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THE HISTORY OF ANAESTHESIA SOCIETY PROCEEDINGS

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Honorary Editor
Rajinder K Mirakhur

THE HISTORY OF ANAESTHESIA SOCIETY PROCEEDINGS

VOLUME 54

While the manuscripts have been edited for style and presentation, the opinions and/or facts as stated are entirely authors' own.

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Acknowledgements

I would like to acknowledge the help of all the authors whose presentations at the meeting and whose manuscripts have made this publication possible.

I would like to acknowledge the help of Dr Adrian Kuipers, the President and all past and present members of the Council. My thanks to Dr Alistair McKenzie for the photographs of the speakers.

My thanks to Dr John Pring for reviewing the manuscripts, and arranging the printing and distribution of the Proceedings.

Papers and Abstracts from the Cirencester Meeting 2022

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Professor Tony Wildsmith

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Dr Rachel Wood

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Dr Adrian Padfield

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Ms Emma Stuart

Human Remains from Corinium's Western Cemetery
Mr James Harris

HISTORY OF ANAESTHESIA SOCIETY

Scientific Meeting, Corinium Museum , Cirencester

7-8 September 2022

Scientific and Meeting Organiser: Professor Tony Wildsmith

FUTURE MEETINGS

UK History of Anaesthesia Society

Information will be available in due course about the 2023 meeting at www.histansoc.org.uk

The History of Anaesthesia Society Proceedings
Honorary Editor

Professor Rajinder Mirakhur
Belfast, Northern Ireland
Email: r.mirakhur@btinternet.com

HISTORY OF ANAESTHESIA SOCIETY

Council and Officers – September 2022

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Mrs Patricia Willis, London

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David Zuck Memorial Prize 2022

Adjudication committee

Professor Rajinder Mirakhur (Chair)
Brigadier Ivan Houghton
Dr Elizabeth Bradshaw
Dr Marten van Wijhe

There were six excellent entries for this prize.

The winner of the David Zuck Memorial Prize 2021 was the following publication:

John Davies Thomas: Chloroformist in London and pioneer South Australian doctor

Rajesh P Haridas

P.O. Box 1065, Burwood North, NSW 2134, Australia. Email: rajesh.p.haridas@gmail.com

Anaesthesia and Intensive Care 2021, Vol. 49(1S) 6–16.

The Committee and the Council extend their congratulations to Dr Haridas.

Deaths of Members 2021-22

Dr John AH Davies	Birmingham
Dr Jean M Horton	Cambridge
Dr John F Nunn	London
Dr Robert Palmer	Portsmouth

Cirencester Meeting: Speakers' photographs

Dr Adrian Kuipers

Dr David Wilkinson

Dr Marten van Wijhe

Dr Ann Ferguson

Ms janet Pickles

Dr Peter Featherstone

Professor Tony Wildsmith

Dr Rachel Wood

Dr George Francké

Dr Alistair McKenzie

Dr John Moyle

Dr Adrian Padfield

Mr James Harris

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LIST OF DELEGATES

History of Anaesthesia Meeting, Cirencester, 7-8 September 2022

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Dr Peter Featherstone
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Dr Anna-Maria Rollin
Mr Christopher Seymour
Dr Ian Smith
Dr Wulf Stratling
Ms Emma Stuart
Dr Declan Warde
Dr Marten van Wijhe
Prof Tony Wildsmith
Dr David Wilkinson
Mrs Patricia Willis
Dr Rachel Wood

EDITORIAL

Although cases of Covid-19 continue to be reported particularly with newer variants of the virus, life has slowly continued to return to a sort of normal state since our last meeting in Shrewsbury.

This year's meeting of the Society was held in Gloucestershire in the historic market town of Cirencester, known to have strong Roman origins, and the home of Corinium Museum with extensive Roman collections. The Society's meeting was held in this museum with Guest Lectures at the end of the meeting being delivered by the Museum officials.

The whole meeting was organised by Professor Tony Wildsmith. The Council of the Society is grateful to him for all his hard work.

There was a diverse programme for the meeting. An interesting presentation by Janet Pickles traced the history of the temperature compensated vaporisers of the TEC type. This will have stimulated the memories of those who used the early Fluotec vaporisers. There were also presentations about airway devices and airway management.

Our original Guest Lecturer Dr Katharine Walker couldn't give her presentation due to being unwell at the last minute but the two speakers, Ms Emma Stuart and Mr James Harris, from the staff of the Corinium Museum delivered interesting presentations about Roman Medicine and discoveries from the Corinium's Western Cemetery.

Of some concern at the meeting was the presentation by the Past President Dr McKenzie about the declining attendance at the Society's meetings [1]. The membership of the Society has been declining from a high of over four hundred in 2000 to just over half that twenty years later. In addition most of the membership now comprises retired anaesthetists. The attendance at meetings has also been getting smaller.

Dr McKenzie suggested that the reasons for declining membership could be due to deaths of older members and the lack of interest by the younger generation. Another reason could be the many Specialist Societies which the

younger and actively working anaesthetists find of clinical interest in their day to day working. History of anaesthesia is also not in the curriculum of the trainee anaesthetists. The Society needs to examine the future direction and consider among others the proposals put forward by Dr McKenzie [1].

Rajinder Mirakhur
Hon Editor

Reference:

1. McKenzie AG. A review of the History of Anaesthesia Society's scientific meetings in its first thirty-five years – HAS Quo Vadis? *History of Anaesthesia Society Proceedings* 2022; **54**: 84-91.

Palliative care or calculated murder?
An Eastbourne anaesthetist in the 1950s

David J Wilkinson
Retired Anaesthetist, Llanddulas, Conwy, UK

Abstract

In 1957 a General Practitioner from Eastbourne was prosecuted at the Old Bailey in London for the murder of two elderly patients. He had been a GP in the town for over thirty five years and had close links with upper social circles in the area. John Bodkin Adams was a qualified anaesthetist and his patients had received high doses of opiates just prior to their deaths which he claimed were to provide analgesia. He was found not guilty of murder and eventually returned to practice in Eastbourne. There remains a significant suspicion that he was a serial murderer who benefited financially from the deaths of elderly ladies in Eastbourne. He died in 1953.

Early Life

John Bodkin Adams was born in Ranaldstown, County Antrim on 21st January 1899. His father was a watchmaker, and the family were devout Plymouth Brethren. After local primary schooling, his family moved north some 40 miles to Coleraine so that he could attend the prestigious Academical Institution. John's father died in 1914 and John became even closer to his mother, The family moved from Coleraine to Belfast in 1916 and John started medical studies at Queen's University, Belfast.

Medical training

John was regarded as a bit of a 'loner' and more of a 'plodder' than a high-flying academic student. He suffered from repeated respiratory illnesses in college and kept himself pretty much to himself. He joined the Officer Training Corps (OTC) with a view to becoming a surgeon probationer in the Royal Navy, but he fell ill again and had to resign from the OTC suffering from what he later described as a septic virulent infection. It has been suggested that this was tuberculosis. The illness affected his studies, and it

was suggested that he give up medicine but he persevered, and qualified with the rest of his year in 1921.

With his religious upbringing he had attended a missionary study-class conference in Larne in his last student year, run by a Professor Rendle Short (the Professor of Medicine at Bristol University). Soon after Adams had qualified, Short sent him a telegram offering him a position as an assistant houseman at Bristol Royal Infirmary. Adams accepted this and was soon working in their Accident and Emergency Department.

During this six-month job he studied for, and passed, a Diploma in Public Health. Short then showed him an advertisement for a GP post that had been placed in a Christian weekly paper. Adams applied, was interviewed, and appointed.

Starting in General Practice

Eastbourne town had been partially created by the efforts of the Dukes of Devonshire. It had a population of around 25000 when Adams started there in 1922 and was regarded as a pleasant seaside resort with large mansions owned by the wealthy on its west side and a less affluent area to the east. Rows of hotels faced the sea and the pier, and holidaymakers came down in droves by rail in the summer. Adams borrowed £2000 from his bank, and bought into the practice in College Road, Eastbourne. He moved into a retired partner's home, 12 Upperton Road where there was a Maternity Home on the opposite side of the street. He moved his mother, and a cousin, Florence, into his new home and settled into practice. His home was a very religious one with morning prayers, bible readings and attendance at Brethren meetings twice on Sundays. The practice into which he had moved was a Christian-based practice where the day also started with morning prayers.

Adams was an attentive doctor who worked long hours and who became very popular with the many elderly ladies in Eastbourne. He was a very good shot and started receiving invitations to local shooting weekends and thus increasing his social circle. A town GP of this era had an automatic social status and Adams utilized this to its fullest capacity.

When Adams started in Eastbourne, he visited patients by bicycle and then moved on to a small motorcycle, much to the chagrin of his partners who felt that Adams should travel round by car. Adams eventually agreed and in 1924 bought a small Renault which he changed annually moving next to a Belsize, then a Humber followed by an Austin. He passed an MD in Public Health in 1926 which allowed him to gain a full partnership with increasing financial rewards. He immediately employed a chauffeur to drive him around. As his finances continued to improve, he moved again to Kent Lodge and installed his mother and cousin together with a servant and his chauffeur. This new home was close to a private nursing home, The Esperance.

Succeeding in Eastbourne

Adams increased his social life as his practice continued to develop. His shooting skills resulted in his helping to found Bisley Rifle Club. He joined a local Wine and Food society and attended dinners regularly, and he started a local camera club. He joined Eastbourne YMCA Committee and organized Crusader bible classes for young people. He seems to have engendered either great affection or severe dislike amongst people in Eastbourne. In 1934 he was appointed as a part-time anaesthetist to Princess Alice Hospital in Eastbourne. This was a a voluntary hospital named after the sister of King Edward VII and had been opened in 1883 some four years after the death of Alice. She had spent her last months in Eastbourne.

Adams was regarded as the first specialist anaesthetist in Eastbourne, but he was not a very good advertisement for the profession. There are numerous stories of him falling asleep during operations and there was even a small pillow kept in theatre for Adams to rest his head on while sleeping! Around this time, he became engaged to Nora O'Hara, the daughter of the richest butcher in Eastbourne, who bought the couple a house in Carew Road, Eastbourne. However, they never moved into it as Adams broke off the engagement. Another source of local gossip was the ex-Mayor and ex-High Sheriff, Roland Gwynne who was overtly gay and held lavish parties at which Adams was a regular guest and they often holidayed together. Adams stayed single and continued to develop close friendships with elderly women patients.

Deaths and presents

In 1935 an elderly widow, Matilda Whitton, died in the hotel room that she had been living in for the previous six years. Adams had been her GP and had developed a close friendship with the lady, taking her out for picnics and lending her his car and chauffeur. As she grew older, she became less well and staff at the hotel were concerned that she seemed to be worse following Adams's visits! He regularly gave her injections of unknown drugs and her death certificate stated myocardial degeneration, high blood pressure and renal insufficiency contributing to her demise. Adams was the main beneficiary of her will receiving around £5000 (around £340000 today) and a car. Whitton's stepchildren contested the will but it was upheld. Stories started to circulate about Dr Adams and his interest in elderly widows.

Adams was well off now and travelled to Chicago and the Mayo Clinic in 1935. He rented rooms in Harley Street in London and examined patients there and would refer patients to London specialists rather than local surgeons in Eastbourne. This again created strong resentment around Eastbourne. In 1936 he became the Senior Partner in his GP practice. With the onset of World War Two, Eastbourne changed dramatically. Adams's younger partners were called up and by 1940 the German army was massing just across the Channel. Mass evacuation of people occurred with the town's population falling from 50 to 10 thousand, the maternity unit closed, grass started to grow in the streets of the town and Adams's income dropped significantly.

Adams decided to enhance his anaesthesia knowledge and enrolled on Macintosh's first ever revision course for the DA held in November 1940. Adams sat for the DA the following year and had Ivan Magill in his viva who he knew from Queens University, Belfast. He passed.

Adams's mother died in 1943 and was taken to the family grave in Coleraine for burial. As the war ended so people returned to the town and Adams's income started to revive.

More deaths

In 1950 a 75year old widow, Mrs. Morell died. She had suffered a stroke while in the Lake District and had been started on morphia by the local doctors. On her return to Eastbourne, Dr Adams took over her care and was very attentive. On the day of her death, he gave her a 'large' hypodermic injection and instructed her night nurse to repeat the dose if she did not settle. He then left and was not reachable by phone when the patient continued to be unsettled. Reluctantly the nurse gave the second injection and the patient died shortly afterwards. Adams put CVA on the death certificate and had her cremated, with the ashes scattered in the English Channel according to her wishes. He received around £2000 (c£150000 today) in her will plus an almost new Rolls Royce car.

Five years later a wealthy Lloyds underwriter, Jack Hullett, who had retired to Eastbourne and who had Adams as a close friend as well as his GP was diagnosed with colonic cancer. Adams arranged for Sir Arthur Porritt to come down to Eastbourne and perform surgery while he administered anaesthesia. Initially Hullett did well but within five months was ill again. Adams diagnosed a CVA or heart attack and gave him a morphine injection. Hullett died that night. Adams was left £500 in his will and the body was cremated.

Adams had introduced Hullett to his second wife and she was devastated by her husband's death and became very depressed. Adams treated her with barbiturates. She wrote a new will around this time and issued a cheque for £1000 to Adams and a day later was found deeply unconscious. Adams refused to allow her to be admitted to hospital, saying that this was not what the patient wanted, and four days later she died, still at home. She left a further £100 to Adams and another car.

Involvement of Scotland Yard

By now the rumour mill and whispering that was going on in Eastbourne became a crescendo. Superintendent Hannan of Scotland Yard was asked to investigate Adams while the newspapers had a field day with lurid headlines.

Adams was arrested for the murders of Mrs. Morrell and the Hulletts in mid-December 1956 and went to Brixton prison. A series of Adams's patients were exhumed and in January 1957 Adams appeared at Eastbourne Magistrates Court. The court case lasted nine days and focused initially on Mrs. Morrell. She had been given 1200 mg of morphia just prior to her death and there was considerable doubt as to whether she was in pain before this. It was also stressed that Adams had gained significant wealth from her death. After five minutes of reflection Adams was referred to the Old Bailey for trial.

Old Bailey trial

On the 18 March 1957 Adams pleaded not guilty to the murder of Mrs. Morrell. The prosecution focused on evidence from a resident nurse, Miss Stronach, who gave Mrs. Morrell a dose of 16 mg of morphia every night at 9 pm. On that specific day Dr Adams arrived and gave her an unknown drug in an unknown amount at 11 pm and drew up another syringe and said give this if she is restless later. Dr Douthwaite, a senior physician from Guys Hospital, told the court that opiates should never be given to patients after a CVA and that he was certain the level of drugs administered would have hastened her death. This opinion was strengthened by the evidence given by a neurologist, Dr Ashby, who was on the staff of six London Hospitals and who stated that the combinations of heroin and morphia given must have caused her death. He saw that there was no attempt made to wean her off opiates or to perhaps use barbiturates to help her sleep. He did not believe the patient had died from natural causes, but the drugs given must have caused her death.

The defence started by stating that Dr Adams would not be called to give evidence. A Dr Harman, a physician from St Thomas's Hospital stated that the drugs used were quite reasonable. Opiates had been started in Carlisle after Mrs. Morrell had suffered a CVA and Dr Adams merely continued that treatment to create a 'comfortable state' for the patient. He believed that the doses Mrs. Morell had received namely 2665 mg of morphia, 2496 mg of heroin and 10mls of paraldehyde over the last five days of her life were reasonable and she would be expected to survive them.

The defence also showed that the nursing evidence given by the prosecution was potentially fallible as, despite instructions to the opposite, the nurses involved had all travelled up and down from Brighton to London by train, and had sat discussing details of the case, and the evidence they were going to give. In addition, the nursing records did not support all of the doses administered despite evidence from Dr Adams's chemist who had provided the prescriptions used.

In summation the defence stated that the prosecution had not provided absolute evidence over the past 13 days to permit certainty of murder beyond reasonable doubt. Suspicion, probability and likelihood were not enough.

The prosecution again repeated that the dosages administered were certain to cause death in a frail woman of 81 years of age and so murder was the only possible outcome.

The jury retired for 44 minutes and then returned to record a verdict of not guilty. The prosecution was then asked if they were going to submit evidence in relation to the Hulletts and the Attorney General stated that no further evidence would be put before the court. Dr Adams was set free.

Post-trial

Adams was whisked away from the trial by reporters from the Daily Express who took him to a secret 'hideaway' in Westgate-on-Sea in Kent where he stayed for the next three weeks. They paid him £10000 (about £550,000 in today's currency) for his story which continued to make newspaper headlines.

After this little 'holiday' Adams returned to Eastbourne but within a month had resigned from his NHS practice and continued only in private practice. He was asked to resign from the Eastbourne Medical Society and the YMCA Committee because of the adverse publicity occasioned by his trial.

In July he was prosecuted at Sussex assize Court for irregularities in cremation forms and failure to keep records of controlled drugs. Adams pleaded guilty to 13 charges, was found guilty and fined £2400 (c£160000 today) but was not jailed. The Home Secretary passed an order two months

later banning Adams for holding or prescribing controlled drugs again. A month after this the GMC erased his name from the Medical Register.

Adams still had considerable financial resources and he continued to shoot competitively all over Europe, and enjoyed a series of long cruises while maintaining his religious devotions. He felt that he had been greatly wronged and every year appealed to the GMC for reinstatement onto the Register. In 1961 they agreed stating that most of the condemnation against Adams had come from Press campaigns. He was however still unable to prescribe opiates.

Continuing his private medical practice in Eastbourne, Adams remained very popular with elderly ladies. He resumed his active social life, dinning out regularly and supporting local events and charities.

Death

At the end of June 1983, he fell after slipping on the steps of a hotel and fractured his femur. He had this pinned as an emergency and seemed to be doing well postoperatively for the first couple of days. He then developed a 'bad chest' and died in heart failure a few days later. His funeral was a major event with huge numbers of mourners and an equally large press presence. After being cremated, his ashes were placed on his parents' grave in Coleraine.

Aftermath

There have been a series of books written about his life and the court case (see bibliography). The one written by his close friend from the Daily Express, Percy Hoskins, paints a very rosy spectacled image of the man. Interestingly Patrick Devlin, the later Appeal Court Judge, felt obliged to add his views. There has even been a television play broadcast about him. In 2003, a 700-page tome written by Pamela Cullen concluded he was guilty and should not have been discharged from prison and likened his activities to that of the proven serial killer Shipman, also a community GP. She suggests that Adams was having a homosexual affair with the Lord Lieutenant of Sussex, that he was a drug dealer and a serial killer. She castigates the police and Crown Prosecution Service for not using the evidence available about

three other deaths where the evidence of foul play was even more convincing than that surrounding Mrs. Morrell.

In 2013 another author, Jane Robins, who had met many of the 'victims' children and families, went further and states that Adams was a psychopath who enjoyed power and control and was unequivocally a murderer.

Conclusion

Adams was found not guilty of murder at the Old Bailey. Anyone can now read details of his life and work and draw their own conclusions.

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The Dutch Canons:
Collection of fifty key historic facts

Marten van Wijhe MD PhD
Retired Consultant Anaesthetist
University Medical Centre, Groningen
The Netherlands

At the beginning of the present century there was an attempt to build a Dutch national historic museum, a place where the nation's history could be experienced by the young and the old. Plans were well underway and even the finances were in order when political arguments regarding the envisaged location sunk the ambitious plan. The organisers, some quite disappointed, came up with the alternative idea of making a Canon project. Fifty "windows" on our history could be made as a book, but also be web based, with links to further information. The schools could use it to tell the students about the history of the nation.

A group of eminent historians decided on the topics and what to include and, what to omit. As typical alphas they forgot Newton's contemporary Christiaan Huijgens (1629-1695) the astronomer, mathematician and builder of the pendulum clock. This omission was the only one they corrected when the concept Canon was made public [1].

The concept caught on and a group of scientists asked fifty postgraduate science students in 2008 to research and write a paper each on the history of science. The papers were published in the weekly Science section of a national newspaper. "*De Bètacanon*" was published on completion of the cycle, and this sold well. The fifty papers of four pages each on mathematics, astronomy, physics, chemistry, biology and engineering make fascinating and easy reading. Out of the medically related topics only research into hygiene and nutrition, which led to the discovery of vitamins, were mentioned. In the foreword, the Minister for Education Ronald Plasterk, himself an accomplished molecular geneticist, hoped the book would find its way in schools and museums, which unfortunately hasn't happened [2].

Medical historians, not to lag behind, jumped on the bandwagon. Frank Huisman and Mart van Lieburg, Professors of Medical History, collected

fifty topics. They started in prehistoric times with the "girl of Yde", a mummy found in a bog in the east of the country. She was probably sacrificed as evidence of strangulation was found, besides suffering idiopathic scoliosis. There was not a female medical doctor in the Netherlands during the Roman times, the Middle Ages, the Renaissance, Rembrandt's 26th century, or Boerhaave's 17th century; this happened only in the 19th century followed by the first anaesthetist in the 20th century. The sequence was deliberately made in order of societal importance and the Dutch tradition. The importance of the introduction of anaesthesia to surgery in the mid-nineteenth century is discussed in the introduction to Johannes Zaaijer's work of 1923 on nitrous oxide anaesthesia in Leiden. Relevant to modern anaesthesia, and also from Leiden, was Willem Einthoven's cardiograph, for which he earned the Nobel prize in 1924. Contrary to modern practice, he did not patent his invention, the string galvanometer, which made recording of the electrical activity of the heart possible. There is no mention of the Amsterdam surgeon Ite Boerema, renowned for his work on treatment with hyperbaric oxygen. Far more important as it is to the specialty of anaesthesia, there is no mention of Boerema's initiative to employ Dr Doreen Vermeulen-Cranch in 1945 to start the first "School of Anaesthesia" in the Netherlands with the aim of training medical doctors as anaesthetists in a two year course. She duly became the (great) grandmother of today's 2000 + professionals in the country [3].

Among the many Canons made throughout the country, for example even of my home town, the "*Canon van de Anesthesiologie*" (Figure 1) is the real subject of this paper. For the occasion of the Dutch Anaesthetists' Society's 65th anniversary in 2013, the Society's History Group accepted the challenge to edit a Canon. Naively, the six editors assumed that accepted experts in their fields would be thrilled to be invited to write a one thousand word paper on their favourite subject. After finding some experts' unwillingness to cooperate, the editors ended up writing 17 papers themselves. In a few cases the quality of the submitted material was very poor, a fact carefully omitted from the foreword.

The result of our efforts is a book containing a series of fifty nationally and internationally important topics. We started with the prehistoric times followed by 18th century resuscitation along Amsterdam's canals, Napoleonic war surgery, the introduction of ether and chloroform, failed

spinal anaesthesia, nitrous oxide and the aforementioned Dr Doreen Vermeulen-Cranch's coming to our country.

Figure 1. Canon van de Anesthesiologie

Beside the advancements common to all Western countries, a typically Dutch topic is the commotion around the introduction of compulsory monitoring apparatus, which divided the old school practitioners and the modern anaesthetists. Another is Professor Diederik Keuskamp's "Amsterdam Infant Ventilator", an apparatus which he engineered himself. The working principle is an automated T piece control. The apparatus was commercially produced by the Loos Company and was in clinical use until recently.

The textbooks that describe anaesthetic practice in periods at the beginning of the 20th century, after World War 2 and from the 1960s onwards are reviewed. A past President wrote an unfriendly letter regarding a topic with the Society's Board's role which had been forgotten. Each of the two facing-page papers contains three illustrations, making the Canon a lively text. The

Publishers' hopes of riches with the proceeds of advertising in the book did not come about, as companies and businesses working in the field of anaesthesia were either near monopolies or in financial difficulties. The result was a limited printing of just enough copies for each member of the Society, a pity really as the book would be most attractive to newcomers in the specialty. Happily, the publisher sold the copyright to the Society for a low price so that it is now available on the Society's website [4].

Historians differ on the importance of a "Canon" to introduce or describe a field or subject. Some complain that oversimplification leads to neglecting more serious texts. Other argue that some attention by many is better than none. Of course, some complain that their favourite subject has been omitted by the incompetent editors, and others object to irrelevant issues being given inappropriately more attention. When the national historical Canon was reviewed in 2020, fourteen years after the first edition, there were ten changes of topics which goes to show how great the influence of current opinion and politically correct views can change in short time.

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Ordeal beans, multiple poisonings and the miracle at St Alfege's.

Ann Ferguson FRCA DHMSA
Retired Consultant Anaesthetist
East Kent Hospitals.

The west coast of Africa was explored by the Portuguese, the Dutch, and then the British. Trade routes developed in gold, ebony, palm oil and later, Calabar beans.

In Calabar, a bean known locally as eséré or chopnut was used as an ordeal poison. Locals under suspicion of crime or witchcraft were made to eat a Calabar bean which was frequently fatal. Unpleasant side effects were described by a Calabar gentleman thus:

"*Him do dis, Soap come out of him mout and all him body walk."*

We would use the terms "salivation" and "fasciculation."
This use of the ordeal bean was described in Edinburgh by William Daniell in 1846. A Scottish Missionary, Hope Waddell, following this trade route, visited Old Calabar and reported further on the chopnut ordeal trials [1,2].

Robert Christison (1797-1882) was Professor of Medical Jurisprudence from 1822 to 1832, and Professor of Materia Medica from 1832 to 1877 at the University of Edinburgh, and specialised in toxicology. Waddell gave Christison two Calabar beans, and Christison then obtained three parcels of seeds from a mercantile friend. His paper, written in 1855 describes his investigation into the toxicity of the beans [3]. It is clear from this paper that he often tasted the poisons he was examining. He found it unusual that the beans tasted like haricot beans, as it was his experience that all other poisonous seeds of the genus leguminosae are bitter.

Christison described the difficulty of determining the actual cause of death by the ordeal bean in an experiment using "the lower animals". Two rabbits subjected to the bean extract developed muscle weakness and twitching, and the heart action became feeble, but he thought that sensation was maintained.

His problem was, which came first, the muscle weakness, or the failing circulation? He decided to try it on himself.

One evening, he took an eighth part of a seed, about six grains, and retired to bed noticing no effect. However, in retrospect he thought that he had experienced:

> *"a slight numbness in the limbs, like that just before sleep after taking opium."*

The next morning, he took a quarter of a bean. Fifteen minutes later he experienced a slight giddiness, which he attributed to his imagination, and he took a warm shower-bath. The giddiness became severe and there was a "*peculiar torpidity over the whole frame*". Now alarmed and needing an emetic quickly, he drank his soapy shaving water, whiskers and all, with the desired effect. Twenty minutes after ingestion he experienced extreme giddiness, weakness and faintness. He lay down on his bed, sending his son for Dr Simpson, who arrived about forty minutes after ingestion and found Christison prostrate and pale, his heart and pulse extremely feeble, "*tumultuously irregular"* but with his mental faculties quite entire.

> "*Entire Condition like that induced by profuse flooding after delivery".*

Now this would be described as hypotension, but bedside measurement of blood pressure was not possible until 1860.

Dr Maclaggan, a surgeon, toxicologist, and lecturer in Materia Medica and a good friend of Christison's, was summoned. Meanwhile, Christison felt sick, tried to raise himself but failed, thinking "*This is not debility, but volition is inoperative."* He noticed twitching of his pectoral muscles, and sluggishness of articulation.

Dr Maclaggan's first thought was that the symptoms shown by Dr Christison were very similar to aconite poisoning which had been described in Christison's book in 1845 [4].

> *"Christison's countenance was very pale, his prostration great, his heart was feeble and irregular."*

He slept but when he woke his heartbeat was still irregular, but after a cup of coffee it became regular. He still felt weak, but the next day he was restored to normal.

He concluded that the fatal action of the bean was on the heart, but that it has

> "a*n additional action of paralysis of the voluntary muscles with suspension of the influence of volition"* and also *"integrity of mental facilities was most remarkable."*

He listed possible uses for the beans, saying that there may be a therapeutic use, and it might be of use for humane execution.

John Hutton Balfour (1808-1884) started in medical practice in Edinburgh in 1834, but became Professor of botany in Glasgow in 1841, and in Edinburgh in 1845. He was given some Calabar beans by Waddell, and both he and Professor James Syme at Millbank planted them. Although the plants grew vigorously, it was impossible to get them to flower, so he obtained some flowers preserved in spirit from Calabar. After listing members of the Leguminosae known to be poisonous, he went on to describe in detail the plant and flower and establish with botanical colleagues that it was new, so far an unclassified plant. The unusual feature of this plant is the stigma, which has a crescentic or hooded appendage, which he believed was hollow, although we now know it to be solid (Figure 1). He therefore named the plant *Physostigma* from φυσαειν (physo), meaning to inflate or "bladder like" and στιγμα (stigma), applied to the upper part of the style. He added "venenosum", as it is poisonous, and Balfour, as he was the first to describe it [5].

Thomas Fraser was a pupil of Christison, who later succeeded him as Professor of Materia Medica. He experimented on the beans in great detail, and described his findings in his inaugural dissertation [6-8].

Fraser experimented on many animals, also trying it on himself, and he nearly fell down the stairs due to muscle weakness. He demonstrated its

effects on the pupil, central nervous system, heart, glands, voluntary muscles and intestines.

Figure 1. Physostigma venenosum (from Balfour JH. Description of the plant which produces to Ordeal Bean of Calabar. *Transactions of the Royal Society of Edinburgh* 1861; 22: 305-12).

Fraser was awarded a gold medal by the University of Edinburgh for this work.

Fraser's observation that Calabar bean extract caused pupillary constriction was communicated to Argyll Robertson who published his results following experimentation, both on "the lower animals" and on his own eye [9]. His conclusion was that:

> *"there can be little doubt that in the Calabar bean we possess an agent that will soon rank as one of the most valuable in the ophthalmic pharmacopoeia."*

He listed several uses, the main one being contraction of the pupil following administration of atropine, a use which became very popular. Its use in glaucoma was first suggested by Laqueur [10].

George Harley, Professor of Medical Jurisprudence at University College London, published a paper in the BMJ suggesting several more possible uses; as an anodyne to sooth nerve irritation without destroying intelligence, as a cathartic and a possible use in tetanus [11].

The beans look attractive, and taste like haricot beans. Cases of poisoning started to be reported. Two children, aged three and six developed weakness, epigastric pain and vomiting after finding and eating some beans. They were treated with ipecacuanha and survived [12].

Liverpool Southern Docks were being extended, and because of the likelihood of injuries to workers, the Southern and Toxteth Hospital was built in Greenland Street. In 1857 it became The Southern Hospital and a purpose built children's ward was added, for the treatment of burns and scalds, which at the time were very common.

At the beginning of August 1864, at Queens dock, the Barque Commodore had unloaded its cargo of palm oil, Calabar beans and ebony. The remaining mess on the dock was dumped on waste land between Greenland Street and New Bird Street. The beans were found by 46 hungry local children and one pregnant adult and were rapidly eaten. They were all admitted to the Southern Hospital Children's ward, prostrated, with loss of muscular power, vomiting, some with slow pulse and cold extremities, and epigastric pain. Several were noted to have constricted pupils. They were all in what we would now call cholinergic crisis. All were given a sulphate of zinc emetic, followed by a mustard emetic if necessary. They were wrapped in warm flannel and nursed on their mothers' laps [13,14].

A report was published by the houseman, detailing how each child was treated. One, aged 6, died, and the inquest report was published. No law had been broken, so the Coroner brought in a verdict of death by *'Incautious eating' of Calabar beans which he had not realised were poisonous* [15,16].

Rudolf Lenz had shown that the Calabar bean acts on the last part of the nervous system in the heart so that vagal inhibition is potentiated [15]. This would also contribute to the effects on the heart.

The same year, four prisoners were cleaning some single rooms at the Kaiser Hospital in Prague, when they found a locked box, in which there were three bottles containing clear liquid. Thinking that they were spirits, they broke open the seals and drank some. It was actually atropine. Prisoners one and two were not badly affected, prisoner three appeared drunk, laughing, his pupils dilated, and his knees sagged. He was delirious, cyanosed and his head lolled. His temperature was 38.7C, and his pulse 70. He was moving his arms and legs as has been previously described in atropine poisoning and he needed restraining. Prisoner four was, so they thought, terminal. He was unconscious, cyanosed, with a high temperature and widely dilated pupils. Dr Kleinwachter, who was attempting to treat them, told Dr Niemetschek, a lecturer in ophthalmic optics about them. Knowing that physostigma reversed the effect of atropine in the eye he suggested it for these two men. They gave the available supply to the fourth prisoner, who they thought was near to death, with rapid effect. The third prisoner took several days to recover [16].

Fraser continued to experiment with physostigma, having noted that Professor Schmiedeberg had demonstrated, although in Fraser's view imperfectly, that the lethal effect of muscaria may be prevented by atropia. In 1870 Fraser published the results of experiments in which he had administered a known lethal dose of physostigma to a series of animals, also treating them with atropia, either just before, at the same time, or after the physostigma. He noted that where the atropia was given after the physostigma, some animals salivated abundantly, pupils were contracted. faeces was being passed, the animal seemed paralysed, and respirations were noisy and laboured. They all survived. Several days later he administered the same dose of physostigma to the same animals without atropia, and they all died, thereby proving that the atropia had counteracted the physostigma. He recommended that in case of physostigma poisoning in man, atropia should be given subcutaneously, until the pupils are fully dilated [17].

In July 1871, a ship discharged its cargo in Coburg dock in Liverpool, and the mess left on the dock, including Calabar beans, was dumped in Boundary Street. Seventeen children found the beans, ate them, and were poisoned. Some were taken to Mr Smith, a druggist in Athol Street who administered emetics, and Inspector Macauley was called who called the police surgeon Dr Clarke of Roscommon Street, who prescribed for the children [18,19].

I (the author) was very surprised and dismayed to read in an unreferenced article in the New Scientist in 2003, that that the reason the children in both episodes of poisoning in the Liverpool Docks had survived was because they were given atropine [20]. Although atropine is an antidote, there is no evidence that I can find that any atropine was administered to any child in either of these mass poisoning events. They survived as a result of good prompt treatment with emetics.

Efforts continued to find a use for physostigma in epilepsy, and progressive paralysis of the insane but with disappointing results [21].
In 1877 it was found to work for a time for muscle weakness, which might have been myasthenia [22]

Physostigmine became a research tool. In 1900 Pal was working on the effect of physostigmine on the gut of curarised animals. He discovered that as soon as he administered physostigmine, the diaphragm started to contract [23]

Surgeons, who were carrying out abdominal operations without the benefit of paralysing anaesthesia or antibiotics, tried using physostigmine to treat postoperative ileus, with some effect [24].

Physostigmine remained a tool for physiologists for the first third of the twentieth century. In a previous paper to this society, in Wakefield, I described the work of Langley investigating receptor sites and Loewi and Dale investigating the existence of acetylcholine, and how William Feldberg, in 1933, brought the use physostigmine to Dale's laboratory, enabling them to identify acetylcholine as a transmitter agent [25].

Physostigmine is very unstable in solution, and in 1931 a group of chemists decided to find a more stable replacement. They eventually synthesised

neostigmine which is more stable and does not cross the blood-brain barrier [26]. Like physostigmine, it causes twitching and paralysis as can be seen in an experiment carried out on volunteers in 2018 [27].

It was Dr Mary Walker in 1934, working at St Alfege's Hospital in Greenwich, who noticed that myasthenia looked very like curare poisoning, and tried treating it with physostigmine, with great success although the effect was short lived [28]. This has been described as *"The miracle of St Alfege's"* [29].

Mary Walker also reported the use of neostigmine successfully for treating myasthenia gravis although it had been described by Lazar Remen two or three years before her [29,30]. Lazar appears not to have realized the full importance of his observations. He was also discouraged by his chief who more interested in trying glycine as a treatment. Viets also believes there might have been other circumstances for not encouraging Lazar [29].

Physostigmine and later neostigmine became standard treatment for myasthenia.

More recently, Dr Michael O'Brien has suggested in a letter to the JRSM that what actually had happened was that Mary Walker phoned Dr Charles Symonds, and he suggested physostigmine, as myasthenia looked like botulinum toxicity, but that Mary Walker never acknowledged his suggestion in the report [31].

Neostigmine has become the standard agent for reversal after the use of nondepolarising muscle relaxants. Physostigmine is sometimes used in treatment of the Central Anticholinergic Syndrome [32,33].

But, what of the Calabar bean? In 2001 the headless limbless torso of a child was found in the Thames, near Tower bridge. The child came from the Benin City area of Nigeria and had Calabar bean residue in the gut [34]. It is ironic that what Christison had predicted that the only place Calabar bean might have may be in humane execution might have been borne to be true in this case!

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Anaesthetic temperature compensated vaporiser and relative analgesia equipment development: A UK perspective timeline

Janet Pickles
RA Medical Services Ltd

On 5th August 1947 three men, Bill Edmondson, Wilf Jones and a silent partner, Lord George Wellesley (Figure 1), founded a new Company called Cyprane, with an initial capital of £2,000. A further Company called Anaesthetic Equipment Ltd was also established at the same time.

Wilf Jones had joined Coxeter's as a designer in 1938 – the year that Coxeter and Sons celebrated the 100-year Centenary of making surgical and anaesthetic equipment and nitrous oxide. They were also the original manufacturers of the Boyles and Walton anaesthetic machines.

Figure 1. Bill Edmondson, Wilf Jones and Lord George Wellesley (from left to right)
(Edmondson and Jones images supplied by and reproduced with kind permission of Robert Edmondson; origin of Lord Wellesley image unknown).

1947
Cyprane & Anaesthetic Equipment Ltd were located in a garage in Jew Lane, Oxenhope, (near Keighley) West Yorkshire. Work started immediately on development of a range of equipment including the Tecota, AE Gas Machine

and latterly, the temperature compensated vaporiser, known as the Tec range - initially for Halothane (Fluothane).

The initial project was the development of the Cyprane Trilene Inhaler (Figures 2 and 3), being the first item to go into production in the late 1940's and was used for self-administration in obstetric analgesia, but apparently also used in other medical fields such as dentistry.

Figure 2. Trilene Inhaler with original packaging.

Figure 3. Cyprane Trilene Inhaler with mask fitted

1950

Expanding equipment design and manufacturing brought the need to move to larger premises. Cyprane and Anaesthetic Equipment Limited moved to

Fallwood Works, Oak Street, Haworth. These premises, known to locals as the 'Brewery Works' were on the site of an old brewery.

1954

In August, Cyprane received approval for production of the Tecota Trilene Anaesthetic inhaler, used during childbirth (Figures 4 and 5). The liquid Trilene was poured into the vaporising chamber and this converted it into a vapour for the patient to breathe; 0.5% Trilene/Air.

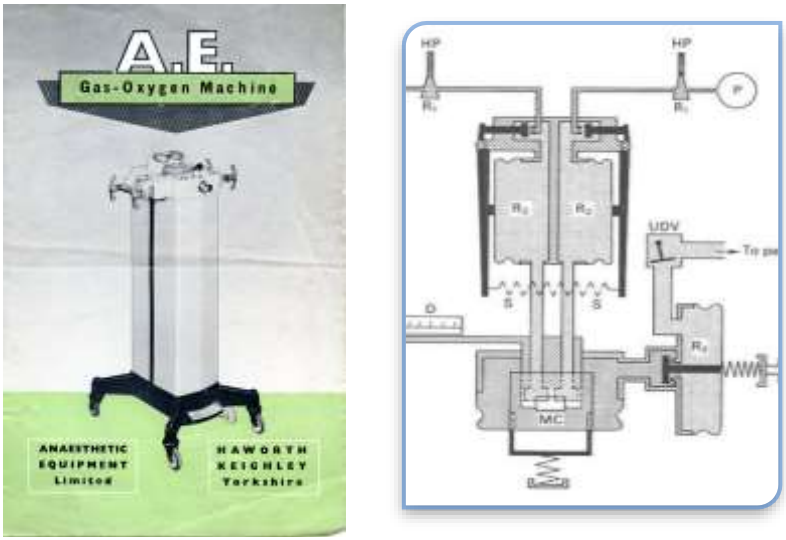
Figure 4. Wilf Jones in 1953 with the Tecota inhaler
(image used with kind permission of Robert Edmondson)

Figure 5. Tecota inhaler being used in midwifery

All machines had to be performance tested by the National Physics Laboratory at Teddington and sealed prior to use. Wilf Jones eventually wrote, in a document entitled 'Cyprane Ltd' dated 7th March 1989, that "the work conducted on temperature compensation for this unit was of great assistance in the later development of the Fluotec vaporiser". The UK retail price for this machine was £8.80 at that time!

1950s

In the latter part of this decade, The Anaesthetic Equipment Company developed the AE Gas Machine (Figures 6a and 6b). This machine for dental anaesthesia was designed to deliver more accurate percentages of oxygen and nitrous oxide and incorporated a three-stage pressure reduction. It was an intermittent flow machine, working on a very different principle from the other units available at that time such as the Walton V or McKesson and proved very popular. The original price of the machine was £145.00.



a b

Figure 6. Original Anaesthetic Equipment Ltd Advertising Brochure (a) and Internal Circuit Diagram of AE Gas Machine

(Diagrams property of R A Medical Services Ltd)

The AE machine could be used for general anaesthesia with the addition of an anaesthetic vaporiser and remained in constant use until 2001 when general anaesthesia was barred from use in dental surgery settings with the issue of The Amendment to the NHS General Dental Services Regulations 1992 iss. 2001. It had proved very reliable and was sadly missed by its faithful owners.

1956

Into the overall picture now enters some overseas involvement. A Canadian, Fraser Sweatman, started a corporation – Fraser Sweatman Inc - under the State of New York Laws, with headquarters in Buffalo, NY State. Prior to this, Fraser had already had contact with Cyprane, and their development of the temperature compensated vaporiser programme and he eventually became the American agent for anaesthetic equipment sales.

Fraser Sweatman participated in the R & D of the Quantiflex Gas Machine which incorporated the first twin-series (high/low) flowmeter system with protection against oxygen failure (failsafe) and the now standard position of oxygen downstream of all other gases.

A real turning point in safe practice came with the development by Sweatman's engineers, including his then Sales and Design Engineer, Gary Porter, of the Monitored Dial Mixer (MDM) flowmeter. This machine was specifically designed to prevent the delivery of a hypoxic mixture and this dual hypoxic guard was rapidly adopted by other manufacturers of gas machines. This is the same design which is still manufactured and in wide use today, with very minimal changes or alternations. Fraser also developed a pin-index system for vaporisers.

> ***Historical Note****: The Sales and Design Engineer for Fraser Sweatman Inc, based at Orchard Park, Buffalo, NYS, was Gary Porter, who was very instrumental in the Quantiflex development. Gary Porter later went on to found his own business, Porter Instruments Inc. in Hatfield, Pennsylvania – this company now manufactures the MDM having purchased the Matrx Nitrous Oxide Division in 2008 from Midmark.*

By the late 1950s, the combined Cyprane/Anaesthetic Equipment Ltd workforce had grown to 30 employees.

> ***Equipment Historical Note****: Around this period, quite exciting developments were being made with anaesthetics. In 1956, ICI started clinical trials of Halothane - or Fluothane as it became known. The difficulties of administering accurate percentages of Fluothane using available equipment quickly became apparent, as much smaller dosages were required. This breakthrough drug can quite rightly be claimed as a product of industry in the Liverpool and Manchester area, with clinical trials being conducted at Manchester Royal Infirmary.*
>
> *More than a modified Boyles bottle was needed, and a request was made for a vaporiser with a consistent output over the range 0.5 to 3% at continuous flows between 3 and 8 l* min^{-1}.

A prototype Mark I vaporiser was given by Wilf Jones to Dr Brennan, Consultant Anaesthetist at Manchester Royal Infirmary, for clinical trials. Dr Brennan was delighted with the performance of the unit. This took place a few days after 24th December 1956, the date of the Patent Application (U.K. No. 814427).

Wilf Jones wrote of that time: "Following three or four more prototypes we went into manufacture very quickly".

The Cyprane Fluotec Mark 1 vaporiser gave an accurate output, but the output fell off below flows of 3 l min^{-1}. This was the first temperature-controlled vaporiser apart from the Tecota and is the forerunner of all modern anaesthetic vaporisers in use today. The Mark I was quickly replaced by the Mark 2 Vaporiser to correct a sticking valve issue

The Mark 2 (In 1966 it retailed at £40.00) and Mark 3 (1968) models followed for use with anaesthetic agents (Isotec for Isoflurane, Pentec for Penthrane etc). Many Tec 3 type vaporisers are still widely in use today in the veterinary sector.

1959
Approximately 30 Halothane Mark II Vaporisers (Figure 7) a day were being produced at the Haworth Works, but conditions were becoming cramped.

Figure 7. Cyprane Mark 2 (Property of R A Medical Services Ltd)

Early refractometers (Figures 8 and 9) for testing the vaporisers were made in-house by Bill Edmondson and Wilf Jones. These units were later replaced with Hilger & Watts refractometers. The Hot Box was temperature controlled. This revolved and consisted of an upper chamber at 90 degrees Fahrenheit and a lower chamber at 85 degrees Fahrenheit. This was to check the performance of the temperature compensating thermostatic valve.

1961
In April a house with a very large garage was purchased in Bird Avenue Buffalo, NY State, and set up as Cyprane Inc for servicing of anaesthetic vaporisers.

29th June 1961
A US Federal trademark registration was filed for the name ‘Quantiflex’.

16th January 1962
The following entry appeared in the US Patent Office Official Gazette:
SN 123,396. Fraser Sweatman Inc, Buffalo. N.Y. Filed June 29th, 1961.
QUANTIFLEX for Anesthetic Administering Machines;
First use Dec 7, 1960.

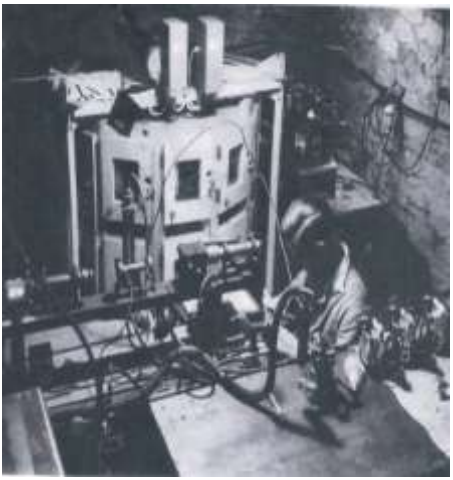


Figure 8. Refractometer and Hot Box for testing of vaporisers
(image property of R A Medical Services Ltd)

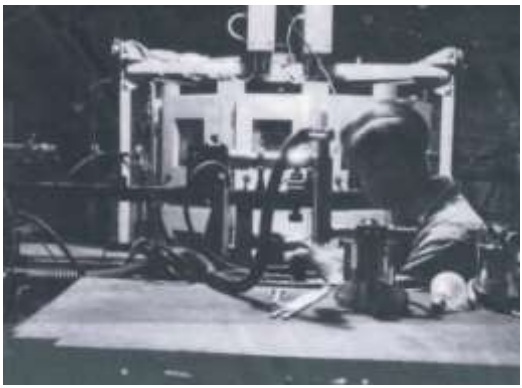


Figure 9. Close up of Figure 8 showing refractometer operator Cyril Whitteron (image property of R A Medical Services Ltd).

Cyprane Quantiflex MDM started being promoted at this stage (Figure 10) and the workers celebrated (Figure 11).

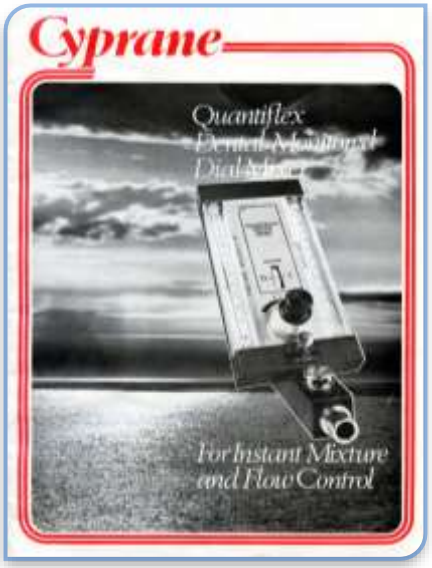


Figure 10. Original advertising leaflet for the Cyprane Quantiflex Monitored Dial Mixer (MDM) Flowmeter.
(Property of R A Medical Services Ltd)

1962
In the U.K., the Haworth premises were becoming too cramped, so a larger building, Joe King's Mill, West Lane, Keighley, amounting to approximately 18000 sq. feet, at a cost of £9,000 was purchased. The Haworth works were retained for some time, but gradually all work was transferred to the Keighley site and the Haworth works were sold off. The use of the Anaesthetic Equipment Ltd name was also discontinued, with only Cyprane remaining in use.

> ***Historical note:*** *The Cyprane Works Manager at that time was Thomas Pickles, father of Chris Pickles, who in 1960 was given a part time holiday job. Chris found the involvement with the early years of compensating vaporiser design fascinating and was*

eventually offered a full-time position. He also met and worked with Fraser Sweatman and witnessed many changes that took place during this period.

One amusing contact was between Fraser Sweatman and a young Christopher Pickles who, on admiring the rather large and loud kipper tie Fraser was wearing one day rashly stated; "I like your tie", the response being "You do – here it is", at which point Fraser removed the tie and presented it to a rather embarrassed Chris!

Figure 11. Cyprane Works outing to the Lake District in 1961. Thomas Pickles Works Manager, top row, extreme right. (Image kindly supplied by C J Pickles -photograph originally taken by Wilf Jones).

24th November 1964

Cyprane incorporated to a limited company. Bill Edmondson retired at the age of 65 on 30th November 1964. Cyprane was purchased by Fraser Sweatman and merged with Canam Surgical Services Ltd of Canada and Fraser Harlake Inc of the US to form one larger company. Wilf Jones was appointed as first Managing Director in England. The name Cyprane continued to be used in the UK.

1964
A UK manufacturing license was granted and production of the Quantiflex Mark 1 R A Flowmeter was commenced by Cyprane followed by the Quantiflex MDM and Quantiflex Mark II (also known as the Fraser RA). The Quantiflex range was manufactured in both the USA and the UK simultaneously, the main difference being the medical gas colour coding, with oxygen being in green cylinders in the USA and in white ones in the UK.

1965
On the 6th July the US Patent Office issued a patent for a Volatile Anaesthetic Vaporising Apparatus – the Drawover Vaporiser. The inventors were named as William Edmondson and Wilfred Jones. This vaporiser was commonly used in conjunction with an MDM Flowmeter until 31st December 2001 when administering a general anaesthetic in a dental surgery setting ceased. The use continued in hospital settings or on portable anaesthetic machines such as those used by the Armed Forces in a field hospital setting.

A Report, issued in July 2000 by the Department of Health and entitled 'A Conscious Decision; A review of the use of general anaesthesia and conscious sedation in Primary Dental Care', was responsible for the eventual cessation of general anaesthesia in general dental surgeries

1966
The Board of Cyprane were becoming concerned by the competition from Drager and were pressing hard for a redesigned vaporiser. The Tec 3 design was based on the theory that the heat sink of the metal blocks would take care of 75% of heat loss due to evaporation and the internal thermostat would deal with the rest.

The first Tec 3 prototypes (Figure 12) went into clinical trials in July 1967 but the process was not straightforward and many alternations/redesigns were required.

Production started at a U.K retail price of £100.00, but it was felt this was not competitive enough and was eventually reduced to £60.00.

1967
Lord George Wellesley dies on the 31st July.

1969
The Fluotec 3 receives a very good write up in the British Journal of Anaesthesia [1].

Figure 12. Isotec 3 with Selectatec and Key Filler fittings (this latter required a colour coded bottle adaptor to fill the vaporiser with the liquid anaesthetic eg purple for isoflurane, red for halothane etc)

Historical Note*: In the late 1960s, Fraser Sweatman purchased the Harris Lake Company and changed the name to Fraser Harlake. Originally based in Canada, eventually all USA flowmeter manufacturing moved to Orchard Park, Buffalo, NY State, where it remained until 2008 when Midmark sold the Matrx Nitrous Oxide Division to Porter Instruments (Parker Hannifin).*

Historical note*: In 1972 a Quantiflex R A Head – available finished either in black with wood grain centre panel or silver tone – cost £160.00. A mobile 4 cylinder stand cost £75.00 and a wall plate*

with 12" swing Arm cost £20.00. These prices were taken from a quotation sheet offered to a prospective user dated 31st August 1972.

Figures 13 and 14 show the original Cyprane Handbook and the original advertising leaflet for the Quantiflex Mark I flowmeter respectively.

Figure 13. Original Cyprane Handbook (Property of R A Medical Services Ltd)

1970
Development of the Mark 4 vaporiser commences.

1972
British Oxygen Company (BOC) purchase the group. Wilf Jones retained as Managing Director. Fraser Harlake/Cyprane become part of BOC Medishield.

1973
The performance of Quantiflex MDM is analysed and its safety confirmed by Heath, Anderson and Nunn in the British Journal of Anaesthesia [2].

1974
Bill Edmondson dies aged 74. He had retired in November 1964.

1975
Cyprane Keighley now manufacturing 75% of the world's calibrated, temperature compensated vaporisers.

1984
New extensive factory built at Steeton, 3 miles from Keighley and all manufacturing moves from West Lane, Keighley; West Lane premises sold.

Figure 14. 1972 Original advertising leaflet for the Quantiflex Mark I flowmeter - black finish with wood grain effect central panel. (Property of R A Medical Services Ltd)

1984
BOC/Airco group all medical equipment factories (approximately 12) come under the name Ohmeda (Ohio/Medishield).

1991
Fraser Sweatman dies aged 88. His obituary states "Good humour, enthusiasm, integrity, perseverance and vision were prominent in his personality and enabled him and his staff to revolutionise the ways in which anaesthesia was practiced only 30 years ago" [3].

1996
Ohmeda factory in Steeton closes for business and a quantity of the internal assets are sold off by auction. Some assets are transferred for use in the Ohmeda USA factory, which continued production of the vaporisers.

2000
Wilf Jones dies aged 86. His funeral takes place in Keighley, West Yorkshire and is well attended.

> ***Historical Footnote****: In 1994 a Company called R A Medical Services was formed to offer maintenance on existing relative analgesia flowmeters and Tec range vaporisers. Due to existing contacts, USA Companies such as Matrx, Accutron and Porter Instruments agree to supply with products and service training.*
>
> *By 2022, the Company has become the premier UK supply Company for supply and maintenance of Inhalation Sedation equipment across the UK and Ireland with third generation of family involvement, hopefully ensuring the continuing success and progression for years to come and allowing the heritage of Cyprane and the post-war pioneers to continue.*

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Chambers and Tents for the Delivery of Oxygen

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The full text of the cover note on which this paper was based [1] is accessible via the *Anaesthesia and Intensive Care* journal website (https://journals.sagepub.com/home/AIC).

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The DA (RCP&S): 1935 to 1953
From 'Jewel in the Crown' to 'Thorn in the Flesh'

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The Diploma in Anaesthetics (DA) of the Royal Colleges of Physicians and Surgeons in London was the world's first formal qualification in anaesthesia. It was introduced in 1935 on the initiative of the newly formed Association of Anaesthetists of Great Britain & Ireland (AAGBI), and has rightly been referred to as the 'jewel in the crown' of that organisation. So why, 87 years later, am I suggesting that it became a 'thorn in the flesh'; and whose flesh? Well, mine for a start when I made my first appearance as a member of a consultant appointment committee, 'somewhere' in Scotland. There were three applicants: two had completed the training programme, including acquisition of the Fellowship, but the third was very different.

Older, he had not progressed beyond registrar grade, had never held a career grade appointment, and did not have the Fellowship. He did have the DA, had been a long-term locum for the post under consideration, and it soon became apparent that a local surgeon was trying to engineer his appointment even though he did not meet the requirements in the further particulars. When I had the temerity to point out that the candidate did not have the Fellowship, I was asked, very aggressively, "Isn't the DA a qualification in Anaesthesia?", and answering the question was a struggle. I had not given much thought to the DA because it was irrelevant to my career, but it was a thorn in my flesh that day, and led me to wonder why on earth did the specialty have two qualifications of different standards?

The opportunity to answer that question came decades later consequent upon a search of the Archives and Library of the Royal College of Surgeons of England. As Honorary Archivist of our Royal

College I had set out to reverse the lack of records of activities during the years before independence. Good relations between our then president, Dr J P van Besouw, and his opposite number at Lincoln's Inn meant that I was allowed to search their archives for relevant material which was scanned by our archivist, Mrs Rosemary Sayce, so that the College now has its own copies. Recognising that much of what I found was about the DA I decided to research its history, and this is a brief summary of the first eighteen years.

The story starts in Victorian London where the London Society of Anaesthetists promoted the compulsory teaching of anaesthetics to medical students. The activity had to cease when the Society became part of the Royal Society of Medicine (RSM), but individuals, notably Frederick Hewitt, continued the work. Regulations were introduced by a number of organisations, and an Anaesthetics Act, supported by the GMC, was drafted, but lost to the press of Parliamentary business before World War One. After that terrible war it was some years before previous activities recovered, but in 1931 the office bearers of the Section of Anaesthetics of the Royal Society of Medicine (RSM) were the key players. The Honorary Secretary, Ivan Magill, began to pursue a diploma, but was told that this was outwith the remit of the Society. In parallel, the Section President, Henry Featherstone, had realised that the specialty needed another organisation to pursue non-academic matters.

The consequence was the formation of the AAGBI in 1932, and the establishment in 1935 of the Diploma in Anaesthetics of the Royal Colleges of Physicians of London and Surgeons of England (DA RCP&S), run by their 'Conjoint' Examinations Board. Anaesthetists who had held a 'visiting' appointment to a teaching hospital for at least 10 years were awarded the DA without examination, and the first diet was in November 1935, continuing twice yearly thereafter. Candidates had to have spent a year in resident posts, half of it in anaesthetics, or produce evidence of having given 1,000 anaesthetics. In the first five years the overall pass rate was 63%, high for a

Postgraduate Diploma, but fell to 35% during World War 2, resulting is strengthening of the entry requirements. The numbers sitting continued to increase, but the pass rate did not, even after the War when there was further tightening of the regulations.

However, bigger changes were on the way in response to the impending introduction of the National Health Service. The President of the Royal College of Surgeons suggested that to take advantage of this new organisation the specialty needed both its own academic organisation (resulting in formation of the Faculty of Anaesthetists) and an examination of Fellowship standard. Time was short so the DA was upgraded by addition of a modified version of the surgical primary and some strengthening of the DA as a final examination. A notable change was the addition of non-anaesthetists to the team of examiners, basic scientists to the primary, and surgical & physician examiners to cover the relevant parts of their subjects in the final. Unfortunately, there was soon concern about the poor pass rates, especially in the primary, with the Conjoint Board's Committee emphasising that their diplomas were really for GPs with a specialist interest.

This resulted in the introduction of the Fellowship, initially on the same lines as the two-part DA, but run by the Faculty, and with the DA reverting to its original format, a one part examination now aimed at GPs. Many of the Faculty wanted the DA abolished then (perhaps predicting the difficulty I experienced decades later), but part-time GPs were still a major component of the workforce. Thus they needed some 'screening', and the two examinations were to run in parallel. Sadly, having agreed with Faculty representatives that the DA would revert to its original format (specifically an examination of anaesthetists by anaesthetists), the Conjoint Board changed its mind. They added a surgeon and a physician to the examination team, but this was not communicated to the Faculty until after the change had been approved by both College Councils.

There had been a good working relationship between Conjoint and Faculty Boards during the time of the two-part DA, but the breach of faith (of adding a physician and a surgeon) seems to have caused such unhappiness that the minutes of the Board of Faculty do not mention the DA again for nearly a decade after 1953. It might be that this understandably long interval could be dismissed as the longest 'sulk' in anaesthetic history, but it is obvious that I am not the only one for whom the DA became a 'thorn in the flesh'!

The continuing story of the DA after 1953 is the subject of ongoing study.

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At the Royal College of Anaesthetists: Minutes of the General Purposes Committee of the Faculty of Anaesthetists of the Royal College of Surgeons of England.

Acknowledgements

I thank the Presidents and Councils of the above three organisations for allowing me to study these documents, their Archive and Library Staff for ready cooperation in providing access, and special thanks to Mrs Rosemary Sayce, sometime Archivist to the Royal College of

Anaesthetists, for undertaking the considerable scanning exercise which means that the specialty now has its own copies of the documents recording the early history of its organisations and examinations.

Advances in Difficult Airway Management

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The 'difficult airway' remains an infrequent but significant challenge for anaesthetists. It has been defined in multiple varied ways, including 'a clinical situation where a healthcare provider who is skilled at airway management experiences difficulties with one or more standard methods of airway management'[1], and 'the clinical situation in which a trained anaesthetist experiences difficulty with facemask ventilation, difficult tracheal intubation, or both' [2].

Surgical tracheostomies have been described in one form or another from as early as the Bronze Age, as well as in Ancient Egypt, Greece and Rome. The first written record of a technique resembling tracheostomy was around the time of Imhotep (27th century BCE), and the ancient Egyptians had records of other therapeutic surgical procedures besides this [3]. Later Galen wrote about the operation in the 2nd century when he attributed its inception to Asclepiades. This was followed by a significant period when it was believed by many to be futile to perform the procedure, as the cartilage would not heal after incision, but this was debunked by Albucasis in the 11th century who successfully sutured a tracheal wound in a girl who had cut her own throat [4].

Belgian anatomist Andreas Vesalius is hailed with providing the first example of assisted ventilation in 1543, when he inserted a reed into a pig's trachea, blew into it, and observed that the lungs inflated and heart contractility re-started [3,5]. A similar practice was recounted by German surgeon Lorenz Heister two hundred years later, though this time the reed was inserted into the trachea of a human rather than a pig. He described how people who were apparently drowned could be resuscitated via this method [6].

The practice of resuscitating drowned people continued in Amsterdam, where a specific society was formed. In the following years, the Humane

Society was inspired and established in London, designed to attempt resuscitation in those who had drowned in the Thames and to encourage others to learn resuscitative techniques [6]. It was in an essay presented to the society in 1788 that Charles Kite outlined one of the first tracheal tubes designed for permitting ventilation of the lungs, which he suggested should be done using house bellows. Figure 1 shows this tube which is curved and metallic and designed to be inserted into the trachea blindly. It was described by Kite as ‘an instrument to pass below the glottis’[7].

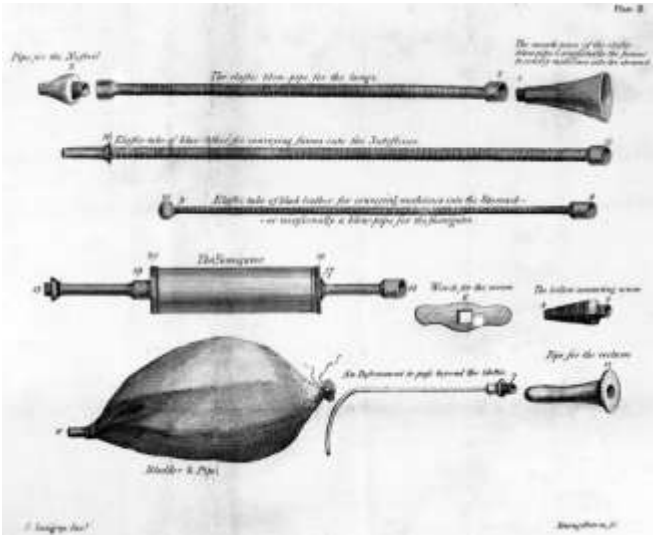

Figure 1: Charles Kite’s instrument design, from ‘An Essay on the Recovery of the Apparently Dead’. (Reproduced with permission from the Wellcome Collection, under the Creative Commons License, Attribute 4).

The first example of an inflatable cuff being used was in 1869, when Frederick Trendelenburg, whose eponyms are widely known throughout medicine, used an inflatable rubber bag attached to a tracheotomy tube. He named this the ‘Tamponkanüle’, or tampon cannula. Also now referred to as the Trendelenburg cone and cannula, this prevented the aspiration of blood into the larynx [8].

Similarly, Scottish physician Sir William Macewen (1848-1924) wanted to

prevent blood from entering the larynx by using a tracheal tube, and was the first person to administer anaesthetic agents through one [9]. In 1881 he spoke on 'The Surgical Treatment of Croup and Diphtheria by the Introduction of Tubes into the Trachea Through the Mouth' at the International Medical Congress in London, although he is seldom recognised as the inventor of orotracheal intubation.

Just after the First World War, in 1919, Sir Ivan Magill was posted as an anaesthetist at Queen's Hospital, Sidcup. Described as the 'doyen of anaesthesia', he, alongside Stanley Rowbotham, developed a technique of tracheal intubation through the nose [10]. This was one of the earliest examples of nasotracheal intubation, need for which arose in 1922 in response to the need of a soldier who had laboured breathing as a result of jaw deformity which prevented adequate expiration [11,12]. Magill particularly liked nasotracheal intubation, as it allowed the surgeon to work in the mouth which was often required for the soldiers with facial injuries being treated at Sidcup [11].

Development of the Laryngoscope:

Of course, it is not possible to discuss tracheal intubation without delving into the development of the laryngoscope. The original inventor of the precursor to the modern laryngoscope has been heavily debated, with both Benjamin Guy Babington and Manuel García II considered to have contributed significantly to pioneering the device. In 1829, Benjamin Guy Babington presented what he termed a 'glottoscope' to the Hunterian Society, the first example of a device which improved the view of the larynx by retraction of proximal tissues [13]. Although visualisation of the larynx may have been improved with this device, there is no documentation that the vocal cords were ever seen [14]. There is only one paper referring to its use under the term 'laryngoscope', first coined by Dr Thomas Hodgkin [13]. Manuel García II is attributed, meanwhile, with being the first person to have viewed the entire glottis. As a Spanish singing teacher living in London, he used a device containing mirrors illuminated by sunlight and documented his findings in a paper entitled 'Physiological Observations on the Human Voice' [15]. This described how the vocal cords moved during inspiration, expiration and phonation. In his explanation of the device he states:

> "*The method which I have adopted is very simple. It consists of placing a little mirror, fixed on a long handle suitably bent, in the throat of the person experimented on against the soft palate and uvula. The party ought to turn himself towards the sun, so that the luminous rays falling on the little mirror, may be reflected on the larynx"* [16].

This, however, was still a far cry from the laryngoscopes used today. The first successful example of laryngoscopy used in clinical practice appears to be by Professor Johann Nepomuk Czermak. He built on the work of Dr Ludwig Türck, who had employed a method similar to García's, but struggled to find an adequate light source and worked only in the summer months using the sun's rays. Czermak, on the other hand, observed his own larynx during the winter months using an artificial light source, and beat Türck to publication in the Vienna Medical Weekly in 1858 [17,18]. Initially Czermak acknowledged Türck's contributions to laryngoscopy, but subsequently withdrew the claims, leading to a dispute between the two men which is now referred to as the 'Türckish War'.

The earliest report of direct laryngoscopy in a child is by Horace Green in 1852 [19]. However, it is Alfred Kirstein who is often credited with inventing the first direct laryngoscope in 1895 [20]. He developed the 'autoscope' after a colleague inadvertently intubated the trachea rather than the oesophagus while using an endoscope. Kirstein combined an electric light source in the handle of the autoscope and attached a rounded metal blade, resulting in a laryngoscope morphologically similar to those we still use today. This design was modified by Chevalier Jackson, who after his first U-shaped iteration in Philadelphia in 1903, later moved the light source in the laryngoscope from proximal to distal. He was the first person to describe both direct visualisation of the larynx and the tracheal intubation together, and published a paper about it entitled 'The Technique of Insertion of Intratracheal Insufflation Tubes' in 1913 [21].

In 1941, Robert Miller published a paper entitled 'A New Laryngoscope' in which he described how easily damage to the teeth could occur as a result of using a laryngoscope [22]. He also noted that the available laryngoscopes of the time were too thick at the base, increasing chance of trauma to the teeth.

In addition, the tip of the laryngoscope was not a suitable shape for lifting the epiglottis, and the blade was often too short with the curve of the blade too close to the end. These features, he concluded, meant 'adequate exposure of the larynx in difficult patients is not facilitated'. The notion of the difficult airway resulted in Miller designing a new blade which was longer, narrower and more suited to exposing the larynx.

Two years after Miller's design, Professor Sir Robert Macintosh in 1943 described the continually curved blade to facilitate easier tracheal intubation [23]. The curved blade allowed the tip to lie proximal to the epiglottis and be lifted up, in order to allow visualisation of the vocal cords and provide more room than the Miller blade to pass the tracheal tube.

Since the 1940s there has been relatively little change to these direct laryngoscopes which we still use today, but there remains a small proportion of patients for whom visualisation of the larynx is impossible using these blades. This therefore prompted further laryngoscope designs, including the Siker laryngoscope in 1956, its aim being to improve the view of the larynx by providing a mirror image in its shiny reflective surface; the Huffman prism which followed in 1968 with a clip-on attachment which refracted an image by 30 degrees, and the McCoy levering laryngoscope in 1993 [15].

Videolaryngoscopy is another useful tool in managing the difficult airway and provides an indirect view of the glottis. Devices such as the Glidescope®, introduced in 2003, were considered revolutionary in terms of managing such cases as these removed the need for alignment of oral, pharyngeal and laryngeal axes and provided good glottic visualisation [24]. However in a summary by the National Institute of Clinical Excellence in 2018 it was concluded that while videolaryngoscopy gives better visualisation of the glottis as compared with direct laryngoscopy, and works at least as well in managing patients with a difficult airway, it is not necessarily superior [25]. It has, however, been shown that once learnt, the success rate of intubation carried out by novice anaesthetic trainees improved [26]. This difference however does not appear to extend to all practitioners and settings [27].

Recognition of the difficult airway

In their article 'Anaesthetics in Plastic Surgery of the Face and Jaws', Rowbotham and Magill describe clearly the physical characteristics of soldiers' airways that presented a challenge in intubation:

> *"Our chief difficulty, however, is always that of maintaining a proper airway. Loss of part of the mandible, scarring and adhesions around tongue, microstoma, trismus and splints or other apparatus fixed in the mouth are the chief obstacles to be circumvented"*[28].

By 1956, the notion of contributing factors to difficult intubation were recognised and published by multiple authors. Cass, James and Lines in an article in the BMJ highlighted some of these, based on a series of cases they had encountered [29]. They remarked that this was:

> *'rare but embarrassing problem for the patient and the anaesthetist alike'.*

They however did not seem to acknowledge that it conferred an increased risk of morbidity or mortality.

Although it is hard to pinpoint exactly when formal anaesthetic pre-assessment came into practice, Rowbotham and Magill's accounts of the physical attributes of patients which presented airway challenges for intubation shows that it was an organic part of delivering anaesthesia, which developed as the specialty did [28].

Referring back to old anaesthetic charts to evaluate if there have been prior airway difficulties or concerns is common practice nowadays, but it hasn't always been this way. Codman and Cushing were early proponents of anaesthetic record charts and advocated their use in 1894 [30]. Tovell and Dunn of the Mayo Clinic published an 'anaesthesia study record' in 1932, designed to allow comparison of patient characteristics and for 'correlation between sets of phenomena which may be of interest clinically' [31]. It was comprehensive and included information about intubation, including whether tracheal intubation was achieved through the nose or mouth, whether a laryngoscope was used, and left room for remarks about the induction and

intubation process. Some of those same components are still seen on the anaesthetic charts today. There is some variation between sites but these are generally similar.

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Anaesthetic Equipment from the Royal London Hospital: Mouth Props, Modifications and More

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Introduction

The Royal London Hospital has been home to multiple advancements in anaesthetic equipment since its foundation. Originally established in 1740 to care for the poor sick of East London, it has witnessed many changes in anaesthetic practice during its lifetime. This paper aims to detail the contributions made by four notable individuals who developed their equipment whilst working at this charitable institution.

Sir Frederick William Hewitt

Sir Frederick William Hewitt (1857-1916) was one of the most influential anaesthetists of the 19th century. He was appointed Instructor in Anaesthetics at The London Hospital in 1886 and was later promoted to Consulting Anaesthetist in 1901 [1]. A leader in the field of anaesthesia, he was appointed anaesthetist to King George VII, whom Hewitt famously anaesthetised for his appendicectomy in 1902 [2]. He wrote several textbooks, including *'Anaesthetics and their Administration: A Manual for Medical and Dental Practitioners and Students'*. First published in 1893 and republished until its fifth edition, it detailed many of Hewitt's contributions to anaesthetic equipment, which were considerable [3]. He modified Junker's and Clover's inhalers for the administration of ether and chloroform respectively. He also modified Hillischer's apparatus for delivering nitrous oxide and oxygen. In addition, he devised his own 'air-way', the original oropharyngeal device [4].

Modification of Junker's chloroform inhaler

In 1892 Hewitt published his modification of Junker's chloroform inhaler in *The Lancet* (Figure 1) [5]. Hewitt identified two problems with Junker's

inhaler. Firstly, it was possible to connect the efferent India rubber tubing to the afferent metal port on the inhaler, which had a longer internal limb. If mistakenly used in this fashion, it could result in the delivery of liquid chloroform to the patient. Secondly, tipping the inhaler (for example against a pillow) could yield the same result, which, Hewitt reported, had resulted in fatal consequences on 'more than one occasion' [5].

Figure 1. Junker's inhaler, complete with hand-bellows and facemask. (From *The Lancet* 1892 [5]); **(**Manufactured by Krohne & Co).

To rectify this, Hewitt's modification comprised an inhaler with coaxial tubing, whereby the efferent tubing ran inside of the afferent tubing (Figure 2). The tubing was designed to be worn around the neck of the anaesthetist and was secured at the front by a metal chain. Hewitt would later tweak his modification in 1901, adding a stopcock to the inhaler's lid to allow easier transportation, along with 'other little improvements which hardly deserve special notice' [6].

Mouth props

To complement his modification of Junker's inhaler, Hewitt devised several mouth props which allowed the administration of chloroform for operations involving the nose and throat. The simplest of these devices comprised a thin metal tube which served as a conduit for chloroform vapour and appeared in

the first edition of *Anaesthetics and their Administration* [3]. Other props incorporated such a tube with existing surgical equipment. One utilised a

Mason's gag, the 'chloroform prop', combined a tube with a dental bite block (Figure 3) [3,6].

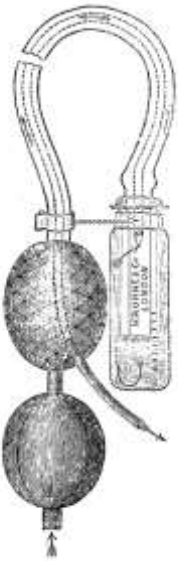

Figure 2. Hewitt's modification of Junker's inhaler. (From *The Lancet* 1892 [5]); **(**Manufactured by Krohne & Co).

Figure 3. Chloroform-prop (From *The Lancet* 1901 [6]); **(**Manufactured by Krohne & Sesemann).

Modification of Hillischer's apparatus

In addition, *Anaesthetics and their Administration* outlined Hewitt's approach to providing anaesthesia using nitrous oxide and oxygen. It was in this text where he detailed his modification to Hillischer's apparatus. Hillischer was a Viennese dentist who had incorporated the combination of nitrous oxide and oxygen into his practice [7]. Hewitt considered the main disadvantage of Hillischer's apparatus that its 'oxygen cannot be regulated with that nicety which is necessary in actual practice' [3]. In other words, a small turn of the lever resulted in a large change in the amount of oxygen delivered. Hewitt's modification offered finer control of the fraction of inspired oxygen, utilising a series of small holes which could be opened by turning a handle (Figure 4).

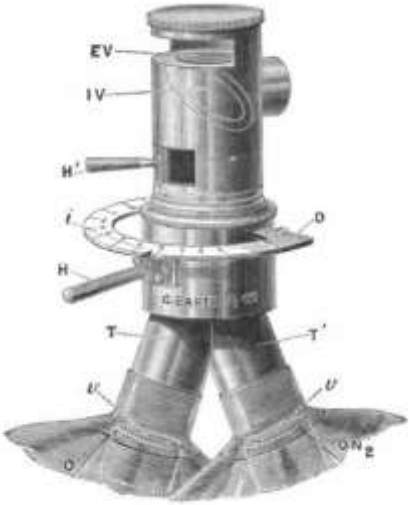

Figure 4. Stop-cock and regulating arrangement of Hewitt's modification of Hillischer's apparatus (From *Anaesthetics and their Administration* [3]; (Manufactured by Barth and Co).

The increments on the dial referred to the number of holes open, rather than a percentage of oxygen. Hewitt had attempted to measure the amount of oxygen delivered by his device but found great variability in his measurements; he later acknowledged this was partly due to the variable pressure of the oxygen and nitrous oxide bags. However, he did provide an

estimation, which providing both oxygen and nitrous oxide bags were partially distended, with one hole open, the device delivered an oxygen concentration between 3.5 and 6.5 percent, providing a hypoxic gas mixture which was typical of that era [3]. With all thirteen holes open, by Hewitt's reckoning, the device would offer a maximum of 24.5% oxygen. His apparatus was later modified to have a total of thirty holes, offering an even greater range of potential oxygen concentrations [8].

Modification of Clover's inhaler

Hewitt's next key modification was that which he made to Clover's inhaler (Figure 5). In 1901 he shared his work delivering a lecture at The London Hospital which was subsequently published in *The Lancet* [6]. There were several advantages to Hewitt's modification. Firstly, its wider bore offered less airway resistance resulting in less stertor and cyanosis than Clover's original design. Secondly, the facemask was screwed on to the inhaler which helped to avoid inadvertent disconnection. A third benefit was that the refill port on the inhaler was rotatable, which meant that after induction with nitrous oxide, the user could top up the inhaler with ether without removing it from the patient. This reduced the chance of the patient experiencing the unpleasant smell of ether, as well as offering a less time-consuming technique.

Figure 5. Hewitt inhaler (modified Clover's inhaler; manufactured by Barth and Co). Photograph taken by the author at the Barts Health Archives, 2022.

Hewitt's 'air-way'

The final key piece of equipment crafted by Hewitt was his oral 'air-way', which he published in *The Lancet* in 1908 (Figure 6) [9]. It comprised a hard metal ring to separate the teeth, connected to a rubber tube to separate the tongue from the palate. At its pharyngeal end it had a bevelled edge with its opening designed to face inferiorly. It was three and a half inches in length and had an internal diameter of half an inch. Hewitt didn't advocate the routine use of his device but recommended it if patients were "taking the anaesthetic badly"; in other words, in cases of airway obstruction [9]. He recommended a deep level of anaesthesia prior to its placement and found it particularly useful for patients in the Trendelenburg position. The device appeared curved in the fifth edition of *Anaesthetics and their Administration* [8].

Figure 6. Hewitt's 'air-way' (From *The Lancet* 1892 [5]**. (**Manufactured by Barth and Co).

Robert James Probyn-Williams

Robert James Probyn-Williams (1866-1952) was a colleague of Hewitt's at The London Hospital and was appointed Instructor in Anaesthetics in 1897 [1]. Probyn-Williams was also aware of the drawbacks of Clover's inhaler, specifically in terms of its calibre which was narrower than the trachea, thereby restricting spontaneous ventilation of the patient. He thus developed his own modification, built with a cross-sectional diameter greater than the trachea (Figure 7) [10].

Probyn-Williams' inhaler was egg- shaped, which made it easier to hold owing to its lower centre of gravity. Weighing 16 ounces, it was lighter than other wide-bore modifications, such as those made by Wilson-Smith and Hewitt [11]. Owing to its wider bore, Probyn-Williams noted it resulted in

'quicker respiration' as well as less respiratory secretions and cyanosis [10]. A further advantage was that the device could be separated into two and boiled as a means of sterilisation.

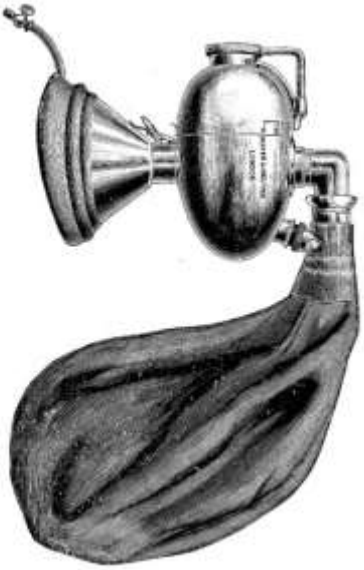

Figure 7. Probyn-Williams' modification of Clover's inhaler, complete with reservoir bag and facemask (From *The Lancet* 1903 [10]. (Manufactured by Mayer & Meltzer).

Probyn-Williams also published several textbooks on anaesthesia, amongst these were *Golden Rules of Anaesthesia* and *A Practical Guide to the Administration of Anaesthetics* [12,13]. In the latter, he shared the development of his own mouth prop, much like Hewitt's in that it allowed continued administration of chloroform vapour intraoperatively (Figure 8). This one was designed to be used for tonsillectomies, with the advantage that it rested on teeth more anteriorly, and therefore in bilateral surgery did not obstruct the tonsillotome [13]. However, Probyn-Williams advised caution with its use, acknowledging that teeth more anteriorly were more easily damaged compared to the molars.

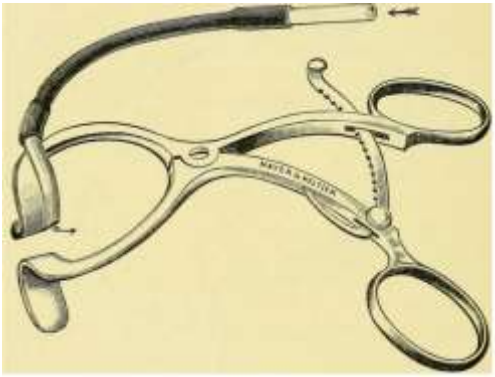

Figure 8. Probyn-Williams' mouth gag (From *A Practical Guide to the Administration of Anaesthetics* 1901 [13]. (Manufactured by Mayer & Meltzer).

John Victor Innes Young

A third contributor to anaesthetic equipment from The Royal London Hospital was Dr John Victor Innes Young (1927-1987) who was appointed Consultant Anaesthetist at The Royal London Hospital in 1961, a post which he held for 25 years [14]. His interests were predominantly in neuroanaesthesia and mechanical devices and in 1966 he published guidance for the use of his 'Halox' vaporiser in *Anaesthesia* [15]. Young's invention was based on a 'Copper Kettle' style of vaporiser first designed by Lucien E. Morris and was manufactured by the British Oxygen Company. For this type of vaporiser, oxygen controlled by a flowmeter was bubbled through the anaesthetic agent to be delivered via a sintered glass diffuser. Now saturated with halothane vapour, this gas was combined with the main gas stream before being delivered to the patient. The prototype varied considerably from the final design (Figure 9).

The prototype was made from copper, whilst the exterior of the final product was made of glass. Critics argued this was a cost-saving exercise [16], but Young clarified that this change was deliberate, allowing the anaesthetist to inspect the bubble streams produced inside correctly, and which he felt

'outweighs any advantage of temperature stabilisation which could be achieved by utilising copper' [17].

Figure 9. Young's Halox vaporiser (right; manufactured by British Oxygen Company) and prototype (left). Photograph taken by the author at The Museum of Anaesthesia at The Royal London Hospital, 2022.

A vernier calculator was also provided to allow calculation of the percentage halothane administered. Young was conscious that the use of such a calculator might serve as a distraction. He therefore suggested a more practical solution was to use a 'vaporising factor', whereby knowledge of the oxygen through halothane flow rate at a given temperature provided an approximate vapour flow rate [15].

The advantages of Young's Halox were that it could be used as part of a closed circuit and thus was more economic, and its one-way valve meant that its average output was not affected by positive pressure ventilation. In addition, other anaesthetic agents such as trichlorethylene could be used in the same vaporiser. However, its lack of temperature compensation was a major disadvantage, especially for a device that underwent rapid changes in

temperature, which potentially meant lots of calculations. Young's creation was criticised for being overly complicated and ultimately proved unpopular [17-18].

Archie Brain

The final contributor to anaesthetic equipment to mention is Archie Brain, who revolutionised anaesthetic practice on a global scale, and whose efforts to gain corporate interest are a lesson in perseverance. Brain was appointed lecturer in anaesthesia to The Royal London Hospital from 1981 to 1983 and published his original article on laryngeal mask airway in the *British Journal of Anaesthesia* in 1983 [19]. His laryngeal mask, which comprised a Goldman paediatric dental mask stuck to a Portex endotracheal tube with acrylic glue, was used in twenty-three patients in his preliminary study. Brain reported that there was 'very little commercial interest' in his device at first, including from Portex [20]. It was Mr Robert Gaines-Cooper who eventually invested in Brain's device; however it wasn't until 1988 when the LMA Classic first became commercially available in the UK [20].

The laryngeal mask airway has since evolved into an array of variations and imitations, all of which are now staples of airway and resuscitation trolleys worldwide. Such variations of the LMA have featured consistently in Difficult Airway Society guidelines [21,22]. Brain has been awarded a number of national and international prizes for his efforts, including the Royal College of Anaesthetists' Dudley Buxton Prize in 1995 and the Difficult Airway Society medal in 2011 [20,23].

Conclusion

In summary, it is clear the equipment developed at The Royal London Hospital has left its mark on anaesthetic practice globally, particularly regarding advances in airway management. Progress relies on the continual cycle of trial and improvement exemplified by the notable individuals mentioned here, and the fact that these pioneers developed their equipment alongside their clinical commitments makes their contributions all the more impressive.

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A review of the History of Anaesthesia Society's scientific meetings in its first thirty-five years – HAS *Quo Vadis*?

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A brief history of the HAS

Although much of the history of the HAS can be found in its *Proceedings* [1], many important details are not included therein. The inaugural meeting of the Society took place at the Royal Berkshire Hospital on 7 June 1986, following the work of a Steering Committee formed in the previous year. Having recently acquired from Dr David Wright the programme of the inaugural meeting (see Figure 1), the author has now passed it on to the Society's archive. At the inaugural meeting the Society's name, constitution and logo were approved, and Officers, Council and Honorary Members were elected. There were 204 founder members. Arguably the elected President, J Alfred Lee, was an obvious choice. His popular textbook *A Synopsis of Anaesthesia* was by this time in its 9th edition [2] and from the start the first chapter had always been "The History of Anaesthesia", instilling interest in this history, especially in trainees who at that time could expect a history question in examinations.

The 2nd International Symposium on the History of Anaesthesia (ISHA) was held in London in July 1987, sponsored by the Association of Anaesthetists of Great Britain and Ireland (AAGBI). Interestingly many on the Organizing Committee were Officers and members of the HAS. The Chairman was Thomas B. Boulton, his deputy was Richard S. Atkinson, and the Scientific Programme was largely organized by Peter W. Thompson, Ian McLellan and David J. Wilkinson [3]. The symposium was a great success.

Figure 1: Front page of programme of inaugural HAS meeting

From 1988 the HAS usually held two meetings each year – a 1½ days meeting in summer and a single day meeting in either spring or autumn. In 1994 the Society sponsored the reprinting of Barbara Duncum's famous book *The Development of Inhalation Anaesthesia* [4] (first published in 1947). In 1996 it funded conservation of the John Snow Case Books held at the Royal College of Physicians of London. In that same year, Barr, Boulton and Wilkinson edited a book

Essays on the history of anaesthesia [5], which comprised the full text of many presentations at HAS meetings up to 1989.

In the year 2000 membership reached 437 (361 UK & Eire, 76 overseas) and a dedicated website was arranged by Dr David Zuck. In September 2001 the 5th ISHA was held in Santiago de Compostela, Spain and there, because of the efforts of C. Neil Adams, the HAS won the bid to host the 6th ISHA in Cambridge. Neil asked Jean Horton for help and on return to England they set up an organizing committee, which was chaired by Ian McLellan. The Society duly organized and hosted the 6th ISHA at Queens' College, University of Cambridge in September 2005 – again, a great success. Every delegate was given a copy of the book *Henry Hill Hickman* [6] which was compiled by Adrian Padfield and colleagues from the manuscripts of the late W.D.A. (Denis) Smith. After the symposium, the papers were collated and compiled in the Proceedings, which were edited by Peter Drury and colleagues, and eventually published by the HAS in 2007 [7].

Regarding the frequency of the HAS scientific meetings, after 2010 due to declining attendance, the Society reduced the meetings from two to one annually. All the Proceedings have been put on the Society's website, where they may be accessed free of charge, including indexing by both volume number and author. These Proceedings remain a rich source of information on the history of anaesthesia. Over the years the Society has donated generously to museums and exhibitions related to the history of anaesthesia. It contributed to the costs of restoring the graves of John Snow, Joseph Clover, Sir Frederick Hewitt and Sir James Young Simpson. It has encouraged presentations by trainees at its scientific meetings, and jointly with the AAGBI it has sponsored essays from trainees for the annual Thomas Boulton Anaesthesia History Prize.

Unfortunately, in more recent years the membership of the Society has declined (total 222 in 2021), now being about half of what it was 20 years ago. The reasons seem to be:

- Loss of existing members due to deaths and frailty of advancing age
- Lack of interest by younger generations of anaesthetists.

If we accept that the composition of the membership is reflected in that of the Council, this is now very different from what it was in 1987. Then 88% were in clinical practice (just 12% retired); now 83% are retired.

Attendance at the HAS scientific meetings

Average attendances at the scientific meetings over the years are shown in Table 1 – excluding the joint meetings (Table 2), because including the joint meetings would falsely elevate the numbers. In the early years, from 1988 to 1991 the average number attending the main meeting was 56. During 1992 to 2001 this rose to 68. From 2002 to 2011 this level of attendance was maintained (67). However

Table 1. Average attendance at HAS main (usually summer) scientific meetings (excluding joint meetings).

Period	1988 - 1991	1992 - 2001	2002 - 2011	2012 - 2021
Average number attending	56	68	67	47

from 2012 to 2021 the average attendance fell to 47, about two thirds of that in the mid-20 years.

It is interesting to consider *who* attended the scientific meetings in the past ten years. Eighteen people attended 7 or more of the past 9 meetings, i.e. about 80% or more of the meetings – eight of those regularly present papers at the meetings; all of these have now passed middle-age. There are a few other people who attended 60% or more of the meetings. Without these people, attendance will be below 30 per meeting.

Table 2. Attendance at HAS meetings held jointly with other societies

Joint meeting	Number attending
July 1989 with Scottish Society of Anaesthetists	90
January 1997: 150th anniversary with AAGBI and Royal Society of Medicine	369
May 1999: bicentenary Davy meeting with Society of Anaesthetists of the South Western Region and Anesthesia History Association	157
May 2005 with Royal Society of Medicine	99
June 2011: bicentenary Simpson meeting with Lad o Pairts at Royal College of Surgeons of Edinburgh	88

Questionnaire-survey

To obtain views on the format of the scientific meetings and opinions on engagement with academic historians, the author sent questionnaires to the 42 registrants for the HAS 2021 (Shrewsbury) meeting. Thirty-two completed questionnaires were returned, a response rate of 76%. There were 13 questions, the last of which invited freehand opinions on more involvement of graduates in history/ social science. A full report on the survey [8] was sent to the President of the Society in May 2022. A summary follows.

- Responders perceived the main values of HAS meetings to be increasing knowledge and socialising
- In answer to the Question ‘what aspect is most absent from HAS meetings?’, about ¼ said: youth in participants
- About 2/3 felt that attendance was low
- About 2/3 felt involving academic historians would improve the academic quality of meetings, but only 1/3 felt this would improve the social aspects
- About ¾ *disagreed* with the attitude testing stem ‘non-clinician historians do not have the technical knowledge and skills required to write on the history of anaesthesia’, *agreed* that involving academic historians would improve the academic credibility of the HAS, and felt that there *is* a need to bridge the gap between the academics and clinician historians
- BUT there was NOT a majority wish to change the focus of papers from ‘events and biographies’
- Analysis of the free-hand opinions on ‘more involvement of graduates in history/social science at HAS meetings’ revealed that only about ½ the responders were positive about actively involving them.

This survey has obtained the opinions of the sample of HAS members who registered for the 2021 scientific meeting. Logically, a second stage is desirable – to obtain the opinions of the many HAS members who do not attend such meetings. Next, a third stage could be contemplated: interview the handful of HAS members who *are* academic historians/museologists/archivists, plus perhaps a few others who are not members, but are known to have published on the history of anaesthesia – to obtain their opinions on engagement with clinician historians.

Problems facing the HAS and possible strategies for the future

There seem to be three main problems:

- Attendance at the scientific meetings is now about 2/3 of what it was in its mid-20 years
- About half of delegates are regular attenders (now past middle-age), and about half of those often deliver papers
- It is likely that in a decade or less, the number of delegates will be less than 30, and papers submitted will only be sufficient for 1-day meeting (not 1½ days).

Possible strategies for the future are:

- Consider actively involving academic historians – this has been mentioned in the past. The need for engagement between medical authors and professional historians has been advocated by Henry Connor [9]
- Consider holding more joint meetings with other societies
- If submitted abstracts fall below the number required to fill 1.5 days, the meeting duration may have to be reduced to a single day, or perhaps part of the meeting could be a tour/visit of interesting sites
- If membership severely declines, consider amalgamation with another society.

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Fireside Bellows for Resuscitation

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In the basement of the new building of the Association of Anaesthetists of Great Britain and Ireland (AAGBI) in Portland Place in London, there is a splendidly laid out museum with various items of anaesthetic equipment and memorabilia. Pride of place must go to a pair of small leather and wooden bellows in absolutely immaculate condition with various attachments, all in their original box (Figure 1). It is on loan from the Royal Humane Society (RHS), a society which was inspired by the success in Amsterdam of a Society for Preservation of Life from Accidents in Water which was founded in 1767. William Hawes and Thomas Cogan, the latter having visited Amsterdam, were the driving force behind the formation of RHS in 1774. It was originally called Society for the Recovery of Persons Apparently Drowned.

Figure 1. Bellows used for resuscitation.

Resuscitation sets, including ladders, were placed by the society in strategic places such as the Thames and the Serpentine. It also built a "Receiving House" in Hyde Park, where the victims of near drowning would be

immersed in a hot bath and their limbs vigorously massaged to restore circulation [1]. Its approved resuscitation regime for amateurs as advised in 1774 consisted of, in order of importance, the application of heat, mouth-to-mouth ventilation and tobacco smoke enemas [2], for which the bellows were used with various attachments connected (Figure 2).

Figure 2. A drawing illustrating the resuscitation of a drowning woman (Source: Wellcome Collection, Attribution 4 International (CC by 4.0)

Physicians if present, were valued for their record keeping but they were not actively involved in the resuscitation. One of their main roles was to prevent fraud as the payments involved were huge for their day. The attempted resuscitation had to be performed for at least two hours. If successful the team could expect four guineas, if not this was reduced to two. If the resuscitation was carried out in a pub, the landlord would be given a guinea.

In a specially enlarged First Edition Facsimile of Beeton's Book of Household Management published in 1882 (Figure 3), I was amazed to find two references to the use of bellows for resuscitation purposes [3]. By the time her book was written, The Royal Humane Society had stopped using bellows altogether. This was initially in favour of Marshall Hall's "Ready

Method". Later in 1862, a report by the Royal Medical and Surgical Society, having been asked to investigate the subject of suspended animation, found strongly in favour of the new Silvester method. Surprisingly, despite this report, the Admiralty distributed over a thousand leaflets recommending the Method advocated by Marshal Hall. However, if there was no success after 3 to 5 minutes, it was recommended to switch over to the method advocated by Silvester.


ORIGINALLY PUBLISHED IN
1859-61
IN MONTHLY SUPPLEMENTS TO
S. 0. BEETON'S
"THE ENGLISH WOMAN'S DOM ES'I'IC MAGAZINE."
FIRST PUBLISHED BY
S. 0. BEETON IN 1861
AS ONE VOLUME ENTITLED
"THE BOOK OF HOUSEHOLD MANAGEMENT."

THIS ENLARGED EDITION
FIRST PUBLISHED IN GREAT BRITAIN
IN 1982 BY
CHANCELLOR PRESS
59, GROSVENOR STREET
LONDON WI

REPRINTED 1984.

Figure 3. Details of Beeton's book (From page 1 of the enlarged First edition Facsimilie of Beeton's Book of Household Management published in 1882)

Isabella Mary Mason was born in 1836, the first child of Elizabeth and Benjamin Mason [4]. Benjamin Mason was a successful draper in London who sadly died aged 39 leaving Elizabeth widowed with four children. She married a widower Henry Doring, who had lost his wife while having their fourth child. She went on to have thirteen more children with him. Isabel became the eldest daughter of a family of twenty-one, very large even in those days! Henry Doring was a successful manager of the Epsom race course and, except for racing days, his children were housed in the Grand Stand. Isabella was educated locally but at the age of fifteen she and a few of her sisters were sent to a finishing school in Heidelberg where amongst

other things she learnt French and German which stood her in good stead later in life. She married Sam Beeton who at the time was a successful publisher. He made a lot of money from publishing Uncle Tom's Cabin, an antislavery novel by American author Harriet Beecher Stowe [5]. There was nothing in law to stop him from doing this. One of Sam Beeton's successes with which Isabel became heavily involved was the Englishwoman's Domestic Magazine. As well as making a lot of money he made some very bad decisions which caused many financial problems.

It took Isabella four years to compile her Beeton's Book of Household Management which was originally published in monthly parts. It contained much of the material from the Magazine. She died in 1865 at the age of 28 from puerperal fever following the birth of her fourth son. Her death was not announced so that money could still be made using her name.

In the chapter 'Bearing etc of Children' the lay person is instructed to use fireside bellows to resuscitate:

> "*While in the bath, the friction along the spine is to be continued, and if the lungs still remain unexpanded, while one person retains the child in an inclined position in the water, another should insert the pipe of a small pair of bellows into one nostril, and while the mouth is closed and the other nostril compressed on the pipe with the hand of the assistant, the lungs are to be slowly inflated by steady puffs of air from the bellows, the hand being removed from the mouth and nose after each inflation, and p1aced on the pit of the stomach, and by a steady pressure expelling it out again by the mouth. This process is to be continued, steadily inflating and expelling the air from the lungs, till, with a sort of tremendous leap, Nature takes up the process, and the infant begins to gasp, and finally to cry,"*

The second reference is in the chapter 'The Doctor'. In the preface, Mrs Beeton states it is written by an experienced surgeon fully entitled to confidence. The anonymous surgeon (who seems to be rather confused as to the difference between carbon monoxide and carbon dioxide gases) gives instructions for the treatment of adults in cases of "suffocation from Carbonic Acid Gas or Coke-Damp of Mines".

"The principal means, however, to be employed in this, as, in fact, in most cases of apparent suffocation, is what is called artificial breathing. This operation should be performed by three persons, and in the following manner: the first person should put the nozzle of a common pair of bellows into one of the patient's nostrils; the second should push down, and then thrust back, that part of the throat called "Adam's apple; "and the third should first raise and then depress the chest, one hand being placed over each side of the ribs.

The three actions should be performed in the following order: first of all, the throat should be drawn down and thrust back; then the chest should be raised, and the bellows gently blown into the nostril. Directly this is done, the chest should be depressed, so as to imitate common breathing. This process should be repeated about eighteen times a minute. The mouth and the other nostril should be closed while the bellows are being blown. Persevere, if necessary, with this treatment for seven or eight hours, in fact, till absolute signs of death are visible. Many lives are lost by giving it up too quickly."

It would be fascinating to find out who the experienced surgeon fully entitled to confidence was? His recommendation is hard to fault.

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Plethysmography in Anaesthesia

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I would like to begin with two quotations:

> 1. Comroe & Botelho reported in 1947 that few physicians interpret slight degree of cyanosis; most of them recognise definite cyanosis at arterial oxygen saturations (SaO_2) of 81-85%; some physicians do not recognize definite cyanosis until SaO_2 of 71-75%; and consistency in this is very uncommon [1].
>
> 2. In 1675, Isaac Newton said "*If I have seen further than others, it is by standing on the shoulders of giants*".

The first quotation surprised this author but there is no reason not to suspect that it is still true today. The Isaac Newton quotation should be remembered even with the most modern technologies.

Photoplethysmography (PPG) is the change in volume as measured by change in absorption of light. There were many of Newton's "*giants*" that lead up to modern peripheral PPG and pulse oximetry [2].

An abbreviated chronology can be split into three eras of Newton's "greats": Spectroscopy, Oximetry and PPG [3].

Spectroscopy

The following are the notable dates:

1851	Beer-Lambert law.
1864	George Gabriel Stokes discovers a pigment which is the oxygen carrier in blood.
1864	Felix Hoppe-Seyler purifies the pigment and calls it haemoglobin (Hb).

1876 Karl von Veirordt studies the reflection spectra of haemoglobin solutions and the finger.

1887-90 Carl Gustav Hufner (1840-84) studies absorption spectra in general.

Oximetry

The notable dates in oximetry are:

1919 August Krough (1874-1949) and I Leicht use spectroscopic methods to measure oxygen saturation of blood in fish.

1931 Ludwig Nicolai (1904 – unknown date of death) investigates the quantitative spectrophotometry of light transmitted through human tissues.

1934 Kurt Kramer (1906-83) makes precise measurements of the oxygen saturation of blood flowing through cuvettes.

1935 David Drabkin (1899-1980) and James Harold Austin (1883-1952) measure the spectrum of undiluted haemolysed and non-haemolysed blood.

1939-45 World War 2: great military interest in oximetry in pilots at high altitude.

1940 JR Squire (1916-1966) passes red and infrared light through the finger web for the continuous monitoring of oxygenation; it requires compression of tissues to create a bloodless field for calibration.

1940-42 Glen Alan Millikan (1906-1947) coins the term oximeter and develops the Millikan oximeter [4].

1948-50 Earl Wood (1912-2009) develops Wood's ear oximeter.

1949 Robert Brinkman, (1894-1949), Professor of Physiology in Groningen designs his “Cycloop” oximeter, so-named as the combined light source and detector were mounted on the forehead in reflective mode [5].

1960 Development of the first bench “CO-oximeter” able to distinguish between haemoglobin, carboxyhaemoglobin, and methaemoglobin.

1964 Robert Shaw develops the eight wavelength ear oximeter. It was marketed in 1970 by Hewlett-Packard but it was not a success mainly because it weighed 14kg, cost $13000 and was very inaccurate below 70% saturation.

Photoplethysmography

Plethysmography as such was really of no use in the search for true estimation of arterial oxyhaemoglobin saturation. However, from 1937 Hertzman published a number of papers about single wavelength PPG and its uses in cardio-vascular physiology including monitoring heart rate and cardiac cycle, respiration, hyper- and hypovolaemia and blood pressure [6,7].

In 1972 Takuo Aoyagi (1936- 2020), electronics engineer with the Nihon Kohden company in Japan was researching into the measurement of cardiac output by dye dilution using light emitting diodes (LEDs) when he came upon the idea of assessing *arterial* haemoglobin oxygen saturation by PPG [3]. The time was ripe for this advance because of the availability of different coloured LEDs which are very small light sources which are able to generate coloured light at very narrow band width and can be switched on and off very rapidly (<1ms) unlike incandescent light sources.

Microprocessor technology had also become readily available. Looking at the absorption spectra of adult human haemoglobin (HbA) in its oxygenated and de-oxygenated states Aoyagi found available a red (660nm) and a near-infrared (NIR, 940nm) LED available conveniently each side of an isobestic point (807nm). By switching between these two LEDs at a rate of around 700Hz, beamed through an extremity (initially the ear-lobe) he was able to detect a PPG transmitted for each wavelength with a semiconductor sensor. There were of course many absorbents apart from arterial haemoglobin but the only absorbents that were pulsatile were those in the arteries and arterioles. Thus he was able to program a microprocessor to separate the ratio between the red and NIR arterial absorptions and hence indicate the SaO_2 (this soon became known as SpO_2 to indicate the method of measurement). The SpO_2 could not be directly calculated using the Beer-Lambert law because the law only applies when the solution under test is not turbid and no other absorbents are present and so the red/NIR ratio was empirically applied to a look-up table by the microprocessor. Aoyagi sadly missed out on a Nobel Prize for Medicine which he should have been awarded, judging by the extreme increase in the safety of anaesthesia and medicine in general that his invention caused. Many tributes have deservedly been paid to Dr Aoyagi [8-10].

However, one of the main concerns that soon became apparent was that pulse oximetry was so easy to apply especially by those who did not or were not concerned with its limitations [11]. This author classified the most important limitations in 1994 [3] and are summarized in Table 1.

	SAFE	Dangerous
Technical	Mechanical Artifacts Electro-magnetic interference (EMI) e.g.diathermy	Accuracy Calibration Delay "Flooding" "Penumbra"
Physiological	Pulse dependence Volume Rhythm	Abnormal haemoglobins Other absorbents Delay Pulsatile veins Pigmentation

Table 1. Some limitations of pulse oximetry

In this classification "SAFE" limitations are those in which it is obvious that the device is not showing a correct value because the plethysmograph shows that there is no pulsatility or no value of saturation is displayed. The "DANGEROUS" limitations are those where an incorrect saturation value may be indicated despite no warning of inaccuracy. "Delay" occurs when a particular machine holds a value of saturation which is the last value before the plethysmographic signal disappears. Calibration refers to which haemoglobin type is present; normal adult being HbA, abnormal Hbs especially carboxyHb and MetHb which are the commonest dyshaemoglobins.

Joe Kiani, Iranian by birth, and American electronics engineer and entrepreneur founded a medical technology company, Masimo, in 1989. In 1995 he developed "Signal Extraction Technology" (SET®) which hugely improved the technical limitations of oximetry including weak signals and EMI, and even eliminating the effects of any venous pulsation and many types of cardiac arrhythmia [12]. It was such an improvement that Kiani not

only manufactured much improved pulse oximeters under the Masimo logo but also produced the SET module which is now embedded in pulse oximeter by around forty "partner" manufacturers including such companies as Philips, Drager and even Nihon Kohden.

There was still the problem of abnormal or dyshaemoglobins. Conventional 2-wavelength pulse oximeters are calibrated for human HbA. The most dangerous situation occurs if there is any circulating carboxyhaemoglobin (COHb) Because of the absorption spectrum of COHb, the 2-wavelength pulse oximeter indicates approximately SpO2 = SaO2 + %COHb. This obviously is a dangerous situation! Normally there is about 1.6% COHb circulating due to the metabolism of haemoglobin producing carbon monoxide but may be as high as 10% in haemolytic anaemia and even 20% in heavy smokers [13] and those cooking over BBQs and pizza ovens due to the inhalation of carbon monoxide. This was and still is a very serious problem as the vast majority of users of pulse oximeters, even anaesthetists, are unaware of this serious limitation.

Joe Kiani came to the rescue again! Taking advantage of the increasing range of LED colours/wavelengths available, his company has developed a 7-wavelength "Rainbow"® CO-pulse oximeter which came onto the market in 2013 and can distinguish between HbA, HbF, COHb and metHb. However, it will be some years before this new technology replaces all 2-wavelength devices with their serious limitations and therefore education of those who apply conventional pulse oximeters is of vital importance.

A recent paper suggests that there should be better education about all monitoring technologies as they become more complex so that their limitations are understood [14].

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C J Massey Dawkins
MA MD B Chir (Cantab) MRCS LRCP DA FFARCS
A Notable Name; Un-Noted Twice

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I start with a disclaimer: Massey Dawkins was a mentor, before that word became common usage, and a friend. Over 20 years ago I suggested that he should be in the Oxford Dictionary of National Biography and when it was agreed, I was asked to supply his entry. More recently, I wrote his Life of Fellows for the Royal College of Anaesthetists. In 1968 I was a registrar in the Royal Free rotation, working at the Hampstead General Hospital (HGH) (above the then new hospital at Lawn Road) where I came to know Massey Dawkins. Before the NHS, Massey (as he was generally called) was in general practice in Hampstead with Sylvia, his wife, with honorary appointments in anaesthesia at the HGH and elsewhere. I can't recall how often I was at HGH but enough to learn, become adept and enthused about epidural analgesia as taught to me by him and Geoffrey Steel. I have case details in my 1968 Hospital Medicine diary and I'll describe some of my experiences working with him. The late Edward Armitage's 1998 paper to the History of Anaesthesia Society is enjoyable to read [1] though I have discovered a few errors about the origins of the family and the occupation of Massey's father.

Charles John Massey Dawkins was born on 13 July 1905 at 4 Tanza Road, Hampstead (close to the Heath), the only child of Charles William Dawkins (CWD) (1870–1948) CBE, European manager of the Massey Harris tractor company (not a banker), and his wife, Eleanor Selina Cranfield. Guy, his grandson told Ed Armitage that 'Massey' came from a Canadian branch of the family who made the tractors. That is actually not correct: CWD was the first employee of a branch of the firm set up in Britain by Fred I Massey, an American member of the Massey family and CWD said he named him Massey after Fred, not the tractors. The family were non-conformists, so Jack as he was known to the family and friends went to Mill Hill School from 1918 to 1923; probably as a day boy, because the school is not far from Hampstead. I (the author) was a boarder there but apart from it being a point

of contact, I don't recollect talking about the school and his time there. His portrait is hung there with other eminent Old Millhillians who include Francis Crick. Jack's father worried that his father was a gambler, and knowing Jack was generous with money, had given him the choice of the Church or Medicine. On leaving school he went up to Emmanuel College, Cambridge, from 1923-26 and then to the Middlesex Hospital in 1926 for his clinical training.

Massey married Sylvia Mabel Ransford (1904-1995) secretly on 29 July 1929, while they were both still students (she at the Royal Free), and publicly in 1930, after qualifying. They had one son who died in 1965 after a short illness and two daughters; the son and younger daughter both became doctors. After qualifying, he took the post of resident anaesthetist at the Middlesex Hospital, and then became anaesthetist to its dental department (1931-1938), with honorary posts at Paddington Green Children's Hospital & HGH. It was impossible to support a family solely on the meagre fees from private practice before the existence of National Health Service (NHS); so, he and his wife went into general practice in Hampstead. (Figure 1). He proceeded to MD in Cambridge and passed the newly created Diploma in Anaesthesia (DA) in 1936.

Figure 1. CJ Massey Dawkins' name plate at the surgery

Jack, or Massey as he was commonly known, was appointed assistant anaesthetist at University College Hospital London in 1939, and honorary anaesthetist in 1940. He became the senior anaesthetist there from 1946 until his retirement in 1970. Apart from this he had sessions at other hospitals. His wife perhaps carried the burden of the general practice

although she was very active with the Family Planning Association and psychosexual medicine at the Tavistock Clinic at the same time.

Massey Dawkins, at the advent of the NHS in 1948, became a consultant at HGH (part of the Royal Free) and also Paddington Green Children's Hospital (part of St Mary's). It was perhaps unique to be appointed to three London teaching hospitals. He published what was a historically inaccurate paper about the centenary of the first public operation carried out under an anaesthetic in Europe describing it as having taken place in London [2]. The first anaesthetic for surgery in Europe is actually reported to have been administered in France [3]. Following this a blue plaque was placed on the wall of the University College Hospital in London (UCL). He became one of the Foundation Fellows of the Faculty of Anaesthetists of the Royal College of Surgeons in 1948.

Massey regularly used (di)vinyl ether (Vinesthene) at Paddington Green Childrens' Hospital and in 1940 published a paper about its use in the BMJ in which he described four cases of convulsions in 196 inpatient operations and five cases in 2210 children aged 3 - 9 years old having dental outpatient extractions [4]. His interest in vinyl ether continued with a further publication about it [5]. He judged Vinesthene to be the safest inhalational anaesthetic agent as it had caused no fatalities. This conjecture was partly based on the quantity sold by May & Baker but many ampoules lay unused in the back of anaesthetic cupboards.

Massey Dawkins is particularly notable as the British pioneer in the use of epidural analgesia; he administered the first epidural in the UK in 1942. He reported the first 'extradural' on 8 January, 1945 at a meeting of the Section of Anaesthetics, Royal Society of Medicine (RSM), with 75 more he had performed for surgical operations and for the relief of labour pain. This account is published in the RSM April 1945 Proceedings [6]. The first patient described was needing a second stage thoracoplasty for pulmonary tuberculosis. The first stage thoracoplasty had become septic precluding local anaesthesia and the patient was too ill for general anaesthesia. The other patients were aged 9 to 65 years and for surgery from the thorax downwards. He had borrowed a copy of Dogliotti's book [7] (figure 2) from the RSM Library and I was told he retained it for a long time, perhaps because no one else wanted to read it.

Over the years he kept records of every epidural he administered in which he recorded all details such as methods of finding the epidural space and its distance from the skin. He described the early use of Xylocaine (lidocaine) for extradural block as well as the use of a catheter for administering continuous epidural analgesia for major surgery in the over 75s [8,9].

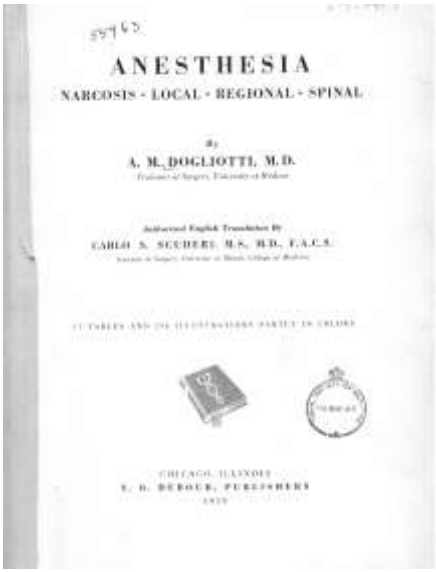

Figure 2. A scan of the front cover of Dogliotti monograph

The following year Massey made a film demonstrating epidural analgesia for caesarean section, a digital copy of which rests with the Association of Anaesthetists. (*Author's note: It appears that the film had been lost but was later found in an unused desk pushed against a wall when the AAGBI moved from Bedford Square to their present headquarters*). He was interested most in the use of epidurals in major abdominal surgery (including caesarean section), but I recall him using thoracic epidural analgesia for a simple breast excision. The patient lay on the operative side for ten minutes following epidural administration to maximise analgesia; this was followed with a general anaesthetic using hexobarbitone (Evipan). He preferred

hexobarbitone to thiopentone as he believed anaesthesia to be less deep with it while lasting longer. A tiny dose of suxamethonium would be added to stop possible twitching and sneezing. A laboratory stand and clamp holding a wisp of cotton wool was positioned above the patient's nose and mouth as an indicator of breathing. In 1968 I used diazepam for sedation but he still used hexobarbitone. At some point I asked him about caudal epidurals; he replied that he never did them as there was a 10% failure rate before one touched the patient!

Massey Dawkins, in 1963, published a critical analysis of the many methods of finding the epidural space [10]. This is a very comprehensive review of all the methods available at that time. He and Ronald Green described continuous epidural analgesia by continuous infusion which they had been using for seven years [11]. In this publication Massey Dawkins referred to his presentation to the 4th Congress of the Scandinavian Society of Anaesthetists in Finland some ten years earlier in 1956 when he first advocated the technique. Massey Dawkins had visited Finland and given lectures in previous years and was appointed the first Honorary Member of the Finnish Society of Anaesthesiologists in recognition of his major contribution to the development of the specialty in Finland (Dr Matti Reinikainen of the Finnish Society of Anaesthesiologists, Personal Communication). I (the author) am told he was described as the "Father of Finnish anaesthesia".

Massey Dawkins and colleagues also described the use of bupivacaine, a new local anaesthetic at that time [12]. He published (what would now be called a meta-analysis) a detailed and meticulous analysis of 350 publications world-wide relating to epidural and caudal analgesia and its complications in 1969 just before retiring and before computerized retrieval systems were available [13]. It included his own experience of more than 4000 epidurals over 25 years. Soon after retiring, in 1971 he co-authored a paper on thoracic epidurals with Geoffrey Steel [14] and he was awarded honorary membership of the Association of Anaesthetists of Great Britain and Ireland.

Massey and Alfred Lee were very good friends and they exchanged many letters, some apparently less than complimentary about other colleagues. His notes of all his epidurals have vanished. They went to Lee after his death and

were kept for a long time in the anaesthetic department office at Southend Hospital but sadly were thrown away in a clear out some years ago.

Massey Dawkins was elected President of the Section of Anaesthetics of the RSM in October 1974. His presidential address, *'The relief of post-operative pain with special reference to epidural block'*, a brilliant review of his own unparalleled experience in the subject, was published in the *Proceedings of the Royal Society of Medicine* just before his death [15].

Massey had what I think was a TIA crashing his vehicle (Registration: CSF 2) into traffic lights. He died at home (27 Well Walk, Hampstead) on 8th August 1975 just before completing his presidential year of the Anaesthetic Section of the RSM. Alfred Lee and Geoffrey Steel wrote affectionate obituaries in the BMJ [16]. There were other obituaries, one from a UCL colleague (JDE) in the Lancet and another in 'The Times' obituary [17,18].

Envoi

From my memory I would like to add some personal details from my association with Massey. Ed Armitage's account is well worth rereading [1]. Though not included, I recall Ed telling how Massey (Figure 3) deliberately exploded cyclopropane during one of his lectures to UCH students. I was respectful and slightly awed, and it was some time, given the necessarily intermittent nature of contact, that I came to know him.

Figure 3. CJ Massey Dawkins

Despite describing many ways of finding the epidural space it always seemed to me that he could feel his way into it without need for an indicator. My wife and I were entertained at his house in Bradwell juxta Mare (later changed by Essex council changed to Bradwell by the sea to his annoyance: 'It's not by the sea, he expostulated'). Next door there was a corrugated ex-chapel filled with all sorts of 'stuff' (or 'junk' as Armitage puts it) such as Victorian religious posters: "The road to Hell is paved with good intentions". I never was much of a sailor but we had some common ground in my enthusiasm for the inland waterways; he had a Dutch barge amongst other craft. Gillian and I entertained Jack and Sylvia to dinner after dining with them.

After I got a Senior Registrar post in Bristol in 1969, I arranged for him to speak at an Anaesthetic Club meeting. At the time there was still some resistance from midwives to epidurals for labour to which he alluded and was criticised from the floor by the Professor of Obstetrics & Gynaecology at Southmead Hospital.

I went to Sheffield in 1972 (and used epidurals for renal transplant surgery!) and I arranged for him to talk to the Sheffield Anaesthetic Club in early October 1974, a month before his Presidential address to the Section of Anaesthetics, RSM. The December meeting was 'Lest We Forget', and Magill, Macintosh, Langton Hewer, Nosworthy and McConnell (about Vinesthene) were the speakers. I had attended the Section of Anaesthetics fairly regularly (from the mid '60s) and Jack invited me to join the Section Council, leading to my own presidency twenty years later.

Edward Armitage describes Massey's personality much better than I, but I feel that one reason he has been overlooked was his modesty and diffidence. He could be provoked into strong views on lots of subjects but he never sought to impose them on others. To quote from Geoffrey Steel's BMJ obituary [16], "He nothing common did or mean". He gave warmth to us all, and the world is much colder for his going.'

Massey Dawkins' professional achievements surely merit his inclusion as a 'Notable Name' in anaesthesia. However, he appears to have gone

"unnoticed not once but twice" when the monographs on Notable Names were published by Roger Maltby and Alistair McKenzie [19,20].

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Health and Hygiene in Roman Corinium

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Roman Corinium had a population of around 20,000 people. Archaeological evidence is gleaned from material culture, tombstones and building and human remains.

Hygiene was important in the Roman world but perhaps not achievable for everyone. Many objects that we find from Corinium are high-end, belonging to people with money. Medical care would have been available to people who could afford it. Organic objects perish but metal object tend to survive. We have some examples of copper alloy (bronze) implements that would have been carried around on chatelaine kits. This shows some evidence of concern for cleanliness with three objects in a kit usually featuring an ear scoop, nail cleaner and tweezers. The objects featured at the talk in Cirencester were found at villas situated at Kingscote, Claydon Pike and in Corinium.

Slightly more specific tools relating to medical practice (Figure 1) have also been discovered and are held in the museum collections. Some of these have been collected by Antiquarians from the Victorian period so provenance is not always clear, although some objects would have been found at the site of the Roman fort or in Corinium. These were often collected either as curios or for educational purposes. What we seem to have are examples of tools that would make up a surgeon's kit. Basic surgical kits consisting of probes, hooks, forceps, needles, cautery tools, bone saws, flesh hooks and scalpels were readily available.

In the army, slashing and cutting wounds from swords would have been particularly common, as well as wounds from arrows. Occasionally these could be quite deep, exposing internal organs. In fact, military service provided a great opportunity for physicians to learn more about human anatomy, as examination of cadavers was taboo and physicians tended to use animals for their training.

Physicians cleansed wounds with vinegar and honey. The military physician Dioscorides wrote that honey is cleansing, opens pores, and draws out fluids. Boiled and applied, it heals flesh that stands separated.'

Figure 1. Image of medical tools

In Roman times, healing and medicine went hand in hand with religion and the gods were often asked for help through prayer, votive offerings and sacrifice. Many of the Greek and Roman gods were believed to have healing powers, but one in particular played a prominent role in ancient medicine. Asclepius, the Greek god of healing, was the prominent deity that governed both Greek and Roman medical practice and his symbolic snake-entwined staff continues to be used as a symbol of the medical field today. He is closely associated with his father, Apollo, the god of medicine.

Asclepius was so good at healing that he could even bring back people from the dead. With the prospect of eternal life for mere mortals on the table, Zeus had to act and so he killed Asclepius. As one story goes, Asclepius was killed by Zeus at the request of Hades, the god of the underworld, who feared Asclepius was stealing souls away from him

US army medical corps, US ambulance – Star of Life and the North West Ambulance Service use the images of the rod of Asclepius and the caduceus both to the present day. The middle contains a Rod of Asclepius – an ancient symbol of medicine.

The Asclepeion or sanctuary at Epidaurus was founded in the 4th century BC apparently by physicians from Epidaurus. To enter a patient had to undergo two stages of initiation:

The first was the Katharsis or purification stage. This is when a patient would undergo a series of baths and other methods of purging, such as eating a clean diet over a series of several days or purging their emotions through art. The patient would then make an offering such as money or a prayer to the temple, therefore to Asclepius. The priest of the temple then gave the patient a prayer which would ease the patient's mind and create a more positive outlook for them.

The second was incubation or dream therapy. Patients would sleep in the "Abaton" or "Enkoimeterion," which was a dormitory located in the Asclepieion. Here, they would be lulled into a hypnotic state, likely induced by hallucinogens, and begin their dream journey. As they slept, they were visited by Asclepius or his daughters Hygeia and Panacea. These dream visitations were prognostic in nature, revealing the projected course of the disease and ultimate patient outcomes.

During this time, patients would also discover what it was they needed to do once they woke in order to have their disease treated. Upon awakening, the patient would recount their dream to a temple priest, who would then prescribe a treatment based on their interpretation.

There was also a sanctuary at Pergamum which is where the noted physician Galen trained.

Galen very much followed the four humors theory of medicine first propounded by Hippocrates. This theory maintained that there were four basic elements or humors within the human body **– blood, phlegm, yellow bile, and black bile.** These humors had to remain in equlibrium for a person to stay healthy and if you got sick it was the physician's job to realign these humors to help you get better. The methods of healing at the Asclepeions obviously did not involve modern techniques, but depended more on the healing powers of certain plants (pharmacology) and the power of suggestion.

Votives of body parts (Figure 2) were offered in their hundreds at temples to Asclepius. In the museum collection there is a votive leg from just outside the town of Corinium showing front and back – deposited in water course probably as an offering to request healing from the gods.

Figure 2. Roman votives offered for healing; also Romano-British copper alloy model caduceus found at Cirencester Amphitheatre in 1977. (Did Hermes adopt some of the attributes of Asclepius after his death? Mercury is the Roman equivalent and carries a caduceus which differs slightly from the rod of Asclepius).

Oculist's stamp from Corinium (Figure 3)

Oculists were specialised doctors who treated eye diseases. The original stamp would have been used to mark either semi-solid blocks of eye-ointment before they became hard or the seals on jars. They usually contained information on the maker, what the medicine was for and what it was made of. This stamp would have been used for a 'pleasant smelling' mixture designed for cicatrices and granulations (scar tissue) of the eye.

Oblong block of green schist with Latin inscriptions on four faces (giving the name of the physician, the nature of the salve and instructions for use) in reversed lettering. One face is engraved with the swastika symbol near the centre and a leaf at each end.

The Physician Galenus identified cataracts and set about healing by scraping the surface of the eye. Putting salves on the eye appears to have been practised in Roman Britain with oculists' stamps being found amongst archaeological objects from the town.

Figure 3. Oculist's stamp found in Corinium

Another stamp made of green schist was found in Cirencester in 1818, formerly in the possession of a Mr P.B. Purnell (see Buckman and Newmarch, 1850), now in the British Museum (reg. no. 1872.5.20.1). The original was found in a pottery urn (now lost), and is thought to bear the Christian monogram engraved on the side. The medicine was probably Laudanum, to be used with white of egg in case of inflammation; and an ointment of quince or apple, described as a panacea. Painted plaster replica of an oculist's stamp. Oblong block inscribed on two faces (with name of physician, nature of the salve and directions for use) in reversed lettering and Cross marks on each end.

The Roman baths were an integral part of society and daily life for all social classes, and regular cleansing helped fight germs and bacteria. In ancient Rome, thermae and balneae were facilities for bathing. Thermae usually refers to the large imperial bath complexes, while balneae were smaller-scale facilities, public or private, that existed in great numbers throughout Rome. Most Roman cities had at least one – if not many – such buildings, which were centres not only for bathing, but socializing and reading as well. Bathhouses were also provided for wealthy private villas, town houses, and

forts. They were supplied with water from an adjacent river or stream, or within cities by aqueduct. The water would be heated by fire and channelled into the caldarium (hot bathing room). We do not know the location of Corinium's public bath house.

Aqua Sulis and Sulis Minerva

One role of Minerva was as Roman goddess of medicine. The spring at the Roman Baths is a natural mineral spring found in the valley of the Avon River in Southwest England; it is the only spring in Britain officially designated as hot. The name is Latin for "the waters of Sulis." The Romans identified the goddess with their goddess Minerva and encouraged her worship. About 130 messages to Sulis scratched onto lead curse tablets (defixiones) have been recovered from the Sacred Spring by archaeologists. Most of them were written in Latin, although one discovered was in Brythonic; they usually laid curses upon those whom the writer felt had done them wrong

The Roman civilisation is renowned for developing advanced systems that influenced the community's health. These included toilets, the establishment of street cleaning, waste disposal and provision of fresh water supplies in a large number of Roman towns and cities. Lead water pipes were used to supply the homes of the wealthy citizens of Rome with water – it is not uncommon to find the owner's name cast into the pipe. Having a water supply plumbed directly into one's home was a status symbol that few could afford. Virtually every bathing establishment, whether in town or villa, made use of lead pipes even if often only to drain a bath through the adjacent wall; remarkably few carry inscriptions. A small number of inscribed pipes are known from Bath and Chester. A Roman lead pipe existed from the fort of XX Legion in Chester. The pipe is stamped with the name of Agricola in the reign of Vespasian. Agricola was the General responsible for the conquest of Britain & reached as far north as the Moray Firth in Scotland.

Beeches Road townhouse had a private bath suite, possibly used by officials visiting the town. Warm pools were heated by hypocaust systems. Bathing was a ritual process with people visiting a warm bath, a hot bath and then a cold plunge bath. The caldarium was a bath (alveus, piscina calida or solium) of hot water sunk into the floor and there was sometimes even a

laconicum—a sauna or hot, dry area for inducing sweating. Patrons would use olive oil to cleanse themselves by applying it to their bodies and using a strigil to remove the excess. Romans would begin in the caldarium, move to the tepidarium (warm bath) to regulate body temperature before plunging in the cold bath. This was considered good for energy, reducing inflammation and releasing various chemicals beneficial to the body. This seems to be returning in the present day with the Wim Hoff method.

No description on Roman health and hygiene would be complete without mentioning the spongium, also known as a sponge on a stick. None have been discovered in the town of Cirencester to the organic nature of the implement making survival in archaeological context unlikely. The spongium, a 'hygienic' utensil used by ancient Romans to wipe their bottom after defecating, consisted of a wooden stick with a sea sponge fixed at one end. This was shared by people using public latrines. To clean the sponge, they simply washed it in a bucket with water and salt or vinegar. Despite the positive principle of keeping your bottom clean, unfortunately latrines could become a breeding ground for bacteria, causing the spread of disease. Better to carry your own!

The Cirencester talk continued with examples of human remains from the Western Cemetery in the museum collections. Some individuals showed signs of fractures to bones and there was also an example of a person with polio which could be ascertained from the skeletal remains. Several skulls with anomalies were also found. The human remains store in the Corinium Museum is separate from all other collections and is a quiet space offering a respectful residence for the dead. Most remains come from rescue operations when the specimens would have been lost and damaged due to building works taking place. The museum has a Human Remains policy and adheres to the Code of Ethics for Museums. There are strict regulations in place for researchers accessing the remains and their research is shared with the museum to aid further understanding of the collections. Ethical considerations are made before displaying skeletal or cremated remains and signage informs the public that there are human remains in display in the museum.

Human Remains from Corinium's Western Cemetery

James Harris MA
Collections and Engagement Officer
Corinium Museum, Cirencester

Introduction

Over 450 individuals were found during excavations of a Roman cemetery west of Cirencester between 1969 and 1974 by the Cirencester Excavation Committee, led by the late Alan McWhirr. The cemetery was positioned along both sides of the main road that led through the western gate and into the Roman town of Corinium Dobunnorum, the second largest town in Roman Britain. The human skeletal material was studied by the late Calvin Wells and catalogued in advance of publication (McWhirr, Viner, and Wells, 1982).

Burial 305 is an adult male with an estimated age of 45-55. There is evidence of violent trauma and surgery as well as signs of pathology and possible genetic traits. Newly identified evidence for this individual suggests that it may be possible to develop a more cohesive narrative for this and other individuals from the cemetery, adding significant knowledge to what is known about the lives and treatment in death of the people of Roman Cirencester and, indeed, Roman Britain.

The Grave

Burial 305 was found in a single grave cut alongside another adult male skeleton (burial 304). Both were laid in the same grave cut, oriented south-north (head to the south, feet to the north). This orientation was seen in around 60% of the burials and is typical of the third and fourth century. The two skeletons were largely complete and well preserved and both lay supine with arms laid straight at their sides, suggesting that they were buried together. Further evidence of this is that both had been decapitated. Wells is careful to state that it cannot be proven whether the decapitation was peri- or post- mortem. The angle of the cut in burial 305, delivered by a single blow from a very sharp bladed weapon, from behind and above, does however suggest that this individual was upright. The blow was powerful enough that

it continued through the axis and into the back and underside of the mandible, suggesting that the head was bowed. This evidence favours the theory of execution and perhaps that these two men were executed around the same time.

Burial 304 showed evidence of a fracture to his left ulna and radius. This is not the clear evidence of violent trauma, separate from decapitation, as seen in burial 305, but there exists the possibility that this is a parry fracture. His decapitation is evidenced by a clean cut through the C5 vertebra.

Burial 305 presents a greater list of injury and violent trauma, pathology, and traits.

Evidence recorded in the osteological catalogue

The sacrum has 6 vertebrae instead of the typical 5. The L5 vertebra is fused to the sacrum, leaving 4 lumbar vertebrae. This is not likely to have caused symptoms.

The left humerus is 22mm shorter than the right and less well built. Wells suggests this might be as a result of childhood injury or an attack of poliomyelitis, but the difference between the two bones is not as great as has been observed in other individuals in the cemetery.

There is a triangular wound in the right temporal bone which has formed an island of bone which has been depressed and has healed (Figure 1). There is a cut from a sharp blade running from the front of this wound towards the frontal bone. The injury was likely caused by a heavy blow from a sharp sword.

On the frontal bone is a well-healed, elliptical wound with a bevelled edge, which Wells suggests is a wound from a trepanation that was likely performed to relieve pressure on the brain caused by inflammation following the heavy blow to the right of the cranium.

There is an osteochondritic pit on the left navicular. These are known to be caused by repeated stress and commonly seen on sports people. This

suggests repeated stress on the foot of this individual related to an active lifestyle, but the specific cause cannot be known.

Figure 1. Photograph of the Skull at the Corinium Museum; Burial 305 (copyright, Corinium Museum, Cotswold District Council).

There is enamel hypoplasia of the canines, which may have a genetic cause or a lifestyle cause such as vitamin deficiencies during the developmental stage of these teeth. This is common in the archaeological record throughout time. The teeth are also crowded.

Newly identified anomalies and evidence for pathology

There is an inca bone on the skull – an extra island of bone in the lambdoid suture at the junction of parietal and occipital bones. Inca bones are a developmental abnormality with a number of possible causes including heredity – some closely related populations show a higher prevalence, including the Incan people in whom this bone was first observed.

The skull has a much lower than average brow width, but a typical cranial maximum breadth for an adult male, which further emphasizes the narrowness of the brow. A long narrow face with crowded teeth is commonly seen in life along with ankyloglossia, commonly known as

tongue tie, which in some cases can cause difficulties feeding in childhood and may or may not account for any signs in an adult skeleton of earlier periods of malnutrition. The enamel hypoplasia here is however minor and no other clear signs of malnutrition have been identified.

There is marked asymmetry in the skull across many positions. The vertical position of the eye and nasal sockets are asymmetrical; the right eye socket is slightly larger than the left; the underside of the mandible in norma frontalis slopes down to the right; the angle and position of the outer edges of the maxilla differ; the positions of the mastoid processes are asymmetrical. This asymmetry may have developed with age, and it cannot be certain how visible it would have been in life.

Despite the general asymmetry throughout the skull, the parietal and temporal bones are symmetrical. The wound on the right parietal therefore does not appear to have been a factor in the asymmetry of the skull. The asymmetry may therefore have been inherited.

Spina bifida occulta is evident in the lower part of the sacrum. This is a less severe version of spina bifida where there is an opening along part of the sacral spine. Spina bifida occulta is most commonly asymptomatic, but in more severe cases can cause lower back pain and bladder control problems. Part of the central section of the sacrum was not recovered during excavation due to its preservation. The full size of the opening in the sacrum cannot be known but is between one third and two thirds the length of the sacrum. This may be the difference between this individual experiencing severe symptoms and no symptoms at all. The sacrum is also moderately asymmetrical.

Conclusion

The suggestion that trepanation was performed therapeutically to relieve pressure following the heavy blow to the right parietal is persuasive. Further specialist study is needed to confirm trepanation as a reason for this wound and whether the chronology of the two wounds can be firmly ascertained.

Limb length discrepancy has been noted as being caused by spina bifida but is unlikely in this case considering the incidence of the less severe form, spina bifida occulta. Poliomyelitis remains a persuasive theory for the cause

in this case, although when coupled with the other asymmetry identified in the skeleton, may yet have a different cause, such as some form of anaemia.

There is a significant list of traits and signs of pathology, some of which have been newly identified. The severity of these is not clear but there may not have been any symptoms associated with these at all. There is however some possibility that some of these signs and traits are genetic and inherited. There are other incidences of an inca bone coupled with a narrow palate in the assemblage of human remains from the Roman cemetery, at least one of which was also decapitated.

It is clear that further research has great potential to newly identify anomalies and pathology across the remains as well as familial relations. A review of the osteological catalogue is therefore well overdue. This in turn could inform a rational selection of material for scientific analysis. A DNA analysis can confirm exact and immediate familial relations, i.e. parent and offspring; siblings etc… and can also reveal racial origins. Strontium isotope analysis can provide clues as to the movements of a person over their lifetime including the predominant geographical location of childhood and where this changes in teenage or early adulthood. New bone growth in healed wounds can give a later strontium isotope reading.

Archaeology is entering a golden age of advanced scientific analysis, and, in time, it will be possible to learn more, and to tell much more detailed stories about the people of Corinium Dobunnorum.

Further information sources:

McWhirr AD, Viner L, Wells C. Cirencester Excavations II: Romano-British Cemeteries at Cirencester. *The Cirencester Excavations Committee* 1982.

Wells C. Osteological catalogue for the Bath Gate Cemetery excavations 1982; unpublished, but exists as microfiche and as a bound paper copy in Corinium Museum library.

Citation for Honorary Membership of the History of Anaesthesia Society: Dr Alistair G McKenzie

Alistair McKenzie was born in Zimbabwe where he lived his formative years. He qualified as a Pharmaceutical Chemist at Rhodes University, South Africa in 1974 but returned to Zimbabwe where he worked as a Pharmacist.

Having decided that medicine would be a more satisfying career he enrolled at the Medical School in Harare in 1978 and obtained his MB ChB in 1982. He worked as a Houseman in the Harare and Parirenyatwa Hospitals. Anaesthetics formed part of his Senior House Officer training (SHO) at the above hospitals. Alistair must have enjoyed the speciality of anaesthesia so much that he decided to choose it as a career specialty.

Dr McKenzie came to the UK to further his career and obtained the post of SHO in Poole in Dorset, which he held for one year, and then joined the Lothian Area Anaesthetic Training Scheme as a Registrar, based at the Royal Infirmary of Edinburgh UK Having qualified FCAnaes, he returned to Harare where he continued his career in anaesthetics and was appointed as a consultant in 1992

Alistair returned to Scotland in 1995 working at the Royal Infirmary in Edinburgh with interest in obstetrics and pain management. He served for over three years as Clinical Lead in Obstetric Anaesthesia.

Alistair retired from clinical practice in 2019. Rather than taking it easy he has continued and taken on many roles – to name a few: Honorary Clinical Senior Lecturer, Honorary Archivist at the Association of Anaesthetists**,** Immediate Past President of the History of Anaesthesia Society, and Editor of the Royal College of Anaesthetists' Lives of Fellows Biographies in 2021.

Although primarily working as a clinical anaesthetist, Alistair's academic output has been truly remarkable. He is the primary author of over fifty papers, many presented to this Society and published in its Proceedings. He has written three books as well as contributing chapters in others. Notably he served on the HAS Council from 1997 to 2002, and was Hon Editor of the Proceedings from 2006 to 2012. He has been the sole organiser of three

summer meetings of our Society and organised the scientific part of the meeting for two more. Alistair agreed to be our President at short notice and fulfilled this role for three years, a very hard act for me to follow.

The History of Anaesthesia Society has much to thank Alistair for all he has done for anaesthesia and for this Society in particular. It is therefore my great pleasure to recommend Alistair McKenzie for Honorary Membership of the Society.

Dr Adrian J Kuipers
President, History of Anaesthesia Society

Citation for Honorary Membership of the History of Anaesthesia Society: Brigadier Ivan Houghton

Ivan Houghton qualified in medicine at Cambridge University in 1966, after being a clinical student at St Thomas's Hospital, London. He had joined the TA whilst an undergraduate, being commissioned in 1963 into 131 Parachute Engineer Regiment. In 1967 he transferred to the RAMC(V) and later became Regimental Medical Officer of 23 Special Air Service Regiment. In civilian practice, he trained in anaesthesia through appointments in Birmingham, Coventry and Liverpool, and obtained the FFARCS in 1970. Attracted to a military career, he joined the regular army in 1972 and, after training, served as an anaesthetist with 23 Parachute Field Ambulance in the parachute field surgical team.

Ivan completed SAS selection in 1975 and was then posted as Regimental Medical Officer of 22 SAS Regiment, with tours in several parts of the world, including Northern Ireland. Having completed the design of the Triservice Anaesthesia Apparatus he regularly used the prototype in 1976. This draw-over system was subsequently adopted by British Army, The Royal Navy and the Royal Airforce and by 1980, was manufactured by Penlon Ltd. It remained in service for some 45 years.

Ivan became a founder member of the History of Anaesthesia Society in 1986. The following year, by correspondence course, he graduated LLB (Hons), London University (external), and began an extended posting in Hong Kong. There he was heavily involved (1989) in the foundation of the Hong Kong College of Anaesthesiologists for which he was Company Secretary. He was a Member of the Council of that College and also of the BMA (Hong Kong Branch). Furthermore he was Honorary Lecturer in the Department of Anaesthesia and Intensive Care at the Chinese University of Hong Kong, where he conducted research leading to the award of MD.

Ivan was posted to the British Military Hospital, Rintein (Germany), as Head of Anaesthesia for the British Army on the Rhine in 1994. There he was appointed Commanding Officer in 1996, serving until its closure in 1997. During this time he was awarded the Diploma in Medical Care of Catastrophes, Worshipful Society of Apothecaries (London, 1995) and the

Diploma in Medical Education, University of Dundee (1996). His next and final posting was to the Royal Hospital Haslar at Gosport, Hampshire as Clinical Director of Critical Care. Later he became the Specialty Director of Anaesthesia and Resuscitation of the Defence Secondary Care Agency and Adviser to the Surgeon General, with responsibility for the careers and training of all service anaesthetists. Appointment as Queen's Honorary Surgeon came in 1999. The following year he was appointed to the Anaesthetic Equipment Committee of the British Standards Institute. He retired from the Army in 2002.

Ivan continued his interest in the history of anaesthesia in retirement. He graduated BSc (Hons) in the Conservation and Restoration of decorative hard surfaces at London Metropolitan University and then proceeded to a Higher National Diploma in furniture restoration. Following that, he was appointed an Honorary Research Fellow to assist in the teaching of students and as an Honorary Researcher in the frame conservation department at the Tate Gallery.

Ivan was elected to the HAS Council in 2013 and then served as Hon Editor of *The HAS Proceedings* from 2014 to 2021. Concurrently he was President of the Medical Society of London for 2020-21. In 2022 he is President of the City of London Branch of the Royal Army Medical Corps Association. I have great pleasure in nominating Brigadier Ivan Houghton for Honorary Membership of the History of Anaesthesia Society.

Alistair G. McKenzie
Immediate Past President
History of Anaesthesia Society

A gavel, with pedigree!
(A short history of the Society's gavel(s))

Dr John Pring
Honorary Archivist and Past President
History of Anaesthesia Society

In the Society's archive is a copy of a letter dated February 1988 from the History of Anaesthesia Society (HAS) Honorary Secretary to Dr Rod Calverley thanking the Anesthesia History Association (AHA) for a gavel presented to the HAS (Figure 1). The gavel was apparently inscribed "Handcrafted in Jefferson, Georgia" (Figure 2) and was used at our meetings until it temporarily "disappeared" around 2004 and subsequently re-appeared in early 2022 along with a *second* gavel!

Figure 1. Gavel presented by the AHA

I am grateful to William Hammonds, Emeritus Professor of Anesthesiology at Emory University, for providing an interesting and unexpected account of the possible origin of the Society's gavel.

Figure 2. Inscription on the gavel gifted by the AHA

Soon after Dr Crawford W. Long opened his practice in Jefferson, Georgia, he planted a mulberry tree in front of his office, which stood on the site of the present Crawford W Long Museum. A few years later Dr Long moved away, first to Atlanta then Athens, Georgia, but the tree thrived and continued to grow. In 1910 there was a severe thunderstorm in Jefferson and the tree fell down, before being chopped into smaller pieces to be discarded. An enterprising citizen passing by decided to rescue what was left of the tree, which he took home and stored in his basement. That citizen had a hobby of woodturning so he made a gavel on his lathe, to which was attached a small brass plaque giving some history of the wood from which it was made, before it was presented to the Medical Association of Atlanta. Several other gavels were made and are in the possession of various Medical Societies or in private hands. It would be an interesting touch to think that the Society's gavel is one of those made from Crawford Long's original mulberry tree.

Where did the second gavel (Figures 3 and 4) appear from? We have to thank Past President Adrian Padfield who made the gavel from a yew tree in *his* garden sometime before the 2004 HAS meeting in Grange-over-Sands. For £50 he got his local jeweller to make and fix the silver plate on it after finishing it, thus commemorating his time in office.

Figure 3. Gavel presented by Dr Adrian Padfield

Figure 4. Inscription on the gavel presented by Dr Padfield

To complete the mulberry tree story, when the wood turner who'd made the gavels died, the remaining parts of the mulberry tree were given to the Crawford W. Long Museum, where they remained in the museum basement for many years before being declared infested with termites and had to be removed. All remaining pieces of the tree were given to a woodworker to be cut up and made into letter openers, which are still on sale at the Museum's gift shop!

Obituary
Dr Jean Horton

Jean Mary Horton epitomized for many years the life and soul of the History of Anaesthesia Society (HAS). She was one of the overseas founder members of the Society in 1986, as at that time she was working at the Prince of Wales Hospital in Shatin, Hong Kong. On retirement in 1989, she returned to her home in Cambridge, England. From the following year she became a regular attender at HAS meetings, and in 1991 she was elected to the Council. Soon after she was appointed Assistant Honorary Treasurer and Membership Secretary. She served as Treasurer/Membership Secretary from 1994 to 1998 and President from 1998-2000.

The year 2000 was by no means the end of her services to the HAS. She continued to be a fine ambassador of the Society at International History of Anaesthesia meetings up to 2013. Notably, she played a major role in the organization of the very successful 6th International Symposium on the History of Anaesthesia, which was hosted by the HAS in Cambridge in September 2005. Her energy and enthusiasm were inspirational. One had to admire her driving herself from Cambridge to Caithness in the far north of Scotland at the age of 90.

Jean Horton was born in Weymouth, Dorset in 1924. She was Head Girl at Queenswood School (Hertfordshire) and then proceeded to qualify in Medicine in London in 1948. She obtained the FFARCS by examination in 1958. After various jobs, she was appointed Consultant Anaesthetist with interest in neurosurgery in 1960 in Edinburgh, where she worked until 1970. During 1968-69 she took 14 months unpaid leave to work as a Senior Lecturer in the Department of Anaesthetics at the teaching hospital at the University of Lagos, Nigeria. On return she heard from her friend Aileen Adams, a Consultant Anaesthetist at Addenbrooke's Hospital that a consultant post for a neuro-anaesthetist was becoming available in the Department of Neurological Surgery in Cambridge. She duly applied for this position and was selected after interview. After serving her required notice in Edinburgh, she moved to Cambridge in August 1970. During her years as a consultant in the UK, she published several peer reviewed papers on the role of the anaesthetist in care of head injuries and anaesthesia for neurosurgery. She was elected to the Council of the Association of Anaesthetists of Great

Britain and Ireland (AAGBI) in 1976 and served as Honorary Secretary from 1980 to 1982.

Jean left Cambridge in 1983 to be Consultant Anaesthetist at the Prince of Wales Hospital and Senior Lecturer at the Chinese University of Hong Kong. Remarkably she learned to speak Cantonese. She joined the organizing committee for the 7th Asian and Australasian Congress of Anaesthesiology, which was held in Hong Kong in September 1986 most successfully. Funds generated from this were used to set up the Hong Kong College of Anaesthesiologists, which was founded in September 1989. Jean was elected to the first Council of this College and received Fellowship number 0008. Full details of her career can be found in her book *Heads for Medicine*, published by Bound Biographies in 2011.

In her retirement years, perhaps her main interest was in the history of anaesthesia – she published 11 papers in *The History of Anaesthesia Society Proceedings*. However, she also devoted much time to genealogy, singing in choirs and learning Spanish. She was elected an Honorary Member of the AAGBI in 1996 and an Honorary Member of the HAS in 2001. Jean very much enjoyed her social engagement at the HAS scientific meetings up to the one in Iffley in 2016, after which declining health prevented her attendance. Her cheerful presence is certainly missed.

Alistair McKenzie
Past President, History of Anaesthesia Society

Obituary
Dr Robert Palmer

Robert (Bob) Palmer died on 6th of May 2022. He had been Treasurer and Membership Secretary of the Society since 2019, and the Society has been the fortunate recipient of his enthusiasm and hard work.

Bob was born in Sheffield in July 1944 but moved south to Twickenham soon after. His qualified from St Mary's Hospital Medical School in London in 1968. He undertook his anaesthetic training at the Westminster Hospital in London and undertook his Senior Registrar Training on Winchester and Poole rotations. After his Fellowship and Senior Registrar posts he spent a couple of years working in Montreal and Victoria in British Columbia before moving to Worcester, Massachusetts, where he spent ten years as an Attending Anesthesiologist, refining his interest in obstetric anaesthesia and regional analgesia.

He then returned to the UK, first to a consultant post at Aberystwyth, and then to the much busier Queen Alexandra Hospital, Portsmouth in 1993. Bob was never one to be idle, and did not retire until his seventieth birthday in July 2014.

He maintained a loyal interest in his friends and colleagues, from his cohort as a medical student to his peers in Wessex.

Bob was an enthusiastic contributor to the RCA Lives of the Fellows project. He filled the important role of Honorary Treasurer and Membership Secretary of the History of Anaesthesia Society from 2018 until his death.

Bob was a talented sportsman. He excelled at tennis, and he was a top-class water polo player, representing the University of London, British Universities, and, in the National League, and the Otter Swimming Club. He continued to swim competitively past middle age, and held the British Over 60s fifty metre backstroke record for many years. He considered his life's greatest achievements to have participated and done so well in sport.

Most of all, Bob was a family man. His interests were complimented ideally by those of his wife Valerie. He was brilliantly supportive of his daughters

and ten grandchildren, and was always the ideal and ever available grandad. An obituary was published in Portsmouth News.

He will be widely missed.

Dr Ken MacLeod

Correspondence

Sir,

I read, with great pleasure, the paper by Dr Patrick Magee on the development of the circle system in Volume 53 of the HAS Proceedings. I would like to take exception to one small aspect of this paper where Dr Magee refers to Alfred Coleman as an American Dentist. Perhaps we have to blame Lucien Morris for his misconception although Lucien does (as usual) give correct references for Coleman's work.

Coleman, who qualified MRCS LRCP and LDS, was one of the first to be doubly qualified. After initially working at the Metropolitan Hospital, he became Lecturer in Dentistry at St Bartholomew's Hospital in 1866 joining the staff the following year as a Dental Surgeon. He was an expert in anaesthesia and his paper on carbon dioxide absorption came out in 1868. (Coleman A. Re-inhalation of nitrous oxide. *British Medical Journal* 1868; 2: 114-115.) So, Coleman was an Englishman!

Yours sincerely,
David J Wilkinson
17 Parc Llindir,
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Llanddulas,
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A reply from Dr Patrick Magee:

Sir,

Thank you for giving me the opportunity to reply to Dr David Wilkinson's letter.

I would like to thank Dr Wilkinson for pointing out the error in my presentation that Dr Alfred Coleman was an American dentist, when in fact

he was a British dentist. David is both perspicacious and correct in noticing that this was because my reference source for this assertion, and many of the facts in my presentation relating to nineteenth century, were from Lucien Morris' paper: 'Closed Carbon Dioxide Filtration revisited', from 1994.

Yours sincerely

Patrick Magee
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