anaesthesia in which he had established an effective practice at Hairmyres with the late Bruce Dick, urology in which he worked closely with a variety of individuals of whom the most notable, perhaps, was W S Mack, a future President of the Association of Urological Surgeons, ENT, and general surgery with A B Kerr.
Honours

Pinkerton was a member of the Editorial Board of the *British Journal of Anaesthesia*, having succeeded Fred Napier from the Western Infirmary in Glasgow during the 2nd World War. This, of course, was in the days of Joseph Blomfield as editor. The Board never met, and the *Journal* was becoming increasingly thin. Pinkerton was a member of the Council of the Association of Anaesthetists and became President during his retirement, in 1966. He also served as a member of the Board of the Faculty of Anaesthetists. He was the first Secretary of the Glasgow and West of Scotland Society of Anaesthetists and President of that body in 1948/49. He was President of the Scottish Society of Anaesthetists in 1951. As President of the Association of Anaesthetists his greatest pleasure was in establishing the Associates in Training group for trainee anaesthetists. I know at close hand that his view as to the contribution that group was to make would not accord with the relatively high profile that it has now, but times change circumstances.

As a teacher and a demonstrator of anaesthetic practice, Tony Pinkerton had a style that was enviable. One never saw him ruffled by a clinical problem, although he could show profound irritation at the behaviour of his colleagues. He was a generation ahead of his time in recognising the need for structured training which those of us who were his pupils benefited from 30 years ago. He held a Thursday afternoon 4 o'clock meeting (or 'round' as it would now be called) and there was no mercy shown to any trainee who failed to turn up on time, or any surgeon whose practice on that afternoon extended to the point at which the trainee was prevented from leaving the operating theatre. He was appointed an honorary member of the Section of Anaesthetics of the Royal Society of Medicine in 1981 and he received the Faculty of Anaesthetists' Gold Medal. I believe he was the first to receive that medal although he and the late Pat Shackleton appeared at the top of the list together.

In a social setting Tony had a definite style. He was well-known in Glasgow and was President of the Glasgow Golf Club, an important distinction in these circles, in 1959/60. Tony and his wife Sheila had two children: Peter, who was a year older than myself and is a haematologist in Canada, and Gillian who was younger and who very sadly died of Hodgkin's disease in the mid-1960s. Sheila pre-deceased Tony. She was a very shy individual and was often regarded as being rather aloof, although this was almost certainly a feature of her shyness. In the 1970s Tony had undergone surgery for cancer and, after Sheila's death, he was really rather dejected. During the ensuing year - 1981/82 - he picked up and was making modest social contact. He came to visit us as a house guest, usually proclaiming that his age and infirmity would only allow a short visit, although I can remember one evening when he partied until after midnight leaving those who were many years his junior feeling rather exhausted. On that particular occasion we were able to persuade him that he might enjoy a visit to the Annual Meeting of the Scottish Society of Anaesthetists to be held at Aviemore. In spite of offers, he made his way there alone and appeared on all the right occasions, immaculately attired as always, and paying particular attention to the more attractive younger women for whom, in the nicest possible way, he always had a keen eye. He turned up at dinner resplendent in black tie and was in particularly jovial form at the end of the meeting.
when he went home on Sunday. On the following Tuesday he was admitted to hospital
having, in the week before he travelled to Aviemore, identified what he considered to be a
tumour of his liver. It was not a secondary as he thought, but a new primary. He never
returned to the stage again and was dead within three months - he died on 21 July 1982. If he
had been able to make a choice, and perhaps he had, that last outing amongst his colleagues
and friends was highly appropriate. He had been one of a distinguished group of anaesthetists
whose ability and determination brought anaesthesia out of the darkness.
Alexander Clarkson Forrester graduated from the University of Glasgow in 1931. Having completed a year in Glasgow Royal Infirmary he entered his father's well-known general practice in the south side of Glasgow. He missed hospital practice however and returned to the Royal Infirmary, taking up a full-time appointment as visiting anaesthetist in 1936 earning £50 per annum.

In those days there was no 'department' - only a handful of anaesthetists who, like the surgeons, attended in the mornings and left at lunchtime to get on with the serious business of earning a living! One of these anaesthetists, Dr Primrose, had a strong influence on the young Dr Forrester, particularly with his technique of carbon dioxide absorption, closed circuit anaesthesia and assisted ventilation.

In 1946, in Liverpool, a young Cecil Gray published his first studies with curare. In August of the same year Alex Forrester published a report on the use of curare in a hundred patients. Few people were aware of this work because it appeared in the little-known Glasgow Medical Journal. Most anaesthetists at that time were quick to realise that the introduction of curare would revolutionise the practice of anaesthesia and surgery. Only a very small number, like Alex Forrester, had the vision, the lateral thinking, to appreciate that the skills anaesthetists would develop by assisting and controlling ventilation could be useful in the management of various medical conditions.

In 1947, Alex Forrester, in collaboration with Dr Peter MacKenzie, consultant physician at Belvidere Infectious Hospital, used curare to control tetanus. In 1952, they visited Copenhagen to study the use of manual IPPV via tracheostomy in the treatment of poliomyelitis, returning to Glasgow to set up a special unit for the treatment of polio and other respiratory problems at Belvidere Hospital. The tank type ventilator was laid to rest.

From this beginning, anaesthetists at the Royal Infirmary became directly involved in the management of patients requiring assisted or controlled ventilation. In 1962 one of the first respiratory intensive care units in the United Kingdom was established in a four bed side room of a general surgical ward. As he gained experience with the use of curare, Alex Forrester soon realised that the paralysed patient was extremely vulnerable to mishaps such as disconnections, failed intubation etc. He developed an early interest in the area we now call patient safety. He recognised that, if the apparatus was simpler, patient safety could be improved. He designed a straight-through, light-weight tracheal tube connector complete with hooks. It was easily held in
position by the commonly used Clausen harness, did away with the need for a catheter mount and facilitated easy access for endobronchial suction. The Forrester innovative mind also modified the Macintosh spray so that it could double as a tracheal tube introducer - it worked very well! About the same time, Alex Forrester was one of the first anaesthetists in the UK to advocate using 2.5% thiopentone in place of the standard 5% solution, to avoid major vascular and neurological injuries of the hand and forearm.

During the latter half of the 1950s, the cardiac surgeons were endeavouring to push the frontiers forward by employing hypothermia to permit intracardiac surgery under direct vision. At that time the methods available for inducing hypothermia depended on surface cooling, the most popular being the application of ice bags or cold water immersion. Unfortunately, these techniques were associated with an unpredictable 'after drop' of the core temperature which carried a high risk of ventricular fibrillation.

Alex Forrester, initially alone, but later with the cooperation of James Brown, a lecturer in heat engineering at the Royal College of Science and Technology - later University of Strathclyde - developed a technique of surface air-cooling which, by means of a complex nomogram, enabled the 'after drop' to be predicted and controlled. The anaesthetised patient was placed in a cabinet which was essentially a calorimeter, cooling was induced by blowing cold air over the patient for a predetermined time. The risk of VF became minimal, and this technique provided a safer option until cardiopulmonary bypass became established in the early 1960s.

As the years passed, his concern for patient safety developed into an expertise which led to an increasing involvement in medico-legal matters. In 1967, as President of the Section of Anaesthetics, Royal Society of Medicine, he chose this subject as the title of his Presidential Address.

Continuing this interest, following his retirement from the Chair of Anaesthesia in 1972, he was invited to join the new Renal Transplant Team at the Western Infirmary as policy advisor. He served for three years in this capacity during which time he published a code of practice which was to become the 'gold standard' for those involved in the diagnosis of brain death and the donation of cadaver kidneys.

Alex Forrester's greatest ambition - his life long goal - was the promotion of anaesthesia as a specialty in its own right with an independent academic foundation. In the early days he made repeated approaches to the University Senate to persuade them of the need to create a University Department of Anaesthesia. The people who held the real power within the medical faculty were, of course, the surgeons and physicians. William Arthur Mackey, appointed St Mungo Professor of Surgery in 1953, had the foresight to give his full support to Forrester's proposal.
In early 1955 the University Department of Anaesthesia was established at the Royal Infirmary and Dr Forrester was appointed Senior Lecturer. He was promoted to Reader in 1960 but declined several offers of a personal chair. Following further discussions with the Senate, however, the University Chair of Anaesthesia - the first in Scotland - was founded in 1967 and Dr Forrester was duly appointed. He served as an Examiner to the Faculty of Anaesthetists, Royal College of Surgeons of Edinburgh, and as an elected Board Member from 1971-74. He was awarded the Faculty Medal in 1980. During his distinguished career he was awarded many other honours including Fellow qua Surgeon of this College (Royal College of Physicians and Surgeons of Glasgow), Honorary Fellow of the Faculty of Anaesthetists, Royal College of Surgeons in Ireland, Honorary Member of the Association of Anaesthetists of Great Britain and Ireland, and Fellow of the Royal Society of Medicine.

As an administrator, Alex Forrester recognised the need to recruit a 'balanced team'. In my view this was one of his greatest attributes. He accepted that no one man could be gifted with the full range of abilities - one had to assemble an amalgam of talents - and he worked hard to achieve this. Like all chiefs at that time he had great power, but never misused this privilege. Instead, he gave his junior colleagues complete support to enable them to pursue their special interests. As a typical canny Scot, however, he watched you carefully and if, after a fair trial, it did not work out, he told you!

I would like to make mention of just two of Forrester's balanced team. Walter Norris was one of his most loyal supporters. Unfortunately, he died at an early age but not before achieving recognition at local and national level as a gifted teacher, an enthusiastic clinical researcher and an experienced medical politician.

The best known member of the Forrester team is, of course, Sir Donald Campbell. He joined the University Department in 1960 as a Lecturer, became Consultant the following year and went on to succeed Alex Forrester by taking the Chair in 1976. Needless to say, Alex Forrester has always taken a keen interest in Donald Campbell's distinguished career and confesses to a very special admiration for his contribution to our specialty and to medicine in general.

I recently visited Professor and Mrs Forrester at their home in Broughty Ferry. He is getting on in years now and is, I'm afraid, rather frail. You should know that he still has the interest and concern of a man who gave so much to his chosen specialty. He asked me to convey his apologies for being unable to attend the meeting, and sends his very best wishes to the members of the History of Anaesthesia Society.
The name Monro is best known for its association with the interventricular foramen, but Alexander Monro Secundas added nothing of value to previous descriptions. It is a paradox for him to be remembered for that which he did not do, and forgotten for that which he did. Secundus, his father and his son, are all worthy of remembrance.

The Monro medical dynasty

John Monro, an army surgeon in the 1690s, had studied briefly at Leyden before finally settling in practice in Edinburgh in 1700. He was convinced that Edinburgh would benefit greatly from a medical school and hospital on the Leyden pattern. His son, Alexander, showed an early aptitude for anatomy. He was carefully schooled by his father, and ultimately became the first Professor of Anatomy at Edinburgh University in 1725 at the age of 28, a post he held with distinction for the next 40 years. These two, together with other colleagues trained at Leyden, formed the nucleus of a medical school.

To provide good clinical teaching a hospital was needed, and John Monro worked tirelessly towards this end. By 1741 a 228 bedded hospital - The Royal Infirmary - was open, replacing a small temporary one founded in 1729, and John Monro had achieved his dream.

Alexander Monro produced a son in 1733 - Alexander, known as Secundus to distinguish him from his father. Secundus became conjoint Professor of Anatomy whilst still a student, and later he became Professor of Medicine, Anatomy and Surgery, and remained so for 63 years, dying in 1817.

In his turn, Secundus produced Tertius in 1773, who also became Professor of Anatomy in Edinburgh University and held the post for 29 years.

Famous students of the Monros

Thus the Chair of Anatomy was held for 126 years by one family. During this period the number of students rose from 57 per annum in 1721 to over 400 per annum by 1800. Secundus alone taught 13,404 students. One can imagine the powerful influence the Monros must have had on doctors worldwide and on the formation of many famous medical schools. Unfortunately, Tertius was less able than his forebears and his reign coincided with increased competition from the extramural schools and new medical schools imitating the Edinburgh pattern, so that the number
of Edinburgh anatomy students, already falling, began to decline further. So many students passed through the Anatomy School that it is impossible to mention even all the famous ones. To take a few:

J C Lettsom, a famous London Quaker doctor, who did pioneer work in social reform and alcoholism. He is also remembered for the lines from *Journey to Epsom Races*:

'Next morn it was enough to vex one
A bill was brought from Dr Lettsom
The bill was due that very day
And Pa had not enough to pay
For what was saved to pay poor Lettsom
Was spent the day before at Epsom.'

From Ireland came Colles of the fracture, Corrigan of the water hammer, and Stokes of the Cheyne-Stokes phenomenon. Sir Gilbert Blane (lemon juice for the Navy) and Sir James McGrigor were administrative doyens of the armed forces. From America came William Thornton, Benjamin Waterhouse and Benjamin Rush. The former designed the dome of the Capitol in Washington, Waterhouse became Professor of Medicine at Harvard and introduced smallpox vaccination to America. He personally vaccinated Oliver Wendell Holmes as a child, and was a sworn enemy of John Warren, the father of the Warren who did the first operation under ether at Boston. Rush was the only medical signatory to the American Declaration of Independence. Jean Paul Marat, the Jacobin French revolutionary studied anatomy in Edinburgh in 1773 - no doubt the head and neck engaged his interest. He later received an honorary degree from St Andrews in 1775 and had the first Soviet battleship named after him.

Charles Darwin flirted with medicine in 1825 under Monro Tertius, and Robert Liston was another of his students. William Withering, dog breeder and discoverer of the properties of digitalis, Thomas Beddoes of the Pneumatic Institute, Rutherford - discoverer of nitrogen, Black - discoverer of carbon dioxide, all studied in Edinburgh.

**Academic achievements**

In 1731 Monro Primus formed the first medical society in Great Britain, which later became the Royal Society of Edinburgh. Another Society was formed soon after by five of his students, who found a body to dissect, and enjoyed meeting over it. This became the Royal Medical Society of Edinburgh, the oldest ongoing student medical society. Both Primus and Secundus gave financial and professional help to this society from its informal start in 1734. Amongst its anaesthetic members were H H Hickman and J Y Simpson.
Monro Primus was an able anatomist and researcher. His early books on osteology and on the nervous system were standard texts. Monro Primus taught William Hunter and, in turn, Hunter taught Monro Secundus but this happy relationship changed for the worse as the two families quarrelled over precedence of various discoveries.

Monro Secundus developed some of his father's research interests as well as being an original thinker himself. In 1757 he observed, with Meckel (of the diverticulum), a case of pneumothorax. From this he devised a method whereby, instead of the usual chest incision made by surgeons to expel excess air, he inserted obliquely a blunt cannula, by means of a trocar with a shield. When the excess air was removed he plugged the cannula which remained in situ, or applied a syringe or elastic suction bottle. This was revolutionary for those times.

Another example of his thinking, following a bizarre injury. Two men in liquor disputed their skill at fencing and one challenged the other to a duel with pokers heated at their points, so that there was no doubt as to the hits. The first got a thrust to the chest from which he died on the twelfth day. At post-mortem a purulent collection was found in the pericardium which Monro attributed to the passage of air at the time of wounding. As a result, Monro tried to exclude air at operations by flooding the wound with cold port wine. Eighty years before Lister this was an imaginative piece of thinking.

Monro was a consulting surgeon and physician who dispensed only advice and taught only theoretical surgery, a bone of contention in Edinburgh, where others thought that surgery should be taught by a practising surgeon.

Monro Secundus, by careful dissection, made several discoveries relating to the cranial nerves and the motor and sensory pathways, but neuro-anatomy and physiology were so primitive that it was left to his pupil, Sir Charles Bell (of the palsy fame) to make the breakthrough in the concept of separate motor and sensory nervous systems. Bell acknowledged his debt to Secundus.

Secundus discovered the lymphatic system, and made observations on the measurement of cerebral blood flow and the dimensions of the internal surface area of the lungs. He wrote a beautifully illustrated book on the bursae of the human body. Tertius discovered the function of the cerebellum, though this is not normally associated with him.

Resuscitation

When Drs Hawes and Cogan established the Humane Society in 1774, they sought advice from, amongst many others, Scotland's Dr Cullen. For cases of drowning, his third priority after warmth and rectal insufflation of tobacco smoke, was restoration of the action of the lungs. Here, Cullen mentioned the oro-laryngeal tube described by Monro Primus and others and paid
tribute to the suggestions of Secundus, who recommended mouth-to-nose resuscitation using small wooden mouth pieces and a bellows if desired. By 1782 the bellows was preferred to oral methods, of the many available, Monro's of 1,500 cc capacity were considered by some to be dangerous. Leroy in France showed that the use of bellows could rupture alveoli, and by 1837 all bellows were condemned.

Secundus designed a stomach tube - an iron-wire spiral covered in soft leather, with a perforated 2" brass pipe at the bottom end. He also described cricoid pressure to prevent inflation of the stomach during resuscitation:

'While blowing is practised, the passage of air into the stomach by the gullet may be prevented by gently pressing the head of the windpipe backwards as thus the gullet will be straightened, while the passage through the larynx is not interrupted. The other nostril and mouth must at the same time be accurately closed to prevent the escape of air by these passages.'

These ideas on resuscitation really seem very modern, but unfortunately their attribution has been almost completely forgotten.

Connections

Like his father, Secundus was a man of many and varied interests. One of these was the theatre. He was a great admirer of the Drury Lane actress, Mrs Sarah Siddons, who eventually became his patient with intermittent erysipalis. Samuel Johnson was also a patient, and he and Boswell were Monro's friends. Oliver Goldsmith in his time had been a medical student under Monro, leaving under a cloud of bankruptcy to surface later in London. Goldsmith and David Garrick, who acted with Sarah Siddons, were founder supporters of the Humane Society. Goldsmith's doctor was the Society's main founder - Dr Hawes.

Conclusion

Robert Burns indicated the fame of the Monros when, in 1789, he gave his view on literary critics:

'Critics! appalled I venture on the name
Those cut-throat bandits in the paths of fame
Bloody dissectors, worse than ten Monros
He hacks to teach; they mangle to expose'

In Burns' time, the name Monro was synonymous with anatomy.
Bibliography

Wright St Clair RE. *Doctors Monro - A Medical Saga*. London: Wellcome Historical Medical Library, 1964

Simon SW. The influence of the three Monros on the practice of medicine and surgery. *Annals of Medical History* 1927, IX: 244.


Monro (Tertius) A. *Essays and Heads of Lectures on Anatomy etc. by the Late A. Monro Secundus - with a Memoir of his Life*. Edinburgh: McLachlan Stewart, 1840.

Monro A. *A state of the facts concerning the first proposal of performing the paracentesis of the thorax*. Balfour Auld and Smellie, 1770.

When Black was born, chemistry was in its infancy, having barely escaped from the shackles of alchemy and the dead hand of Aristotle's theory that all matter was a mixture of the four elements - earth, fire, air and water. One of the earliest textbooks on chemistry was written by the great clinical teacher, Boerhaave, there being a close connection between chemistry and medicine in the early 18th century. The first teaching of chemistry in Britain was probably in Edinburgh about 1702 when the Incorporation of Surgeon Apothecaries advertised public lectures in the laboratory of their new Hall. The first Chairs in Chemistry were created in 1713 in Cambridge and Edinburgh. The incumbent in Edinburgh was Dr James Crawford who was appointed Professor of Physic and Chemistry.

Joseph Black was born in 1728 in Bordeaux where his Ulster-Scot father was a wine merchant. He went to school in Belfast before going to Glasgow University at the age of 18. It was his good fortune that one of his teachers was William Cullen who taught chemistry, botany and materia medica. Cullen, the effective founder of the Glasgow medical school, inspired Black and promoted him to being his laboratory assistant. The Royal College of Physicians and Surgeons of Glasgow has portraits of both of them. Black, who had decided on a career in medicine, left to go to Edinburgh which was then the premier medical school in the English-speaking world.

**Discovery of carbon dioxide**

Prior to graduating, each medical student had to submit a thesis in Latin. Black’s was entitled ‘On Stomach Acid and Magnesia Alba’, a curious combination, almost as if he did not believe his work on magnesium carbonate was sufficient by itself. Why did he study magnesia? He was looking for something which might dissolve bladder stones. In his own words ‘My curiosity led me to enquire more particularly into the nature of magnesia ... in the hope of discovering a new sort of lime water which might be a more powerful solvent of the stone than that commonly used’. This was caustic soda, but he added: ‘I was disappointed in my expectations!’

Black’s thesis was a brilliant piece of work, possibly the most significant ever produced by an undergraduate. A description of the steps in his thesis best illustrates the brilliance of his intuitive thought. He showed that:

1. Magnesium carbonate, a mild alkali, lost seven twelfths of its weight when heated. According to the current phlogiston theory, it should have gained weight.
2. Heated magnesia no longer effervesced with acid.
3. The loss of weight was due to the release of 'air' which he recognised as different from atmospheric air. He called it 'fixed air', a term he did not like, but he thought it better to use a word already familiar than to invent a new name, at least until he knew more about the substance.

4. When a weight of heated magnesia was dissolved in acid, it required practically the same amount of acid to dissolve it as did the weight of magnesium carbonate from which it had been produced - though it did not effervesce.

5. When a weight of heated magnesia was dissolved and then precipitated by the addition of a mild alkali, it regained the weight it had lost on heating and regained its property of effervescing with acid.

6. Mild alkalis contained 'fixed air' but caustic alkalis did not.

Within a year or two, he further demonstrated that fixed air was produced in respiration. This he did by breathing in and breathing out through a U-tube with lime water in it. He found that it was also produced by fermentation, putrefaction and by burning charcoal, and he inferred its presence in the atmosphere. He also demonstrated that it was toxic to animal life.

**Significance of Black’s work**

Not only had he demonstrated for the first time the existence of a gaseous constituent of air, carbon dioxide, but he was the first person to undertake a detailed study of chemical reactions. He had weighed the gas in combination, traced it through a series of chemical changes - which included reversible reactions - by means of exact quantitative measurements, and generalised his results by showing the difference in chemical composition between mild and caustic alkalis. He laid the basis for pneumatic chemistry, and since his results were achieved by using very exact weighing, he laid the basis also of quantitative analysis.

The significance of his work was quickly recognised even though some had difficulty in believing that a gas could exist in the form of a hard stone. When, in 1756, his mentor was appointed to the Chair of Chemistry and Medicine at Edinburgh, Black, just two years after he graduated, was appointed to the Chair Cullen vacated in Glasgow. Ten years later, when Cullen was promoted to the more senior Chair of Physiology in Edinburgh, Black became Professor of Chemistry and Medicine Edinburgh, a post he held until his death in 1799.

Black was a tall, very thin man, cadaverously pale. Apparently he suffered from haemoptysis whenever he had the least strain. A bachelor, he led a quiet abstemious life. He shunned publicity and, in his lifetime, had only one article published. That was on the subject of his thesis and was published in *Transactions of the Society for the Improvement of Medical Knowledge*. The organisation later became the Royal Society of Edinburgh, of which Black was a founder member. He was a more than competent lecturer.
The ability to lecture effectively was important in Edinburgh in contrast to Oxford and Cambridge where few lectures were given. There, the teachers were well paid whether they attracted students or not. In Edinburgh, Black, in common with most of his colleagues, received no salary as Professor but was dependent on the number of students he attracted. The class fee was three guineas and Black had 253 students in 1796. Monro was one of the few who did get a salary - £50 per annum - but he had 326 students at three guineas a time. These students were not only, or even perhaps mainly, medical students but included the gentry and anyone interested. They came from all over the English-speaking world, including many non-conformists from England, because the Oxbridge universities did not accept anyone who did not belong to the Church of England.

There were no practical classes in Edinburgh, but Black illustrated his lectures with a great number of experiments and processes. The English traveller, Edward Topham, stated that 'no chemist was ever more successful in his experiments than Dr Black'. One piece of equipment he used was a portable pneumatic apparatus for preparing gases, produced by a former pupil, Thomas Beddoes (of the Pneumatic Institute) and James Watt.

Latent heat

Black did more than discover carbon dioxide, although his fame would be assured were that all he achieved. As Professor in Glasgow, pondering on the slowness at which ice melts, he carried out another series of perceptive and elegant experiments. The current theory was that ice, at its melting point, required only a small amount of heat to liquefy. Black reasoned that if that were so, large quantities of water would be produced at 32°F but, in fact, ice melts slowly. He conceived experiments to confirm his hypothesis in the summer, and had to wait till December for the opportunity of carrying them out!

He took two glasses and filled each with 5 oz pure water. The first he froze and placed in a room at 47°F. The second he cooled to 33°F and placed beside the first. In half an hour the temperature of the latter glass was 40°F but it took ten and a half hours for the ice to reach the same temperature, ie it took 21 times as much heat to melt the ice. He reasoned that if it took 7 units of heat to raise the water temperature by 7°F - from 33° to 40° - and 7 x 21, or 147 units, to raise the temperature of the ice. Subtracting the 8 units required to raise the temperature of the melted ice from 32° to 40°, he found that 139 units had been absorbed by the ice in melting - a simple method to determine this constant. He called this latent heat.

He then went on to apply the same thinking to the evaporation of water. He placed a small quantity of water at 50°F over a hot stove and found that the water boiled in 4 minutes and evaporated completely in 20 minutes. He reasoned that heat entered the water at a rate of 212°F minus 50°F or 162°F in 4 minutes. Since it took 20 minutes to evaporate, five times as much heat
must have entered and become latent (to the amount of 162 x 5 or 810 units). He further noted that different bodies of equal masses required different amounts of heat to raise them to the same temperature.

So, in these experiments, Black:

- discovered latent heat and made heat a quantitative science
- established calorimetry, by distinguishing between intensity and quantity of heat
- discovered specific heat - that different substances had different capacities for heat.

For this work and his discovery of carbon dioxide, he would surely in today's world have won two Nobel prizes.

**James Watt**

Black read an account of his discovery of latent heat before a literary society in Glasgow in 1762 but published nothing on the subject. It had, however, the most far reaching results, being an important precursor of the industrial revolution. He was friendly with a young instrument maker in Glasgow called James Watt who applied the discovery of latent heat to the development of a separate condenser which made an efficient steam engine possible. The Scottish historian Smout put it well as follows:

'It is symbolic of the intellectual atmosphere of 18th century Scotland that one of the most epoch-making inventions of the industrial revolution should have come about through the meeting of an instrument maker from Greenock with a chemistry lecturer from Belfast over a collection of astronomical instruments given to the College in Glasgow by a Glasgow merchant who had made his fortune in the West Indies.'

Black had many friends of great intellect who included, apart from James Watt, the economist Adam Smith, the philosophers David Hume and Dugald Stewart Adam Ferguson, the so-called 'father of sociology' and the outstanding geologist James Hutton. Even in this formidable array of talents, Black stands out.

In Glasgow, and later in Edinburgh, he carried on a medical practice but restricted it to a close circle of friends, although he was appointed Physician to the King in Scotland. In later life he was frequently consulted on such matters as urban water supplies and the industrial production of alkalis. Honours came his way from France and Russia. After his return to Edinburgh, he did no more original work, perhaps because his health was feeble. In 1767, however, he made the first attempt to inflate a balloon with hydrogen. He died in 1799 and his precise mathematical mind is shown by his will in which he divided his property into 10,000 portions, to be distributed among a
list of numerous relatives in shares according to the degree of his friendship or his estimate of their needs.

Addendum

One final remark about his discovery of carbon dioxide. In the 1770s and 1780s, mouth to mouth resuscitation was used and described in exact detail. But it was abandoned because of Black's discovery that expired air which was blown into the patient's lungs contained this nasty stuff, carbon dioxide.

Benjamin Ward Richardson wrote, in the Asclepiad of 1890 (Vol VII, p 206), about a method of artificial respiration by manual compression which he said 'was adopted after the discoveries of Black had put aside mouth to mouth insufflation'. On page 209, he remarks:

'Immediate Insufflation Method: This method, which predates the time of Black and the discovery that carbonic acid is given off by the breath ..... was considered at first effective; but after the discovery that in expiration the poisonous gas, originally called fixed air - carbonic acid - is given off by the lungs; it was argued that to pour the exhaled breath of one human being into the lungs of another .... was to commit a grave physiological error, and to intensify the bad condition which was already present. The objection is partly valid, but the method, after all, is not without its advantages: it introduces warm air, and it regulates quantity extremely well.'

Positive pressure ventilation was almost completely forgotten until its re-evaluation in the 1960s. Then it was found to be much better than compression of the rib cage, which was still in use long after I qualified. Through no fault of his own, Black had set back the benefits of mouth to mouth resuscitation by almost 200 years, a tragic triumph of theory over practice.*

* Editorial

A Puzzle: Dr Masson's paper describing Joseph Black's discovery of carbon dioxide, its emanation from the lungs, and its poisonous nature, provides convincing evidence as to why mouth to mouth methods of resuscitation were dropped. But why did the use of bellows also disappear so completely?

At the Second International Symposium on the History of Anaesthesia, David Wilkinson emphasised the influence of the French workers, notably Magendie, in demonstrating the possibility of alveolar rupture by big bellows. Dr Hovell in this volume notes earlier concern with the large bellows of Monro Secundus. But world-wide there must have been doctors with
successful personal experience, prepared to defy the French 'experts', and to champion the use of bellows. In the hey-day of Victorian science and engineering, some experimenters must have studied lung volumes, and valves which would not cause overinflation by jamming. Dr Masson has reminded me that Benjamin Ward Richardson himself invented a double action bellows.

Is it not extraordinary that inflation of the lungs by bellows, so well described and so effective, fell into oblivion so rapidly and for so long? How complete was its eclipse? How many defied current opinion, and continued to use IPPV, ignoring the new methods of chest compression and expansion? Did no-one before Ralph Waters urge a rethink? If there were such heroes, why was their work ignored? Answers to any of these questions would be welcome as correspondence in the Proceedings.
THOMAS GRAHAM

Dr D Zuck
Honorary Consulting Anaesthetist to the Enfield Health District
President, History of Anaesthesia Society

Although Thomas Graham might seem to have little connection with our specialty, his discoveries, especially in physical chemistry, of which he has been called the father, have a direct bearing on fundamental intra- and extracellular processes, as well as on respiratory physiology, anaesthesia and resuscitation.

Education

Thomas Graham was born on 21 December 1805, at 55 St Andrew's Square, Glasgow. His father was a prosperous merchant and fabric manufacturer, who ensured that his son had a good education. Thomas attended Glasgow Grammar School (later the High School) and, at the age of 13, which then was apparently not unusual, entered Glasgow University. He studied classics, and also chemistry and natural philosophy, or science, graduating MA in April 1824. His father wanted him to follow many of his forebears and become a minister in the Church of Scotland. Thomas, however, had decided on a career in chemistry, and with the connivance of his mother persuaded his father that the best divinity teaching was to be had in Edinburgh. There he enrolled, but in the Faculty of Medicine, not Divinity. Subsequently, his father discovered the subterfuge and disowned him, but he continued to receive help secretly from his mother.

After a thorough training from some of the leading Scottish chemists, Graham returned to Glasgow in 1828, and began to earn his living by extramural teaching, and by contributing articles to a local magazine on the applications of science in everyday life. At the same time he continued with the research he had begun in Edinburgh. In August 1830, on the strength of a preliminary paper on the diffusion of gases, he was elected a member of the Faculty of Physicians and Surgeons of Glasgow. This qualified him to become a university teacher, and in September 1830 he was elected Professor of Chemistry at Anderson's (now Strathclyde) University. This brought about a reconciliation with his father. One of his students of this period described him as having uncombed red hair and a quiet, stiff, hesitant manner. It seems he was never a good lecturer.

International renown

In 1831 Graham presented his definitive paper on the law which is now named after him, his law of diffusion of gases. In 1833 he concluded an important piece of research into the three known phosphoric acids, which established the principle of polybasicity. This work brought him to the attention of the great Justus von Liebig, who sought him out while visiting Edinburgh in 1834 for the meeting of the recently formed British Association for the Advancement of Science, in which Graham was a very active participant. In the summer of
1836 Graham spent three months touring the Continent, and met a number of leading scientists, including Dumas and Gay-Lussac in France, Magnus and Mitscherlich in Germany, and again Liebig, with whom he established a lasting friendship.

In December 1836 he was elected Fellow of the Royal Society, his proposers being the two most eminent scientists in the country, Dalton and Faraday. This confirmed his position as a chemist of international stature and, in June 1837, he was appointed to the Chair of Chemistry at University College, London. He took up residence at 4 Gordon Square, and lived there for the rest of his life. At University College he was engaged in teaching chemistry, mainly to medical students. During the next 18 years he taught some 2,700, lecturing three times a week. Among these was Joseph Lister, who was very much influenced by Graham, and often referred to him appreciatively in later life. According to one source, it was Graham and Sharpey (Professor of Physiology at University College), who persuaded Lister to go to Edinburgh to train in surgery, with Syme. He was Dean of the Medical School during 1842-44, and again from 1850 to 1852.

Graham continued to be active in the affairs of the British Association and the Royal Society, and in 1841, in a move to promote the professional standing of career scientists, he was one of the founders of the Chemical Society, and was its first President. At first the new society was accommodated at the Royal Society of Arts, but soon moved into another part of Burlington House, Piccadilly, where it is still.

**Government adviser**

Five years after Graham's appointment to the chair at University College, his textbook *Elements of Chemistry* was published. In the same year, 1842, he became involved in the work at the new Government Laboratory, later known as the Department of the Government Chemist. The original purpose of the Laboratory was not in any way for the benefit of the public or their environment, but to protect the revenue from fraud. Duty was levied on imported beer, wine and tobacco, and if re-exported duty could be reclaimed. The main purpose of the Government Laboratory in its early days was to ensure that dilution or adulteration had not taken place between import and export so that, for example, one ton of imported tobacco was not miraculously multiplied into two tons of exported tobacco by the addition of non-tobacco leaves, salt, sand and nitre.

The laboratory staff consisted initially of one Excise officer, who was a self-taught chemist, so much of the work was farmed out. During the first year Graham analysed more than 100 samples of tobacco, and gave evidence in several trials. He compiled a list of some 25 common adulterants of tobacco, including sugar, molasses, coltsfoot, rhubarb, oak, elm and plane leaves, salt, potassium nitrate, alum, peat moss, oatmeal, and various dyes. In 1844, Graham was called to give evidence to a Select Committee on the Tobacco Trade, and he became recognised as an adviser on chemical matters to the government.
The advantage of having a trained staff of government chemists was soon obvious, and during January 1845 fifteen excise students started training in Graham's department at University College. This arrangement continued until 1858, by which time it was felt that the Government Laboratory was sufficiently well staffed to undertake its own training.

Graham became involved in the analysis of other products, such as pepper, which was dutiable until 1866, which he found to be adulterated with sago, ground rice, powdered slate, and quartz. He also examined coffee, which tended to contain ground roast peas, beans and orange pips, burnt sugar, and iron oxide. He investigated methods of purifying coal gas, and became an expert witness on chemical patents. In several enquiries he worked in a team with two other eminent chemists, Theophilus Redwood and A W Hofmann whose name became known to anaesthetists in the early 1980s for Hofmann's degradation of atracurium. Hofmann was one of Liebig's brightest pupils, and had been hand-picked by a committee headed by Prince Albert, to set up and lead the newly established Royal College of Chemistry in Hanover Square.

The first investigation the team undertook was into the alleged adulteration of beer by strychnine, and the second was into the purity of London's water supply, stimulated by the cholera epidemic of 1849. The problem here was that no-one knew what it was in water that was harmful. Spa waters, which were thought to be health giving, had been analysed since the mid-seventeenth century, so it was thought that a certain mineral content was desirable in any drinking water. There was, however, what might be described as a gut feeling that the presence of organic matter undergoing active putrefaction was not a good thing. Initially, the level of nitrates was used as an index of putrefaction, and subsequently the reduction in oxygen content, estimated by the discoloration of potassium permanganate. Unfortunately, because of the absence of any standards, the report was indeterminate, and disappointing to the sanitary reformers.

Master of the Mint

In 1851, Graham was a member of the scientific selection committee for the Great Exhibition, and at about the same time he was asked by the Master of the Mint, the great astronomer Sir John Herschel, to advise on the assaying of gold bullion that was being supplied to it, much of which had been found unsuitable for the minting of coins. When Herschel resigned in 1855, Graham was appointed to succeed him, relinquishing his chair at University College. The post was no sinecure. Graham was given the task of reducing waste, and improving the quality of coins. His main achievement was to introduce the more durable bronze that we still

* It is tempting to imagine that these chemists might well have been in touch with John Snow. This possibility is reinforced by the fact that Snow obtained some of his anaesthetic agents, notably his supply of amylene, from John Bullock, a pupil of Liebig, who had a chemist's shop in Hanover Street, and was a friend and patron of Hofmann.
use today, to replace the copper coins which wore very badly. The Mint made a substantial profit from the recovery of the copper.

**Graham's researches**

Among Graham's researches there were three topics of special interest to anaesthetists - the diffusion of gases, osmosis, dialysis and the diffusion of liquids, and inhibition of the oxidation of phosphorus by certain vapours. For the earlier phases of his diffusion experiments, conducted about 1829, Graham enclosed gases in large test tubes with the outlet tubes oriented so as to avoid the effect of gravity. The contents of the tubes were analysed after four hours. The definitive experiments were conducted some 3 years later, with tubes of ½ inch diameter and 6 inches to 14 inches long, sealed at one end by a plug of plaster of Paris 1/5 inch thick, and inverted over mercury. With a tube 6 inches long filled with hydrogen, the whole contents escaped within 20 minutes, as shown by the rise of the mercury to the top of the tube. Subsequently, the mercury level started to fall, as air diffused into the tube. Applying Dalton's law of partial pressures, he reasoned that the external air was a vacuum as far as the hydrogen was concerned, and the tube a vacuum to the air. He experimented with a number of other gases, including carbon dioxide, oxygen, nitrogen, ammonia and nitrous oxide, showing that they diffused at different rates, which were inversely proportional to the square root of their densities.

These experiments were not serendipitous, but arose from some brilliant reasoning. It was by then accepted that the pressure exerted by a gas in a container was a manifestation of the force with which the atoms bombarded its walls. Graham argued that since equal volumes of oxygen and hydrogen at the same temperature exert the same pressure, then the force exerted by the atoms of each gas must be equal. But oxygen is 16 times heavier than hydrogen; therefore, since force = mass x acceleration, the hydrogen atoms must be moving much faster than the oxygen atoms. Hence they could be expected to escape more quickly, which is what he demonstrated.

Graham went on to apply his observations on diffusion to the mechanics of respiration, arguing that while the whole capacity of the lungs is some 300 cubic inches, the volume of a single breath is only about 20 cubic inches. This breath will fill only the windpipe and its larger branches, so that the contents of the ultimate reaches of the lungs might be expected only to advance and recede with each breath. But, he argued, this oxygen diffuses in, and carbon dioxide moves out, and since the latter is denser than the former, 81 parts of carbon dioxide are replaced by 95 parts of oxygen. This mechanism, according to Graham, provided for the full and permanent inflation of the ultimate air cells of the lungs.

As a further demonstration of gaseous diffusion, he placed an animal bladder half full of coal gas in a receiver of carbon dioxide. After 12 hours so much carbon dioxide had diffused into the bladder that it was full to bursting point. This demonstration provided supporting evidence in the debate about whether gases could cross animal membranes. Later, he showed that indiarubber selectively absorbed nitrogen, leaving an oxygen-enriched atmosphere in a bag.
originally full of air. Anaesthetists, of course, are well acquainted with these phenomena, seen, for example, in the passage of nitrous oxide into tracheal cuffs.

His textbook, *Elements of Chemistry*, published by Ballière in 1842, was a massive volume of almost 1100 pages. The first 240 were devoted to the basic sciences: heat, light, evaporation, diffusion, distillation, atomic theory and chemical affinity. He then proceeded through the chemistry of non-metals, metals, organic compounds and, finally, the chemistry of plants and animals. He introduced the linear balanced chemical equation in the form we are familiar with today. What would have been of interest to John Snow was a very full discussion of heat, the boiling point of liquids, the influence of atmospheric pressure on the boiling point, hygrometry, dew point, wet-and-dry bulb thermometry, and a formula for calculating vapour pressure in air. Unfortunately, this is difficult to test today, because the temperatures are given in degrees Raumur, and the pressures in Parisian lines. This book became the standard text and was soon translated into German and other European languages, and was very influential for a number of years.

In 1846, Graham reported experiments on the differential diffusion of gases from a mixture. Almost one century later this work formed the basis of the method used during World War 2 to separate the fissile isotope of uranium, $^{235}\text{U}$, from the ordinary and much more abundant $^{238}\text{U}$. In his Bakerian Lecture to the Royal Society in 1850 Graham considered whether the spread of salts through a solution was similar to diffusion. In 1861 he broke new ground in a paper presented to the Royal Society. He pointed out that, as regards diffusibility, some solutions, in an analogy with gases, might be regarded as volatile, and others as fixed. The volatile solutions were able to crystallise. The fixed were not, and were slow in the extreme to diffuse. Examples of these were starches, dextrin, gums, caramel, gelatine, and certain animal and vegetable extracts. Since glue was the commonest preparation of gelatine, he proposed (from kolla, the Greek word for glue) to designate such compounds as colloids. Substances of the other type would be classed as crystalloids. He suggested that 'the distinction is no doubt one of intimate molecular constitution'.

Other terms coined by Graham are dialysis, osmosis (to replace the old-fashioned osmose), pectin, sol and gel.

The third observation of particular anaesthetic interest is actually the earliest, and is one that John Snow mentions several times. It was well-known that a piece of phosphorus in air is surrounded by white smoke, as a result of the slow oxidation or combustion that it undergoes, and that for the same reason it glows in the dark. In 1829, Graham described how the presence of certain vapours would inhibit this reaction: ethylene, then known as an olefiant gas, in a concentration of 1:450, sulphuric ether 1:150, naphtha vapour 1:1820 and turpentine vapour 1:4444. He described an experiment in which two or three moist sticks of phosphorus are placed in a pint sized jar of air: 'It will fill with white fumes. Introduce a little ether vapour - the fumes will disappear in a few seconds and not reappear, the air becoming quite transparent. Stopper the bottle. The ether will slowly react with oxygen in the air to form acetic acid - this will take a few days, after which the white fumes will reappear. Similarly,
ethylene prevents the luminosity of phosphorus in the dark, and will prevent the sparking of hydrogen and oxygen in the eudiometer."

John Snow used this observation to support his contention that ether and chloroform act by damping down the oxidation process in the body. Snow had shown that oxygen consumption and carbon dioxide output were reduced during anaesthesia. Graham had demonstrated that ether inhibited oxidation in vitro; by extension, Snow argued, this should explain the in vivo observation, too. Graham died at his home in Gordon Square on 16 September 1869. He had returned a few days previously from a stay at Great Malvern. Possibly he had gone to Dr Gully's hydropathic institution in Malvern for the fashionable water cure. I had difficulty finding where he is buried. To their great chagrin, neither the Royal Society, of which he had been a Vice-President, nor the Royal Society of Chemistry knew. His grave is in the grounds of Glasgow Cathedral. There is a statue of him in George Square (Figure 1). A volume of his collected works, in which all the researches described will be found, was published some six years after his death.

Figure 1. Statue of Thomas Graham, in George Square, Glasgow
Conclusion

Graham was described in one posthumous appreciation as an atomist. Certainly all his observations on diffusion strongly supported both the atomic theory and the kinetic theory of heat. In his *Elements of Chemistry* Graham discusses the older material or caloric, and the newer undulatory, theories of heat. He preferred the latter because, he says: 'the different properties of heat can be referred to differences in the size of the waves, as differences in colour are accounted for in light'.

In many of his ideas Graham was much in advance of his contemporaries. He was for long a supporter of the move towards the decimalisation of weights and measures, having observed that scientific papers using national systems were rarely translated into other languages. He also advocated the decimalisation of coinage, and also the establishment of an international unit of currency. During his lifetime, chemistry changed from being an experimental science pursued by a few amateurs and itinerant lecturers, into a fully fledged professional occupation in which one could make a career and a living. No-one did more than Graham to help bring this about.

Acknowledgements

I am grateful to Dr Alan Macdonald for locating the various sites associated with Graham in Glasgow, to Nicola Best, senior library assistant, Royal Society of Chemistry, and to Geoffrey Turner of the Department of the Environment Historical Research Library.

References

8 Ihde JA. *The Development of Modern Chemistry*. New York, Dover Books, 1984, 415-6. [Ihde discusses other aspects of Graham's contributions also.]
10 Graham T. *Chemical and Physical Researches*. Edinburgh, 1876.
There may be a few younger anaesthetists who do not know what an azeotropic mixture is. The story is over thirty years old and covers a period of barely five years. I was reminded of it by an historical piece in the *Canadian Journal of Anaesthesia* in December 1993 on Fernando Hudon, who first used the halothane-di-ethyl ether aze trope in anaesthesia. He worked at the Hôtel-Dieu Hospital in Quebec and, in 1943, in co-operation with Wesley Bourne, Harold Griffith and Digby Lee at McGill University, he established a training programme in anaesthesia, at that time primarily for medical officers in the armed forces. His continued interest in education and research led to his being elected, in 1952, to the Fellowship of the Faculty of Anaesthetists of the Royal College of Surgeons of England. He described the halothane-di-ethyl ether aze trope in 1958.

An azeotropic mixture is a solution of two or more liquids, the composition of which does not change on distillation, and which therefore has a constant boiling point. The exact composition of the mixture is altered only by changes in external pressure, and the components can be separated only by gas chromatography. A random solution of two components which form an aze trope may be separated by distillation into one pure component and the aze trope, but not into two pure components.

In 1802, John Dalton\(^1\) noted the appearance of minimum vapour pressures in a mixture of spirits of wine and water. Two chemists, Wade and Merriman,\(^2\) working in the chemical laboratory at Guy’s Hospital, coined the word ‘aze trope’ in 1911 and showed how the composition of the aze trope of ethanol and water changes with pressure. The word is derived from three Greek words: the prefix ‘a’ denoting not, ‘zeo’ I boil and ‘trope’ change, that is, to boil unchanged.

In 1973, an American chemist, L H Horsley,\(^3\) published an encyclopaedic list entitled ‘Aze tropic Data III’, which mentions nearly 8,000 binary aze tropes, 371 ternary or triple aze tropes, 9 quaternary aze tropes and one five-substance aze trope. They are mostly composed of organic substances, although many of the ternary and quaternary aze tropes include water. At least three familiar substances, chloroform, di-ethyl ether and trichloroethylene are mentioned, but not in combination with each other or with other anaesthetic agents, with one exception. Examples of binary aze tropes are chloroform and ethanol and ether and water, and of ternary aze tropes, trichloroethylene, ethanol and water, and chloroform, ethanol and hexane. The mixture of 2 parts chloroform and 3 parts ether, and the ACE mixture (ethanol 1 part, chloroform 2 parts and ether 3 parts) which used to be employed more than fifty years ago on an open mask, do not form aze tropes.
Ruthane and di-ethyl ether

Fernando Hudon, with the help of his assistant, Andre Jacques and a biochemist, P-A Boivin, first described the azeotrope of halothane and di-ethyl ether in 1958. Halothane had been released for clinical use in 1956, its advantages becoming obvious at once. Soon, the disadvantages also became obvious: little analgesic effect, respiratory and cardiovascular depression, and the danger of overdose with high concentrations. We are all familiar now with the need to give an excess of oxygen and to use specially calibrated vaporisers, but this was not understood at first. To correct the vagal overaction causing bradycardia and displacement of the cardiac pacemaker, Hudon and his colleagues suggested that the stimulation of the sympathetic system associated with light ether anaesthesia might be employed by combining the two agents, using a mixture of 2 parts halothane and 1 part ether, i.e. 66.7% v/v and 33.3% v/v respectively. They found that there was an exothermic reaction when the two agents were mixed in these proportions at room temperature (i.e. 24°C), with an increase to 33°C and an unspecified diminution of volume. At 51.1°C, about 65.8% of this mixture came off in a constant proportion.

By chance, they had chosen a solution within 2% of the azeotrope, which is 68.3% halothane and 31.7% ether. The azeotrope remained unchanged throughout distillation and, when stored in a brown bottle with thymol, remained unchanged for four months. Hall, Norris and Down at Duke University, North Carolina, made it 66% and 34% respectively, with a boiling point of 52.7°C when corrected to 760 mm pressure. On mixing the two agents, they showed that the heat gain was 1,200 calories per mole of azeotrope, and the diminution in volume was about 0.3%, presumably owing to some form of molecular bonding.

The azeotrope was not flammable below 4.4% in oxygen, a concentration higher than that needed in clinical anaesthesia, and no explosions occurred with concentrations of less than 10.9% in oxygen. Even a mixture of halothane 52% v/v and ether 48% v/v did not ignite until after five minutes' exposure to a Bunsen burner flame.

Hudon and his colleagues used the azeotrope in a Boyle's apparatus with a Fluotec, in a Heidbrink machine in both semi-open and closed circuits, and on an open mask. They needed only 2.5% for induction and 0.5% for maintenance, representing 0.8% and 0.16% ether respectively. They found that recovery was rapid, postoperative analgesia was better, and circulatory and respiratory depression were less than with halothane alone. They also found that the azeotrope was expired unchanged and that the concentration of free acids, one part per million, was the same in the inspired and in the expired gases. In 3,016 patients anaesthetised with halothane alone, there were 3 cardiac arrests, but none in 2,444 in which the azeotrope was employed.

In 1959, Aileen Adams, Lambrechts and Parkhouse published their results. They gave the azeotrope in air with a suitably modified EMO inhaler. They cited 200 cases, inducing the patients with either thiopentone or the azeotrope. Provided minimal concentrations were used and the respiration was assured, they were impressed with the results. Others, including
Wyant and his colleagues in Canada, Dobkin and colleagues in the USA and Black and Love in Belfast, gave encouraging results and it looked as if the azeotrope might have a useful place in clinical anaesthesia.

However, dissentient opinions came from Raventós and Dee, working with mice, cats and dogs. They found evidence of severe cardiovascular and respiratory depression, with serious arrhythmias, particularly in dogs. Michael Johnstone called halothane-ether 'an illogical mixture', but he was using 10% halothane in oxygen for induction, followed by 3% azeotrope for maintenance, a higher concentration than others found necessary.

Raventós found that the azeotrope was flammable in oxygen at 8.0%, in 50% nitrous oxide with oxygen at 5.2%, and in 80% nitrous oxide: 20% oxygen at 5.7%. Parkhouse and Simpson pointed out that these figures had no relevance to clinical practice, since they were above those used in anaesthesia in man.

In the United States, Stephen and his coworkers, with an experience of 200 cases, 100 with halothane and 100 with the azeotrope, doubted if its value was greater than that of halothane alone. Davies and colleagues, reporting work in progress in Anesthesiology in 1962, found that ether was eliminated from the body slightly but significantly more than the azeotrope.

**Halothane and methyl n-propyl ether**

In 1961, Rodney Walsh, then a senior registrar at St George's Hospital in London, began clinical work on an azeotrope mixture of methyl n-propyl ether ('Neothyl', 'Metopryl') and halothane. Methyl n-propyl ether was first introduced by Krantz and co-workers in the USA in 1946. Like di-ethyl ether, it is explosive. It has a rather unpleasant smell, but has a good analgesic action and is less irritating than di-ethyl ether to the respiratory tract. A modified vaporiser was provided by Cyprane Ltd, and details of the physical properties of 'Neothyl' and the azeotrope were supplied by the manufacturers, Macfarlan & Co. The proportions, 68.7% v/v halothane and 31.3% v/v 'Neothyl', were nearly the same as those for halothane-ether and it appeared very similar in its action. It also lost its unpleasant smell. Its boiling point was 53.6°C±0.3°C, its flammability not less than 11% in air, and it was similar to halothane-ether in oxygen and nitrous oxide. By mixing 44 ml halothane with 20 ml 'Neothyl', we found that the temperature of the liquid rose by 10°C, although there was no obvious change in volume. After Walsh's tragic death in 1961, I went on to compare 100 cases using the azeotrope with 100 using halothane alone. The results were broadly similar, with a very slightly greater postoperative analgesic effect with the azeotrope.

There was an opportunity to give anaesthetics to two 16 year old identical twin sisters, of the same weight, having the same operation, nasal reduction, one after the other. Each was given the same premedication and anaesthetic, except that the elder had halothane and the younger the azeotrope. The results were similar, except that postoperatively the elder twin receiving halothane vomited many times, while the younger receiving the azeotrope vomited once.
In fact, there was virtually no difference between the two series of cases. None of the effects of either azeotrope was submitted to statistical analysis, but it was obvious that there was no significant difference between halothane and the azeotropes in any respect.

The end of the azeotropes

Between 1960 and 1962, several papers on the halothane-ether azeotrope appeared, all giving much the same results. In 1963, Wyant, with an experience of over 6,000 cases anaesthetised with halothane-ether, wrote what I think was the epitaph on the azeotropes, stating that, although it had a wider margin of safety than halothane alone and might be safer in the hands of relatively inexperienced anaesthetists: 'It can do everything that halothane can do, it does not do it better, nor does it any worse'. The last reference to the use of azeotropes in anaesthesia was in a Polish journal in 1964.

Why did the azeotropes last for such a short time? Firstly, because of the increasing realisation by anaesthetists that halothane was an excellent anaesthetic agent if it was given with sufficient oxygen, with adequate support of the respiration, and in known percentages from a calibrated vaporiser and, secondly, on account of costs. In 1958, a 250 ml bottle of halothane cost about £10. With the azeotropes, this was cut by nearly a third. By 1963, the cost of halothane had fallen to about £6 and continued to fall in real terms for some years. These were the two main factors responsible for the end of the azeotropes in anaesthesia. As far as I know, no-one has tried to make an azeotrope with enflurane, isoflurane, or the newer inhalation agents.

References

1. Dalton, J. On the Constitution of mixed GAS; on the Force of STEAM or VAPOUR from Water and other Liquids in different Temperatures, both in Torricellian Vacuum and in Air; on EVAPORATION and on EXPANSION of GASES by Heat. Memoires of the Literary and Philosophical Society of Manchester 1802; 5:590.
9. Wyant GM, Cockings EC, Muir JM. Clinical experiences with the azeotropic
Rottenrow is the street in Glasgow where the Royal Maternity Hospital is located. The origin of the name is reputed to be a translation of the Gaelic, Rattad'n righ or of the French, Route-en-roi, both meaning the Road of the King. The hospital's 150th anniversary was celebrated in 1984. No wonder Glaswegians have a great affection for the Rottenrow; it has the longest continuous existence of any maternity hospital in Scotland.

The first two Visiting Anaesthetists were appointed in 1930, with £200 per annum salaries. In 1932, a Resident lady Anaesthetist was engaged but she was poached by the Victoria Infirmary in 1934. The Visiting system endured until 1959, when a dedicated Consultant Obstetrical Anaesthetist was appointed. This was Dr T W Baillie whom you may recall produced a monograph on the first surgical use of ether in the old world, at Dumfries Royal Infirmary. In 1963, when Dr Baillie left for Dumfries, I was one of two Consultants appointed to the Royal Infirmary, but with duties weighted heavily towards obstetrics.

The changes introduced with Dr Baillie's appointment were due to the foresight of Professor Alec Forrester. Later appointments and the assimilation of anaesthetic services under the umbrella of the Royal Infirmary Department were similarly to his credit. This provided a first class consultant-based anaesthetic service, with a sound platform for teaching. So, in 1959, anaesthesia moved away from chloroform and ether into airway protection techniques and muscle relaxants. Regional techniques for pain relief were prominent in anaesthetic thinking but a certain resistance by midwives and obstetricians delayed their introduction until just after 1970. The diehards were soon converted and epidural pain relief in labour began to lead to its perioperative use.

By 1980, 53% of caesarean section patients were delivered awake under epidural analgesia. Despite the benefits, a percentage were still experiencing visceral reflex pain during abdominal delivery, sometimes even necessitating added general anaesthesia. While searching for a remedy, I was attracted by Selwyn Crawford's paper in 1979 on spinal analgesia. However, even he said in the 1982 current reviews, that most obstetric anaesthetists would consider this form of anaesthesia to be a poor third choice for caesarean section. Who was I to disagree since my experience with spinal analgesia was extremely limited? I understood the theoretical benefits but I was too timid to try it.

The break-through came with Brownridge's letter to *Anaesthesia* in January 1981 describing a double interspace method of combined spinal and epidural. An intermediate spinal would stop the reflex responses seen with the current epidurals and be safer for cardiovascular stability while the epidural could extend the somatic component. More importantly, if I used a single space technique with the Tuohy needle as the introducer, my technical inadequacies with the direct spinal route could be avoided. It seemed simple until I tried to find a spinal
needle of suitable length. After some months, I procured an all-metal 25g Steriseal needle of 110 mm length. The earliest case record I can find is dated 2 November 1981, perhaps my first 'thru spinal'. The technique reads: 'Intrathecal Marcain 0.5% 2 ml, L2/L3 25g needle. Lumbar epidural canulation same space, 8 ml, 0.5% Marcain'.

Experience of other cases by the end of 1981 made one feel this was a step forward, but Coates' letter to *Anaesthesia* (1982; 37: 89) pre-empted any claim to originality. Obstetrics seemed no different to orthopaedics. After pilot studies, a protocol was drawn up. Aim number one was to study the technical use of dural puncture and intradural analgesia using an 18g Tuohy needle as introducer. Eighty-one cases presented material for analysis. It was now time to present the technique to my peers. An Obstetrical Anaesthetists Association presentation seemed less work than a publication. My submission for the autumn meeting in 1983 was not accepted. A year later, another opportunity presented itself. Although an erudite and distinguished assembly, it was not a discerning or critical audience for an anaesthetic paper. This was a meeting of the Munro Kerr Society on the occasion of the hospital's sesquicentennial anniversary in 1984. It was now three years since the technique was introduced at Rottenrow.

It was also the year of the first published paper on a 'needle thru needle' technique in obstetrical anaesthesia, by Carrie and O'Sullivan from Oxford and I congratulate them on their industry.

In those early days, I never felt that the method went down well with my trainees - especially when my supply of 110 mm needles ran out and I had to substitute 150 mm length through a 100 mm Tuohy. The real reason, I think, was the unexpected demonstration of how spinal analgesia per se was such an efficient method of pain relief. The epidural component was an unnecessary palaver. So spinals took over from epidurals for caesarean section, with speed of onset a great boon. I quote my closing remarks at the 1984 commemorative meeting:

'I conclude by venturing that spinal analgesia has a definite place in obstetrical pain relief and in time may well erode the privileged position of epidurals in theatre work ... history making indeed.'

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**Table 1. Caesarean Section (CS) Royal Maternity Hospital**

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<td>5</td>
<td>21</td>
<td>62</td>
<td>188</td>
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<td>As % of all CS</td>
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<td>1</td>
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Today, spinal is the preferred choice for caesarean section at all three Glasgow hospitals. I feel the catalyst may have been the Rottenrow 'needle thru needle' technique in a city where news does not take too long to travel. Tables 1 and 2 show the progress of spinals in these early years.

**Three other Rottenrow 'Firsts'**

By the late 19th century, caesarean section had been tried and found wanting because of unacceptably high maternal mortality. The grim alternative, foetal craniotomy, carried an equally high mortality. Murdoch Cameron grasped the nettle and, in 1888, performed his first caesarean section on a rachitic dwarf. In September 1890, the *British Medical Journal* reported Cameron's fourth success. He had made the breakthrough and, by the turn of the century, the operation had ceased to attract particular attention.

The next name I bring to attention is Professor Munro Kerr. Although not the innovator, he introduced the first dispensaries for pregnant women, nursing mothers and new born infants in 1915. Parallel with the establishment of an antenatal department was the creation of a postnatal one, which was concerned with infant welfare. The growing reputation of Rottenrow attracted Medical Research Council funding. Munro Kerr championed the cause of maternal welfare and his treatises on maternal mortality and morbidity gained the Harman Prize. As far back as 1929, Kerr recommended that all members of the industrial classes should have their first births in hospital. This ethos is still being promoted today in the creation of the Women's Reproductive Health Service opened in 1991, where the social implications and influences on maternal and child welfare are studied.

My last, but by no means least, name is that of Professor Ian Donald. He took part in the development of ultrasound as a medical tool and introduced it into obstetrics while Regis Professor. Later, his unit moved to the purpose-built Queen Mother's Hospital.

Thus, Rottenrow has enjoyed an illustrious and progressive career in the vanguard of its specialty, while anaesthetic services have complemented obstetrical endeavours. I felt the 'thru spinal' story worth recording as part of the hospital's history.

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**Table 2. Comparison: Percentage of CS under spinal anaesthesia**

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<td>5</td>
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<tr>
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<td>-</td>
<td>&gt;1</td>
<td>2</td>
<td>&gt;1</td>
<td>3</td>
</tr>
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</table>

(With thanks to Drs Frame, Thorburn and Davies for assistance with the data in the tables)
Editor: Dr Ferguson concluded by showing a short video clip of a caesarean section under spinal made around 1984.

References:

THE DARKER SIDE
A review of crimes committed using anaesthetic agents and techniques

Dr E Holmes
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As historians, we tend to focus on the achievements of our colleagues, and the many developments in the specialty, which have improved the safety and effectiveness of our practice. One result of the ongoing advances in anaesthesia has been the ever increasing availability of many potent and potentially lethal drugs. This paper relates some of the instances in which anaesthetic drugs and techniques have been used to kill, or attempt to kill.

Chloroform

In 1875, Adelaide Blanche de la Tremoille, the illegitimate daughter of an English nobleman and a French mother, and at that time 20 years old, married Edwin Bartlett, a prosperous grocer, 30 years of age. Initially, the union seems to have been quite platonic. She was sent away immediately after the wedding, first to a finishing school in England, and later to a convent in France. It was almost 3 years after the wedding before they lived together in a flat above his shop in Herne Hill. Later they moved to Wimbledon, and it was during this time that Adelaide formed a close relationship with 27 year old Reverend George Dyson. It was a friendship actively encouraged by her husband and later that year, when they moved to Pimlico, Bartlett provided Dyson with a season ticket so that he could continue to visit regularly. At about this time Bartlett made a will leaving everything to Adelaide and appointing Dyson as his co-executor.

In December 1885 Bartlett was taken ill with gastritis, and during this time also had some dental extractions. On 27 December, Adelaide asked Dyson to get her some chloroform. He purchased three separate bottles, each from a different chemist, giving as his reason for purchase the need to remove some grease stains. He put all the chloroform into one bottle which he gave to her. On New Year's Eve Bartlett was much improved, eating well and planning a trip out to the countryside on New Year's Day. During the time of his illness his wife had nursed him herself, staying with him at night and sleeping in an armchair in his room.

In the early hours of New Year's Day she awoke to find that he had died, apparently quite some time earlier. She said that she had neither heard nor seen anything unusual. The chloroform bottle was still in the room.

A post-mortem found chloroform in his stomach but no sign of any oral or pharyngeal burning. At this time Adelaide confided to her doctor that her husband was proposing to assert his marital rights and that she had attempted to deter him by giving him chloroform inhalations. She was charged with murder, and Dyson was charged as an accessory. However, as the trial began, the case against Dyson was dropped. Medical evidence was given by Bartlett's own doctor and expert evidence by Dr Thomas Stevenson of Guy's Hospital. The case against Adelaide foundered on the question of how the chloroform had
entered the stomach without burning the mouth or throat. After two hours deliberation the jury stated: 'Although we think grave suspicion attaches to the prisoner, we do not think there is sufficient evidence to show how, or by whom the chloroform was administered'. They therefore returned a verdict of 'Not guilty'.

There are two interesting postscripts in this case. Sir James Paget, Sergeant Surgeon to Queen Victoria, wrote: 'Now that she has been quite properly acquitted she should, in the interests of science, tell us how she did it'.

Thirty years later, in New York, Frederick Mors, a porter in an old people's home, killed seven of the residents. He said:

'First, I would pour a drop or two of chloroform on to a piece of absorbent cotton and hold it to the nostrils of the old person. Soon my man would swoon. Then I would close the orifices of the body with cotton, stuffing it in the ears, nostrils, etc. Next, I would pour a little chloroform down the throat, and prevent the fumes escaping the same way. It wasn't long before the heart stopped beating'.

In 1889, Dr Etienne Deschamps, a dentist from New Orleans, who claimed to have occult powers, persuaded Jules Deitch, a local carpenter, that with the aid of a pure young girl to act as a medium, he could locate and recover the lost treasure hidden by the pirate Jaques Lafitte. Deitch gave his 12 year old daughter, Juliette, into the care of Deschamps who, for the next six months, repeatedly raped the girl after first stunning her with chloroform. The girl's 9 year old sister had witnessed some of these activities and finally brought her father to the house, where Juliette was found dead and Deschamps suffering from self inflicted stab wounds. It was not clear whether the girl died as a result of an overdose, or was deliberately killed to prevent her from speaking out. The court presumably thought the latter and Deschamps was executed in May 1892.

In 1900, the 84 year old Texas oil millionaire and philanthropist William Marsh Rice, founder of the Rice Institute, was killed with a mixture of chloroform and a mercurial compound by Albert Patrick, a lawyer, who had conspired with Rice's secretary, Charles Jones, to pass forged cheques drawn on Rice's account. He was killed when the bank started to question the cheques. Jones turned state's evidence, and was discharged. Patrick was sentenced to death, later commuted to life imprisonment. In 1912 he was pardoned and he died in 1940.

A New York model, using the professional name Dot King, was found in her flat in 1923, having been killed with chloroform and robbed. She was known to have been involved with a Philadelphia millionaire but he was cleared of suspicion. There was speculation in the press of a possible blackmail plot but no one was ever charged with her murder.

My last case involving the use of chloroform is that of Ruth Snyder and Henry Gray, also known as the Granite Lady and Lover Boy. They killed Snyder's husband, Albert, after first insuring his life for $96,000. Gray hid in the Snyder home until Albert was asleep, then hit him
on the head with a window sash weight, chloroformed him, and finally strangled him with a picture wire. He then bound and gagged Ruth and left her to be found when the body was discovered. The police tricked Snyder into admitting complicity by telling her that Gray had been arrested and had confessed. Both were found guilty, sentenced to death and were electrocuted in Sing Sing prison in January 1928. During the time she was awaiting execution, Snyder received 164 proposals of marriage.

Coal gas

Thomas Nunneley of Leeds, in his researches into anaesthetic agents, described coal gas as a safe and effective agent, its only real drawback being the unpleasantness of its odour.

A man known as H H Holmes, real name Herman Webster Mudgett, built a 100 room hotel in Chicago. It was regarded by local residents as a monstrosity and was known as Holmes's Castle. Following an insurance fraud resulting in the death of Benjamin F Pitzel, the man who supervised the building of the hotel, Holmes was arrested and the building was searched by police. It was found to have been built as a death house. The upstairs rooms were of airtight construction with built-in gas inlets. Downstairs were windowless rooms, some with vats of acid, and one equipped with a surgical table and surgical instruments. These rooms were connected to the upstairs rooms by chutes.

At the trial, a car mechanic told how he had worked for Holmes, stripping flesh from bodies which he was told had come from the city mortuary. Holmes was found guilty of murder and sentenced to death. Whilst awaiting execution, he confessed to 27 murders. He was hanged in Philadelphia in May 1986.

About New Year 1932, Mike Malloy, an Irish alcoholic and down-and-out, became known to a group of five New Yorkers, including a taxi driver, a bar tender and an undertaker. They called themselves the 'Murder Trust' and their specialty was taking out life insurance on derelicts and then killing them and collecting on their insurance. At New Year, they gave Malloy as much drink as he could take, including quite a lot mixed with anti-freeze, and left him for dead. The next day he was back looking for more free drinks. Over the next few weeks they tried wood alcohol, turpentine, sardines stuffed with bits of metal and tin tacks and still he came back for more. At this time they nicknamed him 'Durable'. They tried hit and run tactics with a car, soaked him to the skin whilst drunk and left him out in the frost overnight. Still they had no success. Finally, they made him drunk again, and pushed a gas pipe down his throat and left him to die. The 'Trust' would probably have remained undetected had one of them not boasted about their exploits, thus interesting the police in the death. Malloy was exhumed and found to have died of carbon monoxide poisoning. The members of the 'Trust' were found guilty and executed.

The most interesting of these cases, perhaps, from the anaesthetist's viewpoint, occurred in London. John Reginald Halliday Christie, resident of 10 Rillington Place, a dilapidated house in the Notting Hill area, killed two woman, Ruth Fuerst and Muriel Eady, in 1943 and three
more, Rita Nelson, Kathleen Maloney and Hectorina MacLennan, between January and March 1953. Most were prostitutes. He picked up the women locally, usually in a public house, plied them with drink, and then took them to Rillington Place where he would seat them in an old fashioned deck chair which had a canopy and was draped with a towel. He would then persuade them to breathe the coal gas, which he passed through a contraption of his own design, bubbling it through friars' balsam to disguise the odour. The device was made out of a glass jar and tubing, and functioned essentially like a Boyle's bottle. When his victims were stuporous, he would strangle them with a rope prior to committing necrophilia. It is not clear how he persuaded them to inhale the gas. In the case of Muriel Eady who was a nurse, it is thought that he offered to treat her respiratory infection. In other cases he may have offered it as an anaesthetic as a preliminary to procuring an abortion, though there is no evidence that he did actually practice as an abortionist, or he may have offered it as a recreational drug. Ten Rillington Place first came to the attention of police in 1949, when the bodies of Beryl Evans and Geraldine Eady, the wife and fifteen month old daughter of a lodger at the house, Timothy Evans, were found strangled and concealed in the house. At this time the bodies of Fuerst and Eady were already buried in the garden. Evans, who was of low intelligence and illiterate, was charged with the murder of his child, found guilty, and executed in March 1950 at Pentonville. In 1953, Christie killed his wife and then the other 3 women. At post mortem, neither his wife nor Beryl Evans showed signs of carbon monoxide poisoning, although all the other victims did. Christie confessed to all the murders including that of Beryl Evans but not that of the child. He was found guilty and was executed, also at Pentonville, three and a half years after Evans. Sixteen years later, Evans was granted a posthumous pardon.

The wife of Ian Smith, a lecturer in physics from Leeds, was found dead in a caravan, a victim of carbon monoxide poisoning. The death was at first attributed to a faulty butane heater. However, his wife's blood was found to be 80% saturated with carbon monoxide as opposed to Smith's level of 14%, despite the fact that both had been in the caravan all night. Smith later confessed to having given his wife pure carbon monoxide, which he had stolen from his laboratory. In 1981 he was convicted of manslaughter.

Muscle relaxants

Suxamethonium was used by Dr Carl Coppolino, the only anaesthetist (or anesthesiologist) I have been able to discover who has been convicted of murder. He was born in 1933 in Brooklyn. He qualified and became a successful private practitioner in New Jersey. In 1965 he abandoned his practice and moved to Florida City, citing cardiac problems as the reason. His insurance company, though somewhat suspicious, paid him $22,000 annually. His wife Carmela, also a doctor, ran a general practice in Florida thus enhancing their income. Whilst his wife worked, Coppolino commenced an affair with a 38 year old divorcée, Mary Gibson. In September 1965 Carmela Coppolino died of a heart attack only three weeks after her husband had insured her life for $65,000 and, within a month, he had married Mary Gibson. This action infuriated another mistress, 48 year old Marjorie Farber, with whom he had been having an affair since the New Jersey days. She contacted the police alleging that Coppolino
had murdered her husband, Colonel Farber, giving him suxamethonium and suffocating him with a pillow, and that he had done the same thing to his wife. He was indicted for murder in both New Jersey and Florida. Following conflicting evidence, he was found not guilty of murdering Farber but, in 1967, he was tried for the murder of his wife. Examination of her body showed that she had not suffered from cardiac disease. Evidence was given that succinic acid was present in the body particularly around the needle track. He was convicted of second degree murder and sentenced to life imprisonment. He was released in 1979 for good behaviour. The publicity surrounding this case led to suxamethonium becoming known as the 'Doctors' poison'.

In 1975, a call was made by the acting Chief of Staff, Dr Freir, from the Veterans' Administration Hospital at Ann Arbor, Michigan, to the Federal Bureau of Investigation, requesting assistance. There had been 56 cases of respiratory arrest in the hospital between 1 July and 15 August. The expected number in this time, based on previous records, would have been between 8 and 10. Most occurred in the evening and they had become so frequent that the nurses had taken to waiting around in the hallway for the next to happen. An internal investigation had come to the conclusion that patients had been given pancuronium into their intravenous drips.

The FBI sent agents immediately and it was discovered that one of two Filipino nurses, Filipina Narciso, or Leonara Perez, had always been close by whenever an arrest took place. The FBI were surprised at the ease of access to pancuronium and to other drugs which were often not locked away. Blood samples were sent to the toxicology laboratory in Washington and pancuronium was found, although none had been prescribed. Five patients who died were exhumed and pancuronium was found to be present. No needle marks other than those of infusions existing at the deaths were found. The two nurses were brought before a grand jury but there was insufficient evidence and no indictment was made. A year later, the case was re-opened and this time the grand jury returned a 16 count indictment against the nurses including 5 counts of first degree murder. Before the trial, Mrs Betty Jakim, a former supervisor at the hospital, confessed responsibility for the deaths. She was, however, suffering from terminal cancer and was a patient at a mental institution at the time, immediately following her confession she committed suicide. The nurses went on trial: Perez was convicted of poisoning and conspiracy to murder, Narciso was found guilty of one murder and acquitted of two charges of poisoning and one of conspiracy. They were sent for confinement to a psychiatric institution.

A lot of interest had been taken in the trial in the Phillipines, and money had been collected there to finance the defence costs. Imelda Marcos took an interest in the case and suggested that United States immigration policy was unfair and that the nurses were the victims of false accusations, which had been made with the object of deterring immigration by Filipino nurses. Shortly after, the judge announced that there were errors in the original trial and ordered a new trial, which up to now [July 1994] has not taken place. The nurses were released, and were last heard of working in a nearby state. In 1991 Dr Michael Baden, the forensic expert at the original investigation, reported that he had been informed that Imelda Marcos had
threatened to withdraw approval for the US bases in the Phillipines unless the verdict was overturned.

This may have been a case of the 'Munchausen by Proxy' syndrome, the resuscitative procedures following the overdose putting the perpetrators in the limelight, and giving them the excitement they craved.

Between 1977 and 1981, the manager of an old peoples' home on Orkdal, Norway, Arnfinn Nesset, gave doses of 'Curacit' - a curariform drug - to some of his residents, killing 21 of them. His defence was that he was carrying out mercy killings at the request of the residents. He was not believed when it was shown that he had embezzled money belonging to his victims. The evidence against him was largely circumstantial as few traces of the drug were found in his victims, but he was found guilty of 21 counts of murder and sentenced at the Trondheim court to the maximum penalty under Norwegian law, 21 years imprisonment.

The final dreadful story can again be ascribed to the 'Munchausen by Proxy' syndrome.

In 1981, the paediatric unit at Bexar County Hospital, San Antonio, Texas, suffered a series of unexplained cardiac arrests among its patients. It was found that heparin and suxamethonium had been added to the intravenous drip solutions. The evidence seemed to point to Genene Jones, a licensed vocational nurse employed in the unit. Her shift, from 3 pm to 11 pm, had coincided with the times at which most of the arrests had occurred, and had become known as the death shift. Following investigation, however, the hospital, fearing legal repercussions, took no action against Jones, but decided to replace all vocational nurses with registered nurses. They gave Jones the following reference:

'TO WHOM IT MAY CONCERN
Due to the recommendation of a recent Pediatric Intensive Care Site Team Visit, the Pediatric ICU is being converted to an all RN staff composition at Medical Center Hospital.

Mrs Genene Jones has been employed in the Pediatric Unit ICU since 1978. This move in no way reflects on her performance in the unit. She has gained valuable knowledge and experience in pediatric care nursing. During her time of employment this employee has been loyal, dependable and trustworthy. Mrs Genene Jones has been an asset to the Bexar County Hospital District, and I would recommend her continued employment.'

Before long, she obtained a post in a newly opened baby clinic in Kerrville, Texas. Shortly thereafter unexpected problems started at the clinic, and always with Jones in attendance. Several deaths, and near tragedies occurred until September 1982, when a healthy child was brought to the clinic for routine immunisation and developed seizures following two injections given by Jones, who then accompanied the child to hospital. The child died on the way.

Staff at Kerrville were very concerned at the number of emergencies coming from the clinic. One of the staff discussed the problem with a colleague who had recently worked at the Bexar
County Hospital, and the name of Genene Jones was mentioned. Immediately the doctor from San Antonio voiced his suspicions. Investigations showed many irregularities with the suxamethonium supply, including some bottles that had been refilled with saline. In 1983 Jones was charged with murder, and was sentenced to a total of 165 years in jail.

It seems that her motivation was the sense of importance and excitement she experienced following the emergencies, and being in command of resuscitation. In 1987 the murders were the subject of a paperback book entitled 'Death Shift', and there has been a suggestion that Beverly Allitt of Grantham may have read this book prior to embarking on her crimes.

Bibliography

The achievements of Norman Dott, the pioneer Scottish neurosurgeon from Edinburgh, and his contributions to international surgical neurology, are well known and well documented. Perhaps less well known is his interest in anaesthetic apparatus and instruments.

Dott had originally intended to be an engineer and was apprenticed to McTaggart Scott & Co. (McTaggart's father was Sir William McTaggart, the great Scottish painter), but when Dott was only 16 years old, in 1913, a collision between his motor cycle and a taxi resulted in a compound fracture of the tibia and a fractured neck of femur. This accident changed the course of his life. He decided to be a doctor and entered Edinburgh University Medical School in October 1914, at the age of 17.

His early training in engineering gave Dott a lasting interest in the mechanical aspects of anaesthesia and surgery. Mouth gags, and techniques of anaesthesia allowing freedom to operate in the mouth, nose and cranium particularly interested him. As a medical student he had succeeded in sneaking into the operating theatre at Glasgow Western Infirmary to watch Sir William Macewan operating. As an early pioneer of endotracheal intubation and of neurosurgery, Macewan inspired the young student in both fields.

By 1916 there was an acute shortage of medical manpower on the home front. Dott, as a second year medical student, became the sole resident at the Deaconess Hospital in Edinburgh, and claimed to have administered some 3,000 anaesthetics. He would have been aware at that time of the anaesthetic techniques used at the Royal Infirmary of Edinburgh, where A H Torrance Thomson had a Kelly's pump and ether vaporiser for endotracheal insufflation.
Animal anaesthesia

After house surgeon posts at the Edinburgh Royal Infirmary, he undertook research in the Edinburgh University laboratory of Sir Edward Sharpey-Schafer from 1921 to 1923. This research resulted in a thesis on "The pituitary body in its relation to the skeleton with notes on experimental surgery" which was awarded the Syme Surgical Fellowship in 1922. The interest of the thesis for anaesthetists lies in Dott's detailed description of the anaesthetic techniques and instruments he used on dogs and cats undergoing surgery on the pituitary gland. The fruits of his previous clinical experience are apparent. He understood the dose/weight relationship of injected drugs, and species differences. Dogs were premedicated with morphia 1/10 grain per kg. (Note that in 1922 he was using kilograms. Opiate premedication was unusual for children until Sheila Anderson published her work at Great Ormond Street in the 1950s). The anaesthetic agents he used were chloroform and ether, with a preference for ether, because of the danger of hypotension with chloroform in the induction period. These anaesthetics were given by tracheal insufflation. As previously noted, Dott was already acquainted with this technique, and he was impressed that Blair Bell of Liverpool had used the method in his research on the pituitary.

The principle of insufflation of anaesthetic vapour under positive pressure, through a narrow tube passed into the trachea as far as the carina, had been increasingly used in major centres from 1909, following the work of the American physiologists Meltzer and Auer. Sir Robert Kelly of Liverpool introduced the method and the positive pressure pump which bears his name into United Kingdom practice in 1912. The apparatus as used by Kelly consisted of:

1. a pump for producing the air current, or alternatively a cylinder of oxygen;
2. an ether chamber with a tap for percentage regulation, with a maximum of 15%-18%;
3. a device for warming the ether vapour;
4. a safety valve - set to blow off at 20mm Hg;
5. a by-pass tap to intermittently divert the current from the tracheal tube so as to relieve the positive pressure in the lungs;
6. a gum elastic catheter as the tracheal tube.

Dott considered that this technique had many advantages, in particular an efficient air or oxygen supply, warmed anaesthetic vapour, and a clear airway and field for cranial work. He also noted that the presence of an anaesthetist could be dispensed with! There were however some disadvantages. The apparatus was heavy and bulky, tracheal intubation was difficult and the heating by hot water jackets was imperfect and troublesome. He found that the air current blowing over the anaesthetic gave a variable vapour strength; he felt there was a danger of
bronchial infection by the catheter passing through the mouth area, and that a continuous positive intrathoracic pressure might interfere with venous return and seriously embarrass the heart.

Dott's apparatus

The original equipment was not good enough for Dott who designed modifications of the apparatus, which made it small, compact, light and portable. He presented and demonstrated the apparatus at the 11th International Physiological Congress in 1923, where he records that it was made for him by Robert Miller of Atholl Crescent in Edinburgh. But he told Barry Hovell in a letter that 'they were made by a fine old craftsman, over whose shop in Lauriston Place the words 'Philosophical Instrument Maker' appeared, and whose back shelves were littered with prototypes of carbolic sprays that he had been making for Professor Lister in the 1870s.' Dott's apparatus consisted of 3 units:

1. An intubator, introducer or apparatus for tracheal intubation (Fig 1). This was a modified direct vision laryngoscope, probably of the Chevalier Jackson pattern. It was divided by a septum into 2 tubes which converged upon the distal aperture. One tube provided an unimpeded view of the glottis, the other serving for passage of the catheter. It was so arranged that the catheter entered the field of vision just as it reached the distal aperture. When the glottis occupied the field of vision, the catheter on being advanced was automatically guided into, and could be seen passing down, the trachea. The necessary light was reflected down the vision tube by a Brüning's reflection electroscope used for oesophagoscopy, etc). Dott comments that if the induction of anaesthesia had been satisfactory, a rapid, certain and aseptic intubation of the trachea was assured.

Figure 1: Apparatus for tracheal intubation
2. The air pump, blower, or apparatus for producing the air-blast (Fig 2). This consisted of an electric motor, a rotary air pump with 3 blades instead of 2, a rubber gas-bag and an 'interrupting' valve. The bag was filled with air under pressure, and either delivered it in a steady stream or through the interrupting valve in a series of blasts which corresponded to normal respirations. Dott found this interrupting device to be of advantage in permitting a more complete air exchange in the lungs, and overcoming the dangers of continuous positive intrathoracic pressure.

Figure 2: Air pump and anaesthetic vaporiser under operating table
3. Anaesthetic vaporiser (Fig 3). This was a model of engineering design. It consisted of a large ether (a) and a small chloroform container (b) from which the anaesthetics were released by easily regulated needle valves (c,c). The drops of anaesthetic were visible in the glass cylinder (d) as they fell into the vaporising chamber (e). The air or oxygen entered the apparatus (f), passed through the electrically heated chamber(e) where each drop was volatilised as it fell, and left through a second heating chamber. The double heating was necessary to ensure proper vaporisation of ether, and to counteract its cooling effect. Heating was monitored by a thermometer, and regulated by an adjustable electrical resistance(j). Pressure regulators (h,h), an aneroid pressure gauge(i)and water-sight flowmeters for nitrous oxide and oxygen were also fitted. With this apparatus, warmed fresh air or anaesthetic gases with any desired proportion of ether or chloroform or of both, could be introduced directly into the trachea in such a way as to simulate normal respiration.

Figure 3: Anaesthetic vaporiser
Dott anaesthetised his animals with great care. Dogs were induced by being placed under a large bell jar, into which ether was sprayed with an atomiser. When they were deep enough, a tracheal tube was passed and fixed to the lip with a stitch. The delivery tube of the vaporiser was then connected to the tracheal catheter. He was aware of the dangers of uncontrolled cooling of the dogs, which were placed on an electrically heated blanket on the operating table. Also on the table (Figure 4) were a head rest, a head holder of Dott's own design, and a movable instrument tray. The vertical rod at the end of the table was for the administration of subcutaneous saline infusions. The intratracheal anaesthesia apparatus was underneath. It is interesting that in his curriculum vitae Dott claimed to be the first to employ and popularise endotracheal anaesthesia in Edinburgh.
The first cardiac massage in Edinburgh

The present-day specialty of anaesthesia embraces resuscitation and intensive care, but Norman Dott was early on the scene. In 1918, a year before he qualified, he performed the first open cardiac massage in Edinburgh, via a laparotomy on a 22-year-old female dental patient who had been anaesthetised with ethyl chloride. He reported this incident in response to an article on 'Massage of the heart and resuscitation in animals' by Professor Gunn in the British Medical Journal of 1 January 1921. Dott made the important observation that since the arrest was probably due to vagal inhibition, intravenous atropine should have been given. This was his second publication, and only 2 years after he qualified in 1919.

Transfusions and infusions

After working in Sharpey-Schafer's laboratory, Dott went to train in neurosurgery with Harvey Cushing in Boston, USA. On his return in 1924, it was not possible for him to work full-time as a neurosurgeon, and he was appointed Honorary Surgeon to the Royal Hospital for Sick Children in Edinburgh. So for a while he became a paediatric surgeon. One of his mentors, Sir John Fraser, invited him to contribute a chapter to Volume 1 of his 'Surgery of Childhood', published in 1926. Dott's chapter was on indications and techniques for transfusions and infusions, and he elegantly described the techniques he used. Strangely for him, the specially designed instruments for transfusion which he recommended and illustrated are similar to Graham's transfusion needles, but no doubt Dott had made his own modifications. He recommended using the long saphenous vein, and if the anterior fontanelle was open, the superior longitudinal sinus. Among the Dott papers in Edinburgh University Library is an early drawing signed by Dott in August 1918, which appears to be of needles, taps and tubing suitable for infusions. Perhaps he used this apparatus as a student houseman at the Deaconess Hospital.

The Dott gag

This gag is still used in the repair of cleft palates. Dott described its origin in a letter to Mr ACH Watson: 'The story of the gag is quite simple. In 1923 and 1924 I was with Dr Harvey Cushing in Boston. There I learned the technique employed by him of trans-sphenoidal hypophysectomy after Hirsch of Vienna. Cushing used a Davis gag for this procedure. It was an American instrument. I brought one home with me from Boston in 1924. I had a smaller and lighter one made for small cleft palate children, replacing the flange by hooks to hold on to their gums and made them adjustable round the arc of the mouth frame to act as lip retractors. The earlier ones had a tube incorporated with the tongue depressor, to deliver anaesthetic vapour. After about 1926, this was replaced by
intratracheal intubation which I adapted from my animal work in Professor
Sharpey-Schafer's experimental physiological laboratory.

Addressing anaesthetists

In March 1933 he was invited to be the opening speaker at a meeting of the
Section of Anaesthetics of the Royal Society of Medicine to discuss 'Anaesthesia
in Intracranial Surgery'. The letter of invitation from the Section Secretary said: '
I understand that you have developed a line of your own which would no doubt be
of great interest to our Section'.

Dott described his experience over 10 years, how and why techniques had
changed, the gradual realisation that ether raised the intracranial pressure, and
hence the increasing use of local anaesthesia, Novocain and adrenaline, and later of
rectal Avertin. Throughout the discussion he made no mention of an anaesthetist!
A later paper which should be read by all neuroanaesthetists and neurointensivists
is 'Brain, movement and time', published in the British Medical Journal and based
on his Victor Horsley Memorial Lecture in 1960. In the section on head injuries
he discusses the effects of hypoxia on the diencephalon, and the disastrous effects
of snoring and airway obstruction.

Conclusion

In a letter to Dott in 1969, Professor J D (Jimmy) Robertson said: 'I always
realised that it was a tragedy for anaesthesia that you did not become an
anaesthetist'. Dott's interests and skills undoubtedly contributed to his
understanding of the requirements of good, safe anaesthesia for neurosurgery, and
he expected high standards from his anaesthetists. It was my privilege to have
been one of them.

References

1. Rush C, Shaw JF. In: With Sharp Compassion. Norman Dott, Freeman
2. Dott NM. Apparatus for insufflation anaesthesia - Demonstration.
3. Boulton TB, Cole PV, Langton Hewer C. A reassessment of anaesthesia
by endotracheal insufflation Anaesthesia 1965; 20:442-460.
4. Dott NM. Cardiac massage in resuscitation British Medical Journal
1921; 1:192.
5. Dott NM. Transfusions and infusions. In: Fraser J. Surgery of Childhood
Society of Medicine 1933; 26:953-955.
2:12-16.
In 1938, Britain was in the grip of an epidemic of poliomyelitis, with a higher than usual incidence of respiratory paralysis. There was a shortage of mechanical respirators, and children were dying of respiratory failure. In November, Lord Nuffield announced that he was prepared to manufacture up to 5,000 Both Respirators in his Morris car factory at Cowley in Oxford, and he would gift one of these to any hospital in the British Empire which requested one. He was willing to spend £500,000 to do this. Why did Lord Nuffield choose the Both Respirator, and who was Both? Very little information has ever been made public about this remarkable man.

Edward Thomas Both, known generally as E T Both, and to his friends as Ted, was born at Caltowie in South Australia, on 26 April 1908. He was educated at Caltowie Primary School and at Jamestown High School where he showed exceptional ability in physics. At the age of 16 he moved to Adelaide as a workshop trainee in the University Department of Physics. He became a technical assistant to Professor Colin Kerr Grant, who soon came to admire his practical skills.

ECG development

In 1932, Ted Both built an electrocardiograph which created great interest among the leading South Australian physicians. Professor Kerr Grant realised that Both had above-average ability in designing equipment and decided to finance him in a small medical equipment factory. Two rooms in the Old Police Barracks, next door to the Physics Department, were taken over. A small workshop was equipped, and Ted Both invited his brother Donald to come to Adelaide to be his assistant. Donald knew nothing of the work, but he was trained by his brother. Soon they began to design products for the medical profession, and equipment in other fields. Their most successful design in the 1932-36 period was the world's first commercial ECG. Their machines were the only direct-writing models marketed until about 1942.

The Both Respirator

In 1937 an epidemic of poliomyelitis broke out in South Australia, and the health authorities approached the Both brothers to produce breathing machines. At that time the only mechanical respirator available was the Drinker Iron Lung, developed in the USA by Dr Philip Drinker. This was expensive, heavy and cumbersome, and not readily available in Australia. Realising the urgency of the situation, within a week the Both Company designed and built a simple inexpensive respirator, constructed principally of wood. The unit was successful and
dozens were made at top speed. The respirators were still generally known as 'Iron Lungs', although the cabinets were made of plywood.

Ted Both came to London to arrange for the manufacture under licence of his ECG. The year was 1938, and he heard on the radio an urgent call for a respirator. He approached London County Council and offered his services in view of his experience in South Australia. Demonstrations and orders followed, and Ted set up a workshop in North London producing respirators for various hospitals.

There was a lot of publicity about these respirators. The Agent-General for South Australia (Sir Charles McCann) lent Both a show window in Oxford Street at British Industries House. Here, he displayed a complete iron lung and soon had a host of enquiries, some coming from all over Europe.

The Public Health Department of the LCC responded to the general interest in the use of iron lungs by arranging a demonstration at County Hall of the respirators it used in its hospitals. One of the objects was to encourage other local authorities to equip their hospitals in a similar manner. The LCC was constantly being asked for the loan of its apparatus, and was not always able to comply.

During the summer of 1938 Professor Macintosh made a film on artificial respiration. It included views of the Drinker and Both cabinet respirators, the Bragg-Paul Pulsator, the Burstall jacket respirator and other less well-known machines, all in action. Macintosh was introduced to Ted Both at the LCC Western Fever Hospital, and there he saw the Drinker and Both respirators working side by side. Dr Topping of the LCC and the sister-in-charge told Macintosh that, in their experience, the Both was the best machine of its kind on the market; the only tragedy was that there were so few of them. Macintosh's film was seen by Lord Nuffield when he made a tour of inspection of the Nuffield Medical Research Institute in Oxford a month later. The Both respirator impressed him and the effect was compounded by a newspaper story a few days later along the lines of 'Iron Lung arrives too late to save young patient'. Nuffield consulted Macintosh. He wanted to know if the presence of a Both respirator in every hospital in the kingdom would save a couple of lives a year. Macintosh thought it would. This was the aspect Nuffield stressed when he announced his offer on 23 November 1938.

For his part in the project Ted Both was awarded the OBE. I am reliably informed by Dr Richard Bailey, who met Ted and Don Both later, that Ted was offered a knighthood but turned it down. The OBE was know to his family as 'our boy Eddie'. News of Lord Nuffield's generous gift was greeted with acclaim throughout the country and Empire. Philip Drinker, on the other hand, was reported to have said: 'It is a piece of sentimental foolishness and a waste of money'.

Lord Nuffield conceded that some wastage was inevitable. He said: 'It seems a pity to think of some of the respirators being used as coal scuttles, but it is more tragic still to think of the
possibility of a life being lost through failure on my part to spend £25 to £30. Sir Frederick
Menzies and others felt that, since mechanical respirators were still in the process of being
improved in design and construction, it would be folly at that stage to standardise any one
type, to turn it out in thousands by a process of mass production, and to distribute it to all and
sundry when very few would have the slightest idea how to use it properly. Lord Nuffield’s
reply was: 'If I waited to produce the perfect car, I would now be bankrupt. We must get on
with the best available now and improve on it as we go along.'

The Both machine was chosen because it was considered to be the best for general purposes
and because of its simplicity and ease of mass production. It was not covered by patents, but
Nuffield paid Both a royalty on each one produced. When the outbreak of war brought
production to a halt, almost 1800 had been built and distributed to hospitals throughout the
British Empire.

Wartime inventions

During World War 2 the Both brothers produced medical equipment for the armed forces.
They also designed several instruments to assist in the production and testing of armaments.
Among these were electronic devices for measuring the bore and for detecting flaws and
cracks in gun barrels. Late in the war years, while petrol was rationed, they designed electric
vans so that essential supplies of milk and bread could be delivered in the cities. These
vehicles were battery operated with a single driven front wheel. They could travel at speeds of
up to 25 miles per hour and had a capacity of about 40 miles per battery charge. The design
was later used to power motorised invalid wheelchairs.

The Army Inventions Directorate was able to enlist Ted Both’s engineering skills in making the
prototypes of inventions that were submitted to them. In order to help with the supply of
uniforms for the Arméd Forces fighting in tropical areas, clothing factories needed a quicker
type of cloth cutting machine. The Both engineers designed and made a machine capable of
cutting out hundreds of uniforms each day.

In 1943 Ted Both had a special commission to work in Sydney for the Navy guided torpedo
programme. It was about this time that he invented what would appear to be the world’s first
practical facsimile machine. He named it Visitel and patented it. This instrument was capable
of transmitting written messages and drawings. They were received as exact duplicates of the
transmitted messages. This invention caused tremendous excitement in army circles because
of its potential for sending secret messages and plans. Visitel was therefore declared a secret
project, so secret in fact that its production was held up and it was never actually used in war
zones.

Peacetime inventions

After the war Ted stayed in Sydney, working with Automatic Totalisators. In 1947 he
founded a branch of Both equipment Ltd in New South Wales to produce and sell their
equipment. His brother Donald continued to work in the Adelaide medical equipment factory and engaged in extensive research, particularly on pen recorders. These were used for research connected with oceanography, rainfall, drainage, rocketry and physical education.

The Both brothers were keen sportsmen. In 1952 they designed and manufactured electric score boards for use in the Davis Cup match which was held in Adelaide that year. Other electronic score boards were designed for the 1956 Melbourne Olympic Games, the Perth Commonwealth Games and Trotting fixtures in South Australia and Victoria.

In 1954, the people of South Australia raised a large sum to commemorate Queen Elizabeth's visit to their State. The money was used for humidified cribs to improve the hospital care of sick and premature babies. The Both brothers designed these cribs in conjunction with Commonwealth Industrial Gases Ltd.

In the late 1950s, electroencephalographic machines were designed and produced by the Boths and used throughout Australia. Invalid aids were also designed and manufactured at Both Equipment factories.

By 1966 the organisation had grown so much that the brothers decided the necessary expansion was beyond two individual shareholders. They merged the business with a large company - Drug Houses of Australia Ltd. Ted stayed on as the Design Engineer in Sydney and Don remained in Adelaide with a similar appointment. They were happy with their positions, designing being their hobby as well as their true profession.

Edward Thomas Both, one of the most innovative of Australians, died after a long illness on 18 November 1987.

Acknowledgments

I am greatly indebted, first, to Brenda Heagney, Librarian to the History of Medicine Library of the Royal Australian College of Physicians; Megan Hicks, Curator at the Power House Museum; Julie Hook, Director of Library Services at the Royal Adelaide Hospital and Dr Stephen Hagley, Anaesthetist, also at the Royal Adelaide Hospital. The primary source of information about Ted and Don Both was Dr Richard J Bailey, Honorary Librarian/Archivist to the Australian Society of Anaesthetists.

Bibliography

Mechanical Respirators. Correspondence *British Medical Journal* December 1938-February 1939.

In a typically modest lecture, Dr Rees described visiting Australia in 1964, and learning about the successful use of long-term nasal intubation as an alternative to tracheostomy in neonates and infants.

He was first introduced to the technique by Allen and Steven at the Adelaide Children's Hospital in South Australia. Their experience was confirmed by McDonald and Stocks at the Children's Hospital in Melbourne. On return to the United Kingdom, he tried long-term intubation at the Alder Hey, and was immediately convinced of its value. He urged its widespread use, and pressed the Australians to publish their results, which eventually they did in two separate papers published in the *British Journal of Anaesthesia* in 1965.

*Editor's note:* The first description of the technique had been at the First European Congress of Anaesthesia in 1962, when Bernard Brandstatter, a graduate of the Adelaide Medical School, described 12 cases at the American University of Beirut.
John Davies Thomas was a Welshman who trained in London, and served as chloroformist at University College Hospital. He emigrated to Australia, where he published influential studies on anaesthesia and on hydatid disease, and achieved considerable local renown.

He was born in Swansea on 11 October 1844, the eldest of three sons of the Rev Thomas Thomas, a Congregational Minister in the town. On his mother's side he was connected to a family of doctors. Two of his great uncles were naval surgeons, and served with Nelson - John Davies (after whom he was named) and Thomas Davies, who lost his life at Trafalgar. Two letters received from Lord Nelson by John Davies are still in the possession of the family. Three other great uncles were also surgeons, practising in different parts of Wales.

He received his early education in Swansea. At the age of 16, having passed the Matriculation Examination of the University of London, he began his medical course at University College, London. He seems from the first to have applied himself with energy to his studies and his student career was distinguished. He gained several Certificates of Honour, the first Silver Medal in Physiology and the Fellows Silver Medal in Clinical Medicine.

In 1866 he became a Licentiate of the Society of Apothecaries of London and in the following year a Member of the Royal College of Surgeons of England and a Licentiate of the Royal College of Physicians of London. In this year he also passed his First MB Examination with Honours, being First Exhibitioner and taking the first Gold Medal in Organic Chemistry, Materia Medica and Pharmaceutical Chemistry. In 1869 he passed the Second MB Examination, gaining a University Scholarship and first Gold Medal in Obstetric Medicine, as well as the Gold Medal in Medicine. In 1870 he became a Fellow of the Royal College of Surgeons and, in December 1871, he graduated MD in the University of London.

During his student days he was for six months Resident Physician's Assistant to Sir William Jenner and Dr Russell Reynolds, and for another six months Resident Clinical Assistant at the Hospital for Consumption at Brompton. For two years, from 1870-1872, he was Resident Medical Officer and Chloroformist at University College Hospital, being selected from a large number of candidates to fill this important post. In 1872 he resigned on account of ill health. Change and rest being necessary, he obtained the post of Surgeon to the P&O Company and his first voyage to India. His intention was to spend about six months at sea, but he remained in service for two years. In 1873 he married Eleanor Duffield.

To Australia

In 1875 his ship sailed to Australia and there he stayed. After a few months as Resident Surgeon at the Clunes Hospital in Victoria, he was appointed Senior House Surgeon at the
Adelaide Hospital, South Australia and, after occupying that position for a year, he entered for a short time into private practice with Dr Ferguson at Glenelg. In 1878 he joined Dr Whittle in partnership in Adelaide. Dr Whittle retired due to ill health and Thomas undertook the whole of the practice until 1884, when he took Dr Lendon into partnership.

In 1885 he went to Europe, being away for eighteen months: 'this visit was not undertaken for pleasure merely, but to study special subjects - diseases of the eye, throat and nose, also electricity and bacteriology'. He spent three months in Vienna, working at the hospital there, and when in London 'devoted his mornings to study at the Hospitals'.

On his return to Adelaide in 1886 he was appointed Lecturer in Medicine at the University. He was, for many years, Honorary Physician to the Adelaide Hospital, as well as a member of the Hospital Board of Management. He served on the University Council from 1877 until 1891 when he resigned due to his failing health. He had a large practice both as a Physician and Surgeon but he also led 'a busy and exciting life apart from the professional routine of a medical man'. Early in 1890 symptoms of general paralysis appeared and he was forced to retire from active work. He died in January 1893 and was buried in North Road Cemetery in Adelaide.

**Chloroform compared to ether**

While at Clunes Hospital, Thomas read a paper before the Medical Society of Victoria entitled: 'A Consideration of the Respective Merits of Chloroform and Vinic Ether as General Anaesthetics'. The paper originated from his concern at two recent chloroform deaths in a neighbouring colony.

His personal experience of two years as Chloroformist at University College Hospital, had 'impressed deeply on my mind a belief that with Chloroform .... we can never regard ourselves as free from danger'. He had tried other agents, some valueless, some too dangerous, and had arrived at the conclusion that: 'vinic ether was undoubtedly the safest anaesthetic that has been widely employed, and for a long time past I have used no other'. He had no experience of the mixture recommended by the Chloroform Committee of the Medico-Chirurgical Society of three parts ether, two parts chloroform and one part alcohol, but he believed it merited a trial.

Whilst at UCH, Thomas had been complimented by Clover on the care with which he gave chloroform, yet, he had had a death, so that he believed the most careful administration was not an assurance against risk of a sudden chloroform death. In 1871 he had invented a drop-bottle for use with chloroform, published in the *Lancet* of March 2, 1882. It overcame the inconveniences of an ordinary stoppered bottle which required the use of two hands; of the time occupied in removing and replacing the stopper, and the uncertain amounts of chloroform given. It was a two ounce graduated bottle with a screw-top metal cap. The cap contained a stopper which was kept tight by a spring, but by pressing the disc top of the cap with a finger and inclining the bottle, chloroform escaped in a uniform stream from a spout in
the cap. Withdrawing the finger from the disc arrested the flow. With a uniform stream, the administrator was able to regulate the amount poured out.

A NEW FORM OF DROP-BOTTLE FOR CHLOROFORM.

A NEW FORM OF DROP-BOTTLE FOR CHLOROFORM, ETC.

By J. DAVIES THOMAS, M.D. LOND., F.R.C.S.,
RESIDENT MEDICAL OFFICER AT UNIVERSITY COLL. HOSPITAL.

One of the inconveniences experienced in the administration of chloroform on lint, etc., is the difficulty of supplying speedily the lint with fresh chloroform from time to time. When an ordinary stoppered bottle is used, a considerable time is occupied in removing and replacing the stopper; and this generally requires the use of two hands. Moreover, the quantity poured out is extremely uncertain. In order to lessen these inconveniences, Messrs. Mayer and Moltzer, of Great Portland-street, have constructed for me the bottle represented in the accompanying woodcut. It is a two-ounce graduated bottle, surmounted by a metal cap (A and C), the upper portion of which can be unscrewed from the lower, in order to fill the bottle with the anaesthetic. The upper part contains in its interior the stopper, which is ordinarily kept tight by a spring, but by pressing with the finger on the disc A, and inclining the bottle with the spout (B) downwards, the chloroform will escape in a uniform stream. By withdrawing the finger from the disc, the flow is at once arrested. As the stream is uniform in size, a short experience will enable the administrator to regulate tolerably exactly the amount of chloroform poured out; and as there is no risk of spilling the chloroform over the patient's face, it is practicable to continue the supply on the lint without removing it from the mouth.

February, 1872.
He was concerned at the effects of a chloroform death 'on able and courageous surgeons' he knew in London. Some of the leading London surgeons had been converted to using ether: these included Mr Warrington Howard, Mr Pollock and Mr Brudenell Carter of St George's Hospital. Even Mr Clover, 'whose experience and success with Chloroform surpass anyone in the world, is inclined to adopt it frequently'.

Ether was generally used in America and France as 'Chloroform is in British Territory'. There had been deaths in Victoria, one surgeon experiencing a death when he had used chloroform for the first time. Thomas stated: 'I can assert that the recorded deaths under Ether are in absolutely and relatively smaller number than those under Chloroform'.

He compared the therapeutic actions of ether and chloroform from animal experiments, and reached the following main conclusions:

'That ether is less dangerous than Chloroform, but its odour is disagreeable; it is slow in operation and it gives rise to greater excitement', that while: 'with Ether we have only to guard against apnoea .... with Chloroform .... we have not only the risk of apnoea .... but we also have to run the gauntlet of a much greater peril, i.e. an instantaneously mortal syncope, against which all our remedies may be fruitless', and with ether: 'the mere continuance of breathing gives us a safe warrant of the vitality of the individual'.

He considered the phenomena prior to death in fatal cases, where there had been syncope, but where death may not have been due to the anaesthetic, i.e. terror and mortal anxiety. 'Supreme moment' may coincide with the time of administration of the anaesthetic, poor physical state of the patient especially with haemorrhage; certain operative procedures tending to cause syncope. He went on to say:

'Allowing for all these epiphenomena, there still remains a large number of deaths certainly attributable to the effects of Chloroform itself'.

He next discussed, under various headings, the findings in 172 fatal cases. The great majority of the deaths occurred in public hospitals, where he assumed that 'experience had brought skill. Such a fact as this ought by itself to silence those who assert that deaths under Chloroform are attributable to want of skill and care of the part of the administrator. That ignorance and negligence increase the risk no one will pretend to doubt, but in the majority of cases it is the drug and not the doctor which should be blamed.'

He stated that twice as many males died compared with females, most deaths were in the young and middle aged, and syncope was the most common phenomenon, occurring in approximately 75% of cases, apnoea occurring in 10% of cases. In some fatal cases, marked and severe tonic spasm, even opisothotonus ensuing, death occurring after the spasm passed off. In one of Sir James Simpson's cases, death occurred after sudden and profuse vomiting. There were three deaths after violent fits of sneezing.
He concluded:

'that the danger with Chloroform is the risk of the production of syncope and that sudden arrest of the heart action was not confined to cases where the Chloroform was administered in too concentrated a form, for in one of the cases the percentage of Chloroform vapour was as low as 2½%'.

He next discussed the post mortem appearances in fatal cases, considering the state of the heart muscle, valves, heart cavities, lungs, liver and kidney. There was fatty degeneration of the heart in approximately half the cases, 'a condition most prone to cause mortal syncope'. In many cases, where death followed syncope, post mortem revealed a perfectly healthy heart, and 'consequently, Chloroform must bear the entire blame'. The dangerous valvular lesions were aortic regurgitation and mitral stenosis, but 'the condition of the heart muscle is of graver import than the condition of the valves'.

He noted that 'to many medical men the presence of a cardiac murmur is sufficient to prevent the use of Chloroform'. His conclusion was that:

'the only inference that we are fairly justified in drawing ..... is that the appearances found after death are more compatible with death from syncope than from apnoea, and it seems obvious beyond all doubt that the great danger of Chloroform lies in its ability to produce more or less sudden cardiac failure'. He concluded 'that this condition often comes on without warning; that when it does occur the highest skill cannot remedy it in many cases; while neither knowledge, care or special experience will suffice to prevent the peril'.

Thomas next considered fatalities with ether, quoting statistics from various sources. From Lyons in France, one stated that there were only seven dubious deaths in 20 years and that ether was far less dangerous than chloroform, the second stated that during the 14 years ether had been exclusively used in Lyons, there had been no deaths from it. From America, one source stated that not a single well-authenticated ether death could be found, and another reviewed over 92,000 cases of ether anaesthesia with four deaths. He concluded:

'Now, I feel absolutely certain in my own mind that ether is far safer than Chloroform; and I may state that the deaths from each respectively have been estimated as Chloroform - about 1 in 2,500 inhalations, and Ether - about 1 in 23,000 inhalations'.

The usual objections to ether were his next topic. His main reflections were that ether odour 'was a matter of taste'; Ether was 'no more disagreeable to take than Chloroform' and he believed that there was 'less post-operative sickness with Ether'. Inflammability was a serious objection and he recommended the use of the Hawkesley Inhaler, where an elastic tube conveys the expired air to the floor, although he did not believe that an inhaler was essential. He described a simple one, it can be made by anyone 'for it merely consists of a truncated cone of wire gauze ..... covered with several thicknesses of flannel and a sponge pushed into the apex'. He then proceeded to describe his way of giving ether:
'The Ether of the British Pharmacopoeia should be used. Push it liberally. Feed your inhaler gradually at first. If the patient coughs, give him some air. If the patient does not cough or choke pour on the Ether plentifully; for this purpose a drop-bottle will be convenient. A neater apparatus is one invented by myself in 1871 for use with Chloroform. The fault that one generally makes in learning to administer Ether is that one hesitates to give enough. Tell the patient he may feel a choking sensation, and to take deep breaths to relieve himself. In no case, if the patient struggles, take away the Ether. If the face gets blue when the patient is insensible, take away the Ether. You may etherise, then go away and operate without skilled assistance. I have done it repeatedly; but I would never dare do this with Chloroform.'

The meeting resolved that copies of Thomas's paper be sent to all hospitals in the colony, and it was published in the *Australian Medical Journal* of May 1875.

**Hydatid disease**

Thomas's later studies were chiefly devoted to hydatid disease, much dreaded at that time in Australia. The publication in 1884 of his book *Hydatid Disease with reference to its Prevalence in Australia* was the result of many years of research.

The following year, on his visit to England, he read a paper at the Royal Society entitled: *On the Experimental Breeding of Taenia Echinococcus in the Dog from the Echinococci of Man*. Recognising the scientific and national importance of his work, the University of Adelaide placed a building at his disposal to facilitate his researches as Lecturer in Medicine.

On his death in 1870, he was survived by his wife, his brother Mr J Edwin Thomas, who lived in Adelaide, and by 'his still living Mother and older brother in Wales'.

**Bibliography**

1. A consideration of the respective merits of chloroform and vinic ether as general anaesthetics. *Australian Medical Journal* May 1875. (Original held in the Mitchell Library, South Australia)
3. *In Memoriam. Dr John Davies Thomas* 1894. Public Library, South Australia.
THE RISE AND FALL OF LOW-FLOW AND CLOSED CIRCUIT ANAESTHESIA EARLY WORKERS (1)

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Prior to any knowledge of the chemical composition of the atmosphere, speculation existed as to the composition and change in volume of the air breathed by man. The Revd Stephen Hales (1677-1761) recognised that expired air contained a variety of constituents and that certain proportions of the respirable gases could change their volume (or 'elasticity'). Although unaware of their chemical composition, he described them in terms of alkalinity, acidity and neutrality.

It had been a popularly held belief that 'foul air', experienced in the holds of ships, could be purified by the application of vinegar to the floors below deck. In an attempt to explain this, and by causing himself to re-breathe through cotton filters soaked in vinegar, Hales demonstrated that expired air 'could be breathed to and fro, as long again, as the like quantity of air which was not thus purified', and that such a filtration process caused, what he termed 'alkaline air' to be 'reduced by the acid [vinegar] to a more wholesome state'. This was an interesting principle, although the chemical reasoning would subsequently be proved to be faulty - carbon dioxide being actually acidic in solution. In further experiments, Hales investigated the absorption of water vapour when expired air was passed through charcoal and found that the change in volume, i.e absorption, was greater than could be attributed to water vapour alone. Could it be that the charcoal contained sufficient potash to allow for the additional absorption of carbon dioxide?

It was not until some 30 years after these experiments that carbon dioxide was first isolated and recognised by Black. Methods for its detection - usually by absorption - were quickly developed and applied by early physiologists investigating the metabolic aspects of carbon dioxide production - Lavoiser in France and William Prout in England being of particular note in this field. Indeed, John Snow cited Prout's work when estimating carbon dioxide production in patients undergoing anaesthesia with differing volatile agents (ether or chloroform).

John Snow's other great contribution at this early period was the recognition that volatile agents relied for their action on their solubility in blood. In applying these two principles of carbon dioxide absorption and blood gas solubility, Snow was able to suggest that 'were it possible to prevent the rapid excretion of [anaesthetic] vapour to the expired air, it might also be possible to prolong the effects of such anaesthetics'. This he demonstrated by employing his ether vaporiser as a re-breathing chamber containing potash:

'After inhaling as much chloroform as I could without being rendered unconscious, I immediately began to breathe oxygen to and from a balloon and over a solution of potash.
In this way the vapour exhaled in the breath had (the greater part of it) to be reinspired. This process was continued for ten minutes, during which time the feeling of narcoticism subsided very little.'

Thus, the principle of closed-circuit anaesthesia had been established, but it achieved very little in the way of utility either in the United Kingdom or in America. John Snow proceeded further, more particularly in a wide variety of animal experiments, to estimate carbon dioxide production. Anaesthetists in general turned their attention to economising on fresh gas flow by means of a stop-cock, or similar facility, to permit dilution of fresh anaesthetic gases with fresh air as appropriate. An exception to this was Alfred Coleman (1828-1902) at the London Dental Hospital from whence in 1868 he gave accounts of administrations from his economising apparatus which included an absorber utilising slaked lime contained in a canister.

Meanwhile, in the field of resuscitation, Theodore Schwann (1810-1882) who held a Chair of Anatomy in Liege, spent the last 25 years or so of his professional life designing and improving a breathing apparatus for use in mine rescue incidents. He worked with a variety of CO₂ absorbents (barium oxide, manganese dioxide, potassium hydroxide), some of which liberated oxygen. His definitive design described in 1877, utilised two compressed oxygen cylinders, a reducing valve, and an intervening absorption unit containing chunks of lime (calcium oxide) soaked in caustic soda and located in eight discrete chambers.

It is likely that subsequent improvements to the Schwann Resuscitator were undertaken by the Dräger Company and that the principle of carbon dioxide absorption was adopted by German anaesthetists, as is shown by the appearance of carbon dioxide absorbers in their Dräger machines in the early 1900s.

Bibliography

Prout W. Ann Phil 1809; ii. 336.
Snow J. On narcotism by the inhalation of vapours. From London Medical Gazette 1851; XV: 40-41.
'The rise'

The rise of closed circuit anaesthesia was a slow incline, due in no small measure to the participation of animals in the research - bees, butterflies, frogs, mice, rats, guinea pigs, birds, dogs and cats all playing their part. The work of Dennis E Jackson is a good example of this. He was the first to describe a circle absorber system for inhalation anaesthesia. Writing in 1915 he noted: 'Great care has been exercised to confine the descriptions in this article strictly to results which have already been obtained by experiments on dogs....But the conclusion is easily drawn that similar results may be obtained in man'. However, Jackson's medical colleagues showed no interest, and his frustration at this was very great indeed.

In 1920, endotracheal intubation using a wide bore tube was first recorded by Ivan Magill. Four years later, Ralph M Waters wrote on 'The Clinical Scope and Utility of Carbon Dioxide Filtration in Inhalation Anaesthesia'. For closed circuit anaesthesia however, the endotracheal tube would have to make a seal with the trachea, and in 1928 the 'cuffed' endotracheal tube was developed by Arthur Guedel working with Ralph Waters. Guedel owned a dog called 'Airway' and to demonstrate the safety of the cuffed endotracheal tube, he anaesthetised and intubated Airway, inflated the cuff and immersed him totally in water to show that the dog came to no harm. Following this so-called 'dunked dog' demonstration, Airway recovered from the anaesthetic, shook off the water, and settled down for a sleep.

Brian C Sword in 1930 developed a circle absorber system, and described 'The closed circle method of administration of gas anaesthesia'. In 1934, WB Primrose devised a closed circuit machine and a cuffed pharyngeal tube. It appeared to him that 'access had been gained to a new field of anaesthetic administration sighted by others a long time ago'.

It is interesting that the early workers in rebreathing closed circuit anaesthesia used nitrous oxide as well as oxygen. For absorbing the carbon dioxide, many substances were tried including quicklime, but the hydroxides of sodium and calcium in equal quantities came to be used. The basic constitution of 4-8 mesh granules, with silicates to reduce dust formation has remained from the 1940s to the present time, with Baralyme the only rival to soda lime.

Cyclopropane

The anaesthetic properties of cyclopropane were demonstrated by Lucas and Henderson in 1929, and in 1933 it was introduced into clinical practice by Waters in America and Rowbotham in the United Kingdom. This accelerated the universal acceptance of the carbon dioxide absorption technique. Cyclopropane was an excellent anaesthetic, offering much over
what had previously been available. It was used in closed systems because it was explosive, and therefore better contained in the breathing system than scattered round the theatre, and because it was expensive, so rebreathing techniques were cheaper. The gas was well suited to closed circuit administration since the amount entering could be accurately measured by flowmeter, and it was potent enough to be used just with oxygen.

It was not until the 1950s that interest was shown in closed circuit techniques for animal anaesthesia. An attempt to make the practice of anaesthesia for animals equal in standard to that in humans led to the introduction of balanced anaesthesia. This included the use of closed circuit cyclopropane with the Waters to-and-fro canister, the Cope's canister, and the Coxeter Mushin circle absorber. These techniques were developed for large animals as well as cats and dogs. Thus the rise of closed circuit anaesthesia peaked in the 1940s with the widespread use of cyclopropane and ether, and a few years later animal anaesthesia followed.

'The fall'

Halothane was introduced into clinical practice in 1956. This agent was more soluble than cyclopropane, but much more potent, so calibrated, temperature-compensating vaporisers were introduced. Problems became increasingly apparent in not knowing the concentration of anaesthetic in the system, while the vaporisers gave high concentrations at low flows. They could not be used within the circle because of resistance to gas flow. The Goldman low output, low resistance vaporiser in circle offered 'patient control' over depth of anaesthesia, so long as the patient was breathing spontaneously, but bag-squeezing could result in dangerously high concentrations of halothane. In the UK, the use of closed systems declined from 1960 in favour of the non-rebreathing Magill and T-piece systems and their variants.

A further factor at this time was the widespread introduction of ventilators, with increasing use of IPPV. The 'bag in bottle' ventilators enabled the use of closed circuits, but the problems were still there, and Trilene was still in common use. In the UK, anaesthetists mainly used ventilators for non-rebreathing systems, notably minute volume dividers such as the Manley. The non-rebreathing systems gave accurate prediction, and ease of control of anaesthetic concentrations, but the high gas flows were expensive and caused atmospheric pollution. Closed circuit anaesthesia did not disappear. Enthusiasm for low flow rebreathing and closed systems was retained particularly in America and Australia, and there were some British enthusiasts, notably JF Nunn.

Veterinary practice - reverse of a trend

In veterinary anaesthetic practice, the closed or low flow rebreathing systems have been retained for large animals. The minute volume of a St Bernard can be in excess of 10 litres. Professor Mapleson scaled respiratory variables from a standard 70kg adult human to a newborn of 3kg, which has been very helpful with small veterinary patients, eg cats and small dogs. To help with the large animals, he scaled the variables up to 500kg, which is about the weight of a thoroughbred horse. Non-rebreathing systems are not a practical proposition for
animals of this size. It would mean providing them with a fresh gas flow of something like 50 L/min.

In 1958 a circle absorber system was developed with the British Oxygen Company to minimise resistance to peak gas flows of several hundred L/min. It was exciting news in the early '60s that a horse could be anaesthetised without the need for restraining hobbles, and ICI were delighted that halothane was being used to do this. Large bovine animals could also be anaesthetised in a similar manner, provided special care was taken over the airway, as ruminants are always liable to regurgitate when anaesthetised. The system also proved useful for anaesthetising large captive wild animals.

One problem of the circle system is sterility for successive patients. In America, the Dryden absorber was developed as a disposable system. For veterinary anaesthesia this proved useful as it was cheap to purchase and, with some home-made modification, it could be recharged with soda lime for re-use. Newer disposable circle systems have been designed to make it difficult to renew the soda lime. Bacterial filters can be used for systems neither sterilisable or disposable.

Conclusion

The concentration of anaesthetics in closed systems was extensively reviewed by Mapleson, Galloon and Mushin in 1960, and the siting of the vaporiser within or outside the system shown to be a major factor. More recently, Mapleson reviewed the topic using his 'water analogue' and described the difficulties of controlling depth of anaesthesia in low flow systems. Although the Goldman vaporiser was found suitable for use within the circle, being of low efficiency and low resistance, modern anaesthetic machines in the UK almost exclusively use vaporisers outside the circle. There has been concern that the anaesthetist does not know what exactly the patient is breathing, but is there the need, with the monitoring technology now available? Another concern is accumulation of degradation products, but it is still not known whether for example, the production of 2-bromo 2-chloro 1:1 difluoroethylene is harmful. There has recently been an American 'alert' on the production of carbon monoxide with the use of certain halogenated anaesthetics in closed systems with CO₂ absorbents, particularly Baralyme. The possibility of build-up of CO was appreciated during the 'rise', and studied by Middleton et al in 1965, who found it not to be a problem.

One consideration of the totally closed system is that adding anaesthetic to it is comparable to administering an intravenous injection, with the system acting as a distensible reservoir, since there is nowhere for the agent to go except to the patient, unless there is a leak. This implies that anaesthetic could be added to the system accurately by a syringe, obviating the need for a vaporiser. Studies on this have used a servo-control to adjust and maintain the alveolar concentration of anaesthetic to any desired level. Another factor is that newer agents like sevoflurane and desflurane, with low blood/gas solubility, and yet relatively low MAC values, are very well suited to closed rebreathing administration.
Closed circuit anaesthesia had a rise extending over many years, and a fall that took just one or two. Interest in Britain was sustained by the work of enthusiasts. Will it rise again due to constraints of economy and atmospheric pollution? There is much scope for further research, which could usefully discourage manufacturers from providing a mandatory minimal oxygen flow of 300mVmin.

Veterinary anaesthetists in any event, especially those working with large animals, are likely to maintain a demand for rebreathing systems.

References

THE FIRST FRENCH ANAESTHESIA/ANALGESIA SOCIETY

Professor M-Thérèse Cousin
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Ninety years after the introduction of surgical anaesthesia, an anaesthesia society was founded by surgeons in France. This paper describes its bright beginnings, its activities, and its somewhat sad collapse, and assesses to what extent it served anaesthesiology.

The first French anaesthesiology society was the Société Française d'Anesthésie et d'Analgésie (SFAA) set up in June 1934 on the initiative of Parisian surgeons who considered anaesthesia as a part of surgery - an important part, indeed, but only a part. The aim of the society was the study and the development of anaesthesiology, and soon also of analgesia. Membership was limited to 100. There were surgeons, pharmacologists, pharmacists, physiologists, physicians, veterinarians, and finally...anaesthesiologists. Robert Monod, the first secretary, said in his inauguration lecture: 'The objective is not to become a society for anaesthesiologists'.

The plans for the new society were to hold meetings once a term, teaching days and annual congresses, to create a national laboratory for assays, and to publish a journal. The first edition of Anesthesie-Analgésie appeared 6 months later. The organisation of the society closely followed that of the Surgical Society - 100 years old and functioning well. The president was elected annually, the general secretary for 6 years, and a session chairman collated the works of the members. These were basic clinical studies, and all were published in the Journal. Almost 50% of its contents were articles on fundamental research. One main topic was studied each year, starting with intravenous anaesthesia, and later local anaesthesia and pain. Members voted on special problems to be studied eg anaesthetic hazards. An annual prize was awarded.

Some important members

The first president was Antonin Gosset, a distinguished surgeon who was already president of the French Society of Surgery. The true founder was Robert Monod. His surgical interests included thoracic, and later cardiac work, which explains his concern with anaesthesia and ventilation. In the first issue of the journal he published Killian's article on intrathoracic pressure ('differential pressure') including positive pressure ventilation ('baro-anaesthesia'). Monod was also interested in transfusion, and in intravenous anaesthetics. From his experiences in the Great War he feared that in another war many would be affected by toxic gases, and inhalational anaesthesia would be impossible or contraindicated. When he became responsible for the organisation of anaesthesia in the army, he took up Evipan as his main agent. During the war he was a famous member of the resistance. His son, also a surgeon, died in a resistance casualty station.
Desmaret was another surgeon, but he was already a member of several foreign societies of anaesthesia. He developed masks and other anaesthetic equipment, including a circle system with soda lime. (Later, feeling that CO₂ was necessary for spontaneous respiration, he suppressed the use of soda lime in his apparatus). Yet another surgeon was Rene Leriche, who made the suggestion that the anaesthetic society should also become a society of analgesia. Leriche was well known as 'the pain surgeon'.

Of the pharmacologist members, Marc Tiffeneau was known for his studies on the relation between chemical structure and physiological effect. He particularly studied the partition of anaesthetics in the body. Daniel Bovet was a great European pharmacologist who worked at the Pasteur Institute. He later discovered the relaxant properties of succinyl dicholine, and synthesised gallamine. For his work on antihistamines, adrenolytics, relaxants, ergot derivatives and, above all on sulphonamides, he received a Nobel Prize.

Anaesthetists and the Society

Among the elected members there were only four true anaesthetists. Yet thanks to Desmaret and Monod, less than 3 years after its founding the Society exhibited a stand at the Universal Exposition in the Grand Palais in Paris.

With the second world war impending, wider teaching of anaesthesia became essential. The first cycle of courses was very short, just one month. Later, during the war, courses were given to a mixture of nurses, pharmacists and physicians. This generated confusion, and somewhat discredited the medical anaesthetists.

After the war, in 1946, Robert Monod invited the membership to an Extraordinary General Meeting. Only two surgeons attended, and from that time the surgeons no longer contributed to the activities of the society. However, anaesthetic teaching was still considered the task of the Chairman of Surgery. Courses were resumed, once more for nurses and physicians together.

Four years after he retired from the Board of the Society, Robert Monod saw through its last great task - the International Congress of Anaesthesia in Paris in 1951. As President of the Congress he described the future of anaesthesia as he saw it: an important part reserved for anaesthetists, but always a melting pot of different disciplines.

The end of the Society

Young physicians, with limited training as we have seen, came back as anaesthetists in the first French Army of Liberation. They had taught themselves to use closed circle Heidbrink machines abandoned by the US Army, and were better anaesthetists than those still using the Ombredanne inhaler. One of these was Pierre Huguenard. On the other hand, some anaesthetists trained in Great Britain and the United States, returned to France to teach intubation, controlled ventilation, and the use of relaxants. They included Prof Kern, Prof
Vourc'h who was my teacher, and Nadia de Bouchet, the founder of cardiac anaesthesia in France, whom I was honoured to succeed.

In 1946, the anaesthesia practitioners founded a syndicate whose first aim was the recognition of the profession of medical anaesthetist, its teaching separated from the surgeons and with a specialist certificate. With the agreement of Robert Monod, this syndicate gradually took over from the surgeons in the SFAA.

A new society was founded in 1957, 'La Société Française d'Anesthésie, Analgésie et Réanimation' in which surgeons were a small minority. This was deplored by Monod who feared that the new society would be the poorer for having too high a percentage of anaesthetists. In fact, just when the anaesthetists reached this autonomy, the first official University title of Chairman of Anaesthesia was given to a surgeon! Full maturity and independence for French anaesthetists had to wait almost another 10 years.
A MAN NAMED READ

Dr Buddug Owen
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At our Meeting in Guernsey, I described an account in the *Caernarvon & Denbigh Herald* of 7 August 1847 which noted: 'a new Patent Hydraulic Machine has been invented by a gentleman named Read for the restoration of persons in cases of suspended animation'. David Zuck and Barbara Duncum had kindly provided me with references on Read, and he was mentioned by Rod Calverley in Atlanta.¹

Read is a shadowy but important figure from the past, who well merits our attention. He was an innovator, encouraged by clerical and medical men, and came to have a workshop in the east end of London and a shop in Regent Circus (now Oxford Circus). It was to Read that early anaesthetists, including John Snow, turned for valves, tubing, syringes and pumps.

**Read’s early life**

Sir Astley Cooper’s nephew, Bransby Cooper, gives some information on Read in his 1843 biography of his uncle.² I have also acquired correspondence giving some details of his family and early life.

The son of a farmer, the second of nine children of Peter and Susanna Read, he was born on 11 May 1760 at Stonegate Farm, Stonegate, Ticehurst, East Sussex. The farm was of 60 to 80 acres. The house still has its original beams and inglenook fireplace with salt cupboard. As a child he was interested in mechanical objects, and was a great reader especially of history and general science. He attended Christ’s Hospital School, probably from 12 to 18 years.

Although expected to follow his father, he was not interested in farming. He left Stonegate aged 22, to become bailiff to a gentleman farmer in the parish of Horsmonden in Kent. After three years, he thought of going abroad, but the rector of Horsmonden, the Revd Dr Smith-Marriott, aware of Read’s talent and character, arranged that he should superintend the laying out of the garden of his new estate. This was to be known as The Parsonage, but it is now Horsmonden Park Hall. Read became interested in the problem of distributing water and was given a book on hydrostatics by Dr Smith-Marriott which he mastered. The rector also gave Read access to his library during his leisure time. He would study all night, and became knowledgeable in anatomy.

I was allowed to see the garden with its original brick walls, drains, gulleys, lake, waterfall and unspoilt parkland not much changed from when he lived there. There are two wells and numerous springs in the garden.

Read developed injecting syringes to spray the plants, and improved the engine which was used to water the garden. He devised a fire engine and was awarded a Silver Medal by the
Horticultural Society of London for his invention. It was used for washing windows of houses and carriages, fumigating trees and hot-houses and as a fire engine by private families.

He was one of the first men to produce a bent tile which was cylindrical in shape. He made and used as early as 1808 for drainage in the garden of The Parsonage. He was also involved in changing oasts from their square or rectangular shape to a round design in which the heat from the circular fire chamber and conical kiln would be more evenly distributed. He is also reputed to have designed the hair cloths which were used for drying hops.

Stomach pump

The idea for the stomach pump came from reading newspaper reports of deaths from poisoning and intestinal obstruction. His main innovation was the two-way syringe with ball valves, but having problems with the tubes, he also had these made to his own specification.

In 1819 he learnt from Dr Newington, Surgeon of Goudhurst, that he and Dr Wilmot of Hastings had lost a patient with obstruction of the bowels. Following this, he perfected his injecting syringe for which he had a patent in 1820. He submitted this instrument for inspection by the Court of Examiners at the Royal College of Surgeons who highly approved it, and in 1821 gave a testimony of its utility. His idea of using the device to remove poison from the stomach was at first ridiculed. When, in 1822, the Bishop of Armagh died from taking laudanum by mistake, Read again thought of his invention and went to see Sir Astley Cooper. Sir Astley had recently seen a young nurse die after swallowing opium and felt she could have been saved by the use of the stomach pump. He therefore decided to try an experiment in Guy's Hospital, using the stomach pump on a dog. On Friday 21 November 1823 in the operating theatre a drachm of opium in 4 oz water was poured down the throat of a restrained dog. After 33 minutes the dog was narcotised and the stomach was evacuated by Read's pump syringe. The dog recovered, none the worse for the experience. Read was in the theatre the whole time and superintended the use of the instrument. On quitting, he received the applause of all present. Sir Astley complimented him on his ingenuity, observing that had he lived in Greece during its time of splendour he would have been undoubtedly crowned with laurels.

When lecturing at St Thomas' Hospital the following Wednesday, Cooper lauded Read and said the pump could be used in humans. He told his audience: 'This experiment, gentlemen, delighted me. I do not know that I have ever experienced greater pleasure in my life than I felt in going home from the hospital on that day.'

The instrument consists of a brass or silver syringe capable of holding 3 ounces, is 7 inches long, 1 inch in diameter, contracted at its apex to a small opening for receiving the extremity of an elastic tube which is passed into the stomach. Within this opening is a chamber containing a spherical valve an inch above the mouth, and at nearly right angles to it another tube can be attached so that the syringe has two distinct outlets for the attachment of the two tubes.
Figure 1. Diagram of Read's Syringe

Figure 2. One version of Read's syringe
Sir Astley described its use as follows:

‘When any liquid is to be thrown into the stomach the mouth of the syringe is put into the vessel containing it and a long tube composed of elastic gum or leather, with a joint in the middle, previously put into the stomach, is attached to the lateral opening; when the piston is raised the fluid is received into the cylinder from the vessel, which is prevented passing back by means of a spherical valve in the mouth. When the piston is pressed down the fluid passes by means of the tube attached to the lateral opening into the stomach and therefore can inject any quantity. When empty all that is needed is to change the position of the mouth of the syringe.’

‘The tube in the stomach is very long and has a joint in the middle. The tube is disjointed and that part of the tube in the stomach is to be attached to the extreme mouth and the other part to the lateral mouth therefore when the piston is raised the fluid is taken from the stomach into the cylinder and when the piston is forced down the valve in the mouth prevents it going into the stomach and the fluid escapes through the lateral tube. In this tube also there is a valve. This valve closes when the piston is raised and opens when the piston is forced down, the other on the contrary opens when the piston is raised and closes when it is forced down. Near the top of the cylinder is a small tube for admission of air which enables it to be worked more easily.’

As well as for removing poisons from the stomach and administering enemata, the syringe was used to blow tobacco smoke into the rectum as a treatment for strangulated hernia. This was sometimes successful the first time of use but it might have to be repeated 4 hourly for a whole day. In many cases it failed. This treatment had a transient popularity in the 18th century in resuscitation of the apparently drowned but its use in the Navy was banned in 1812.

Read’s syringe could also be used for drawing milk from a breast; removing air from cupping glasses; for removal of retention of urine through an elastic gum catheter to be fixed to the syringe; for conveying nourishment to the stomach, and in veterinary work for dealing with blown cattle.

The patents

Read's patent in 1820 was for 'An Improvement in Syringes'. He was registered as a gentleman of the Parish of Hursmonden in the County of Kent and signed John (L S) Read on 31 August. The Petition was to King George IV in the first year of his reign and for a term of 14 years. There are drawings and an explanation given of the professional purposes of its use.

In 1833 John L S Read was granted a patent for 'Improvements in Machinery or Apparatus for Raising and Forcing Fluids'. His address was given as Regent Street, in the County of Middlesex and he was registered as a Mechanist. This system is able to provide a constant action similar to that produced by two cylinders, by surrounding a single piston and barrel by
an air vessel. It can be used to pump water continuously, and with the arrangement of valves to syringes can be used for stomach pumps and for administering clysters and other fluids.

In 1837 he registered a disclaimer to this patent as he had since been informed that an apparatus or fountain consisting of a globular vessel and a pump within it, the outlet or jet pipe having a stock-cock, was made previous to the date of his patent. He registered a second disclaimer in 1839 as he discovered that it would be injurious should air, in the act of using the pump for administering clysters and other fluids, be forced in with the fluid. He therefore disclaims as a useful invention the using of an air vessel surrounding a stomach pump or pumps for administering clysters and other fluids.

In 18459 he updated this arrangement with further improvements in machinery or apparatus for raising and forcing fluids. The first improvement has for its object the prevention of lateral rotary motion of the ball of the spherical valve and the causing of the valve to return more quickly to its seat. This he does by causing the valve to move within the guides. His second improvement is to provide more ready access to the valves, and the third consists of a compact and economical arrangement for a fire engine.

In 184910 there is another patent in his name as Gentleman of Park Terrace, King's Road, Chelsea in the County of Middlesex. 'This is of Improvement in Machinery for Extracting Fluids from Animal, Vegetable and Mineral Substances and in Compressing the Same, and secondly, his invention consists on giving motion by steam to apparatus used for this purpose'. This was signed John (L S)Read 29th June 1850. However, John Read, who was a batchelor, died in 1847 aged 87 years. Richard Read, his nephew, inherited the surgical instrument business at 35 Regent Circus and also sold horticultural equipment. In about 1850 he published: A brief account of the origin and progress of the patent syringe or stomach pump.11 The last patent must have been taken out by Richard, whose leaflet styles himself Instrument Maker, by Appointment, to Her Majesty.

In 1826 John Read's workshop was in 30 Bridge House Place, Newington Causeway, Southwark. As he was doing so well he opened the premises in Regent Circus which his nephew eventually took over. There were many distributors of his inventions including Maws. The genuine Read's patent enema syringe was easy to identify for it alone bore the Royal Arms on its barrel, but many copies were made as well as modifications by Jukes, Patey, Eguisier and Higginson. Because of repeated plagiarism, Read12 published at least six editions of a pamphlet called: An Appeal to the Medical Profession on the Utility of the Improved Patent Syringe. A Statement of Facts. The Validity of the Rights and Claims of the Patentee John Read.

Resuscitation and anaesthesia

Read was an old man when John Snow turned to him for help. In October 1841 Snow read a paper at the Westminster Medical Society entitled On Asphyxia and on the Resuscitation of still-born children.13 In this he comments that Mr Read of Regent Circus was introduced to
the Society some three years previously by Dr James Johnson where he laid before them an invention for performing artificial respiration. It consisted of a syringe for exhausting the lungs by the mouth, the nostrils in the meantime being held when, on removing the pressure from the nostrils, the chest expanded again by the natural elasticity and resiliency of the ribs, muscles of respiration and pulmonary tissue, causing a tendency towards a vacuum and the air instantly entered by the nostrils, from atmospheric pressure, as in a natural inspiration. When it was again withdrawn by the syringe it became renewed in the same manner. At that time he wondered whether the same plan could be used on still-born children. There the matter rested until Mr Read called to show him an improvement to his apparatus which he had brought to such perfection that using it on himself would supersede his natural respiration for an hour without inconvenience. This was probably the Patent Hydraulic Machine mentioned in 1847 in the Caernarvon and Denbigh Herald.

Snow then suggested he should make a little instrument for the newborn. It consists of two syringes, one of which by a tube adapted to the mouth and closing it, withdraws air from the lungs, and the other syringe returns the same quantity of fresh air through a tube fitted to the nostrils. The two pistons are held in the same hand and lifted up and pressed down together. The cylinders are fixed side by side and each has two valves. Each cylinder contains one and a half ounces.

In December 1841 John Snow read a paper14 at the Westminster Medical Society: On Paracentesis of the Thorax. He described a trocar and cannula with a stop-cock, which he had had made under his direction by Mr Read of Regent Circus. When the cannula is in position, a double action syringe with two distinct valves like a stomach pump, is screwed on to its end. By working the pump the contents of the pleura can be withdrawn without air entering the pleura. No diagram of the apparatus was shown in the report of the meeting.

Read's valves and flexible inhaling tubes were used in the early ether inhalers. At an Extraordinary Meeting of the Pharmaceutical Society15 held on 13 January 1847 seven ether inhalers were displayed and five contained his valves. On 23 January 184716 John Snow displayed his apparatus for inhaling the vapour of ether. This also used Read's very light spherical valves of cedar wood, 5/8s of an inch in diameter, which provided unidirectional flow. Snow specified that the flexible tube should have an internal diameter wider than the trachea, ie 3/4 of an inch, and other apertures through which air passes must not be less than 5/8s of an inch in diameter.

Conclusion

Read died on 3 May 1847. He was buried at his request in Horsmonden where, years earlier, he had sung in the church choir. As a non-medical person he had the distinction of an obituary in the London Medical Gazette17 as the inventor of the stomach pump and other mechanical apparatus used in medicine and agriculture. A marble bust was erected in Horsmunden Church by the representatives of the late Revd Dr Marriott to whom, for many years, John Read was a faithful and zealous servant. The bust was dedicated to the church by
the executors of the deceased. In bold letters at the top is the word 'Integrity'. After his name: 'Inventor of the Stomach Pump and many other useful implements for the benefit or relief of Suffering Humanity. Of humble origin, he yet possessed talents which would have done Honour to the highest station and he used them to the Christian End of doing good to his fellow creatures.'

Read was fortunate that his talents were nurtured by Dr Smith-Marrion and by many eminent medical people of the time, including Sir Astley Cooper and John Snow. He should be remembered as the inventor of apparatus at the birth of our specialty.

References

4. Farrar RF. Personal communication.
5. Cooper AP. Surgical lecture at Guy’s Hospital on Nov 21st. Lancet 1823; 8:276.
FROM NO-MAN'S LAND TO CALMAN'S LAND:
A COMPARISON OF TRAINING IN THE '50s AND THE '90s

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Dr C S Ward, Retired Consultant Anaesthetist, Huddersfield

Of the many important advances in medicine over the last 50 years, anaesthesia has perhaps progressed to a comparatively greater degree than any of the other major specialties. Modern anaesthesia began with the introduction of muscle relaxants. The resulting skills in intubation and assisted ventilation helped to substantiate anaesthesia as an independent specialty. But the development of anaesthesia was not only dependent on pharmacological and technological innovations. In 1946 Ralph Waters wrote: 'The future of anaesthesia depends not upon the discovery of new drugs but upon better facilities for training skilled anaesthetists'.

Currently, it is standard practice for the novice to be given a gentle introduction to anaesthesia. This usually involves a two to three month period of complete supervision. During the late 1940s and the early 1950s, however, it was more a case of being thrown in at the deep end and either swimming or drowning.

What training?

Professor M Rosen began training in 1949. He wrote: 'In that first post there was little direct training. I had to teach myself and learn by experience, and some of the bad habits acquired during that period I have not yet managed to unscramble'. During the 1940s it was common for medical students to give anaesthetics without the cover of an anaesthetist, the surgeon taking responsibility. CW, who graduated in 1949, gave several anaesthetics, including obstetric and paediatric cases, often, the only supervision he received was from other medical students. D W A Smith told us that at St Mary's, between 1947 and 1952, he gave anaesthetics in casualty as a student, supervised by the casualty officer. The technique he was taught started with 100% nitrous oxide. On one occasion, when the surgeon asked if he could start, the sister remarked that he should wait as the patient was not yet blue.

CW began his postgraduate training in 1950 at the Huddersfield Royal Infirmary (HRI). There were no consultant anaesthetists and the department was run by four part time GP anaesthetists. Two of these were appointed because they were willing to use muscle relaxants, but only one of them could intubate! The other two had stopped using intravenous anaesthetics, because of their very high mortality with thiopentone which was only just beginning to replace Evipan at the HRI. One of the GP anaesthetists had reverted to using the Schimmelbusch mask. The training CW received was consequently extremely limited and his learning of anaesthesia was 'essentially experimental'.
Rosen noted that, in the 1950s, the attitude that consultants should train and supervise juniors was unknown. There were, indeed, just not enough consultants to supervise junior anaesthetists adequately. The experience of anaesthetists we have talked to confirms that training and supervision in district hospitals were almost non-existent.

At this time anaesthesia was barely able to provide an adequate service. Anaesthetists of any grade were hard to find. In 1951, CW's National Service was deferred in order for him to take up the post in Croydon of Registrar! There was only one full time consultant and following the death of his wife he was absent for much of the time. Not all juniors of the time would have survived the baptism of fire which CW came through.

**Progress**

How much have training and supervision improved since the 1950s? The changes have been conservative and gradual. In the early 1960s junior doctors were still giving anaesthetics without any postgraduate training. Professor F R Ellis gave his first, a 50/50 mixture of cyclopropane and oxygen, as an obstetric house officer in Bolton. He gave many anaesthetics for forceps deliveries, using nitrous oxide, oxygen and ether by a face mask, without anaesthetic supervision. Within a week of starting anaesthesia training at the Manchester Royal Infirmary in 1961 he was giving unsupervised anaesthetics.

In 1967, a committee in Leeds set up to consider anaesthetic services, was more forward-looking:

'Anaesthesia is a postgraduate subject to which a new recruit arrives with practically no previous knowledge. In no other branch of medicine is mismanagement more likely to lead to a fatality. Even if only on the grounds of safety, the grade of trainee anaesthetist which requires greatest instruction and supervision is the SHO. This means that a new SHO can be expected to make little or no immediate contribution to the service. His subsequent usefulness will depend appreciably upon the time devoted to careful training at this stage'.

But even by 1977, junior anaesthetists were not happy. An informal survey showed that over 60% of respondents were concerned about teaching. They wanted more guidance for doctors just starting anaesthesia, with one senior registrar commenting: 'All too often new senior house officers are pushed in at the deep end'. Again, peripheral hospitals were criticised, with teaching sometimes still being described as non-existent.

Current staffing levels, although still short of the ideal, allow for the Royal College of Anaesthetists' 1980 directive that at least one third of trainees' lists should be supervised. Although the situation has improved, it is often less than satisfactory. ARM, starting in Scarborough in 1990, spent three months learning the basics before going 'on call'. The anomaly was that he was allowed to be 'on call' with no consultant presence, tending acutely ill patients, before being given sole lists during the day when there was usually a consultant in the theatre suite. On transfer to the HRI, one of his consultants said that, since it was not a
teaching hospital, he did not feel that the department had a responsibility to teach. Juniors were lucky if they were supervised for the required 33% of their lists. Conversely, the introduction to anaesthesia at Scarborough was excellent. There were regular tutorials, plenty of help with viva practice close to the exams and at least 40% of lists were supervised. The consultants at Scarborough were, on the whole, extremely helpful and motivated. Their influence encouraged ARM to continue with anaesthesia. It is worth mentioning that CW had originally been inspired by the 'enthusiasm, friendliness and good teaching' of two anaesthetists at the hospital where he had been a house officer. Indeed, all five house officers at that time became anaesthetists. Both our experiences demonstrate the value of good, enthusiastic teaching.

**Academic training**

CW took up anaesthetics in a hospital with no consultant anaesthetists at a time when organised courses were infrequent. What postgraduate training he did receive came from the resident surgical officer who had taken and failed the DA a few years previously. Two quotes of 1948 illustrate the problems faced in teaching anaesthesia, and the attitude of some anaesthetists to how it should be taught:

>'In teaching centres, lectures can be arranged, but with the excellent text books available these should not be absolutely essential.'

>'Success or failure will largely depend on the attitude adopted by the individual surgeon. In the past, many surgeons have tended to be very conservative as to their assistants and anaesthetists, but fortunately this attitude is not now so common, and we can expect sympathy where teaching is required.'

Against this sort of background, it is not surprising that CW was essentially self taught.

The Yorkshire Society of Anaesthetists was formed in 1947 and, by 1950, it was suggested 'that attendance of registrars and residents might be encouraged'. There was no regular organised instruction in Yorkshire until 1964, when half-day release for all trainees in the Region was developed.

ARM's training experiences were very different. During his first year there were regular tutorials outside theatre, every Friday morning. These tutorials, for which juniors were expected to prepare topics, covered all the potential life threatening emergencies as well as some of the more theoretical knowledge required for the first part of the Fellowship. The trainees were well protected against being dragged off to cover lists. There were also irregular teaching sessions on intensive care topics, and a large number of short, exam-oriented, courses. It was not until 1955, five years after starting as an SHO that CW attended a course, in Liverpool. During his first few years of training he was rarely, if ever, encouraged to participate in anything but his service commitment. There was no such thing as study leave. However, while at Croydon, during his second year of anaesthetics, he did travel...
to Guy's Hospital to gain some experience of anaesthesia in a teaching hospital. Such was their opinion of anaesthesia in a district hospital (or their lack of interest in improving standards), that he was attached to a junior who had been giving anaesthetics for only three months!

Historical background to academic training

How has anaesthesia progressed as a specialty? It was not until 1911 that the General Medical Council agreed that medical students should produce evidence of instruction in anaesthesia for their medical degree. Eleven years later, the British Medical Association held the first meeting of its Section on Anaesthesia. The following year, in 1923, *the British Journal of Anaesthesia* began publication. In the 1930s most anaesthetics were given by general practitioners on a part-time basis. The Association of Anaesthetists of Great Britain and Ireland was formed in 1932 allowing only specialist anaesthetists as members. One of the reasons the Association was formed was to institute an examination; however, they referred the matter to the Royal College of Surgeons who, with the Royal College of Physicians, introduced the Diploma in Anaesthetics in 1935. The diploma was changed to a two part exam in 1948, and five years later the first Fellowship exam was held.

Sir Robert Macintosh, the first Professor of Anaesthetics in Britain, probably did more than anyone to establish the academic importance of anaesthesia. In 1940, his Nuffield Department began a twice yearly revision course for those taking the Diploma and it remained the main training centre until 1948, when the Faculty of Anaesthetists in the Royal College of Surgeons was established. This development was probably speeded by the second World War and the formation of the National Health Service, both of which highlighted the need for trained anaesthetists. However, when CW took up anaesthesia in 1950 there was still only the one Anaesthetic Chair. In 1953, the second Professor was appointed in Cardiff, and in 1955 a third went to Newcastle. The lack of regard for anaesthesia can be gauged by the comments of a committee set up in 1964 to consider the possibilities arising through the imminent retirement of three Nuffield professors. They felt that anaesthetics 'was no longer in itself of sufficient academic interest and importance to justify a chair'.

In 1964, the Faculty of Anaesthetists set up a committee on training and in 1970 produced 'Proposals for future training of anaesthetists'. Two years later these were revised and three years general professional training was recommended, ending with the Fellowship exam, followed by higher specialist training. The appointment of regional educational advisers was also proposed. During this period, in 1968, the Royal Commission on Medical Education published the Todd report. This emphasised the need for the proper organisation of postgraduate medical training.

While the Faculty and the Association were trying to standardise and improve anaesthetic training, the specialty was growing in numbers. When the Association was formed in 1932 there were 52 specialists. By 1949, this had risen to 459, and to 1125 by 1969. In the nineties this figure has doubled. This expansion occurred while anaesthetists were developing their
interests outside the operating theatre, particularly in intensive care and pain therapy. A mark of the speciality's progress was the grant of a Royal Charter in 1988, allowing the Faculty to become an independent College, and in 1992 it became the Royal College of Anaesthetists.

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<tbody>
<tr>
<td>Total number of cases</td>
<td>1465</td>
<td>3205</td>
</tr>
<tr>
<td>Number of cases intubated</td>
<td>690(47%)</td>
<td>236(7.4%)</td>
</tr>
<tr>
<td>Number of local anaesthetics</td>
<td>227(15.5%)</td>
<td>20(0.6%)</td>
</tr>
<tr>
<td><strong>General Surgery</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major</td>
<td>232</td>
<td>479</td>
</tr>
<tr>
<td>Minor</td>
<td>165</td>
<td>537</td>
</tr>
<tr>
<td>Total</td>
<td>397(27.1%)</td>
<td>1016(32%)</td>
</tr>
<tr>
<td><strong>Urology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major</td>
<td>31</td>
<td>23</td>
</tr>
<tr>
<td>Minor</td>
<td>64</td>
<td>199</td>
</tr>
<tr>
<td>Total</td>
<td>95(6.5%)</td>
<td>222(7%)</td>
</tr>
<tr>
<td><strong>Orthopaedic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major</td>
<td>123</td>
<td>44</td>
</tr>
<tr>
<td>Minor</td>
<td>186</td>
<td>340</td>
</tr>
<tr>
<td>Total</td>
<td>309(21.1%)</td>
<td>384(12%)</td>
</tr>
<tr>
<td><strong>Gynaecological</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major</td>
<td>88</td>
<td>178</td>
</tr>
<tr>
<td>Minor</td>
<td>243</td>
<td>361</td>
</tr>
<tr>
<td>Total</td>
<td>331(22.6%)</td>
<td>539(16.8%)</td>
</tr>
<tr>
<td><strong>Obstetric</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GAS</td>
<td>60</td>
<td>196(3 intub.)</td>
</tr>
<tr>
<td>Regional</td>
<td>35</td>
<td>0</td>
</tr>
<tr>
<td>Lab. Epi</td>
<td>74</td>
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<tr>
<td>Total</td>
<td>169(11.5%)</td>
<td>196(6.1%)</td>
</tr>
<tr>
<td><strong>ENT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Minor</td>
<td>146</td>
<td>591</td>
</tr>
<tr>
<td>Total</td>
<td>157(10.7%)</td>
<td>602(18.8%)</td>
</tr>
<tr>
<td><strong>Ophthalmological</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major</td>
<td>39</td>
<td>10</td>
</tr>
<tr>
<td>Minor</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>45(3.1%)</td>
<td>14(0.4%)</td>
</tr>
<tr>
<td><strong>Dental</strong></td>
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<td></td>
</tr>
<tr>
<td>Major</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Minor</td>
<td>37</td>
<td>122</td>
</tr>
<tr>
<td>Total</td>
<td>39(2.7%)</td>
<td>122(3.8%)</td>
</tr>
<tr>
<td><strong>Neurosurgical</strong></td>
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<td></td>
</tr>
<tr>
<td>Total</td>
<td>2(0.1%)</td>
<td>0</td>
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Table 1. Workload of A R MacLean and C Ward during their first two years as anaesthetists
Comparison of workloads

Although it was unusual in the 1950s, CW kept a detailed log book of all the anaesthetics he gave. Table 1 compares the workload of each author's first two years. CW gave 1,295 anaesthetics in his first year, and 1,910 in his second. This amounts to more than twice the number given by ARM - 613 and 841 respectively. The disparity in workload is not as great as it seems, however. It is obvious that the amount of service work decreased as the amount of training increased. This changing pattern was reflected in a letter written by Selwyn Crawford in 1976:

"There has, on our behalf, been an apparently uncritical acceptance of the degree that junior anaesthetists of all grades up to and including that of senior registrar, are trainees and as such, are less and less required to fulfil a service need."

ARM, in addition to theatre duties, worked on intensive care, looked after inter-hospital transfers and in the second year provided obstetric epidurals. More time was spent in tutorials and lectures. In addition, more than 40% of lists were 'accompanied'.

The on-call duties were dramatically different. As an SHO, the rota for ARM was two in seven, with a half day off after a night on-call and one half day for private study per week. After 18 months, and promoted to registrar, his duties were even less onerous: one in five, with a full day off afterwards. CW was on a one in one rota. He had one half day off per week which lasted from midday to midnight, one evening off which lasted from 5pm until midnight and one weekend off in three. The amount of work while on call was certainly less, and being up all night was rare. This was just as well, considering how much time he spent on duty.

Chloroform, cyclopropane, ethyl chloride and trichloroethylene were still in widespread use in 1950, but the significantly noticeable difference between our records was the frequency of intubation - 7.4% against 47%. What are the main reasons for this difference? There was no consultant anaesthetist to teach CW and only one of the GP anaesthetists working at Huddersfield could intubate. There were also variations in the then current practice. For example, despite recently published textbooks suggesting intubation for tonsillectomy, its use was not widespread. In obstetric anaesthesia, Frankis Evans' Modern Practice' of 1949 described spontaneous breathing via a mask as the anaesthetic of choice for caesarean section. Of CW's 46 caesarean sections, only three were intubated and none were under regional anaesthesia. ARM was involved in 169 obstetric cases, of which 89 were caesarean sections. Of 60 given general anaesthesia, all were intubated, and 29 were given a regional block. Apart from obstetrics, CW's use of local anaesthesia was still very low. This was partly due to the sparsity of teaching available, and partly to surgeons performing local anaesthetics themselves. During his first two years, his 20 cases consisted of 17 spinals, 2 brachial plexus blocks and 1 peripheral nerve block. ARM's 227 blocks included epidurals, spinal blocks, caudal, Biers and brachial plexus blocks, intercostal and ankle blocks.
1960s, ECG monitors were limited in supply and had to be booked in advance. Clinical monitoring was, of course, available, but the continuous presence of an anaesthetist was not universal. According to Rosen: '...during that period it was the usual practice to administer two or three anaesthetics simultaneously'. One of his colleagues claimed that he had developed the ability to diagnose trouble in the operating theatre whilst drinking his coffee outside!

Conclusion

It is clear that considerable advances have improved the training and reduced the service commitment of novice anaesthetists. Certainly, trainees in other specialties remark on how much better the training in anaesthesia appears compared to their own experiences. The traditional attitudes that encouraged 'see one, do one, teach one', or even 'read about it and then do it' are fast disappearing. With the recent proposals from the government working group on specialist medical training due to be implemented by the end of 1995, further changes are imminent. Whether these changes will advance the training of junior anaesthetists, or simply increase the number and reduce the expertise of accredited specialists, remains to be seen. There must be a balanced mix of three factors to ensure adequate training. They are:

- teaching by trained specialists
- implementation and practising of the techniques and knowledge acquired, under adequate supervision
- a gradual increase in the amount of responsibility a trainee accepts.

So far, the changes in training since the 1950s have resulted in a reasonably even system incorporating all three of these elements. The Calman report will require careful interpretation if it is not to upset this balance.

References

5. *Criteria for recognition of hospital posts under the FFARCS regulations.* Faculty of Anaesthetists of the Royal College of Surgeons, 1980.
GUEST LECTURE

WILLIAM HUNTER AND THE MADNESS OF COLLECTORS

Professor M McLeod
Director of the Hunterian Museum and Art Gallery

[This is a summary version of a full-length illustrated lecture. Ed.]

William Hunter (1718-1783) is mainly famous as a doctor, surgeon, anatomist and male midwife. Although his contributions to medicine are well documented, there was another side of his life which is less well-known: his activity as one of the greatest collectors of the eighteenth century. At his death, Hunter possessed, among other things, a collection of coins and medals acknowledged to be second only to that of the Kings of France, large holdings of geological and ethnological items, a library of over ten thousand books, 650 manuscripts, including many of great importance, and 534 incunabula among which were ten Caxtons. He also owned a very large collection of biological materials, numerous excellent paintings, including three Chardins, a Rembrandt and works he commissioned from Stubbs, as well as the very many anatomical, pathological and medical preparations which he used in teaching and research.

In his will Hunter left all his collections to the University of Glasgow, which he had attended, with instructions that they were to be maintained and preserved for ever and used for the benefit of the University's students. He also left the very considerable sum of £8,000 (perhaps worth over £2 million at today's prices) to create a suitable building to house the collections. This, the first Hunterian Museum, opened in 1807: it was the first Public museum in Scotland. Today, Hunter's collections form the basis for the second Hunterian Museum and the Hunterian Art Gallery which was opened in 1980, and other relevant parts of his collections are housed in the University's Library, the Department of Anatomy and in the Pathology Department at Glasgow Royal Infirmary. Through this most generous bequest and its results, Hunter is comparable with another more or less contemporary medical man, Sir Hans Sloane, whose collections formed the foundation of the British Museum.

I believe that collecting was central to Hunter's existence, an area of his life that almost became dominant as he grew older. From about the middle of his life until his final years he was willing, perhaps even driven, to dedicate much of his time and large parts of his considerable wealth to the acquisition of new specimens, buying ruthlessly from dealers, at auction and from fellow collectors, especially when the latter got into difficulties. As one of the major collectors of his day he was at the centre of a great network of dealers, runners and other collectors and was the recipient of many gifts from friends, students and, in the case of a rare Greek coin, from the King himself. Hunter, like many collectors before and since, delighted in getting a bargain and I am afraid some of his transactions have a rather mean and
grasping air about them. In all, he spent thousands of pounds on his acquisitions and on providing a suitable museum for the ever-increasing collection in his house in Soho.

One contemporary estimated, or more likely over-estimated, that Hunter spent £100,000 on his collection. Even if the actual sum was less, it is unclear how he acquired the vast sums he spent on his collecting. His consultancy fees of ten guineas clearly were extremely high by contemporary standards of wealth and he also made fair, but not huge, sums from teaching and his Professorship at the Royal Academy. Dr Brock has discovered that his account with Drummond's Bank increased spectacularly from £2,200 in 1761 to £15,400 in 1762, and to £28,140 in 1762. She has speculated that large wins in the lottery were the source of much of this money. But, whatever the sources of his funds, much of his income went on purchases. A shell collection was bought for £1,000, the Rembrandt [Entombment of Christ] cost 12 guineas, and 15 guineas was spent on a single mineral specimen. In terms of contemporary wealth these were substantial prices and they were repeated in other areas of his collecting.

I believe that Hunter falls into that class of obsessive collectors for whom even a brief period without an acquisition is a cause of frustration and upset. Such collectors display a number of characteristics. Firstly, they act as if there can be no end to their collecting; however many items they possess, they always want more. Many of them, of course, end up with far more items than they can ever look at, handle or show; acquisition and ownership are at the real end of their activity. One of the most notorious of such driven collectors was Sir Thomas Phillips, Bart (1792-1872) who made the largest and most important collection of books and manuscripts ever created by a single individual. Phillips claimed that he wanted 'one copy of every book' and he lived as if he intended to achieve that aim. Secondly, it is clear that such collectors must satisfy their urge to acquire at regular intervals and, in many cases, the gap between these intervals decreases as the collector gets older. Thirdly, these collectors are willing to sacrifice virtually everything else to their passion: family, friends, their own welfare, may be neglected in order that their resources can be used to acquire more items. Sometimes this willingness to spend large sums on acquisitions contrasts with a notable meanness in other areas. It is related, for example, that Sir William Burrell made sure that electricity in his castle was not wasted, by turning off all the lights from a master switch in his bedroom, whatever others in the household might be doing at the time. Phillips treated his own family with abominable cruelty and neglect in order to spend money on more books and manuscripts and he lied to, cheated and bankrupted dealers who supplied him. Towards the end of his life, Hunter seems to have believed he was in danger of becoming impoverished but he continued to acquire.

Finally, it is a characteristic of such collectors that they are far from scrupulous about how they make their acquisitions. They delight in finding something which others have overlooked, paying far below its market value for it or exchanging it with its unwitting owner for a far inferior piece or even a fake. Collecting of this limitless, obsessive sort often has a peculiar morality in which the ownership of goods acquired by theft or deception or those which have been smuggled or illegally exported, is countenanced by men (and such collecting is primarily a male phenomenon) who apply far stricter rules to other areas of their life.
Hunter, of course, used his collection. I would not wish to give the impression that there were not good reasons by which he might, if asked, have justified such huge expenditure. Early manuscripts, for example, were searched for evidence about medical discoveries, fossils were examined in the light of his anatomical knowledge, coins were related to his Classical learning, and in his collecting, as in the rest of his London life, Hunter was a scholar and scientist.

Owning such a great collection also gave him status and prestige, the poor Scottish boy had obviously made good. Yet, as I have indicated, I believe there was a deeper, perhaps even a darker, aspect to his collecting, and I have formed the view that he was often driven to acquire, sometimes for the sake of acquisition alone. In this area of his life there was a strong and irrational element. If we are eventually to get the true measure of Hunter's greatness, we will need to take into account that side of his character.

Reference:

1. The greatest expert on William Hunter is Dr Helen Brock to whom I am greatly indebted for most of my information.
Richard (Dick) Ellis died unexpectedly on 10 May 1995 aged 57 years, in the postoperative period following an operation. It is a privilege to be asked to record some of his achievements and to examine some of the important and interesting influences which made him what he was, a Christian gentleman, a devoted family man, an outstanding physician anaesthetist, a meticulous investigative medical historian, and a master of the written and spoken word.

Dick Ellis was born in 1937 into a family with a medical tradition. He was the grandson of a highly respected general practitioner in Anglesey, and the son of another much loved family doctor. His mother was a State Registered Nurse. His father's single-handed practice was in rural Essex on the fringe of Greater London, and Dick grew up in an atmosphere in which both parents were dedicated to the patients of the practice, whether rich or poor, by day and by night, and year in and year out.

Dick was a premature baby weighing only 4 lbs (1.8kg) which was quite a challenge for those who cared for him in infancy in the 1930s. He and his mother were attended at the birth and in the postnatal period by a London Hospital nurse who later, by a happy coincidence, became his mother-in-law.

He was educated at Chigwell School in Essex. This is an historic institution founded in 1629, of which Dick later became a Governor, and which numbers amongst its former pupils the Quaker William Penn, founder of Pennsylvania. It has turned out to be fortunate for us all, that Dick's interests, and those of the School at that time, were centred around the humanities. He was taught history and English by two very able and inspiring masters, and this turned him into a voracious reader as well as giving him both an abiding interest in history and the ability to communicate in excellent prose.

When he left school, Dick decided to follow the family tradition and study medicine, but a grounding in the humanities was scarcely regarded as the ideal passport to a medical career even in the mid fifties; however, after hard work studying with a crammer, he secured the necessary scientific A-levels. Then, to the surprise of his family and friends, he took part in a trawling expedition around Bear Island (Bjornoya), within the Arctic Circle some 200km south of the Spitzbergen archipelago, before entering the London Hospital Medical College. Dick had always had a romantic love of the sea from childhood and he hankered to go to sea again, a wish which sadly remained unfulfilled. This desire was recalled at Dick's Memorial service by an impeccable recitation of Masefield's poem 'Sea Fever' by his son Thomas.
Various junior medical appointments followed his qualification in 1961. These included one in dermatology as house physician to his future father-in-law some considerable time before he became acquainted with his chief's daughter! Other posts were in medicine, surgery and obstetrics, and the latter resulted in his passing the examination for the Diploma of the Royal College of Obstetricians. One cannot be certain when Dick chose a career in hospital medicine rather than general practice, but it is not surprising that he did. Conditions in general practice in the British National Health Service were not easy in the early sixties, before the reforms of the 'General Practitioners' Charter' came into effect in 1965. It is not surprising either that one so steeped in the ethos of general practice, should choose the specialty of anaesthesia, which was also developing its expertise in intensive care at that time. Anaesthesia, like general practice, is a specialty which requires an interest in, and a basic knowledge of, many other disciplines.

Dick Ellis rose steadily through the registrar ranks of the Department of Anaesthesia at the London Hospital and was awarded his Fellowship in 1967; then, as a Senior Registrar, he met Elizabeth (Liz) Price, then a nurse in the Intensive Care Unit at the London Hospital in September 1967, and with whose family he had already been involved. He wisely followed another family tradition by marrying her in May 1968. Thus began a partnership which he frequently described as having been 'made in heaven' - and justly so.

His next move was in 1970 to an exchange appointment as a Consultant with special interest in cardiac anaesthesia at the Groote Schuur Hospital in Capetown. This exchange was arranged by the Professorial Anaesthetic Department at the London Hospital less than 3 years after the first cardiac transplant in the world had been carried out at the Groote Schuur. The appointment was highly successful, Dick is remembered to this day as a very capable clinician and a gifted teacher.

Dick Ellis was appointed to the staff of St Bartholomew's Hospital (Barts) in 1971 on his return from South Africa, and he and I then worked happily together as cardiac anaesthetists for the next 3 years, indeed it was partly the certainty that I could justifiably leave the emergent subspecialty of cardiac anaesthesia at Barts in his capable hands, that gave me the confidence to move on to an appointment elsewhere. For this I am personally very grateful to him.

Dick Ellis led an active professional life both inside and outside the operating theatre and the intensive care unit. He served St Bartholomew's, not only as a clinician, but also as Honorary Secretary to the Hospital Medical Council and as a member of the Medical Advisory Committee. It is, however no secret that his independent spirit and his belief in the primacy of professionalism made him unhappy with the later reorganisations of the National Health Service. He was in addition an active member of the councils of both the Association of Anaesthetists of Great Britain and Ireland and the Anaesthetic Section of the Royal Society of Medicine, and he was an examiner for the Fellowship of the Royal College of Anaesthetists.
Dick and Liz showed a somewhat unexpected flair as impresarios when they organised the highly successful social programmes for the Sixth European Congress of Anaesthesiology in 1982 and the Second International Symposium on the History of Anaesthesia in 1987. Dick's charm persuaded the pyrotechnic technicians to mount a celebratory firework display in 1982 the like of which the Thames is unlikely to see again!

Dick Ellis contributed several important papers to the clinical scientific literature early in his career, but from 1980 onwards, his considerable output was almost entirely devoted to historical subjects. His special, but certainly not exclusive, interest was in the events surrounding the introduction of anaesthesia into the United Kingdom in the 1840s, and the subsequent career of the first professional anaesthetist John Snow (1813-1858). His careful research exploded several myths and brought to light much new material. The publication shortly before he died of transcriptions of the 3 surviving Case Books of Doctor John Snow (July 1848 to June 1858) with a detailed and scholarly critique, was the result of nine years of part-time research. This volume would be no disgrace as the output of a professional historian working full-time over the same period. Dick was much in demand as a speaker; in 1985, he undertook a successful lecture tour in the United States during which he delivered the prestigious Lewis Wright Memorial Lecture to the American Society of Anesthesiologists.

He was to have presented an important paper to a joint meeting of the History of Medicine and Cardiothoracic Sections of the Royal Society of Medicine on 16 June 1995, to mark the 70th anniversary of the first trans-auricular mitral valvotomy by the London Hospital surgeon Henry Souttar. The script of the lecture and its slide were fortunately and typically already prepared before Dick's death. Sadly, in the event, the lecture had to be read posthumously. This was done by Dr Aileen Adams CBE (President of the History Section and former Dean of the Faculty of Anaesthetists), with Sir Terence English (President of the Cardiothoracic Section and former President of the Royal College of Surgeons of England) in the Chair.

The size of the congregation at the Memorial Service for Dick Ellis at the Church of St Lawrence-Jewry-next-Guildhall in the City of London on 5 January 1996 bore moving testimony to the esteem in which he was held. The Lord Mayor of London, who for 1995/1996 happens to be John Chalstrey, a St Bartholomew's surgeon, and the Presidents of the Association of Anaesthetists of Great Britain and Ireland, the Royal College of Anaesthetists, and of the History of Anaesthesia Society were all present. The surgeon Lord Robert Winston paid tribute to Dick as a friend and as an anaesthetist, and specifically for his part in furthering the surgical treatment of infertility.

The loss of Richard Ellis is both serious and sad. He will be greatly missed by his clinical colleagues, by all those who study the history of medicine, as well as by his many friends, but most of all by his loving wife Liz, their children Charlotte, Nicolette and Thomas, and the other
members of his family. We must, however, be ever thankful for the contribution which he made
to the general wellbeing during his lifetime, and for the literary legacy he has left behind for us to
study and appreciate.

TB Boulton

Bibliography

Books

Volumes I and II were reprinted simultaneously in the US by the Wood Library-Museum of
Anesthesiology, Park Ridge, Illinois.

Facsimile edition brought to publication and introduced by Richard H Ellis. Eastbourne:
Baillière-Tindall, 1983. This work was also published simultaneously in the US by the Wood

Snow J. *On narcotism by the inhalation of vapours*. Facsimile edition brought to publication
and introduced by Richard H Ellis. London: The Royal Society of Medicine Publications,

Snow J. *The Case Books of Dr John Snow, (1848-1858)*. Transcribed and brought to
publication by Richard H Ellis. Published by the Wellcome Institute for the History of

Papers:

Ellis RH. The first trans-auricular mitral valvotomy. *The London Hospital Gazette* 1963; 68:
Suppl. 10.

The duration of action of local analgesic drugs in thoracic extradural analgesia. (with Hillman
G and Simpson BRJ). *Proceedings of the 4th World Congress of Anaesthesiology*. London:
Excerpta Medica, 1968.

Pain relief with sub-analgesic doses of morphine. (with Walker W, Curran JP, Strunin L and
Medica, 1968.


Bottle, Black, Brunton, Bag and Bubble Boyle at Bart's. (with Boulton TB). *Anaesthesia* 1974; 29: 87.


The first trans-auricular mitral valvotomy. *Anaesthesia* 1975; 30:374  ??? can you check. Unlikely these last 2 the same???


The introduction of ether anaesthesia to Great Britain - I. *Anaesthesia* 1976; 31: 766.


John Snow's Alma mater(Margaret, matter is correct!) *Proceedings of the History of Anaesthesia Society* 1993; 12:36-44


Members of the History of Anaesthesia Society were shocked and saddened by the tragic death in a car accident earlier this year, of our good friend Rod Calverley.

Rod was a Canadian who settled in California, became a US citizen, and eventually a Clinical Professor of Anesthesiology at the University of California, San Diego. He was an outstanding historian of anaesthesia, who helped found the Anesthesia History Association and was a Trustee of the Wood Library-Museum. He joined the History of Anaesthesia Society soon after it was founded, and became one of our most active overseas members. He spoke and wrote with clarity, knowledge, and a bubbling infectious enthusiasm.

Rod’s sincerity, friendliness and Christian concern for peoples throughout the world were obvious on even the shortest acquaintance. Those who had the pleasure of meeting him and his charming wife Janeen, will remember a devoted couple who brightened every occasion. We salute his memory with gratitude and affection, and offer Janeen and his family our heartfelt sympathy.

A Marshall Barr
To commemorate 150 years of ether anaesthesia, the Australian Society of Anaesthetists is publishing a facsimile edition of a most important biography of William Thomas Green Morton, written in 1858. This is Nathan Rice's *Trials of a Public Benefactor* - which Dr Gwen Wilson in her foreword describes as invaluable to anyone making a study of the history of anaesthesia.

This commemorative edition is to be launched at the 11th World Congress of Anaesthesiologists in Sydney, in April. It is hard-bound, 195 x 130 x 55mm, and priced at Aus$60, including packing and postage (economy air). Requests for purchase, with a draft in Australian dollars, should be sent to: The Honorary Librarian, Australian Society of Anaesthetists, PO Box 600, Edgecliff, New South Wales 2027, Australia.