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THE HISTORY OF ANAESTHESIA SOCIETY PROCEEDINGS

Volume 37

Proceedings of the Summer Scientific Meeting

West Park Centre, University of Dundee
29th and 30th June 2007

Contents of Volume 37

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Congratulations are in order for our President, Dr David Wilkinson, who has been awarded the Wood Library-Museum Laureate in the History of Anaesthesia for 2008.

HISTORY OF ANAESTHESIA SOCIETY

2007 Summer Scientific Meeting, West Park Centre, University of Dundee

28-30 June 2007

Organiser: Prof JAW Wildsmith

The Organiser is very grateful for the assistance of Mrs Marie Thomson, Secretary to the University Department of Anaesthesia, all the staff of the West Park Centre and Mrs Fay Wildsmith.

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

BMS Pain Management
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The Society acknowledges with thanks the photographs taken by Dr Geoff Hall-Davies.

HISTORY OF ANAESTHESIA SOCIETY

Council and Officers – July 2007

President	Dr David Wilkinson, Bishop's Stortford
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EDITORIAL

The Dundee meeting hosted by Prof Tony Wildsmith was well organised and entertaining. Friday began with notes on Dundee's medical and anaesthetic history by Stuart McGowan. This was followed by papers on a miscellany of topics, including three on Scottish connections.

After lunch there were four papers on the involvement of anaesthetic agents in death. Next, there were two presentations on anaesthesia in Antarctica, which whet the appetite of the audience for the evening visit to *Discovery*. On a glorious summer evening, dressed for the HAS dinner, the delegates and guests were treated to a champagne reception on board *Discovery*. Guides conducted rewarding tours of the vessel for small groups. Photographs have been posted on the HAS website.

Saturday started with the AGM. The members observed a minute's silence in memory of the late Hon Member, Douglas Howat, who died in November 2006. Prof Tony Wildsmith accepted nomination as the President-Elect. A warm citation was delivered by Aileen Adams to our latest Hon Member, Prof Sir Keith Sykes.

To conclude the meeting there were two guest lectures. Mr Michael Wilson, a member of RSGS and tour guide on RRS *Discovery*, gave a riveting account of Scott and *Discovery*. Prof Derrick Pounder delivered a fascinating and insightful talk on murders involving chloroform, and the forensic implications thereof.

Note that Stuart McGowan's two papers comprise far more detail than his presentation. Funding from Dundee was provided to facilitate printing the larger volume.

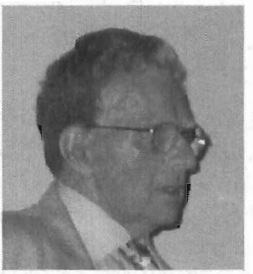
Alistair G McKenzie
Hon Editor

FUTURE EVENTS

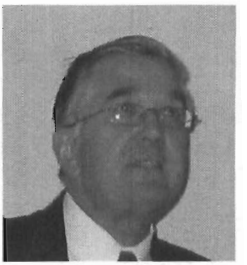
2008 26 -28 June. HAS Summer Meeting, York
Contact: Dr Paul Goulden (paul.goulden@midyorks.nhs.uk)

Speakers at Dundee

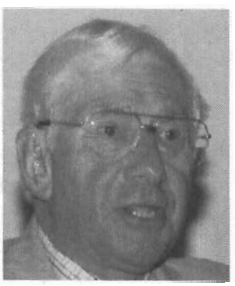
Prof JAW Wildsmith



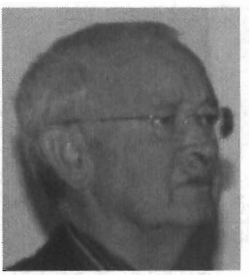
Dr S McGowan



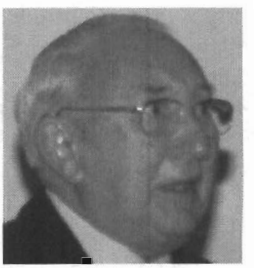
Prof A Dronsfield



Dr E Armitage



Dr A Padfield



Prof Sir MK Sykes

Dr I Levack

Dr AG McKenzie

Dr Jean Horton

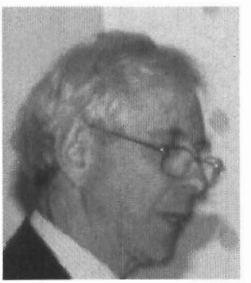
Speakers at Dundee

Dr I McLellan

Dr H Connor

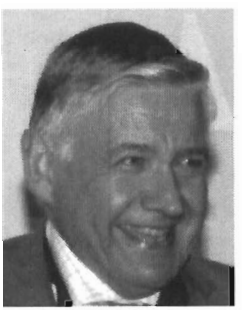
Dr Ann Ferguson

Dr A Kuipers

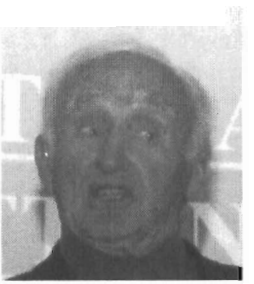


Dr D Wright

Dr Aileen Adams



Dr D Wilkinson



Mr M Wilson

Prof D Pounder

Members and guests attending Dundee meeting

Dr Catherine Adam	Leven	Dr Jenny Meek	Kinghorn
Dr Aileen Adams	Cambridge	Dr Ronald Millar	W. Horsely
Dr Neil Adams	Bury St Edmunds	Dr Peter Morris	Leicester
Dr JM Anderton	Altrincham	Dr James Mulvein	Bristol
Dr Edward Armitage	West Sussex	Dr Angela Murray	Liverpool
Dr Douglas Bacon	Rochester USA	Dr Tony Nightingale	Liverpool
Dr Marshall Barr	Reading	Dr Aidan O'Donnell	Livingston
Dr Moyna Barton	London	Dr Adrian Padfield	Sheffield
Dr Colin Birt	Rochford	Dr Eric Plumpton	Sussex
Dr John Blizzard	Chelmsford	Dr Yash Pole	Manchester
Dr Tom Boulton	Reading	Dr John Pring	Penzance
Dr Henry Connor	Hereford	Dr Jean Robson	Guildford
Dr Ian Corall	London	Dr Nigel Rose	Ledbury
Prof Alan Dronsfield	Derby	Dr Miles Rucklidge	Lancaster
Dr Gary Enever	Newcastle	Dr Priti Shah	Stockport
Dr Ann Ferguson	Broadstairs	Dr Janti Shah	Birmingham
Dr Anne Florence	Liverpool	Dr Ian Smith	Aberdeen
Dr Richard Gabriel	Cheltenham	Prof Alastair Spence	Kilmacolm
Dr Veera Gopakumar	Walsall	Dr Charles Swithinbank	Cambridge
Dr Geoff Hall-Davies	Redditch	Prof Sir Keith Sykes	Devon
Dr Helen Hannah	Chippenham	Dr Alistair Trench	Dunblane
Dr Jean Horton	Cambridge	Dr Maureen Van Ryssen	W. Sussex
Dr Glenys Jones	Edinburgh	Dr Barbara Weaver	Winscombe
Dr Adrian Kuipers	Shrewsbury	Dr David White	Beaconsfield
Dr Iain Levack	Dundee	Dr Malcolm White	Cleveland
Dr David McCallum	Edinburgh	Prof Tony Wildsmith	Dundee
Dr John McClure	Edinburgh	Dr David Wilkinson	Bishop's Stortford
Dr Stuart McGowan	Dundee		
Dr Ian McLellan	Dorset	Mrs Patricia Willis	London
Dr Alistair McKenzie	Edinburgh	Dr Catherine Wisely	Westcliffe
Dr John McLaren	Edinburgh	Dr David Wright	Edinburgh
Dr Kenneth Macleod	Huntingdon	Dr Tod Young	Altrincham

Guest Lecturers:
Mr Michael Wilson, Dundee
Prof Derrick Pounder, Dundee

THE HISTORY OF DUNDEE ROYAL INFIRMARY

Dr Stuart McGowan, Dundee

Especially in recent years, you hear people complain about the National Health Service and talk affectionately about 'the good old days', but I doubt very much if they would be thinking about 18th century Dundee. Dr Johnson, who visited the burgh in 1773, described it as "dirty and despicable" and, earlier, Mary Queen of Scots had wrinkled her nose in disgust at the odours which came from the middens in its principal streets. Epidemics of cholera, smallpox and other fevers occurred frequently, with the poor suffering most when illness struck because they could not afford medical advice and treatment. For them there was no hospital or nursing home available and the situation was remedied only when a group of compassionate and benevolent individuals, headed by the Reverend Dr. Small, minister of St Mary's Church, raised a subscription to establish a dispensary in 1782.

The town was divided into a number of districts, and one physician or surgeon was allocated to each. They not only prescribed for those who called on them, but visited the poor in their own houses. The scheme was so successful that Dr Small suggested founding an Infirmary, and a committee was formed in 1793 to raise the money for this. Soon they were able to purchase a site, between King Street and Victoria Road, and an architect drew up plans - a central pavilion with projecting wings at the east and west ends. It was to be two stories high, with a basement and attic, but only the central portion was built at first, the wings being added in 1825 and 1827.

Originally, the Infirmary could accommodate 56 patients, the first being admitted in 1798, and the total rose to 120 when the wings were added. Each ward could take ten beds, and there was an excellent operating theatre with roof lights and a rail round the table to save the surgeon being pressed upon too closely by the spectators. However, the dispensary did not close when the Infirmary was up and running. On the contrary, the dispensary surgeons attended to thousands of outpatients each year, and it continued to operate right up until 1914 when the National Insurance Act rendered it obsolete.

A housekeeper-matron, one or two nurses and a resident apothecary were appointed to the Infirmary together with two visiting physicians and seven visiting surgeons. The surgeons took charge of all the patients in rotation for a month at a time and performed any operations that were needed during that period. In the beginning the physicians had light duties and visited the hospital once or twice a week.

Of all the surgeons who held office, John Crichton was probably the most remarkable. He was appointed Visiting Surgeon when the Infirmary opened in 1798 and continued to work actively until 1855 - 57 years in all, mostly in the days before anaesthesia and antisepsis. He was especially skilled in the operation of lithotomy – excision of bladder stones – which he performed in 200 cases with a remarkably low mortality of 7%. Patients came to him from far and near, and he operated on every case, whether it was considered favourable by others or not. He attributed his skill to a serenity of mind and a hand that never trembled. He was also the first person in Dundee to use acupuncture, by which he treated not only painful conditions like sciatica, but also swollen joints and hydroceles, with apparently dramatic results. Crichton Street in the city centre is named after him.

The board of directors ran the hospital on strictly business lines and enforced a code of discipline, rules being drawn up for both patients and staff. Patients were not allowed to smoke in the wards or to play cards or dice; the nurses were not to neglect, insult or quarrel with the patients. The apothecary must never be absent from the Infirmary for more than three hours at a time without leave from one of the visiting physicians or surgeons, and when such leave was granted, he must inform the matron where he may be found. He must never be out of the Infirmary after the hour of shutting the gates.

Thus Dundee Royal Infirmary (DRI) was a classic example of the Voluntary hospital movement which sprang up in the 1700s. Fundamentally a Voluntary hospital is a charity – a local charity – whose aim is to provide free medical treatment to the poor when they were sick or injured, not for those who can afford to pay for their medical needs. In a voluntary hospital the medical staff – the visiting physicians and surgeons who were appointed by the governors – gave their services free or for a nominal fee. They did not work full-time in the hospital, but earned their livelihoods in General or Private Practice outside the hospital.

The Infirmary was administered by the Governors who met four times a year at their quarterly court. In June each year, at their Annual Meeting, they elected a Board of Directors consisting of a President, several Vice-Presidents, a Treasurer and a Committee of 18 Governors, called the Weekly Committee, which met every Thursday morning and regulated the admission and discharge of patients, examined and passed accounts, appointed nurses and servants, and generally ran the hospital.

None of the income of a voluntary hospital came from central or local government, it was all raised locally in various ways. In some cases, a wealthy

merchant or landlord donated money to build the hospital - for example Thomas Guy in London, John Addenbrooke in Cambridge and John Radcliffe in Oxford. More often, subscriptions were raised by the local populace. In Dundee every person who subscribed one guinea a year was a Governor - entitled to two outpatients constantly on the list and one in-patient in the year. You could become a Life Governor by subscribing 20 guineas at one time, which gave you the same privileges as an annual subscriber, not only during your lifetime, but for you and your heirs forever.

Being a Governor gave one a superior social status. Before patients could be admitted to the hospital, they had to obtain a Governor's letter of recommendation and take this to the Infirmary at 11 o'clock on Thursday morning. The attending surgeon would then examine the patient who, if considered suitable, would be received by a sub-committee of the Weekly Committee, which met at the same hour for the purpose of regulating admissions. Urgent cases could be admitted at any time.

To supplement the income from Governors' subscriptions appeals were made to the churches to take collections for the Infirmary, and also to the workers in the factories and mills to donate even a penny a month. Donations in kind were welcome, especially in the early days. These are listed in the Annual Reports which were published each year. In a typical year the Infirmary received clothing and old linen, loads of firewood from an undertaker, loads of turnips and potatoes from farmers, game from landed gentry, two pairs of shoes and a journal from the Scottish Temperance League. Dozens of bags of chaff were also received, this being used to fill mattresses, and it was only in 1865 that the Directors reported that hair mattresses were gradually being substituted for chaff beds. As the years went by, the population of Dundee rose rapidly through immigration, chiefly of Irish families seeking work in the textile industry, and the work load of the Infirmary increased in parallel. It became the practice of the Directors to channel the income received into three funds.

First, there was the Fund for the current expenses of running the Hospital. This income came from the Governors' subscriptions and the various collections: from the mill workers, who were themselves poorly paid, and from the churches. Collections taken in churches were often disappointing: in some years only 14 out of the 40 churches in Dundee bothered to contribute. Later, in the 1920s, '30s '40s and '50s, students' charity campaigns, in both Dundee and St. Andrews, became annual events and raised considerable sums for the Infirmary, often £2,000 a year. The Directors' response to this was naming of "The Students' Charities Day Ward".

The people of Dundee were also well disposed to their Infirmary and supported it in many ways. House to house collections were made by the Womens' Auxilliary, flag days were held, an annual football match was played between the ministers and the butchers, and whist drives, concerts and bowling matches between the Rotary and local clubs all contributed to the coffers of the DRI. Latterly many patients sent donations after their discharge.

Secondly, there was the Reserve Fund, made up from legacies and larger donations. It was used to pay off debt in the years when expenditure exceeded income and fluctuated greatly. In 1924 it stood at £147,000, but few years later was totally exhausted.

Finally, the Endowment Fund was built up from large donations and bequests which donors specified should be invested and only the interest used for current expenses. Many people would endow a bed or a cot at 1,000 guineas a time, a brass plaque being placed above the bed. In 1941 a lady endowed a bed with the request that it be named "The Dunkirk Miracle Bed". The endowment fund continued to grow and stood at £520,000 when the National Health Service came into being in 1948.

The policy of the Governors to accept all categories of patients, including mental cases, fevers and accidents as well as medical and surgical, led to problems. This was alleviated in 1819 by the building of a separate hospital for the insane, The Dundee Lunatic Asylum in Albert Road, but the periodic epidemics of cholera, typhus, smallpox and other fevers overwhelmed the Infirmary's resources for most of the 19th century. The conditions for the spread of contagious disease were prevalent in Dundee: the population lived in overcrowded homes with contaminated water supply, and poverty and long hours of work were the rule.

Typhus is rarely seen today, but was widespread in Ireland during the potato famines, and spread with the migration of Irish families, being carried by the body louse. It had a mortality rate of 20% and, as many as 2 or 3 thousand cases were admitted to the Infirmary in the epidemic years. On occasion the Directors gave up their committee room and the surgeons their operating theatre to accommodate more patients, and adjacent buildings were temporarily acquired and converted into auxiliary infirmaries. There was a serious risk to the medical and nursing staff too, many physicians, nurses and other staff becoming victims and several dying. In one year, three resident medical superintendents and a matron all contracted typhus and died.

Cholera was another frequent visitor to the town. After a false alarm in 1826 the Town Council acquired a tenement at the bottom of Union Street, where the Tay

Hotel now stands, and converted it into a cholera hospital. It was brought into use 6 years later when 807 cases were admitted during a severe outbreak of Asiatic cholera. Two thirds of them died. The Board of Health ordered a general fumigation in all quarters of the town, tar barrels being placed at different points along the streets and set alight. When night fell the crackling of wood and the blazing of tar made the town resemble a smithy. Unfortunately, the Cholera hospital was sold by the Town Council the following year to recoup their expenses. It was divided into small two-roomed houses, and so was not available to the Infirmary in 1849 when the next outbreak of cholera occurred, 1,600 patients being affected.

One of the strangest decisions appeared in a report on treating fever cases issued by the medical staff in 1849. After consulting Professor Sir Robert Christison of Edinburgh and other physicians throughout the country, they adopted a policy of Dispersion of fever cases. Rather than isolate them in a separate ward or hospital, they distributed them throughout the common wards of the Infirmary.

The Victorian Building

It was clear by the early 1850s that the old King Street Infirmary was inadequate for the needs of the town whose population continued to increase. The decision on whether to enlarge the existing building or to erect a new hospital was left in the hands of Professors Christison and Syme of Edinburgh. They agreed that the old building was obsolete and supported plans for a new, large well-ventilated building in the open space to the north east of Dudhope Castle.

Fortunately the directors received a handsome bequest from Mr James Soutar and his sister that largely met the cost of the new building. The foundation stone was laid on 22nd July 1852 which was declared a public holiday. A huge crowd formed a procession which made its way from the Royal Arch, up Castle Street, High Street and Constitution Road to the Infirmary. In the hollow of the foundation stone are 9 different newspapers of the day, coins of Queen Victoria, the Dundee half penny and many documents relating to the Dispensary and the Infirmary.

The new building was officially opened in 1855, accommodating 280 patients and having large, well-ventilated and bright wards. It might be expected that this splendid and modern hospital would have the latest in operating theatres, but not so. For the next 40 years, until 1895, the new DRI had no operating theatre, a singular oversight meaning that no provision was made whatsoever for surgical operations. For many years they were performed in the wards or adjoining corridors, a practice which was obviously not only inconvenient, but

highly objectionable. Later the surgeons partitioned off a circular space at the end of the main corridor, but an operating theatre was eventually built as a result of complaints by the medical staff. It was paid for by one of the Vice-Presidents, John Sharp, with this Sharp Theatre later becoming known as Main Theatre. Anaesthesia with ether and chloroform had been available since 1847, but wound sepsis continued to be prevalent. Only when Lister introduced his system of antiseptic surgery in 1867 did the number of operations performed rise dramatically. Aseptic methods followed 20 years later.

In the early days of the Infirmary, the standard of nursing was poor, there being very little distinction between nurses and servants. Nurses had to sweep the floors, and could apply poultices and fomentations, but were not allowed to dress wounds or attend the operating theatre. The first nurses appointed in 1798 were paid 6 shillings a week with board and were often recruited from alcoholic or broken down women, but in 1850 the governors resolved to obtain nurses of a superior class. A head nurse, appointed to superintend the others, was paid 8 shillings a week and rules were drawn up forbidding the nurses to drink hard spirits or use bad language. Then in 1856 the directors resolved to increase the pay of nurses for "without proper and liberal payment you cannot expect to find or retain good nurses".

The real breakthrough came in the mid 1870s when a new Medical Superintendent, Dr Robert Sinclair, presented a comprehensive report on the unsatisfactory state of the nursing department. At about the same time Mrs Rebecca Strong, having been a pupil of Florence Nightingale at St. Thomas's hospital, was appointed Matron. They set up a training school, and within four years the standard of nursing in Dundee was the highest in the country. Nurses were trained to work in the Infirmary, and were also leased out to provide services in patients' homes, so bringing in welcome additional income to the Infirmary. The number of nurses was increased from 36 to 44 and, through the generosity of Mrs Gilroy, additional accommodation for 10 nurses was provided by the erection of the Gilroy nurses home. Four years later, in 1896, the President, Sir William Ogilvy Dalgleish, donated £5,000 to build a new nurses home. Nursing became a popular profession, as evidenced by the rapid rise in applications to enter the training school.

Gifts and Donations

In the second half of the 19th century, and during the 20th century, a great expansion of the work of the Infirmary took place. This was associated with advances in medical practice and treatment, and with increased specialisation. New buildings and hospitals were built, and staff numbers increased with the

jute magnates largely financing these improvements and playing an active part in the running of DRI as directors, Vice-Presidents and Presidents. In 1877 Sir David Baxter funded the convalescent home in Barnhill and this was extended in 1898 to provide 85 beds. In 1883 the first Children's ward was opened, but the outbreak of war in 1914 caused the plans for a 100 bed Children's Hospital to be shelved. Instead, a second children's ward was opened in 1915, and a third in 1927. In 1901Sir William and Lady Dalgleish defrayed the cost of an operating theatre for the eye ward so that the number of eye cases treated increased rapidly, Drs James Duncan and Angus MacGillivray being the surgeons.

In 1900 a maternity hospital, costing £6,000 and paid for by James Caird, was erected in the grounds of DRI with Professor Kynoch and Dr RC Buist as Obstetricians and Gynaecologists. The maternity hospital was sorely needed because infant mortality in Dundee was the highest in Scotland, and maternal mortality was high also. This was surely linked to the fact that so many women, married and unmarried, worked for abysmally low wages and lived in squalid conditions. In 1913, to take a typical year, from 207 deliveries, 33 children were still-born, a further 18 died soon after, and 12 of the 207 mothers also died - from complications of childbirth. The maternity nurses not only worked in the hospital, but were sent out to deliveries on the district. They could travel free on the trams when they were visiting outdoor patients, courtesy of the Town Council.

In 1907, James Caird again provided funds: £24,000 to build the Caird Cancer Pavilion which provided 6 extra wards, 3 of which were used for surgery, gynaecology and cancer, and a fourth for treatment by electricity. Dr Archibald Leitch was appointed Investigator in Cancer Research. In 1910, Caird contributed £2,400 towards the cost of reconstructing and extending the out-patient department, and £10,000 for the Sidlaw Sanatorium used in the treatment of children with pulmonary tuberculosis. The 'Sidlaw' had originally been endowed by Alexander Moncur, another Jute owner, who gave £25,000 for this purpose.

James Caird was created a Baronet in 1914 and died in 1916, having given away over a quarter of a million pounds. His sister, Mrs Marryat, was equally generous in her interest in the Infirmary. In 1917 she donated £10,000 to wipe out the deficit in the DRI accounts for that year and another £25,000 in 1924 to cover the cost of an extension of the Caird Pavilion that included 2 surgical operating theatres known as the East and West Theatres. When Mrs Marryat died in 1927, she bequeathed half the residue of her estate, amounting to £120,000, to the Infirmary which she had served as one of its Vice-Presidents.

Another benefactor was DM Brown who served as a Director for 12 years and later as a Vice-President. His outstanding gift was the reconstruction of the main corridor, the floor of which was lined with terrazzo. The West Door was also enlarged to allow for the more convenient handling of patients.

By the mid 1920s it had become clear that the Caird Maternity Hospital was quite inadequate for the increasing demand. The decision was made to build a new maternity hospital, and the entire cost, approximately £85,000, was met by members of the Sharp family. The building was erected on part of the site of the old Dundee to Newtyle railway.

Among other gifts in kind to the Infirmary was the house at number 5, Dudhope Terrace for the establishment of a Preliminary Training School for nurses. This was a gift from Mr James Prain, one of the Directors, and owner of the Larchfield Jute works. The house accommodated a sister in charge and 7 pupils who spent two months there before going to the wards. The school was opened in December 1929 by Mrs Strong, the former Matron.

Another gift, from Colonel Hardie, Chairman of BOC, was the installation in 1946 of a complete pipeline system to supply oxygen and nitrous oxide to the theatres and wards. Dr William Shearer, who was appointed anaesthetist in charge in that same year, spent many hours in the evenings and weekends crawling through the attic recesses of the hospital where he found dozens of leaking joints. He was concerned not so much with the risk of explosion, but with the cost of all that oxygen going into the atmosphere. Many a nurse was alarmed to see Dr Shearer descending through the access hatches in the ceiling in the small hours of the night!

Dr Shearer was the first whole-time anaesthetist in Dundee, introducing the latest techniques in anaesthesia: intravenous pentothal, muscle relaxants and the use of ventilators. He was a very popular and lovable character, and perhaps a little eccentric in his ways, loving to demonstrate the highly explosive properties of agents such as cyclopropane and ether. In his lectures to medical students, nurses and visiting doctors, he would fill small balloons with mixtures of cyclopropane and oxygen, or ether and oxygen and detonate them using electric sparks or static electricity. The noise was quite shattering, even when you knew to expect it!

The War Years

The two World Wars caused difficulties in various ways. In the First World War, many of the medical staff and Directors were called up or volunteered to

join the forces, many receiving decorations for bravery: 15 the MC, 8 the DSO and 5 the OBE, plus others. Three wards were set aside for the reception of wounded servicemen, and some of the convalescent soldiers were sent to Glamis Castle where the Earl and Countess of Strathmore, and no doubt the late Queen Mother (Elizabeth Bowes Lyon as she was then), looked after them.

In the Second World War, one of the benefits was a great expansion of the blood transfusion service. DRI was one of the centres at which a blood bank was established, here under the supervision of the Infirmary's pathologist, Professor DF Cappell, who was appointed director of the blood transfusion service for the east of Scotland.

Stanley Soutar was appointed full-time resident assistant in the surgical department. Throughout the war he was responsible for virtually all the emergency surgery. Only on Tuesdays and Fridays, from 2pm to 10pm, did George Sturrock relieve him. It was at this time that Stanley met his future wife Margaret. In those days, anaesthetics for out of hours surgery were given by the resident house officers and, because of her attraction to Stanley, Margaret always volunteered to give the anaesthetic when he operated.

In 1944 penicillin was made available for use in a few selected hospitals in Scotland, including DRI. At first its use was restricted to the wounded, but latterly enough was available to provide for the needs of the civilian population. To comply with requirements Stanley Soutar took a course of instruction and was then in charge of this special treatment, with excellent results.

One of the bonuses of the war was a reduction in the surgical waiting lists. EMS hospitals such as Bridge of Earn and Stracathro had been set up, and the government encouraged patients to have their operations in these hospitals.

Rise of the Medical School

Towards the end of the 19th century, DRI's importance grew as it became a major teaching hospital. Through the generosity and determination of Miss Mary Ann Baxter, and her cousin Dr John Boyd Baxter, University College Dundee was inaugurated in 1883. A poem was written to commemorate the event, the first verse surely giving a clue to the author, William McGonagall:

Good people of Dundee your voices raise,
And to Miss Baxter give great praise.
Rejoice and sing and dance with glee,
Because she has founded a college in Bonnie Dundee.

Fifteen years later the Advanced Medical School of the University of St Andrews was established in Dundee, with chairs in Medicine, Surgery and Midwifery filled by Alexander Stalker, David MacEwan and Campbell Kynoch. Another chair created at that time was in Pathology, and Robert Muir was appointed to it. Unfortunately within a year he was enticed to Glasgow where he became internationally famous and a 'kingmaker', placing 8 of his assistants in chairs throughout the UK, two (Daniel Cappell and Alan Lendrum) becaming Professors of Pathology in Dundee.

Generations of medical students will remember Professor WJ Tulloch who held the Chair of Bacteriology from 1921 to 1962. His work on tetanus and meningitis during World War I had earned him the military OBE, but to the students he was known as the 'Dragon' because he smoked constantly, inhaling deeply and blowing out through his nostrils. When he went round setting up microscopes before a class, he would place an ashtray beside every microscope. It was traditional, at his last lecture of the session, for the students to place on the table a glass and a bottle of beer which he would drink to great cheers before delivering his lecture. Tulloch was the outstanding research brain in the faculty of Medicine for many years, his Department produced more gold medal MD's than all the others put together.

As noted, the University Department of Midwifery began with the appointment of Professor Kynoch who held the Chair until 1928 when he was succeeded by John McGibbon, previously Professor of Midwifery in Johannesburg. He resigned through ill-health in 1936, but there was a hiatus of four years before his successor, Margaret Fairlie, was appointed. This was because of a disagreement between the representatives of St Andrews University and the Directors of DRI on the selection committee. The DRI Directors were adamant that Margaret Fairlie should be appointed, but the Principal of the University, Sir James Irvine, was quoted as saying that he could not, in fairness to his colleagues on the Court, recommend the appointment of a woman to a Chair in the University. When challenged, he qualified his statemeet by saying that he could not agree to recommend a woman unless she was particularly outstanding. Finally, in 1940 the University approved her appointment and she became the first woman to hold a medical Professorial Chair in any Scottish University.

In 1926 Fairlie had visited the Marie Curie Institute in Paris to learn the use of Radium in gynaecological cases, and was said to be a fine surgeon who operated like a man. One day, to the great amusement of the students in the theatre, her pink underskirt descended slowly below her gown until it lay around her ankles. Ignoring it totally she carried on to the end of the operation, then stepped out of it, picked it up and walked out of the theatre without batting an eyelid!

Her successor in 1956 was James Walker. He came to Dundee after being Senior Lecturer in Dugald Baird's department in Aberdeen and Reader at the Hammersmith hospital. With his reputation as a first class research worker, he built up an excellent research department in Dundee. Many of his trainees have achieved great honour, men such as Alec Turnbull, Callum MacNaughton and now Lord Naren Patel.

The first Professor of Surgery, David MacEwan, was succeeded in 1919 by Lloyd Turton Price. Unfortunately, he developed a duodenal ulcer, was operated upon in Edinburgh by Sir John Fraser and died in the post-operative period. In his will, he bequeathed his whole estate to Margaret Fairlie whom he had planned to marry. John Anderson was then appointed to the Chair of Surgery, in 1933, but died tragically of tuberculosis two years later. The Directors felt that his death was a tremendous loss, not only to the Infirmary, but to the City of Dundee and a public subscription was opened, resulting in a memorial in the form of a lounge and billiard room built on to the 'Gilroy', which was then the quarters of the resident medical staff.

Professor RC (Sonny) Alexander held the Chair of Surgery throughout the war years, being largely responsible for the Emergency Medical Service in Bridge of Earn and Stracathro Hospitals. He was succeeded in 1951 by Donald Douglas, the first whole-time Professor of Surgery. Sir Donald Douglas, as he became, was particularly interested in cardiac and vascular surgery, pioneering open heart surgery in Scotland using the Melrose pump-oxygenator. These were exciting days in the West Theatre: Michael De Bakey, the world's leading cardio-vascular surgeon, came to Dundee and operated there, staying on in Dundee for a few days to go shooting with the Professor!

Modern specialisation

Dr Oswald Brown arrived in 1950 and set up a first class geriatric service in Dundee, aided later by Bob Ritchie, Cyril Cohen and Ron MacWalter. Now we have a Professor of Ageing and Health (not Ageing and Death as some students would have it!) and it is interesting to see how the perspective of ageing has changed over the years. Scots terms such as 'aigit' and 'decayit' have given way to old, elderly and geriatric, perhaps to be replaced by the more politically correct expression 'chronologically gifted'!

During the last 50 years, surgery has become more and more specialized, with Orthopaedic surgery a prime example. Ian Smillie was appointed surgeon in charge of the Eastern Region Orthopaedic Service in 1948, his skill as a knee surgeon bringing him a world-wide reputation. His department grew

enormously with appointments such as James Hutchison, George Murdoch, Dick Muckart and Wilf Waldie, all excellent golfers and as much mainstays of the Dundee Medical Golf Society as the Orthopaedic service!

Plastic surgery became an individual specialty with the meticulous John Kirk, Arthur Morris and Howard Stevenson. Urology started with John Grieve, and later Keith Baxby and Patrick Weaver, and Bob Pringle made gastro-intestinal surgery his special interest. However, what Dundee lacked most for many years was Neurosurgery. Prior to 1962, all intracranial tumours and aneurysms were sent to Aberdeen or Edinburgh, and head injuries were dealt with by the general surgeons, although when Mr Block was appointed the first neurosurgeon in 1962 he had no theatre, no dedicated ward or beds and no trained nursing staff! For about three years he had to operate wherever he could, and with different nurses each time. Eventually he succeeded in having his own staff and unit, this being opened by Professor Norman Dott from Edinburgh in 1966. The unit, later joined by Mr Jacobson and Mr Varma became a jewel in the crown of DRI, building up an excellent reputation. Andrew Lenman had a similar early struggle to obtain recognition for medical neurology, but it flourished under Duncan Davidson and Richard Roberts.

Professor Sir Ian Hill's interest was primarily cardiac disease and he appointed several colleagues to foster this research. Drs Ken Low, Donald Emslie-Smith and Hamish Watson, with their expertise in cardiac catheterisation and echo-cardiology, all contributed to Dundee's increasing reputation in cardiology. General medicine, like general surgery, hardly exists any more. We now have specialists in renal medicine, endocrine disease, gastro-enterology, haematology and chest medicine.

Arrival of the NHS

The National Health Service came into being in 1948, the aim of the government being to ensure that hospital treatment would be available to everyone who needed it. This was to be achieved through a properly co-ordinated service embracing all the existing types of hospital: the Voluntary Hospitals such as DRI, the local authority hospitals such as Maryfield, and the EMS hospitals such as Bridge of Earn and Stracathro. Dundee Royal Infirmary, being a voluntary hospital, had always relied for its income and its very functioning, on public support, and in the run up to the NHS, its deficits had been growing larger every year.

Instead of being relieved that the government would henceforth shoulder the burden, the Directors were wholly opposed to any measure which would involve

interference with the independence and authority of individual hospitals. The Board felt that voluntary hospitals had certain qualities inherent in their history and tradition that should be encouraged and maintained in the interest of the patient. However, the hospital service, now supported by taxation, has changed perhaps even faster through the nearly 60 years of the NHS than it did during the earlier history of DRI. The academic and clinical developments noted above meant that the Victorian building, in its turn, became less suitable in terms of both space and facilities. Planning for its replacement started in the 1950's and led eventually to the closure of the Victorian building which saw its last patients in 1998, when the final move of all services to Ninewells Hospital took place, but that is another Hospital and another story!

Further Reading

Gibson HJC. *Dundee Royal Infirmary 1798 to 1948: The Story of The Old Infirmary with a short account of more recent years.* Dundee: William Kidd & Sons Ltd, 1948. (The two photographs of the Infirmary appear in this book).

Acknowledgements

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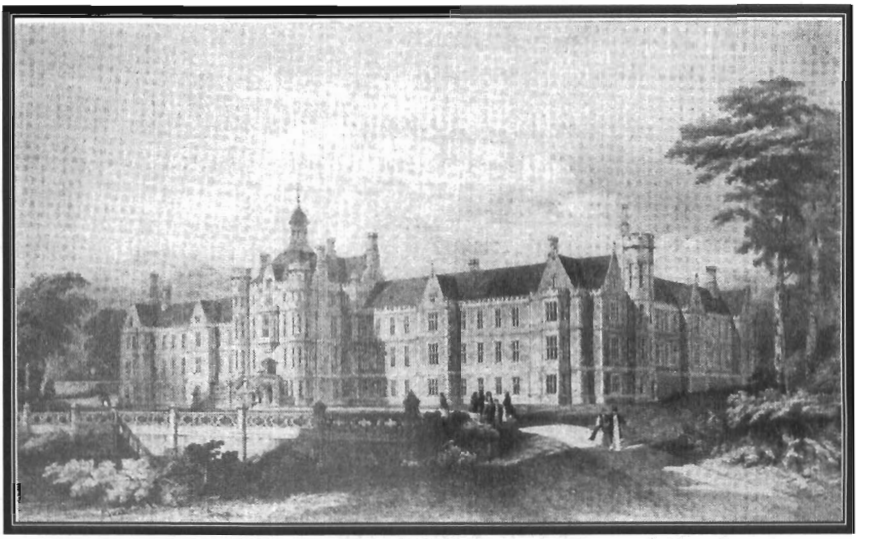
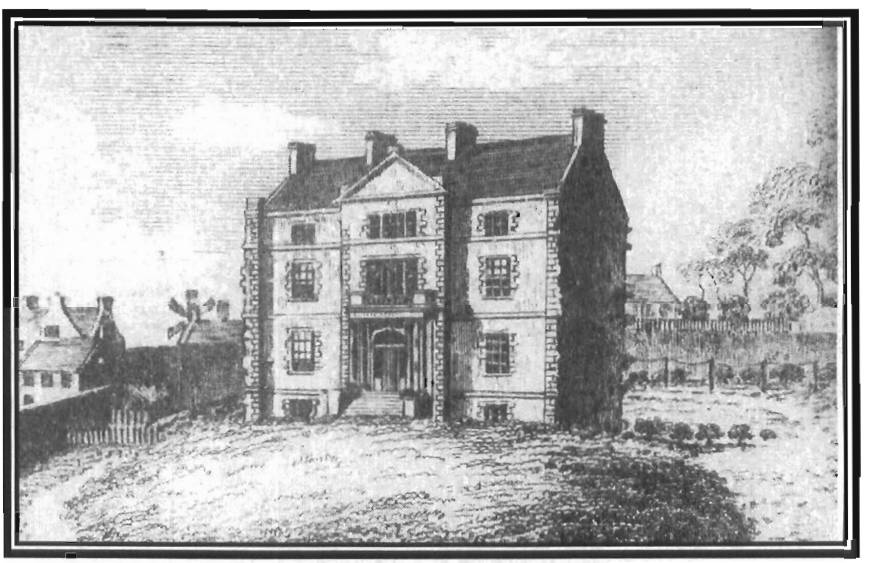


The "new" Dundee Royal Infirmary in Barrack Road: opened 1855, closed 1998



The original Dundee Royal Infirmary in King Street: opened 1798. The east and west wings were added later.

ANAESTHESIA IN DUNDEE (1847 - 1964)

1: Prior to 1847, and the introduction of ether

Few operations were carried out in the days before the discovery of anaesthesia, the numbers recorded in the Annual Reports of the Dundee Royal Infirmary (DRI) varying from 16 to 55, with an average of about 25. Many of these were amputations of fingers, hands and forearms as a result of industrial accidents in the mills, and lithotomy, performed by the perineal route, was also common. It would appear that the pain and discomfort associated with a bladder stone was so great that patients were prepared to endure the agony of surgery without anaesthesia. Dr John Crichton, one of the first surgeons to be appointed to the DRI, was famed for his expertise in this field, performing over 200 procedures with a mortality of only 7%, remarkable for those days. Other operations listed included tracheostomy for diphtheria or oedema, excision of breast tumours, paracentesis abdominis and operations for strangulated hernia. These latter operations were invariably carried out as a last resort, and were always fatal.

There are two main reasons why so few operations were performed at this time. One is that many operations, however expertly carried out, were followed by an overwhelming infection and death. These were the days before antisepsis and asepsis in the operating theatre, surgeons operating in their blood and pus stained frock-coats without first washing their hands. The second reason, of course, was the great pain that accompanied the cutting of flesh. Patients would scream loudly and struggle, having to be held down so great courage was required, not only by the patient but also by the surgeon.

Dr George Wilson, who had a leg amputated in the days before anaesthesia, wrote later to Professor Simpson to describe his feelings at the time of his operation. He had asked the surgeon for a week's grace before the operation to allow him to put his affairs in order, but during that week he suffered great mental torment and anguish as he thought about the forthcoming ordeal. Each morning he woke up with doubts as to whether he should proceed with it, making the point to Professor Simpson that the mental stress prior to the operation was just as terrible as the physical agony of the procedure itself.

Another account of a pre-anaesthetic surgery can be found in an essay by Dr John Brown, a well known Edinburgh doctor in the nineteenth century. 'Rab and his Friends' gives an emotive description of a mastectomy carried out by Professor James Syme in Minto House Hospital at a time that Brown was a medical student and clerk to Syme. The operating theatre was crowded with eager students, the patient, Ailie, in her sixties, walked in dressed in her mutch,

her neckerchief, her white dimity short gown, and her black bombazeen petticoat. She laid herself on the table, gave a rapid look at her husband who was sitting in a comer of the theatre with his faithful dog 'Rab' and shut her eyes. The operation was slow. The surgeon did his work. The pale face showed its pain, but was still and silent. When the operation was over, she was dressed and stepped gently down from the table. Then, turning to the surgeon and the students, she curtsied, and in a clear low voice, begged their pardon if she had behaved ill. Within a week she had died from septicaemia.

2: 1847 to 1914

The news that ether had been used successfully in surgical operations in Boston, Massachusetts reached Britain in December 1846 and soon ether was widely used in hospitals throughout the country. Dr Munro wrote in the annual report of the DRI:

"*After taking charge of the surgical wards on the 1st June 1847, I resolved to take every opportunity of testing the efficacy of the anaesthetic properties of ether and chloroform. At that time ether only was in use, and the first operation we had to perform was lithotomy, and its success in this case was most perfect and pleasing and without the smallest bad consequences. I used it afterwards in several other operations and always with similar results. It soon, however, became superseded by chloroform, which is less irritating and more pleasant to inhale, is more certain and persistent in its effects and, from my own experience, equally free from any bad consequences. The honour of discovering the application of this wonderful agent to such a purpose belongs to Professor Simpson of the University if Edinburgh, and its blessings and benefits are now so universally acknowledged that it is needless for me to say more than that in all the operations performed in the Infirmary, except from special cause, chloroform is used, and in every instance complete insensibility to pain has been the result and without any bad effect having been observed to follow its use.*"

The number of operations performed in Dundee did not rise dramatically. This was partly due to the high incidence of infectious disease in the town. In1847/8 provision had to be made for the reception of nearly 4,000 patients suffering from typhus fever, smallpox and other contagious diseases. To accommodate this influx of patients the Directors gave up their Board Room, the Medical Staff their operating theatre and two adjacent buildings in King Street had to be acquired to act as auxiliary hospitals. Another reason was the high post-operative infection rate until Lister introduced his antiseptic regimen in the late 1860's.

As the population of Dundee increased the workload of the Infirmary increased in parallel, and it became clear that the old Infirmary in King Street was utterly inadequate. The foundation stone for the new hospital, built in Barrack Road, close to Dudhope Castle, was laid in 1852 and it opened on February 7th, 1855. This building could accommodate 280 patients, cost £14,500 and incorporated all the modern improvements of the time in terms of drainage, ventilation and internal arrangement. However, the new Infirmary was lacking in one respect: no provision had been made for an operating theatre! This is all the more curious considering that the old Infirmary in King Street had one:
"*Special care had been bestowed on the construction of the operating theatre, with its roof lights and circular doors finished with architraves (one of the features which earned the architect his parting gift) and it was soon found necessary to add a rail encompassing the table at a proper distance for protecting the operator from being pressed upon too closely by the gentlemen who attended to see the operations performed.*"

By a singular oversight, no provision whatsoever had been made for surgical operations in the new Infirmary. For many years (1855 to 1895) the operations were performed in the wards or adjoining corridors: "a practice which was not only inconvenient but highly objectionable". Later, the surgeons partitioned off a circular space at the end of the main corridor, but complaints by the medical staff led to an operating theatre eventually being built in 1895, paid for by one of the Hospitals Vice-Presidents, John Sharp. The design and construction of the 'Sharp' Theatre (later known as Main Theatre) followed visits by a deputation to several hospitals where operating theatres had been recently erected, including the Royal Southern Hospital in Liverpool and the Western Infirmary in Glasgow. The Directors, in token of their appreciation to John Sharp, erected a memorial tablet in the theatre bearing a suitable inscription. Operations of every nature and degree of gravity were now undertaken in the Sharp Theatre, and with every confidence that the aseptic system of surgery could be carried out in all its details with a perfect smoothness and success.

The number of operations carried out each year in the DRI began to increase in about 1870 (? due to antiseptic methods) and passed the 100 per year mark for the first time in 1871. By the end of the century the numbers exceeded 1,000 per year. Although chloroform remained the most popular agent, ether was making a come-back and mixtures of ether, chloroform and alcohol were used as well as ethyl chloride. Local anaesthesia dates from 1884, using cocaine initially, and later novocaine and stovaine. Spinal anaesthesia and local blocks, such as Bier's block, were used in the early years of the 20th century. In maternity, chloroform was the sole agent.

During this period (1847 to 1914) all anaesthetics were administered by surgeons and the control of, and responsibility for, the anaesthetic remained in the hands of the surgeon who was operating. Occasional deaths under chloroform were reported. In the Annual Report of the DRI for 1901-2 the Directors felt that the proper administration of anaesthetics in a large hospital was of great importance. After conferring with the Medical Staff they resolved to appoint a third Assistant Surgeon, part of whose duties should be, not only in certain cases to administer anaesthetics, but also to give instruction in their administration. To this office Mr. James Gray, MBCM FRCSEd, was appointed, but he died during the year 1906-7 and Mr. L. Turton-Price, MBChB FRCSEd, was appointed to fill the vacancy.

Having considered a letter from Dr. Sydney Campbell (15th July 1909) the House Committee agreed to recommend that the then present arrangements for anaesthetics be altered to a slight extent, chiefly that all Assistant Surgeons share in the work of instructing students. This decision was reached in view of the whole subject having to be revised soon after October 1910 when the Draft Ordinances of the University Commissioners regarding the obligation of all students needing to obtain a certificate of having received instruction in the administration of anaesthetics would come into force. The recommendations of the Committee were as follows:

1. With reference to Dr Campbell: a) that he give special attention to the supervision of the Medical Assistants (House Surgeons) as anaesthetists; and b) that when free he assist Dr Kynoch and help with the instruction of students in the administration of anaesthetics; and

2. With regard to the other Assistant Surgeons: a) that they should assist in the instruction of students in the administration of anaesthetics; b) that all of them take duty in the Outpatient Room, two at a time on alternative days for a fixed period; c) that they assist the Surgeons and Gynaecologists, one assisting Dr. MacEwan and one Dr. Greig (in the Main Building) and the third Drs. Don, Greig and Buist (in the Cancer Pavilion) in rotation; and d) that the Outpatient Work be considered the Infirmary work of the Assistant Surgeon on duty in the Outpatient Room.

On 21st November, 1912 St. Andrews University Court considered the appointment of an Instructor of Anaesthetics, and appointed a Deputation to confer with the Directors of DRI as to the conditions of the appointment. On 12th December 1912 the Deputation from St. Andrews University attended the Board and were heard fully with reference to the appointment of an expert Anaesthetist and Instructor in Anaesthesia. The salary was to be £200 a year, half paid by DRI and half by the University.

On 3rd April, 1913 two applications were received, and on the 10th the Joint Committee unanimously appointed Mr H.V. Welch MB.BS (London) to the post. On the 8th May, 1913 the Secretary read a letter from Mr Welch dated 30th April, 1913 stating that he wished to resign his appointment owing to unforeseen circumstances. On 25th September, 1913 the Joint Committee agreed to advertise again. Four applications were received and were considered on the 23rd October, 1913. They recommended Dr Arthur Mills to the post, he to enter into duty on 1st January, 1914 and in the interval to spend time in London acquiring knowledge of the most recent and special methods employed in the administration of Anaesthetics. On 29th December, 1913 the 'Wants Book' for the Infirmary was submitted and anaesthetic apparatus to the value to £30 was requested and sanctioned.

From the *British Medical Journal*, 3rd July, 1909
"The Anaesthetics Bill introduced last week by Mr. Cooper was issued on Tuesday last and is to take the place of the bill recently withdrawn. This new bill requires a medical practitioner or a dentist applying for registration on or after January 1st, 1912 to submit evidence of having received practical instruction in the administration of anaesthetics, and prohibits any person not a registered medical practitioner or a registered dentist administering an anaesthetic except under certain conditions. It also prohibits any certificate of death being given in the case of any person dying under an anaesthetic. The first clause requires every applicant for registration under the Medical and Dental Acts to produce evidence of instruction in the administration of anaesthetics. The second clause imposes penalties of £10 for a first offence and £20 for a subsequent offence on any person not a registered medical practitioner or a registered dentist who administers any anaesthetic, by inhalation or otherwise, or any drug or mixture of drugs for the purpose of producing unconsciousness during any operation or procedure during childbirth. It makes an exception for an assistant in a case of urgency, when acting under the direction of a registered practitioner or dentist."

3: Dr Arthur Mills (1875 to 1959)

Arthur Mills was born on the 24th November 1875, the son of James Smith Mills (Messenger at Arms) and Rebecca Mills (nee Donald), at 16 Patons Lane, Dundee. On leaving school he followed his father's wishes and entered the banking profession, working in Portugal and Brazil, but at the age of 28 he suddenly decided that he wanted to become a doctor. He saved up enough money to pay his way through university and graduated MBChB with Distinction from St Andrews University in 1909. In that year also he married Elizabeth Barclay, who had also graduated MB ChB with Distinction (in 1908),

and became a general practitioner in Ladybank and Kingskettle in Fife, obtaining his MD (St Andrews) in 1913. Like most GPs at that time he would anaesthetize those of his patients who required surgery, in their homes or the local cottage hospital so when DRI and the University advertised the post of Visiting Anaesthetist in 1913 he applied and was appointed at a salary of £200 a year. He took up the post on 1st January 1914, moved to Dundee and was one of the Founder Members of the Scottish Society of Anaesthetists at its inaugural meeting on February 20th, 1914 at the Balmoral Hotel in Edinburgh. He became President of the Society, the first National Society of Anaesthetists in the world, in 1925 and again in 1934. The Society of Anaesthetists of London had been formed in 1893 and became incorporated into the Royal Society of Medicine in 1908.

Dr Mills remained Head of the Department of Anaesthetics for 30 years, resigning in 1944 and being appointed Consulting Anaesthetist by the Directors of the Infirmary as a mark of their appreciation. He had "rendered invaluable service by organising the Department to a high standard and by introducing new measures designed for greater safety". As Lecturer in Anaesthetics to the University of St Andrews, Dr Mills taught a whole generation of medical students the principles of safe anaesthesia. He was against the teaching of chloroform to students, considering it more important to teach them open ether well, and to impress on them the added dangers of chloroform. With regard to intratracheal anaesthesia, he thought it was often unnecessary, and he adapted a Phillips airway for use in head and neck surgery by fitting a connector which linked it to the anaesthetic circuit. He was active in the British and Forfarshire Medical Associations as well as the Scottish Society of Anaesthetists, and published on a number of anaesthetic and non-anaesthetic subjects. During the First World War he was called up, in spite of strong representations by the Directors of the DRI, and served as a Captain in the RAMC from 1916 to 1918.

Arthur Mills passed his MRCP examination in Edinburgh in 1927, and was awarded the DA (England) in 1935 and the FFARCS in 1944. He was thus extremely well qualified academically, but continued to run a busy general practice (along with his wife) in addition to his anaesthetic commitments and was also Visiting Physician to the Royal Victoria Hospital in Dundee and one of the anaesthetists to the Dundee Dental Hospital. He wrote a Manual of Anaesthetics which, unfortunately, was never published because he felt dissatisfied with it. It gives detailed descriptions of the signs of anaesthesia during open ether with valuable practical advice on managing patients during the anaesthetic, all based on sound principles and long experience.

Prior to the National Health Service, visiting anaesthetists were essentially general practitioners who worked in the Voluntary Hospitals on one or two mornings a week. The operating lists would finish at lunchtime and the general practitioner would then leave to attend to his practice, all emergency cases being anaesthetised by the junior house officers. However, the visiting anaesthetists would build up a private practice with the surgeons with whom they regularly worked. Surgery was performed at a surprising number of private nursing homes in those times: including Fernbrae Nursing Home, 329 Perth Road; Fort House Nursing Home, 434 Perth Road; Westbay Nursing Home, 14 Albert Road, Broughty Ferry; Burnbank Nursing Home, 1 Victoria Road, West Ferry; Marbank Private Nursing Home, 6 Paradise Road; Duneaves Private Nursing Home, 7 Claypotts Road, West Ferry; and Dundee Womens Hospital and Nursing Home, Elliot Road.

Compared with their surgical colleagues, anaesthetists had a lower professional status and did not bill their patients directly, but were paid a fee by the surgeon at his discretion, and when it suited him! The fee was usually between £1 and £3 for each case, and rarely as much as £5, a state of affairs which only improved when higher qualifications were introduced for anaesthetists: the Diploma in Anaesthetics in 1935 and the Fellowship in the then Faculty of Anaesthetists of the Royal College of Surgeons in 1953.

Arthur Mills died on 7th January 1959 at his home, 30 Shaftsbury Place, Dundee at the age of 83.

4: Dr John Duke Stewart (1895 to 1946)

Apart from Mills, the outstanding anaesthetist of the 1920s, 30s and 40s was Dr Stewart, who was appointed visiting anaesthetist to DRI in 1923 and came from a very distinguished family. His brother, James, was Professor of New Testament Language, Literature and Theology in the University of Edinburgh, Chaplain to the Queen in Scotland, Moderator of the General Assembly of the Church of Scotland (1963) and author of many books; and their cousin was Sir Stewart Duke-Elder GCVO, an internationally renowned ophthalmologist.
Having graduated MA (St Andrews) in 1915 and MB ChB (St Andrews) in 1921, he was Senior House Surgeon in Perth Royal Infirmary (1921-22) before entering general practice in Dundee. His interest in, and commitment to, anaesthesia increased as the years went by and eventually he gave up his practice to devote his whole time to anaesthesia, working in Main Theatre with Mr Frank Brown and, during the war, with Mr Stanley Soutar. He also worked with Mr Robert Mathers in ENT, and in the Dundee Dental Hospital and Arbroath Infirmary.

Stewart was regarded as a superb anaesthetist. He introduced cyclopropane to Dundee, used thiopentone for Caesarian sections and constructed a little tent-like structure at the top of the table for difficult and unco-operative children. He used a towel, sprayed with ethyl chloride and placed over the chest and round the back of the neck, which he gradually pulled up over the child's mouth and nose. He is remembered as suave, with dark hair, a moustache and an affected anglified accent. Latterly he had an extensive private practice, being friendly with the senior honorary physician, Dr JM Morgan, and the senior surgeon, Mr FR Brown, whom he golfed with each week at Panmure Golf Club.

Dr Stewart was awarded the DA (England} in 1935 and became President of the Scottish Society of Anaesthetists in 1938, his presidential address being entitled "Pre-medication: physiological and other considerations". He was also a member of the Forfarshire Medical Association, a Fellow of the International Anaesthetic Research Society, the International College of Anaesthetists and the Association of Anaesthetists of Great Britain and Ireland. When Dr Mills retired in 1944, Dr Stewart became senior anaesthetist to DRI and Instructor in Anaesthesia in the University of St Andrews, but tragically died from acute gastro-enteritis due to food poisoning on 7th June 1946 at the age of 51.

5: Dr William Macdonald Shearer (1907 to 1976)

Dr Shearer was born the son of a Baptist Minister in Galashiels on the 26th February 1907 and entered medicine comparatively late in life. He trained first as a pharmacist, starting to work in Boots the Chemists at the age of 14 in 1921 and acquiring the MPS in 1928, but starting medicine in 1932 at St Andrews University (BSc 1935, MBChB 1938). He was a GP in Troon and Ashton under Lyme before taking a post in anaesthetics in Swansea General Hospital where he met and married his wife, Gertrude Beatrice Jeffries (Betty), in September 1941. One month later he was called up into the RAMC, his postings including several in Britain (Woolwich, Tunbridge Wells, Hitchin, Eltharn and Brighton), overseas (Sierra Leone and Poona, India) and taking part in the D-Day landings. In 1943 he had taken a Course in Anaesthetics, run by Professor Robert Macintosh in Oxford, and he obtained the DA on the 27th January 1944 before being demobbed in November 1945.

On leaving the army, he worked as an anaesthetist in Law Hospital for a year before applying for, and being appointed to, the first whole-time anaesthesia post in DRI. According to the Court Minutes of St Andrews University of 20th November 1946, Shearer was recommended for the office of Lecturer in Anaesthetics and whole-time Medical Officer in the Department of Anaesthetics at a salary of £1000, rising annually to £1100. He assumed a whole-time

consultant post on the inception of the NHS in 1948 with, in the beginning, a Department consisting of one resident anaesthetist plus himself and a few general practitioner anaesthetists. By the time he retired in 1972 the Department had grown to 24. One of his 'hobbies' was to keep records of all the anaesthetics given by individual anaesthetists each year and his totals were always the highest: 1343 in 1947, 1655 in 1948 and 2013 in 1949.

Dr Shearer had an outstanding clarity of intellect and any address or publication was always prepared meticulously. He proceeded MD in 1948, with a thesis on "The use of atropine and narcotic alkaloids in Anaesthesia". Always a Staunch supporter of the Scottish Society of Anaesthetists he attended every annual meeting from the year the Society was resurrected in 1950 until he retired, and was elected President in 1953. The subject of his address was "A Pipe Line Problem", and no-one who saw hispreparations for this paper will forget his expeditions over the roofs and into the lofts of DRI in search of leaks. Along with Dr Norman Rollason of Aberdeen Royal Infirmary, he was co-founder of the North-East of Scotland Society of Anaesthetists in 1960, and was its second President. He joined the Edinburgh and East of Scotland Society of Anaesthetists and encouraged his colleagues and junior staff to do likewise, so every month one or two car loads of Dundee anaesthetists would make the journey to Edinburgh after work. This was before the Tay and Forth Road Bridges were built (the Forth was crossed at Kincardine Bridge or by ferry), and before motorways and dual carriageways. When the weather was particularly bad, the Dundee anaesthetists often outnumbered the Edinburgh members, but Dr Shearer ensured a good turnout by putting on call those who chose not to go!

He was an excellent clinical anaesthetist and this was his main interest. He had little time for committees and did not consider that he was really fulfilling his duties unless he was working in the operating theatre, where, until the day of his retirement, he put in a prodigious number of sessions, often working into the small hours. He had been given one small room off the ground floor corridor of the DRI and this was to remain the Department of Anaesthetics until Ninewells Hospital opened in 1974. Dr Shearer was not provided with a Secretary and had no wish to have one, carrying a portable typewriter with him where ever he went and using all his spare moments to arrange the rotas and deal with correspondence. He took pride in providing an anaesthetic service with the minimum number of staff, this often involving diverting a registrar or senior registrar who had a short list in Arbroath or Liff to do an extra case or even list in DRI or Maryfield.

The techniques which Dr Shearer introduced in Dundee were those he had learned in Oxford from Professor Macintosh. Abdominal surgery was carried

out under high spinal anaesthesia covered by thiopentone and cyclopropane, or by nitrous oxide, oxygen, ether and blind nasal intubation. When the Professor of Surgery, Donald Douglas, began to perform closed heart surgery under hypothermia, Dr Shearer provided the required anaesthesia, immersing the children in a cold water bath.

In 1952 Dr Shearer, accompanied by Dr William Jamieson, the Physician Superintendent of Kings Cross Hospital, visited Copenhagen where a severe outbreak of poliomyelitis had struck. The Danes had developed a new method of treating patients with involvement of the muscles of respiration and swallowing by intubating the trachea and ventilating the lungs, using either bag-squeezing or a mechanical respirator. A report was sent to the Regional Hospital Board, as a result of which two Blease Respirators were purchased to be available for cases of respiratory polio, but were in fact used in the theatres of DRI.

Dr Shearer gave a course of lectures in anaesthesia to all the medical, dental and nursing students. In addition, the medical students had to administer at least 12 anaesthetics under supervision and sit an examination in the subject with a prize awarded each year. For many years Dr Shearer enlivened his lectures with a demonstration of anaesthetic explosions, using plastic bags filled with mixtures of oxygen and cyclopropane or ether, and detonating them by static electricity or spark plugs. These invariably caused alarm, even when the audience was prepared for the loud bang!

Dr Shearer was a man of absolute integrity and, though modest and self-effacing, would stand firmly for any principle in which he believed. There was also a lighter side to his character - a wonderful sense of humour and an ability to remain cheerful under the most trying circumstances. He established friendly and helpful relations with his surgical colleagues and built up a happy Department in which his adherence to the traditional values of medicine was an example to all who worked with him. He died suddenly at his home on 15th January 1976.

6: The Visiting Anaesthetists

William Edmund Alexander Buchanan 1920-1926: MBChB (Glasgow) 1915; General Practitioner 79Albert Street, Dundee; visiting anaesthetist to DRI and the Dental Hospital; Lecturer at University College, Dundee; one time Medical Officer to Dundee East Poorhouse Hospital. In the Second World War he rose to Lt. Colonel RAMC and was awarded the MBE and TD.

JM Taylor 1920-1921

John Macdonald Clark 1921-1945: MB ChB (St Andrews) 1919; DA (England) 1935; General Practitioner, Oakdene, 229 Strathmartine Road, Dundee; educated at Harris Academy and St Andrews University. After serving as House Surgeon and House Physician in the DRI he gave long service as visiting anaesthetist, having a long association with Professor John Anderson. He was a demonstrator in anaesthetics to the University of St Andrews and the Dental Hospital, and was a popular physician who carried on the best traditions of the older type of family doctor. He died in January 1951.

James M Stalker 1920-1923: He was the son of Professor AM Stalker, Professor of Medicine, and held the post of visiting anaesthetist to DRI from 1920 to 1923, prior to becoming Assistant Physician (1923-1936) and later Visiting Physician (1936-1942).

John Duke Stewart 1923-1946: See earlier section.

Alexander Hepburne Macklin 1926-1930: MB ChB (Victoria University, Manchester) 1912; MD 1920; OBE; MC; Polar Medal; Order of St Stanislaw. In a life full of adventure Macklin was, for a brief period a Visiting Anaesthetist to DRI. In 1914 he had sailed on the Endurance with Sir Ernest Shackleton as Surgeon to the Imperial Trans-Antarctic Expedition, and also accompanied Shackleton in the later expedition to Antarctica during which Shackleton died. Macklin settled in Dundee in general practice in 1925 and during the four years he spent as a Visiting Anaesthetist he wrote several papers on the use of nitrous oxide and oxygen as the sole anaesthetic for surgery, his series of 553 cases including 61 upper and 175 lower abdominal operations. The first patient in this series was a woman of 72 years, admitted with acute intestinal obstruction due to carcinoma of the descending colon. The operation lasted 60 minutes and was a complete success. In 1930, he went on to become a visiting Physician and Cardiologist in DRI. He served in both world wars with distinction, being promoted to Colonel and ADMS to the East Africa Command. In 1947 he moved to be Physician in charge of Student Health at Aberdeen University where he continued to work right up until his death in 1967 at the age of 77.

J Ferguson 1929-1946

Margaret C Muir 1930-1964: MB ChB (St Andrews) 1922; educated at Harris Academy, where her father taught English for 22 years, and University College, Dundee; first joined the DRI staff in 1923, and worked in London for a year before setting up private practice at 231 Perth Road, Dundee. Appointed

Visiting Anaesthetist to DRI in 1930, she gave up her general practice in 1956, but continued to work as a hospital anaesthetist until her retirement in February 1964. She was President of the Scottish Society of Anaesthetists (1962-63) and also of the Forfarshire Medical Association. An excellent chairperson and speaker, especially on her travels, she was an enthusiastic soroptomist, leaving more than half a million pounds to build a complex, known as 'Muirlands', of 15 flats in Seafield Lane, Dundee for retired single ladies.

J Emmerson 1932-1960: MBChB (Glasgow) 1929; a native of Paisley, working there initially as House Physician and SHO in Surgery at the Royal Alexandra Infirmary before settling into general practice in Dundee; also worked in Dundee Dental and Maryfield Hospitals; served in the RAMC in East Africa during WW2. He was very musical and had a collection of violins from 1570-1764, including a Stradivarius. He died on January 1st 1960 from a mid-brain haemorrhage at the age of 54.

Margaret Elizabeth Soutar 1944-????: MB ChB (St Andrews) 1940; appointed visiting anaesthetist after acquiring considerable experience of anaesthesia as resident house officer in Dundee, Shrewsbury and Oswestry; became a consultant after the inception of the NHS and worked largely with her husband, Stanley, one of Dundee's leading surgeons.

Janet Leng 1945-53: MB ChB (St Andrews) 1924; MD 1950; granddaughter of Sir John Leng, proprietor and editor of the Dundee Advertiser and MP for Dundee. Initially she worked as an osteopath in the USA, and then Dundee, before developing an interest in anaesthesia during active service during WW2. She attended one of the Oxford courses run by Macintosh and Mushin before obtaining the DA in 1947. She lived with her parents and drove a Rolls-Royce while working at DRI, but retired after her father died in 1953.

JG Ferguson 1946-????

7: The Introduction of the NHS in 1948

Dr Shearer was appointed Consultant in Charge of the Department and gradually the part-time general practitioners were replaced by full-time Consultants, Senior Registrars and Registrars. Some of the GPs (including Drs Duke Stewart, John M Clark, Margaret Muir and WEA Buchanan) abandoned their practices and devoted their lives wholly to anaesthesia.

Next to be appointed a consultant (1956) was Dr Ian Lawson who arrived from Liverpool as a Senior Registrar in 1951 and introduced paralysing doses of

muscle relaxants, with artificial ventilation by bag squeezing, having completed the Liverpool Course and benefited from the teaching of Cecil Gray, John Dundee, Jackson Rees and Edmund Riding.

Three further Consultants were appointed during the period under review.
David Dangerfield (MRCS LRCP DA FFARCS) was born in 1915 at St Albans and left school early to work in the family business before deciding on medicine. He graduated from University College London in 1940 and worked in Swindon before joining the RAF, being stationed in St Asaph. He moved to Stirling in 1948, and then on to Dundee as a Senior Registrar, before being appointed Consultant Anaesthetist in Salford Royal Infirmary in 1951, where he was involved in pioneering cardiac surgery. Being troubled with his chest, which he attributed to the damp and pollution of Manchester, he returned to Dundee in 1960 where he worked until his retirement. He was a talented amateur pianist with a passion for chamber music and a wide range of other interests.
E Harvey Franks (MB BS MRCS LRCP DA FFARCS) was born in 1926, one of three sons of Polish immigrant parents. He was brought up in London, studied medicine at St Mary's Hospital and was still a houseman when he found his niche in anaesthesia. Conscripted into the RAF for two years he used the time to increase his expertise in anaesthesia, as well as taking up marquetry for which he won many prizes. He passed his FFARCS examination in 1954 and held a succession of Registrar posts in the South of England and a Senior Registrar post in Professor Mushin's department in the Welsh National School of Medicine in Cardiff. He had a range of clinical research interests and became deeply interested in 3-D photographic techniques, receiving the Associateship of the UK Royal Photographic Society for his work on this. He died suddenly from a heart attack in 1973, his relatively short life being intensely active, varied and productive.
Karl Walter Baruch (MB ChB DA FFARCS) was born in 1919 in Hamburg, Germany and moved to Britain with his family during the 1930's. He was brought up in Liverpool and studied medicine at the university there overcoming the trauma of being rejected by his country of birth because of his Jewish ancestry, a massive subarachnoid haemorrhage at the age of 17, and being interned as an 'enemy alien' at 21, only to return voluntarily to Britain from Canada a year later. After completing his studies, Dr Baruch went into general practice in Liverpool before starting work in anaesthetics at St Luke's Hospital in Bradford and eventually being appointed Consultant Anaesthetist at Stracathro Hospital near Brechin in 1963. He later worked for a year in Stobhill Hospital, Glasgow before returning to the east in 1966, but in 1976 he left to set up an anaesthetics department in a hospital in the Netherlands (Ede and Oldenzaal).

COCAINE TO NOVOCAINE – A CHEMICAL JOURNEY

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The discovery of local anaesthesia

In the 1860s a Corsican doctor, Angelo Mariana marketed a tonic made by soaking the leaves of the coca plant in Bordeaux wine. This concoction (Vin Mariana) was widely endorsed by celebrities of the day including the actress, Sarah Bernhardt and scientist Thomas Edison. Allegedly it was prescribed by some 8,000 doctors, including the young Sigmund Freud, then a Viennese neurologist, who later acquired lasting fame as "the father of psychoanalysis". He became fascinated by the properties of pure cocaine and perceived that its stimulant action might render it effective against the torpor symptomatic of morphine addiction. He began a series of experiments on the drug and was helped by a friend, Carl Koller, who also was a recently qualified Viennese medical graduate.[1]

Earlier Koller had been trying to solve a vexing problem in eye-surgery. If a patient was lightly anaesthetised, usually with ether or chloroform, the eye would move rapidly on any stimulation, rendering intervention impossible. However, if the patient was more deeply anaesthetized, the coughing and retching accompanying recovery would raise intra-ocular pressure sufficiently to rupture the surgeon's fine stitches. Koller wondered if some form of topical application might anaesthetise the eye sufficiently to permit surgery and had tried solutions of chloral hydrate and morphine sulphate, but without success. A little later, stimulated by Freud's work on cocaine, he found that instilling a few drops of a solution of cocaine hydrochloride in a frog's eye suggested sufficient anaesthesia to warrant human experimentation: *"...We trickled the solution under each other's lifted eyelids....took pins and with the head, tried to touch the cornea. Almost simultaneously we were able to shout jubilantly 'I can't feel a thing!"* [2] On 11 September 1884 Koller used cocaine to anaesthetise a patient's eye prior to surgery for glaucoma and reported his success at the German Ophthalmalogical Congress at Heidelberg just five days later. Within 14 months some 60 papers had been published on the anaesthetic action of cocaine, including William Stewart Halstead's discovery of conduction anaesthesia, more popularly known as "nerve blocks".[3] In 1885 Leonard Corning reported that a 2-3% solution injected between the posterior spinous

processes effectively anaesthetised the lower limbs.[4] Spinal anaesthesia was exploited for surgical purposes by August Bier from 1898 and, two years later, in obstetrics.[5]

Drawbacks associated with the use of cocaine

But all this was not without cost. The effects of cocaine were unpredictable, and some patients died as a consequence of its use. While as little as 18mg could be lethal for some patients, others could tolerate as much as 1.5g. In the early years of its use, dentists favoured infiltration anaesthesia, rather than blocking the relevant dental nerve. Painless extraction of a single tooth required infiltration of about 10-15mg of cocaine into the gum, an amount uncomfortably close to the minimum lethal dose. Jesús Calatayud provides us with some quantitative information, but it is insufficient to calculate precise risks: "*Between 1884 and 1891, 200 cases of systemic intoxication were reported, and 13 deaths attributed to the drug were recorded, quenching enthusiasm for it and prompting physicians to turn to gases such as nitrous oxide and ether, particularly for minor surgery such as that involved in dentistry*". [6] Henry Noble, a distinguished historian of dentistry, confirms this view. In his biography of Adam Cubie (who studied at the Glasgow Dental Hospital 1899-1903) he writes: "*Most dental operations at this time were carried out without any local anaesthetic mainly because of the unpredictable and dangerous effects of cocaine.....The general anaesthetics then in use at the Hospital were nitrous oxide, nitrous oxide and ether in sequence and ethyl chloride*".[7]

Apart from its unpredictable toxicity, cocaine had other drawbacks:[8]

- Solutions had to be freshly prepared; they would become mouldy on standing for only a day or two
- Cocaine solutions decomposed on boiling (though there is some doubt as to the extent), so it was not possible to sterilise cocaine injections.
- A ready supply of pure cocaine in surgeries led to some doctors and anaesthetists becoming addicted to the drug.

Some authors saw the expense of the agent as yet another drawback, [9] but in truth this was not a significant factor. In 1897 cocaine was available in the USA at $2 per ounce, [10] which equates to a cost of 1.5p for a dental injection at today's prices.

The second half of the 19th century had seen an enormous development in organic chemistry, brought about by the use of structural representations for substances previously only known by properties and molecular formulae. In 1856 William Henry Perkin synthesised Mauveine, the first of the commercially

successful coal-tar dyestuffs. Within 30 years such colorants had replaced all the dyes of natural origin, with the exception of indigo blue. They were colour-fast and reproducible in their effects, two significant advantages over their natural counterparts. We conjecture that scientists of the late 19th century could have considered that cocaine, a local anaesthetic of natural origin, might be similarly replaced, with advantage, by products generated by the synthetic chemist. At the time of Koller's discovery, cocaine was known to have a molecular formula of $C_{17}H_{21}NO_4$, although its molecular structure was not clarified until 1898. In the absence of structural information, chemists could follow one of two initial strategies. Firstly, there was the "hit and miss" approach of injecting whatever chemicals the researcher had to hand and see if they had a cocaine-like effect. Secondly, although the precise structure of cocaine was still to be established, it was possible to modify, chemically, the basic molecule that nature provided. The unknown "core" of the material would be retained, but groups attached to it could be manipulated chemically. This approach led to the synthesis of Tropacocaine (1891), even though the material was available in small amounts in coca leaves. It enjoyed brief popularity as a spinal anaesthetic in the last years of the 19th century.

Foremost of the "hit and miss" school was Oskar Liebreich, a Berlin pharmacologist who was already famous for introducing the hypnotic chloral hydrate to medical practice. He injected, subcutaneously, unspecified amounts of various chemicals into rabbits and guinea pigs and then noted the animals' responses to pin-pricks (See Table 1).[11]

Table 1: Some of Oskar Liebreich's "local anaesthetics"

Perceived to be a local anaesthetic	Perceived not to be a local anaesthetic
Ammonium chloride, bromide and sulphate	Ammonium carbonate and nitrate
Sodium bromide	Potassium bromide
Lead acetate	Zinc salts, generally
Hydroquinone	Copper sulphate
Antipyrin (a predecessor of aspirin)	Ether
Resorcinol	Ethanol
Dilute serpent venom	Glycerol

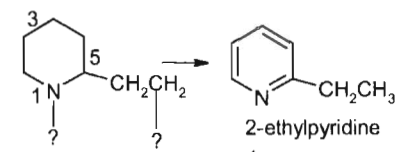
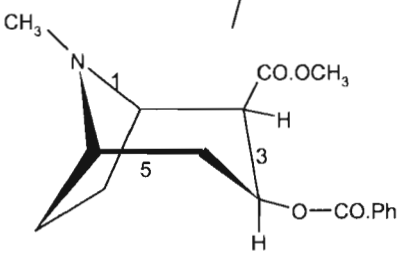
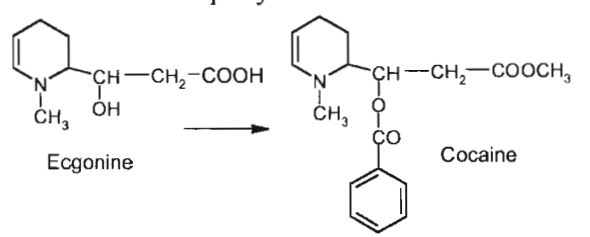
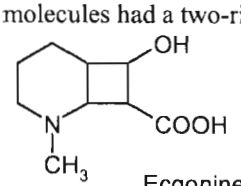
These experiments were cruel and the results misleading. Most of the substances, but especially those in the first column, were profound irritants and would have caused the animals much distress - so much so that they might well fail to register the additional pain from the pin-pricks and thus be erroneously included in his column of local anaesthetics.[12] Liebreich was aware that some of his injections might cause pain, but appears to have given little regard to the fact.

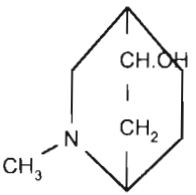
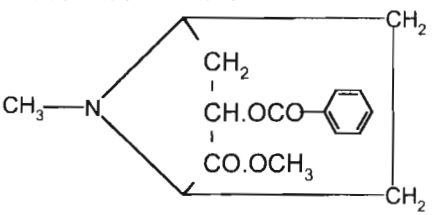
Insights into the structure of cocaine

Clearly such a haphazard search for alternatives to cocaine would be tedious and probably fruitless with only a dubious chance of success. However a disciplined search based on existing knowledge of cocaine's structure might yield synthetic substances with useful local anaesthetic properties. The table below lists some landmarks in solving the structure of cocaine.[13]

Table 2: Landmarks in the structural elucidation of cocaine

Landmark	**Date; Discoverer**
Cocaine isolated and a molecular formula obtained, $C_{16}H_{20}NO_4$	1861; A Niemann
Formula corrected to today's version, $C_{17}H_{21}NO_4$	1865; W. Lossen
Noted that cocaine could be hydrolysed to give ecgonine (then of unknown structure), benzoic acid and methanol. Points to presence of –OH and –COOH attached to core structure. Structural commonality was established among cocaine, tropine, tropane and ecgonine. Although all four structures were unknown, a structural insight into one could give insight into the other three	1885; W. Lossen

Tropane yields 2-ethylpyridine when heated with zinc dust. Indicates a piperidine-like group within the core structure, as was later found to be the case.  2-ethylpyridine  Cocaine, in 3-d [Ph = phenyl (benzene) ring]	
Nitrogen discovered to be tertiary, that is, connected to three hydrocarbon groups	1888; A Einhorn
Incorrect structure for ecgonine proposed which in turn could relate to an equally incorrect structure for cocaine:  	1889, A. Einhorn
Results could be better explained if the cores of the molecules had a two-ring structure:  	1891, C. Liebermann

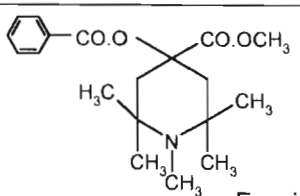
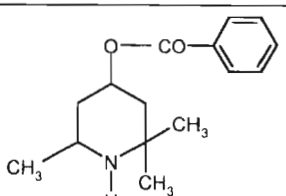
Four membered ring in above structure thought to be too strained, so a less strained two-ring core for tropine was proposed:  	1891; G. Merling
Chemical evidence was obtained for the presence of $-CH_2-CH(OH)-CH_2-$ within the molecule, together with a seven-membered ring containing only carbon atoms. The above structure was recast and the two ester groupings attached to give today's structure for cocaine, drawn here in its two-dimensional form:  	1898; R. Willstätter

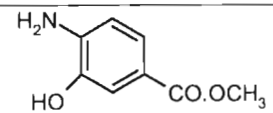
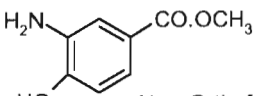
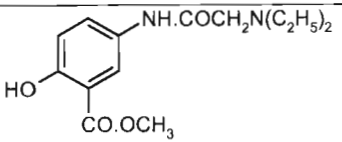
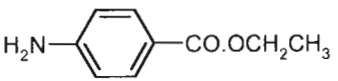
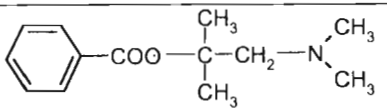
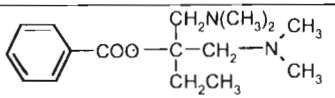
In synthesising candidates for possible local anaesthetic action, chemists looked for molecules that contained some of cocaine's structural features:

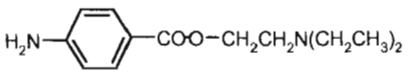
- A nitrogen atom connected to three hydrocarbon groups, one of which might profitably be a methyl.
- Ester attachments of the type –OCO-benzene ring, and $-CO.OCH_3$
- Incorporation of the nitrogen atom within a six membered (piperidine-type) ring
- Constructing rings consisting solely of carbon atoms, with appropriate attachments.

Putting these ideas into practice yielded several scores of molecules with local anaesthetic action. Table 3 lists some of those that entered medical practice:[8]

Table 3 Synthetic local anaesthetics, 1897 – 1904

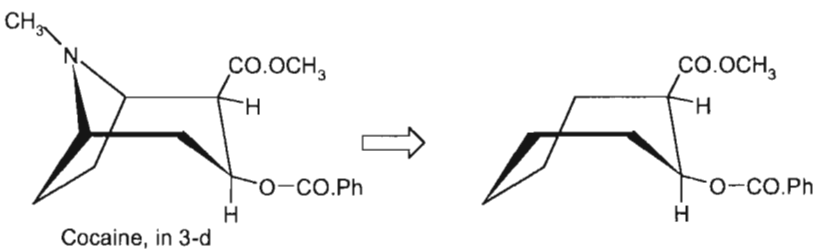
Local anaesthetic	Comments
 α-Eucaine	This is based on the piperidine fragment of cocaine. Published in 1896, it predated the *full* structural knowledge of the alkaloid. Less toxic, stable at 100°C to thus permitting sterilisation using boiling water or steam. Non-addictive. But it was an irritant, leading to soreness at the injection site
 β-Eucaine	Again, this is obviously based on the piperidine ring system. As the lactate salt, it caused very little post-injection pain. Synthesised around the time of α-eucaine it became a very popular alternative to cocaine, 1900-1910

 Orthoform  New Orthoform	Reported by Alfred Einhorn in 1896,[14] who chose to work on six, rather than seven-membered carbocyclic rings (see text). Both species were too insoluble for injections, but were used as anaesthetic dusting powders on ulcers and wounds
 Nirvanine	Another of Einhorn's molecules (1898). It is structurally related to the orthoforms, but the presence of $-N(CH_2CH_3)_2$, when combined as a hydrochloride salt, confers water-solubility and hence the possibility of injection. Nevertheless, in terms of lack of irritation, it could not compete with β-eucaine
 Benzocaine	Synthesised by Eduard Risert in 1902. Initially was reported to be free from toxic effects. Too insoluble to be used in injections but was (and still is) used topically: sunburn treatment, teething gels and in the manufacture of some condoms
 Stovaine	Synthesised by Ernest Fourneau in 1904. Widely used for spinal anaesthesia at least until the early 1950s
 Alypin(e)	First reported in 1904 and used medically in 1905. Its toxicity was comparable to that of cocaine. Nevertheless it was used in the early 20th century, mainly for ophthalmic surgery

 Novocaine (Procaine or Scurocaine)	Synthesised by Einhorn in 1904 [15] and first reported, medically, in 1905.[16] Essentially it possesses the main structural features of benzocaine, but with the nirvanine diethylamino solubilising group.

Enter Novocaine

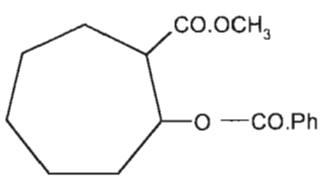
The connection between the molecular structure of cocaine and that of Novocaine could, it must be admitted, be stronger. The three-dimensional figure of cocaine, below, is dissected into its carbocyclic ring system:



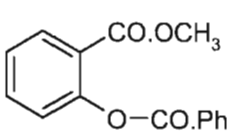
Cocaine, in 3-d

[Ph = phenyl (benzene) ring]

Flattened out as



The ring is seven membered, and is aliphatic (i.e. free from double carbon-carbon bonds). Yet the Novocaine ring system is six-membered and, with its alternating double/single bond arrangement, is classified as aromatic. Alfred Einhorn explains his decision to focus his experimental work on benzene, rather than cycloheptane, derivatives on the grounds that the former are the technically more accessible.[9] Indeed, some half a century on, a reasonably comprehensive undergraduate textbook on organic chemistry devotes less than a page to cycloheptane chemistry compared to a massive 197 pages to the chemistry of benzene and its derivatives.[17] Thus Einhorn's starting molecule for his investigations was an ortho-substituted aromatic di-ester:



It became apparent early on in his investigations that attaching the benzoyl group (-CO.Ph) to the lower oxygen atom conferred no particular anaesthetic advantage and most of his molecules, incorporating a phenolic function left it unsubstituted as-OH (as in the case of his orthoforms).

Novocaine revolutionised local anaesthetic practice. It was significantly less toxic than cocaine, and had an intravenous LD_{50} (dog) of 38mg/kg. True, some patients and practitioners developed an allergy to it and showed asthmatic or eczema-like symptoms,[18] but sudden collapse in the dental chair due to a local anaesthetic injection became a thing of the past. Its use, especially when combined with a small amount of adrenaline as a vasoconstrictor, meant that dentists could numb areas of the jaw for up to 30 minutes at a time. It could be used for pain-free extractions, but its most important role was to facilitate conservative dental surgery. Novocaine, combined with the increasing availability of electrically operated drills (first invented in 1875, but not used to any great extent until the first decade of the 20th century) transformed dentistry from a tooth-pulling trade into a restorative profession.

And it all started with Sigmund Freud's collaboration with friend Carl Koller, and with Alfred Einhorn's epoch-making discovery of the synthetic congener to cocaine, Novocaine.[19]

Acknowledgements

We thank Professor J. A. W. Wildsmith and Drs A. Padfield and K. Pooley for helpful comments. The history of other local anaesthetics (not discussed in this paper) is available in Walter Sneader's excellent text.[20]

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THREE ANAESTHETIC REGISTERS FROM KING'S

Dr EN Armitage, West Sussex

This talk begins with a health warning: never go near an old-style ward sister when she is spring-cleaning her cupboards. I accidentally did this in the late 1960s when, as a senior registrar at King's College Hospital, I was passing the end of Fergusson ward. There was a commotion going on from behind the stationery cupboard doors when the sister emerged, saw me, said "Dr. Armitage, you like funny old things – catch these" and threw three books at me in quick succession. I caught the first two, then ran out of hands, and the third landed on the ground and has a damaged spine.

Fergusson at King's was the **gynae** ward, and the three books turned out to be anaesthetic registers for the years 1923-26; 1926-29 and 1932-35. They record the name and age of the patient, the operation, the anaesthetist and anaesthetic used, and the surgeon. They contain a wealth of information about the evolution of obstetrics, gynaecology and anaesthesia during the years covered, and I have had great difficulty deciding what to extract for special mention, but I've selected some of these trends, some noteworthy individual entries, the lives of the main players, and some of the men who feature as young doctors and dressers who went on to distinguished careers in gynaecology, anaesthesia and other fields and, finally, I've thrown in some of my own memories of these people when I came to know them 30 or 40 years later.

Trends

Surgery

As to the trends, there was a marked increase in surgical activity from 1926. The number of abdominal hysterectomies increased from 42 (1923-26) to 162 (1932-35); and combined operations, such as appendicectomy with hysterectomy, became more common.

There was also a big increase in the use of radium, from 17 (1923-26) to 83 (1926-29) and 157 (1932-35). The radium situation is intriguing. At this time it was in very short supply and, of course, was very expensive. The Radium Institute, an experimental research centre, had been established at Mount Vernon Hospital and a clinical research centre was based at the London, and they both had supplies. The Middlesex had managed to get some from somewhere, but even the National Physical Laboratory, which surely deserved a supply, had virtually none. It wasn't until the early 1930s that the influential

Royal physician Lord Dawson of Penn and the nuclear physicist Lord Rutherford got together and regularised the medical use and distribution of radium, so it would be interesting to know how King's obtained its supply in the 1920s.

We also find an increase in repair operations such as colporrhaphy and suspensions: 26 (1923-26) to 88 (1932-35), and the first glimmerings of social surgery appear - sterilisation, myomectomy and tubal surgery. The figures for obstetrics show an increase in the number of Caesarean sections from 17 between 1923-26 to 117 between 1932-35.

Anaesthetics

It has to be said that the anaesthetics remained largely unchanged over the 13 years and consisted mainly of ether or chloroform, nitrous oxide and, occasionally, ethyl chloride. Only four spinals are recorded. Nembutal, Avertin and Evipan put in an appearance in the later book.

Noteworthy individual entries

These include two cases of ether convulsions and tetany, and two patients, anaesthetised by the same individual, who developed atrial fibrillation within a week of each other. As these are the only times when atrial fibrillation is mentioned, one suspects that something or someone (perhaps a lecturer) had drawn the attention of the anaesthetist to the condition. One of these cases had a stovaine spinal block as well as an ether general anaesthetic. The other received ethyl chloride and ether.

The management of cardiac arrest is described in an obviously sick lady suffering of bilateral pyosalpingo-oophoritis and reads as follows:

> Ether & chloroform; Induction began 2.20pm. Operation 2.35; stopped breathing 3.25; Pituitrin 1cc given; Artif. Resp.; Adren. into heart 5 drachms; pulse stopped 3.30; cardiac massage 3.40; began beating 3.45; resps begun 5.5pm at intervals of 3 mins; patient died in ward at 7.45pm; resps then 8 per min.

It is not clear why this patient received such intensive and prolonged care. It was certainly not the norm. One entry simply states "Pt. died after 30 min", and another, for a patient having a Caesarean section for antepartum haemorrhage, says "Op. 1h. Death 20 mins. later". Yet another entry records what, even in my day as an obstetric house surgeon 30 years later, was a not infrequent occurrence – induction of labour, version of the foetus the next day, followed

three days later by Caesarean section and delivery of a stillborn child for which Dr. F.F. Cartwright gave the anaesthetic.

Nembutal, Avertin, Evipan and the lower segment approach to Caesarean section appear in 1933 and replant of a tube a year later.

My favourite entry records neither the operation, surgeon nor anaesthetist, but states: "Abandoned due to severe cough of patient".

Lives of the main players

The surgical dynasty starts with **Hugh Playfair**, born 1864 in Edinburgh and a dresser to Lord Lister, though never actually his houseman. He retired in 1925 so doesn't appear much in the second two books. He and Cheatle, the breast surgeon of Cheatle forceps fame, used to go on Continental holidays together. Playfair seems to have been a collector, and Cheatle recalls that "while antique hunting in Milan, Playfair unearthed a type of painting he was collecting. Playfair's instinct for attaining his object was so intense that he failed to notice the incidence of a small earthquake, which sent the owner of the shop and me into the street in great alarm. On our return we discovered Playfair still expostulating with the assistant upon the enormity of the sum demanded for the picture. Neither of them had been aware of the earthquake."

William Gilliatt succeeded Playfair in 1925 and did the lion's share of the work over the next ten years. Born in 1884, he qualified from the Middlesex in 1912, won all the prizes and had a good war as a Captain in the R.A.M.C. He then built up a fashionable Wimpole Street practice and, between 1935 and 1942, delivered all three children of Princess Marina, Duchess of Kent, but he is, of course, best known for delivering Prince Charles in 1948, the year in which he was knighted, and Princess Anne. There is, however, an intriguing sign in the third book of the aristocratic circles in which Gilliatt was beginning to move because he operated on a 50 year old Lady Knowles in April 1933 for a panhysterectomy. His society connections were continued to the next generation when his son Roger, a neurologist at Queen's Square, was best man when Anthony Armstrong Jones married Princess Margaret.
Even allowing for obituary hyperbole, Gilliatt does seem to have been a charismatic figure: "His patients were his life and fundamentally it mattered not whether they were from the aristocracy or from the humblest homes. It was as a clinician that he excelled. His diagnostic acumen and sound clinical judgment were the basis of his pre-eminence. No detail in management of his patients in the ward escaped his attention. He expected the highest possible standards from

his assistants and could, if he thought they had been negligent in the care of a patient, chastise them with a biting remark which cut to the quick."

Alex Palmer, born 1887, doesn't appear until the second book (1926-29) and must have been a junior Consultant to Gilliatt. He seems to have been an improviser and innovator, and was one of the first strongly to advocate vaginal hysterectomy and repair for certain cases of prolapse, but his obituarist throws a different light on him:

"When we, his colleagues, think of him it is of course primarily as a gynaecologist. But there are lots of vivid memories of him as a sportsman. There must be many who now, alas, can only watch rugby who will remember clearly the bangs and bruises received from the flying legs or a powerful hand-off when trying to tackle the sturdy figure of Alex Palmer. When he was in full flight for the corner flag he was an extremely difficult man to bring down. Capped for England for several matches in 1908 & 1909, he was a highly successful wing of international class." He was actually a New Zealander, born in Dunedin!

About 12 years ago I called at the Royal College of Obstetricians and Gynaecologists in Regent's Park to get some information about **John Peel**. I had previously combed the obituary columns and found nothing. The College secretaries exchanged knowing smiles and then disclosed that Sir John, as he then was, was still very much alive, and indeed was currently on his honeymoon after marrying his third wife at the age of 91. He lived to be 101 and died in 2005.

He was a Lancastrian, educated at Manchester Grammar School where he scooped the classics prizes, at Oxford where he got first class honours in physiology, and at King's where he qualified in 1930, so he doesn't appear until the third book.

Having assisted Gilliatt at the births of Charles and Anne, he was the natural choice to deliver the Princes Andrew and Edward and, later, Princess Margaret's children Viscount Linley and Sarah Armstrong-Jones.

I was at King's at this time and there was a story going the rounds that on one palace visit, he took with him his senior registrar, commonly known, in those days, as Bodger. So that they could go their separate ways afterwards, they took two cars, Peel's Rolls and Bodger's Mini. Being an egalitarian Northerner, Peel elected to ride with Bodger while his chauffeur went in front alone in the Rolls, but when a set of traffic lights suddenly turned red, the brakes on the Rolls proved more effective than the Mini's and Peel had the unusual experience of being a powerless passenger in the car which ran into the back of his.

The citation for his honorary South African Fellowship mentions his "disarming humility and lack of ostentation" and from my own brief professional contact with him, I can endorse that.

Others who went on to distinguished careers

Ladies

After the main players come some of those in the books with "bit parts" – the ladies and the dressers. There weren't many **ladies** – I could only find four, but it seemed to help their cause if they were double-barrelled, as two of them were. Miss Drummond Robinson was allowed to do a D.&C., and Mrs. Isabelle Rosalind Humphreys-Owen gave anaesthetics. She went on to become senior resident medical officer at the Salvation Army Mothers' Hospital, Clapton, then retired to Basingstoke and became a J.P.

Dressers

The **dressers** were young men going through, who hadn't settled on a career at that stage and, indeed, were not even qualified.

Hugh Astley Cooper who gave two anaesthetics in July 1923 must surely have been a descendant of THE Astley Cooper, the famous Guy's surgeon in the pre-anaesthetic era who was senior anatomy lecturer to John Keats. He practised in the body snatching era and once chillingly told a group of MPs who were investigating the grizzly practice, "there is no person, let his station in life be what it may, whom, if I were disposed to dissect, I could not obtain." It has recently been calculated that in 1815, his income was more than £1m. in today's money. Hugh, our man, was apparently quite the opposite of his cutting surgeon namesake and became a psychiatrist at Broad Green Mental Hospital, Liverpool.

Terence Cawthorne also appears as a dresser in 1923. He became a leading ENT surgeon, developed the fenestration operation for otosclerosis, and was knighted. He acquired some unwanted tabloid publicity when he performed a tracheostomy on Elizabeth Taylor when she developed bronchopneumonia in London, but he wasn't really a throat man and used a vertical incision which didn't please the lady.

Geoffrey Bateman also appears as a dresser. He went on the become an ENT Consultant at St. Thomas's and he too was knighted.

R. Cove Smith appears on the first page of the first book and, for me, he was an exciting discovery. The name is unusual and I recalled that I had been introduced to a Dr. Cove Smith at a dinner of the Brighton Medico-Chirurgical Society shortly after I arrived in Brighton. He was so disabled with arthritis that he couldn't let go of his arm crutches to shake hands. I later established that he

was the same man who appears as a dresser in January 1923. He had been a GP in London before retiring to Brighton and, ironically in view of his severe disability, had had a special interest in physical medicine and had written books entitled Health for Everyone, Bathing, and Keeping Fit. But the real surprise came a few years later in his 1988 obituary. It reads:

"It was during the years 1921 to 29 that he won his greatest fame in rugby, the story of which is almost an obituary in itself. He led a British Isles touring team to victory in 1924 and captained England twice in 1928/29, playing with Wavell Wakefield (later Lord Wakefield) and other famous names in the vintage years of rugby. He was a formidable player."

Anaesthetists

When we come to the **anaesthetists**, I've selected three young men who went on to specialise in anaesthesia and had been Consultants for some time before I moved from UCH to Kings in the late 1960s.

The first to appear in the registers, in March 1929, is **Vernon Hall.** He was closely involved with Kings as Vice Dean and Dean, and in retirement wrote a history of the hospital and its medical school. He was a member of the Senate of London University, and a strong supporter of women in medicine. He worked with both Gilliatt and Peel so he attended all four Royal births and was awarded the CVO (an honour given for personal services to the sovereign) in 1960. He was a quiet man of great wisdom, kindness and generosity, and not only did he welcome me, an outsider, to Kings, but when I went from there to Great Ormond Street, he made sure that Marcia, his wife and a paediatrician there, did her best to help me through the first intimidating weeks. I have much to thank him for.

The next to appear, in December 1932, is **Ferdie Cartwright,** well known as a medical historian and a former Life Member of this Society. He was a very likeable man who spent much of his time in theatre correcting proofs of his latest book, but I remember him for a time when he phoned me late one evening to explain that he had a case at the London Clinic first thing next morning so would I please start his list with Mr. Kendall. Now Wally Kendall was senior surgeon at King's in the James Robertson Justice mode with a loud voice and a fearsome temper. To make matters worse, the first patient, for major abdominal surgery, was the stuff of nightmares – fat, emphysematous and veinless – and those were the good bits. I eventually got him into theatre and struggled to keep some sort of anaesthetic control while Wally attacked the abdomen, chuntering the while. This situation continued for an hour or so until Ferdie appeared, a few bob the richer, and greeted everyone serenely. "Everything all right, Armitage?"

Before I could say anything, Wally was off. "No, everything is not all right. The patient's been moving, patient's been blue, patient's not been relaxed, patient's been talking ..."
While I couldn't refute the first three charges, I felt I had to defend myself against the charge of talking, so rather weakly said, "No, Sir, the patient can't have been talking, he's intubated." But Wally was in full flow and having none of it. He brushed me aside with "Huh, thought it sounded a bit muffled."

The third is **Archie Galley** who first appears in March 1933. Although Archie was always immaculately dressed, he seemed to me to lack the Consultant's gravitas and was always cheerful. I felt he had a touch of the cheeky Cockney about him. But from our point of view he had one priceless asset – beautiful, legible handwriting of which he was particularly proud. He would never use abbreviations if he had time and space to write things out in full, with the result that his entries in the registers are the easiest to read and give the greatest detail. He was the one to use Nembutal, Avertin and Evipan, but I want to illustrate Archie with one those little asides, nothing to do with anaesthesia, which occasionally leap out at you from these pages. **W. Gilliatt ESQ** and **A. Palmer ESQ.** Had the surgeons been more than usually above themselves that day and in need of a bit of micky-taking, or was Archie feeling even more cheery than usual? We shall never know, but there's surely a story there somewhere. And on his last day, he signs off "Au revoir".

Achievement – in retrospect

It's easy to romanticise these people as part of a glorious surgical age which never actually existed, but the work rate was high, the mortality was low, bearing in mind that many of the patients were 'high risk', and the incidence of re-operation for surgical complications was very low. Surgical and anaesthetic innovations were taken up promptly, and the beginnings of social gynaecology are discernable. These men were at worst honest journeymen and at best leaders in their field. Two of the gynaecologists became knights of the realm and a third had already had a distinguished career as a rugby international. Two of the dressers became knights and a third was in the middle of his legendary international rugby career. If some passing anaesthetist were to come along 70 years from now and look into our activities, I think we'd be very pleased if we survived the scrutiny as well as they have done. One thing, though, would be different. The old style ward sister has been bred out of the nursing system, so it's most unlikely that our passing anaesthetist would have the books thrown at him.

L'APPAREIL DE DUPUY DE FRENELLE

Dr Adrian Padfield
Retired Consultant Anaesthetist, Sheffield

My paper is the result of noticing a strange anaesthetic apparatus in a small museum at the end of a tour of a mediaeval hospital in Lessines, Belgium. I photographed it in its glass case (Fig.1) and persuaded the curator to let me look at and photograph the instruction leaflet with it.

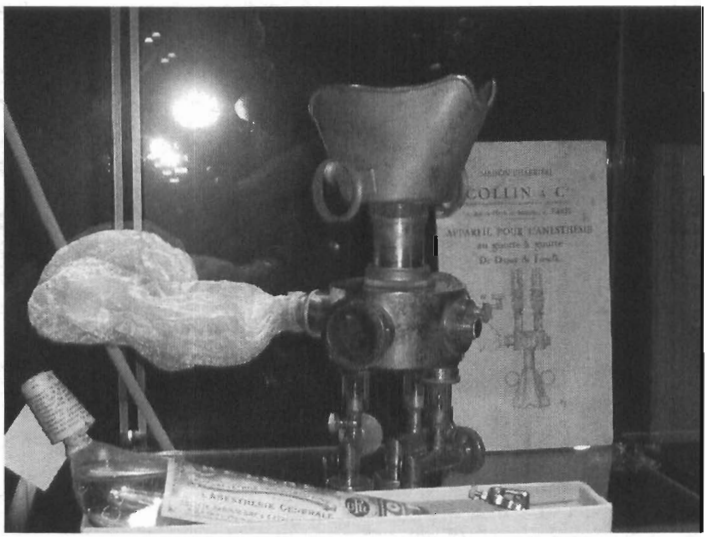

Fig. 1 Dupuy de Frenelle apparatus in display case

I had some difficulties translating the booklet. I was very sorry to hear of the death of Douglas Howat whose knowledge of French would have been so helpful in this respect. Having talked to Jean-Bernard Cazalaà at 6th ISHA in Cambridge, I visited him in Paris where he showed me a similar piece of apparatus albeit with two needle valves rather than three. Jean-Bernard was very helpful in providing me with references and images that included a book by Dupuy de Frenelle: *Pour diminuer le risqué operatoire* (Paris 1924, 1935 & 1951).[1] The book incorporates a fuller description and pictures (Fig. 2) of the apparatus and a tribute to 'the ingenious foreman of the Collin company' M. Boucher. Dupuy de Frenelle was a surgeon with orthopaedic leanings. Jean Horton also photographed the apparatus on another occasion and helped me

with the translation; Alan Dronsfield suggested that '*baryte*' was barium sulphate rather than barium oxide and David Zuck is, as always someone, I contact if I don't understand something.

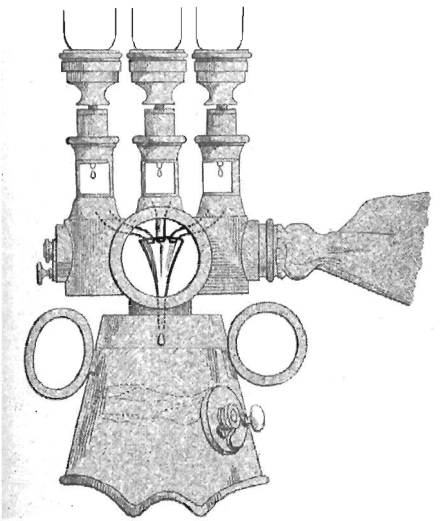

Fig. 2 Illustration of the apparatus in the booklet (p. 77)

L'Appareil de Dupuy de Frenelle (The booklet translated)

This apparatus delivers pure ethyl chloride or mixtures with chloroform or with ether, drop by drop, onto a gauze pack inside the [metal] mask.
It works with ampoules made by *Usines de Rhone*. Each ampoule contains 30 cc and there are three sorts *(Fig.2:*
Kélène pur (Ethyl Chloride) (tube no. 30 for Dupuy de Frenelle's device)
Chloro-kélène, containing 3gms ChCl3 & 27gms EtCl2 (Dupuy de Frenelle's mixture no. 23)
Kélène-éther, containing 10gms ether & 20gms EtCl2.
These tubes screw directly into the device. A special tube is attached to it to deliver pure ChCl3 or pure ether, drop by drop.
Generally I use only two taps; one for EtCl2, the other for ChCl3/EtCl2 mixture. I don't use the ether/kélène mixture. (D de F)

The *appareil* consists of two parts:
the mask that is applied to the face & the '*distributeur*'.

THE MASK *(Figs 3 & 4)* Fig. 3

The mask has two apertures and an air inlet. The apertures are where the *appareil* is attached according to the position of the patient.

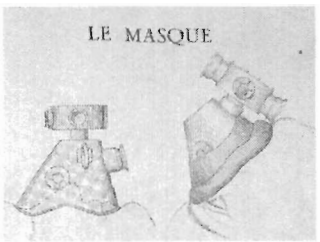

Fig. 3 The mask

Preparing the Mask

Fit the rubber cushion (not essential). Turn the mask over and inside, at the level of it's opening, put a 4-layer gauze pack, the edges of which are inserted, with a clip, into the circular groove around the mesh. In winter I put on the pack 3 or 4 drops of Vapex (*pharmacie Roberts*) made up of balsamic essences. Usually the air inlet stays closed – to supply air, the anaesthetist lifts the mask. When the mask has no rubber cushion, put 3 or 4 layers of gauze on the face to soften the contact with the bridge of the nose and prevent air leaks between the mask and the skin. The mask must be sterilised frequently.

THE *DISTRIBUTEUR* (MANIFOLD) *(Figs 5-7)* Fig. 4

The *manifold* comprises 3 needle valves each opening into a glass chamber so that the speed of the drops may be observed. A small screw on the glass chamber holds each tap. Loosening the screw allows easy withdrawal, so the anaesthetic ampoule can be screwed into the circular opening of the valve. At the base of the opening is a thread into which the ampoule is screwed. This opening is fitted with a rubber ring making a hermetic seal. The rubber ring must be changed from time to time. When the joint leaks, put in a rubber collar like that used for plugging bottles.

'Quote': *It is sufficient to equip the apparatus with two tubes of anaesthetic only: one tube of Kélène and one tube of Chloro-kélène. I rarely use Kélène-éther. I never use the tubes of pure chloroform or pure ether that fit the apparatus as mentioned above.*

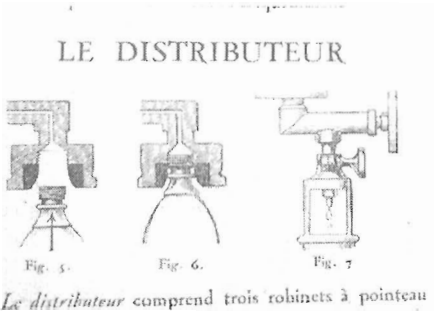

Fig. 4 The manifold

At the centre of the distribution device is a funnel that collects the drops and directs them down on to a wire mesh in the lower part of the appliance. It is easy to withdraw the mesh and the glass funnel from the base to clean it. *At the beginning of the anaesthetic one must cover the mesh with several layers of gauze to filter the anaesthetic agent.*

For Induction

Put four layers of gauze on the face. Gently position the mask and get the patient to breathe into it for a minute to warm the appliance. Check there is no leak between the mask and the face. Open the ethyl chloride valve so that drops fall at about 15 to 20 drops per minute. Gradually shut the holes of the air inlet on the sides of the mask. The air inlet must be closed completely during anaesthesia. After 2 minutes, increase the flow to 20 drops/minute. After 3-4 minutes to 30-40 drops and after 5-6 minutes if the depth of anaesthesia is insufficient, progressively increase from 30 to 60 drops *Kélène pur* per minute.

If anaesthesia isn't deep enough with *Kélène pur*, which is common, shut the *Kélène* valve and open the mixture tap. This should be adjusted to between 20 and 40 drops/minute depending on the need of each case.
As soon as surgical anaesthesia is reached, the speed of drops must be reduced, particularly if the induction dose was very large.

If at induction, the patient is restless perhaps it is because anaesthesia is insufficient, in which case the complexion will be pink; if too deep, (intoxicated) the face starts to go blue. Then the valves must be closed immediately and the mask lifted to give air.

To maintain Anaesthesia

The anaesthetist is guided by the colour of the face and the respiratory rhythm and sounds. When the face is pink and the breathing is regular and quiet, the anaesthetist has nothing to fear, except inopportune awakening. If the colour becomes blue, respiration short, rapid and shallow, the patient snores and breathing is accompanied by raucous laryngeal sounds, the anaesthetist must be beware of asphyxia. (!)

Device to pass the anaesthetic into a bag where it mixes with warm expired air before arriving at the mask. (*Fig. 8*)
To use this device, replace the funnel with a special piece of glass shaped like a pipe bowl onto which is screwed a tube that goes into the bag. The bowl is fixed by a screw that must be undone to withdraw it. To clean the supply pipe, undo the screw that fixes the bowl, unscrew the bag, the tube of the pipe and remove the glass pipe bowl by the large window in the *distributeur*.

Device allowing the warming of anaesthetic vapours. (*Fig. 9*)
This is a hollow sphere with a double wall. Inside, within the two layers, is barium sulphate *(b)*, which is warmed up by placing the sphere in boiling water for 10 minutes before anaesthesia. In the centre of the sphere is a wide corrugated tube in which the anaesthetic agent vaporises drop by drop. To use this device one employs the tube and screws the warming ball on to the distributor in place of the bag, which is then attached to the other end of the sphere.

Device to re-warm the anaesthetic vapours. *(Fig. 10 & 12)* Fig.5

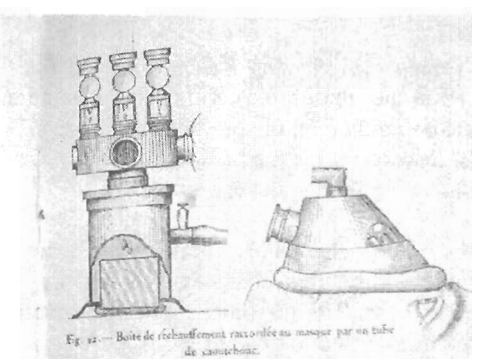

Fig. 12. — Boîte de réchauffement raccordée au masque par un tube de caoutchouc.

Fig. 5

This is a double walled metal cylinder. In the centre is a block of barium sulphate, placed in the base of the apparatus after being heated for 10 minutes in boiling water. On the top of the cylinder is an opening to which can be attached my device, or Ombrèdanne's, by using a connector. When my device is used, the drops of ethyl chloride vaporise by falling onto a sieve on top of the heating block. On the periphery of the cylinder is an outlet tube to which can be attached a rubber tube to lead to a mask on the patient's face. This system allows induction of the patient in any position. At the start of anaesthesia a large quantity of the anaesthetic agent is required to fill the apparatus and the rubber tube but it is very flexible and less rough than the *distributeur* which discharges ethyl chloride directly above the patient's mouth. If this device doesn't produce sufficiently deep anaesthesia, it's easy to put the *distributeur* directly onto the mask over the patient's mouth. Also I use a more powerful electric heating system. It is a kind of cylinder in which there are electrical resistances, on the top of which is an opening for the '*appareil*'. This cylinder is connected to the 'mains' for 10 minutes before the operation and remains warm for nearly an hour.

Device for the addition of oxygen and balsamic vapours to the anaesthetic.
(*Fig. 11*) Fig.6

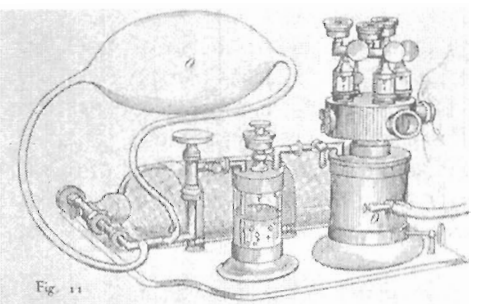

Fig. 11

contenant un mélange d'éther, de goménol et d'eucalyptol (mélange antiseptique de Dupuy de Frenelle fabriqué par les

Fig. 6

This device connects to an oxygen bottle *(supplier: Pharmacie LeClerc)*. It consists of a tube to which a rubber bag is attached and which joins the decompression valve to a needle valve that regulates bubble-by-bubble oxygen flow. From the needle valve, the oxygen bubbles through a flask with a mixture of ether, *goménol* and *eucalyptol* (The antiseptic mixture of Dupuy de Frenelle, manufactured by *Usines du Rhone*). The anaesthetist can thus keep track of oxygen flow. From the outlet of the flask, oxygen goes via a tube into the warming cylinder on which my *distributeur* is placed.

To use oxygen

Screw the device onto the neck of the oxygen bottle. Fill the bag by carefully opening the valve on the bottle. Open the needle valve – Open the tap connecting the bubble flask to the warming cylinder. Wait until the patient is soundly asleep before adding the bubbled oxygen to the anaesthetic, which then allows a reduction in the amount of anaesthetic required to maintain sleep.

IF THE PATIENT BECOMES BLUE, speed up the output of oxygen bubbles.

WHEN THE PATIENT RETURNS TO PINK, reduce the flow.

IN CASE OF SEVERE BLUENESS/Cyanosis, shut the anaesthetic tap, open the needle valve wide or better still transfer the outlet of the bag (O) to the nozzle attached to the outlet of the warming cylinder (O).

AT THE END OF ANAESTHESIA, let about half a litre of oxygen into the mask.

Too great a quantity of oxygen will be noxious and may irritate the lungs.

To avoid asphyxia.

The only accident I have seen in the course of more than 4000 anaesthetics given by my immediate entourage, is blue syncope (Dupuy de Frenelle). Serious asphyxia is characterised by spasm of the constrictors of the jaw and the larynx. To avoid this it is advisable to put a MAYO airway into the mouth as soon as the patient is asleep. The precursor signs of this alarm are contraction of the masseters, agitation of the hands and feet, spasmodic arrest of respiration, which becomes irregular, the raucous noise of laryngeal spasm and blueness of the face.
As soon as the prodromic signs of anaesthetic intoxication appear, shut the tap then lift the mask, open the mouth and pull up the tongue. The respiration rapidly restarts and the patient wakes up. *Fig. 12 (= Fig. 10)*

The most flexible, practical and soothing arrangement is the system in two parts: the *distributeur*/manifold is fitted on the warming cylinder and connects to the mask by a rubber tube.

Author's assessment of the apparatus

My assessment of the apparatus in the history of anaesthesia is rather negative. It seems to me it is a rather elaborate method of dropping an anaesthetic agent onto gauze in a mask. A comment in a contemporary French manual

'*Anesthésie en pratique chirurgicale*' also says *'cet appareil est lourd'* (this device is heavy) and this is borne out by the last sentence in the booklet.

Reference

1) Dupuy de Frenelle. *Pour diminuer le risque operatoire.* Paris: Ed. Maloine, 1924, 1934, 1951.

BARTON'S TONGUE CLIP

See Adrian Padfield's paper on George Alexander Heaton Barton, MD in the previous issue of the *HAS Proceedings* (vol. 36) pages 87-91.

Price 10s. 6d.

A COMBINED TONGUE CLIP AND JUNKER TERMINAL.

Designed by Dr. G. A. H. Barton.

Extract from *British Medical Journal*, Dec. 24, 1910.

Price 10s. 6d.

During operations on the upper air passages the anæsthetist not infrequently has his hands literally full. To render his task a little easier I have designed the combined tongue clip and Junker terminal here illustrated, and made for me by Messrs. Mayer & Meltzer. The tongue clip is of the Watson Williams pattern, except that the point protector has a little slit on either side, allowing of the passage of the fine end of the pin in or out when the spring is depressed, rendering its adjustment slightly easier. The pin is set on the Junker terminal at 1¼ in. from its free extremity. The terminal is short, its cross section oval, and slightly curved upwards at its free end to carry the orifice away from the dorsum of the tongue. Whilst not suggesting for a moment that this device should replace the many excellent gags which are supplied with Junker terminals attached, I think it a useful alternative in the class of case indicated above—and, indeed, in many operations on the head and neck region where Junker's method is a convenient one. When no traction is required on the tongue, the pin serves to hold the terminal in place; if traction is required it can be effected by a single finger in the loop.

THE EUROPEAN RESEARCH GROUP ON RESPIRATORY INTENSIVE CARE (ERGRIC)

Prof Sir Keith Sykes, Budleigh Salterton, Devon

In most branches of scientific research there is a strong element of competition and secrecy that may hinder the development of new ideas. This is the record of a small international research group that thrived on the free discussion of the problems facing those working in intensive care units. The members of the group not only played a leading role in the development of research into respiratory aspects of intensive care in Europe in the 1980's and 1990's, but also had a major influence on the development of intensive care throughout that period.

Creation of the group, 1979

The group was created by Adrian Versprille in 1979. Versprille was a clinical physiologist who had worked in the department of paediatrics in Leiden, The Netherlands, in the late nineteen sixties and early seventies, and who had organised informal discussions on research projects between a small group of engineers, physicists, physiologists and clinicians. The interdisciplinary approach, which was relatively novel in medicine at that time, proved to be intellectually stimulating and encouraged members to develop a number of new research projects. In 1973 Versprille was invited to become the head of the pulmonary function unit of the department of pulmonary diseases in the University Hospital "Dijkzicht", Rotterdam, but found that most of the clinicians who were involved in respiratory care were not interested in discussions on basic science related to their practice.

In 1978 Hilmar Burchardi, an anaesthetist working in Göttingen, submitted a paper on pulmonary diffusing capacity for presentation at a meeting in Rotterdam. Versprille, who was one of the organisers of the meeting, and who was particularly interested in the topic, invited Burchardi to present his studies to members of Versprille's clinical physiology department so that the results could be discussed in depth. Burchardi, who was new to this field of research and not certain of the significance of his results, had already discussed his work with the famous German respiratory physiologist Johannes Piiper, and remembered that Piiper encouraged him by saying "we are not interested in the results: we are only interested in the questions". Versprille replied "That's it. I always had it in mind to create a group to discuss questions".[1]

The meeting with Burchardi stimulated Versprille to approach other workers who were carrying out research into respiratory problems in intensive care and, in October 1980, Versprille hosted a two-day meeting in his department that was attended by Jens Andersen (Copenhagen, Denmark), Hilmar Burchardi (Göttingen, Germany), Luciano Gattinoni (Milan, Italy), and Keith Sykes (Oxford, UK). Others who joined the group shortly after were Herbert Benzer (Innsbruck, Austria), who often invited the engineer Marcel Baum to our meetings, Göran Hedenstierna (Uppsala, Sweden), Maurice Lamy (Liege, Belgium), Myron B. Laver (Basle, Switzerland), François Lemaire (Paris, France), Antonio Pesenti (Milan, Italy, invited by Gattinoni), Antonio Artigas Raventos (Sabadell, Spain), Daniel Scheidegger (Basel, Switzerland), and Peter Suter (Geneva, Switzerland) (Fig 1). Members who joined later included L. Brochard (Paris), Konrad Falke (Berlin, Germany), Charis Roussos (Athens, Greece), Herwig Gerlach (Berlin Germany), Jos Jansen (Rotterdam, The Netherlands) and Michael Sydow (Göttingen). Members who were hosting the meeting were encouraged to invite co-workers from their own department and others who were interested to join the meetings. Among those who contributed in this capacity were John West (La Jolla, California), Kai Rehder (Mayo Clinic), J.J. Marini (Minneapolis) and J. Milic-Emili (Montreal). The members named the group "ERGRIC" (European Research Group on Respiratory Intensive Care).

Fig. 1 Members of the group in Stockholm, 1986. (*Left to right. Front row:* Sykes, Versprille, Benzer, Burchardi. *Back row:* Artigas, Suter, Hedenstierna, Lamy, Lemaire, Andersen, Scheidegger.)

The meetings

The meetings were held twice a year, each member hosting the meeting in turn. The meetings lasted for one or two days, and usually included a visit to the host's intensive care unit and laboratories. During the scientific sessions, speakers gave informal presentations on research in progress or discussed current problems in the treatment of patients with respiratory failure. About half of the time was devoted to presentations from members of the host's department and half from members of the group. Presentations were very informal and each speaker was subjected to a barrage of questions and frank, but friendly, criticism both during and after the talk, and discussions often continued into the late evening. The group thrived because of the informal nature of the discussions, because every statement was challenged, and because speculative comments were welcomed. There was no academic hierarchy, there was no secrecy, and there was no political agenda. Members became firm friends whose interests (and peculiarities!) were known and respected by other members of the group, and humour was never far from the surface. There was every opportunity for communication because members stayed in the same hotel, and the host usually entertained the group to a convivial dinner in a restaurant or in his home. Whatever the venue, the evening always finished with a somewhat lengthy and philosophical speech by the group's founder. These performances, enlivened by wit and Dutch aphorisms, soon became a tradition and were complemented by the presentation of flowers to the hostess. Whilst the host was responsible for the basic cost of the meeting, members paid for their own travel and accommodation. These costs were sometimes offset by associating the group meeting with a major congress or by the host organising a larger open meeting at which the speakers were members of the group ("the mafia")!

Advances in ventilation techniques

The 1980's and 90's were decades in which there were enormous developments in the care of the patient with respiratory failure. In 1967 Ashbaugh and colleagues had described the Adult Respiratory Distress Syndrome (ARDS) and the associated severe hypoxaemia[2] and, by the late 1970's, it had became apparent that the use of positive end-expiratory pressure (PEEP) during both spontaneous and mechanical ventilation could recruit collapsed alveoli and so improve oxygenation.[3] It had also been recognised, however, that the resulting increase in mean and peak airway pressures tended to decrease cardiac output and to cause further lung damage. In order to minimise the increase in mean intrathoracic pressure a number of workers began to replace controlled ventilation with PEEP with techniques utilising various forms of assisted rather than controlled ventilation (Fig.2). Techniques such as intermittent mandatory

ventilation, in which a regular large controlled breath was superimposed on the patient's spontaneous ventilation, were initially provided with quite crude breathing systems, but the development in the 1980's of very sophisticated electronic ventilators with greatly improved patient-triggering devices enabled the various ventilatory assist modalities to be synchronised with the patient's spontaneous respiratory efforts. In the new ventilators the gas flows were controlled by rapidly-acting inspiratory and expiratory valves that were servo-controlled from pressure and flow sensors: these soon spawned a multitude of new techniques, each of which was claimed to be more advantageous than its predecessor.[4] Naturally, each new claim produced intense discussions within the group and so stimulated members to study the efficacy of these techniques. Other techniques that were intended to minimise lung damage while optimising gas exchange such as the various forms of high frequency ventilation[5 6] and extracorporeal oxygenation or extracorporeal CO_2 removal[7] also featured regularly in our discussions.

Increase end-expiratory lung volume to recruit collapsed alveoli
Continuous positive pressure breathing
Intermittent positive pressure ventilation with positive end-expiratory pressure
Intermittent mandatory ventilation with positive end-expiratory pressure
Synchronised intermittent mandatory ventilation with positive end-expiratory pressure
Mandatory minute volume with positive end-expiratory pressure
Biphasic intermittent positive airway pressure
Airway pressure release ventilation

Decrease peak inspiratory pressure to minimise lung damage
Permissive hypercapnia
Inverse ratio ventilation
High frequency ventilation
Extracorporeal membrane oxygenation
Extracorporeal carbon dioxide removal

Fig.2. New techniques of respiratory support used in intensive care from the 1970s to 1990s.

Influence of the meetings

Although it is obviously impossible to attribute particular advances in respiratory intensive care to specific discussions of the group, there were a number of topics that members have identified as being strongly influenced by the meetings.

Hysteresis

One of the first was the cause of hysteresis in the pressure/volume curve of the whole thorax. In the 1980's the static compliance of the total respiratory system was determined by ventilating the lungs with oxygen, disconnecting the patient from the ventilator, and then injecting aliquots of 200-300 ml of oxygen from a large syringe. The volume injected was recorded by an electronic device that tracked the movement of the piston in the syringe and this signal was plotted against the mouth pressures recorded about 3 seconds after each change in volume.[8] Records were made during inflation and deflation. The resulting graph of volume versus plateau inflation pressures showed that, at a given lung volume, inflation pressure was higher during inflation than during deflation (Fig 3). A number of possible explanations such as recruitment of lung units, stress relaxation of the chest wall and changes in intrathoracic blood volume were considered, but later it was shown that much of the hysteresis was due to the unequal exchange of O_2 and CO_2 during the period of measurement.[9] Sydow *et al.* then showed how this error could be overcome by measuring airway pressure and volume during intermittent interruption of mechanical ventilation of the lungs.[10]

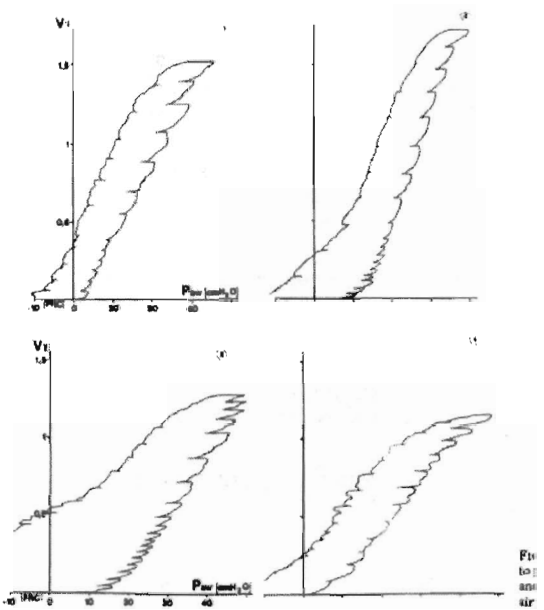

Fig. 3 Pressure/volume curves of total respiratory system obtained by injecting aliquots of oxygen and recording volume injected (Vt) versus airway pressure (Paw). 1. Normal. 2. Early ARDS. 3. Intermediate. 4. Late ARDS.

(Reproduced with permission from: Matamis D, Lemaire F, Harf A, Brun-Buisson Ch, Ansquer JC, Atlan G. *Chest 1984; **86**:58-86.*

Pressure/volume curves

The demonstration of a high as well as a low inflection point on the pressure/volume curves of patients with ARDS was another topic that produced much discussion. It was soon realised that the lower inflection point was associated with recruitment of previously collapsed alveoli, and that the upper point was related to overdistension of the small area of ventilated lung. The understanding of the significance of the pressure/volume curve later had a major impact on the way airway pressures were modified to minimise lung damage during mechanical ventilation.

Ventilation/Perfusion Ratio

Another topic of that was frequently discussed was the technique used for quantifying ventilation/perfusion inequality and true shunt in the intensive care unit. The experience of Hedenstierna, Lemaire and other members of the group encouraged Pesenti and his colleagues to develop a new technique for this purpose.[11]

Gas exchange abnormalities and augmentation

Perhaps the most important topic to be discussed was the dramatic demonstration of the gravity-related lung opacities revealed by the introduction CT scanning by Hedenstierna and colleagues during anaesthesia,[12-14] and by Gattinoni and his colleagues in patients with ARDS.[15] These remarkable images, combined with the information yielded by the six inert gases technique, introduced a new understanding of the mechanisms causing gas exchange abnormalities during anaesthesia and in patients with ARDS.[16 17] Engineer Marcel Baum recalled recently that when these scans were shown at an ERGIC meeting in Monza he sat up all night in his hotel room developing a mathematical model that could fit the findings.[18] When he returned to Innsbruck his group initiated a number of CT studies to validate this model and to study the effects of posture on the lung changes. These new concepts ultimately led to the development of a number of new techniques for augmenting gas exchange and minimising lung damage in patients with ARDS, one of which was the technique of biphasic positive pressure ventilation (BIPAP) developed by the Innsbruck group.[19] Other modalities, such as airway pressure release ventilation and inverse ratio ventilation were also shown to be effective in patients with ARDS.[20]

Formalisation of Intensive Care as a specialty

The meetings also provided an opportunity for informal discussions about other topics related to intensive care. A major initiative was the formation of the European Society of Intensive Care Medicine (ESICM). The idea originated during the First International meeting on Intensive Care in Paris in 1980.[21] Some members of ERGRIC (principally Burchardi, Lamy, Lemaire, Suter and Pesenti) formed the first committee, hammered out a constitution with statutes that had a legal basis in Switzerland, and then convened the first meeting at the headquarters of the World Health Organisation in Geneva on May 13th 1982. The meeting was attended by representatives from 12 European countries who adopted the first statutes, and elected the first executive committee. This unconventional method of setting up the Society without any support from an established organisation was interpreted as a hostile act by some of those working in intensive care at the time, but the new organisation was soon accepted because the ESICM constructed a new framework for training and scientific collaboration across national borders, and maintained a strict neutrality with respect to the various specialities that were developing intensive care.[22] The Society has made many advances since that time (such as initiating a Diploma in Intensive Care Medicine), and it is notable that Burchardi, Gattinoni , Lamy and Suter later became Presidents of the Society, Lemaire and Falke were Editors of *Intensive Care Medicine*, the Journal of the ESICM, while other members held other influential positions in the organisation.

Other initiatives

Three other initiatives should be mentioned.

1. The first was in 1982 when Antonio Pesenti was sent by Luciano Gattinoni to the University of Düsseldorf (Germany) to help Konrad Falke treat a young lady who had developed post-traumatic sepsis and severe ARDS. This was the first successful clinical extracorporeal CO_2 removal to be performed outside Italy.[23]
2. The second initiative was cooperation on laboratory-based research related to intensive care. In 1983 Antonio Artigas spent three months working in Versprille's laboratory studying the cyclical changes in stroke volume produced by mechanical ventilation in an experimental model of pulmonary hypertension in the pig. These experiments were probably the forerunners of the technique now used in intensive care units for determining preload and fluid resuscitation. In the same year François Lemaire, who had previously reported that changes in cardiac output in patients with ARDS could change intrapulmonary shunt,[24] spent a period in the laboratories of the Nuffield Department of

Anaesthetics in Oxford developing a method of altering cardiac output by the opening and closing of arterio-venous fistulae. In 1984 Hilmar Burchardi also came to Oxford where he studied the effects of increased cardiac output on pulmonary blood flow distribution during hypoxic vasoconstriction.[25]

3. The third initiative was the participation of some members in large-scale clinical trials on ARDS.[26 27]

Demise of the group

The group continued to meet regularly until 1998 when Versprille announced his impending retirement (Fig 4). Although new members had been recruited, the older ones became more and more involved in administration and found it increasingly difficult to attend meetings regularly. But what really produced the demise of the group was the absence of the founder, Adrian Versprille.

Always enthusiastic, always controversial, he led the group by the force of his personality and intellect. We clinicians recognised the intellectual integrity and search for truth imparted by a lifetime in a basic science discipline and benefited enormously from his challenges and his irresistible logic.

Acknowledgments
The author is deeply indebted to Adrian Versprille who provided much information from his records of group meetings, and to Marcel Baum, Herbert benzer, Hilmar Burchardi, Konrad Falke, Luciano Gattinoni, Göran Hedenstierna, Francois Lemaire, Antonio Pesenti, Antonio Artigas Raventos, Daniel Scheidegger, Michael Sydow and Peter Suter for their personal reminiscences and help.

Fig.4 Participants at the last meeting organised by Charis Roussos on a Greek cruise ship in 2001. *Back row from left to right*: Hilmar Burchardi, Daniel Scheidegger, Luciano Gattinoni, Charis Roussos, Michael Sydow, Herwig Gerlach, Antonio Artigas, John J. Marini, Antonio Pesenti. *Front row:* Göran Hedenstierna, Peter Suter, Adrian Versprille, Maurice Lamy, Konrad Falke.

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ADDENDUM TO HISTORY OF INTENSIVE CARE MEDICINE

Keith Sykes kindly pointed out a misleading statement in Rajan Seth's paper on this topic in the previous issue of the *HAS Proceedings* (vol. 36) page 70. The sentence that (Bjorn Ibsen) "devised a bag and CO_2 absorbing canister system" should read "adopted Waters' to-and-fro CO_2 absorber system".

VICTORIA, LISTER AND CHLOROFORM AT BALMORAL

Dr Iain Levack, Consultant Anaesthetist, NHS Tayside

Queen Victoria was the longest reigning monarch in British history. She is remembered by many place names around the world. Queensland and Victoria in Australia, the capitals of British Colombia and Saskatchewan (Regina) in Canada, the capital of the Seychelles, Africa's largest lake, and the Victoria Falls. There are also railway stations, statues, institutions, thoroughfares, parks and structures named after her. Many people will have daily familiarity with more than one. If there was ever a British Empire it was surely during the reign of Queen Victoria. She was the great great grandmother of our Queen, Elizabeth 2nd.

Much of Queen Victoria's life was spent at Balmoral in the valley of the River Dee which flows from its source in the Cairngorm mountains east towards the North Sea at Aberdeen. Near Braemar at a village called Crathie, she and her husband Prince Albert bought and refurbished Balmoral Castle which remains a favourite residence of the royal family. She spent four months of the year at Balmoral. If illness was to strike, there was a good chance it would do so when she was at Balmoral and this happened in 1871. But first a few more details about Queen Victoria.

Accession of Victoria to the throne

In 1817, Princess Charlotte of Wales died of a post partum haemorrhage following the birth of her stillborn son. The story has been the subject of numerous learned lectures and publications.[1] Sir Richard Croft was the royal accoucher/obstetrician. He elected not to use forceps during a prolonged second stage of labour. The baby was stillborn and the maternal death followed some hours later. It is hard to imagine Croft's turmoil but he has our sympathy. He shot himself six months later.

Princess Charlotte was the only child of the Prince of Wales who was the eldest son of George 3rd. Therefore the second and third in line of succession to the throne died within hours of each other. The remaining sons of George 3rd then scrambled to marry and produce legitimate offspring as heirs to the throne. In 1819 two years after the deaths, Princess Victoria of Kent was born at Kensington Palace - the only child of Edward, Duke of Kent – the fourth son of George 3rd.

When Victoria was eight months old, her father who was then aged 50, died of pneumonia. George 3rd died six days later and was succeeded as King by

Victoria's uncle the Prince of Wales (previously known as the Prince Regent). This was George 4th. When he died 11 years later another of Victoria's uncles became king. This time William 4th. Because he had no legitimate children, Victoria then became first in the line of succession. When William 4th died, Victoria was 18 years old and became Queen of the United Kingdom of Great Britain and Ireland.

Further landmarks in the Queen's life, including chloroform

Queen Victoria lived for nearly 82 years, during 64 of which she was Queen. At 21 she married Prince Albert of SaxeCoburg and Gotha whose statue stands in the grounds at Balmoral. There were 9 children. At the age of 42 Victoria became a widow. She was inconsolable and for the rest of her life she wore black clothing. Ten years later she became ill at Balmoral. She had chloroform anaesthesia for the incision and drainage of an abscess in her axilla. Her previous experience with chloroform had been during childbirth which has been widely recognised. On Albert's death, the Queen erected to his memory a 32 feet granite cairn in the shape of a pyramid. It remains a prominent feature on the skyline of the hill Creag Lurachain on the Balmoral estate.

The ballroom at Balmoral, photographed in the 1870s by the Aberdeen photographer George Washington Wilson, remains today largely unchanged. There are stags' heads, tartan plaids and carved wood panelling. Electric lights in the chandeliers have replaced candles. It has been the venue of countless ceilidhs and Ghillies' Balls through the generations. Queen Victoria started the tradition of these with Prince Albert and after his death John Brown became her substitute partner at these functions to the consternation of many in the Household.

Atmosphere to this history can be seen in the feature film Mrs Brown. In 1869 there was resentment that the Queen spent so much of her time outside London. The main characters in the film are Disraeli who was Prime Minister at the time, a number of her children, Ponsonby her Private Secretary and Sir William Jenner the Physician. John Brown, the Queen's Highland Servant became an important figure in her life.

The painting by Charles Burton Barber shows John Brown attending a mournful and reflective monarch on horseback in her characteristic black attire with Balmoral Castle in the background. The Queen was an assiduous diary writer, most of which has been published under the title The Letters of Queen Victoria.[2]

Royal diary notes on surgery at Balmoral

Balmoral 3rd Sept. – "Had a bad night and got up quite late. Sat in the tent. Slept a little after my lunch, then saw Dr Marshall, who examined my poor arm and begged I should let some other surgeon, for instance Professor Lister, see it, as he felt the responsibility too great. I rather demurred, but said I would think the matter over. Finally I consented to Professor Lister being telegraphed for.

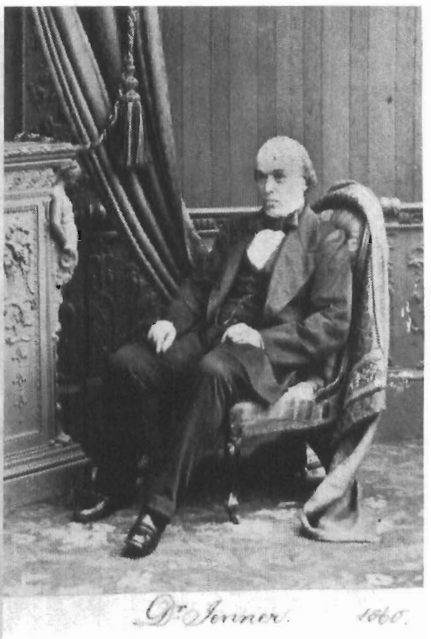
4th Sept – In the afternoon took a little turn in the garden chair. It was so fine. On coming in heard Mr Lister had arrived. Sir William Jenner explained everything about my arm to him, but he naturally said he could do nothing or give any opinion till he had made an examination. I had to wait nearly half an hour before Mr Lister and Dr Marshall appeared! In a few minutes he had ascertained all and went out again with the others. Sir William Jenner returned saying Mr Lister thought the swelling ought to be cut; he could wait twenty-four hours, but it would be better not. I felt dreadfully nervous, as I bear pain so badly. I shall be given chloroform, but not very much, as I am so far from well otherwise, so I begged the part might be frozen, which was agreed on. Everything was got ready and the three doctors came in. Sir William Jenner gave me some whiffs of chloroform, whilst Mr Lister froze the place, Dr Marshall holding my arm. The abscess, which was six inches in diameter, was very quickly cut and I hardly felt anything except the last touch, when I was given a little more chloroform. In an instant there was relief. I was then tightly bandaged, and rested on my bed. Quite late saw Beatrice and Affie for a moment, after Mr Lister had been in to see me. Felt very shaken and exhausted.

11th Sept – Thankful and happy to be relieved of my bandages. Today I have been very miserable from a violent attack of rheumatism or even rheumatic gout, which has settled in my left ankle, completely crippling me and causing me dreadful pain. I am quite disheartened, as this makes almost a third illness. Mr Lister took his leave this morning, and Dr Marshall dressed the wound and put on the bandage. It made him a little nervous, but he did it very well."

Sir William Jenner (Physician) and Dr Marshall

Dr Marshall was the resident doctor to the Balmoral household and Sir William Jenner the Physician in Ordinary to the Queen. Jenner was Professor of Medicine at University College Hospital, London and later President of the

Royal College of Physicians. He was widely recognised as the leading physician of his generation and there is much detail about him in the literature. Marshall however was less well known and less fortunate than Jenner.



> "The Late Dr Marshall was originally in practice at Balmoral. He was Her Majesty's own private resident medical attendant and he held this position until he retired three years ago in bad health, having symptoms of 'brain mischief'."[3]

In The Perthshire Constitutional and Journal. Wednesday December 24, 1884:

> "Dr Marshall about three years ago retired from the service of Her Majesty on account of ill health, owing to a lingering attack of general paralysis which culminated in his death. He was born in the parish of Methven, went to the United Presbyterian School there and later graduated in medicine with honours at Glasgow University. He later was appointed household physician to the Queen at Balmoral which he held for seven years, five of which he was resident at Braemar and two at the village of Crathie. He continued to hold this post for ten years until he retired through failing health."

Marshall was buried in a country churchyard at Fowlis Wester, close to Methven about eight miles west of Perth. He died at the age of 50 and was buried by his father.

Joseph Lister and his surgery on the Queen

Lister of course is widely recognised as the founding father of antisepsis in surgery. His operation on the Queen was picked up by the media and in this case the Aberdeen Journal.[4] As the Queen's Surgeon in Ordinary in Scotland, Lister was much more discreet. He never gave the identity of his patient. Perhaps this was because he used a technique he had never used before.[5]

> "I continued to use a strip of lint as a drain for about five years with perfectly satisfactory results. But in 1871, having opened a very deeply seated acute abscess of the axilla, I found to my surprise, on changing the dressing next day, that the withdrawal of the lint was followed by escape of thick pus like the original contents.
> It occurred to me that in that deep and narrow incision, the lint, instead of serving as a drain, might have acted like a plug, and so reproduced the conditions present before evacuation.
>
> Taking a piece of the india rubber of a Richardson's spray producer[6] that I had used for local anaesthesia at the operation, I cut holes in it and attached knotted silk threads to one end, so improvising a drainage-tube. This I put to steep overnight in a strong watery solution of carbolic acid, and introduced it in place of the lint on changing the dressing next morning. The withdrawal of the lint had been followed by discharge of thick pus as before; but next morning I was rejoiced to find nothing escape unless it were a drop or so of clear serum. This rapidly diminished and within a week of the opening of the abscess I was able to take leave of my patient, the discharge from the abscess cavity having entirely ceased."

He was of course referring to the operation on the Queen at Balmoral. The Richardson's spray was in common use at the time for application of ether to the skin to provide localised cooling and literally freezing of the flesh to diminish the pain of incision. This operation is an early example of combining local anaesthesia and inhalational anaesthesia which later in 1913 was definitively described and published by Crile in America.[7]

Courage of the Queen's doctors

We are reminded of Lister at the Regent's Park end of Portland Place near the Association of Anaesthetists. It is a handsome statue. Lister wrote authoritatively about the administration of anaesthesia. Not surprisingly having been a prominent surgeon in both Glasgow and Edinburgh before moving to King's College Hospital in London, he favoured the use of chloroform over ether. He was obviously experienced in its use and in particular understood how to maintain a clear airway.[8] However, knowledge of its association with ventricular fibrillation in the presence of increased sympathetic tone was still in the future.[9] Nonetheless, all three doctors, Lister, Jenner and Marshall must have had great courage to operate on their Queen.

John Brown

Lastly, the importance of John Brown in Queen Victoria's life has been a subject of intrigue for over a century. Victoria relied on his reticent and direct non obsequious service both before and more obviously after the death of Prince Albert. He is also commemorated - at her instruction - by his statue in the grounds of Balmoral.
His grave is in Crathie kirkyard. The granite and engraving are immaculate, both having endured the weather.The epitaph implies a close relationship.

Balmoral Castle in Aberdeenshire is open to visitors from April until July.The effort of getting there is well rewarded.

Acknowledgement

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THE GILLIES ANAESTHETIC MACHINE*

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The original Department of Anaesthetics at the Royal Infirmary of Edinburgh was founded in 1940, led by Dr John Gillies. He wasted no time in designing a new anaesthetic machine, the prototype of which was built on site about 1941 by Mr John Morrison, a hospital plumber. Hence this prototype was called the 'Gilmor machine'.

The first production model was made by A Charles King Ltd, London. Its major feature was a true circle (closed circuit) with carbon dioxide absorber – so-called two-phase method. The absorber and reservoir bag could be shut off to facilitate interposition of a Waters canister and bag for the "to and fro" method – so-called single phase. Also the absorber alone could be shut off to convert the system to a semi-closed apparatus. Thus the machine was extremely versatile. It was probably the first British true circle apparatus. Furthermore it incorporated vaporizers *inside* the circle (VIC).

By 1948 a new model of the Gillies machine was available. In this the (second) ether vaporizer was eliminated from the expiratory limb of the circuit.

A rival to the Gillies machine was the Coxeter-Mushin apparatus introduced around the same time. However it was not a true circle.

By 1951 the Gillies Apparatus Mark III was being produced by BOC's Coxeter-King medical section – in both hospital and portable assemblies. This was promoted for its versatility, having three roles: (1) semi-closed (partial rebreathing) system, (2) closed circuit "circle" method, and (3) draw-over mode. The Gillies machine continued in use through the 1960s.

* Abstract only, at author's request

SOME INTERESTING NEUROANAESTHETIC TECHNIQUES DEVELOPED IN EDINBURGH IN THE 1960s

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When Norman Dott returned to Edinburgh from the United States in 1924 after training with Harvey Cushing, he introduced surgical neurology to Edinburgh, but it was not until 1937 that he was eventually appointed as a neurological surgeon to the Royal Infirmary of Edinburgh and given a ward of 18 beds. This was Ward 20 in the roof space which had previously been the female ward for venereal diseases.[1 2] The department was equipped with funds from Sir Alexander Grant, a wealthy food merchant, and the Rockefeller Foundation. During World War II, the Department expanded to Bangour Hospital, 20 miles from Edinburgh. As the specialty advanced with new techniques, an increasing workload and no room to expand in the Royal Infirmary, Dott persuaded the Department of Health to build in the grounds of the Western General Hospital a Surgical Neurology Unit, which was opened on 1st July 1960. The new unit of six floors had 60 beds, two innovative operating theatres, large anaesthetic rooms, an adjacent neuroradiological suite and departments of physiotherapy and occupational therapy.

The two consultant anaesthetists, Dr Allan Brown and Dr Jean Horton, devoted all their time to the Department of Surgical Neurology and to neuroanaesthesia. The availability of the state of the art operating theatres, new equipment and the introduction of the neuroleptanalgesic drugs, haloperidol, dehydrobenzperidol (Droperidol) and phenoperidine by Eric Nilsson and Paul Janssen and De Castro and Mundeleer, facilitated some interesting techniques for neuroanaesthesia, three of which are described.[3-5]

Elective hypotension with intracardiac pacemaking for the operative management of ruptured intracranial aneurysms.

The commonest cause of spontaneous subarachnoid haemorrhage is rupture of an intracranial aneurysm arising either on the Circle of Willis or on one of its major branches. In the 1960's surgical management was considered to be the best option in suitable cases, requiring a craniotomy for direct approach to the aneurysm which was then clipped, ligated, or wrapped with muscle and muslin gauze. When considering anaesthetic techniques which would provide optimum conditions for the surgeon it was necessary to think about some of the pathological changes that take place in the brain following rupture of an intracranial aneurysm. The vessels in continuity with and near the aneurysm go

into intense spasm, which reduces the size of the tear in the aneurysm and seals it with a clot, but also produces ischaemia in the area of the brain supplied by those vessels, in particular the small perforating vessels in the region of the anterior communicating artery, resulting in ischaemia of the hypothalamus, basal ganglia and internal capsule, and this damage may be enhanced by the retraction necessary for exposure of the aneurysm and by prolonged periods of hypotension.

The successful operative management of the ruptured aneurysm relied upon a careful surgical approach with minimal retraction on a slack brain. Frequently the operation field could become completely obscured by haemorrhage from the aneurysm and this could be controlled by lowering the systolic blood pressure. Techniques used to lower the blood pressure were arteriotomy, the ganglion blockers, hexamethonium or Arfonad, and halothane. All of these methods had the disadvantage that rapid reversal of the hypotension could be difficult and the period of hypotension too long with the consequences already outlined.

In 1965 on learning that Jack Small and Victor Campkin of the Midland Centre for Neurosurgery in Smethwick had developed a technique using a cardiac pacemaker for producing profound and easily reversible hypotension, a team from Edinburgh visited Smethwick and saw the technique demonstrated on one of our own patients from Edinburgh.[6 7] The technique relied upon the fact that in an areflexic anaesthetised patient under moderate hypothermia, an increase in heart rate will reduce the stroke volume and cardiac output because the baroreceptor reflexes are depressed and therefore the blood pressure falls and at a heart rate of 240 beats/minute the cardiac output is zero.

It was considered that this technique could be advantageous and so a study of the method commenced from July 1965 to 1966 in twenty selected patients in whom the operative risk was increased because the aneurysm had a large sac or particularly difficult anatomical relations. The team consisted of three surgeons who carried out the operative procedures, two anaesthetists, two cardiologists and a biochemist.[8 9]

Table 1 Patients prepared for cardiac pacing

Anterior communicating artery aneurysm	8
Middle cerebral artery aneurysm	7
Posterior communicating artery aneurysm	3
Basilar artery aneurysm	2
Total number	20

The Birmingham technique was modified for use in Edinburgh. The standard premedication at that time was atropine 0.6mg, haloperidol 25mg and pethidine 100mg, with the addition of chlorpromazine 25-50mg or promethazine 25-50mg.

General anaesthesia was induced with thiopentone, succinylcholine and phenoperidine, and maintained with nitrous oxide, d-tubocurarine and phenoperidine. The patient was placed between heat exchanger blankets with the object of producing moderate hypothermia to 30°C. A Barnet ventilator controlled ventilation with a positive-negative phase, with the addition of CO_2 to the inspired gases to keep the pCO_2 between 35-40mm Hg to overcome the fall in pCO_2, which occurred during hypothermia.

As the patient cooled, the cardio-physiologist introduced mid thoracic arterial and venous pressure lines through the right femoral artery and vein using the Seldinger technique. A cardiac conducting catheter inserted into a vein in the right antecubital fossa was wedged into the apex of the right ventricle, and attached to a specially adapted pacemaker.

During this period 500 ml of intravenous 25% mannitol was given to promote an osmotic diuresis and provide a slack brain. As the body temperature approached 34°C the patient was transferred to the operating theatre and the craniotomy commenced with the object of approaching the aneurysm when the oesophageal temperature was between 31°C and 30°C.

During the final approach to the aneurysm the surgeon decided whether hypotension would be needed and informed the anaesthetist and the cardiologist. Should the approach be difficult or the aneurysm ruptured, a rapid profound hypotension between 30mmHg and 40mmHg was produced by pacing the heart to a very high rate, 240 beats/minute. The drop in blood pressure was immediate and returned to normal as soon as pacemaking was discontinued. Twelve patients received cardiac pacing. These high ventricular rates and a blood pressure lower than 30 mmHg provoked ventricular fibrillation in 4 cases and atrial fibrillation in 2 cases. All returned to normal rhythm with external cardiac defibrillation.

Table 2 Patients who received cardiac pacing	**n**	**Fibrillated**	
		Ventricular	Atrial
Anterior communicating artery aneurysm	5	2	
Middle cerebral artery aneurysm	5	2	1
Posterior communicating artery aneurysm	2		1
Total	12	4	2

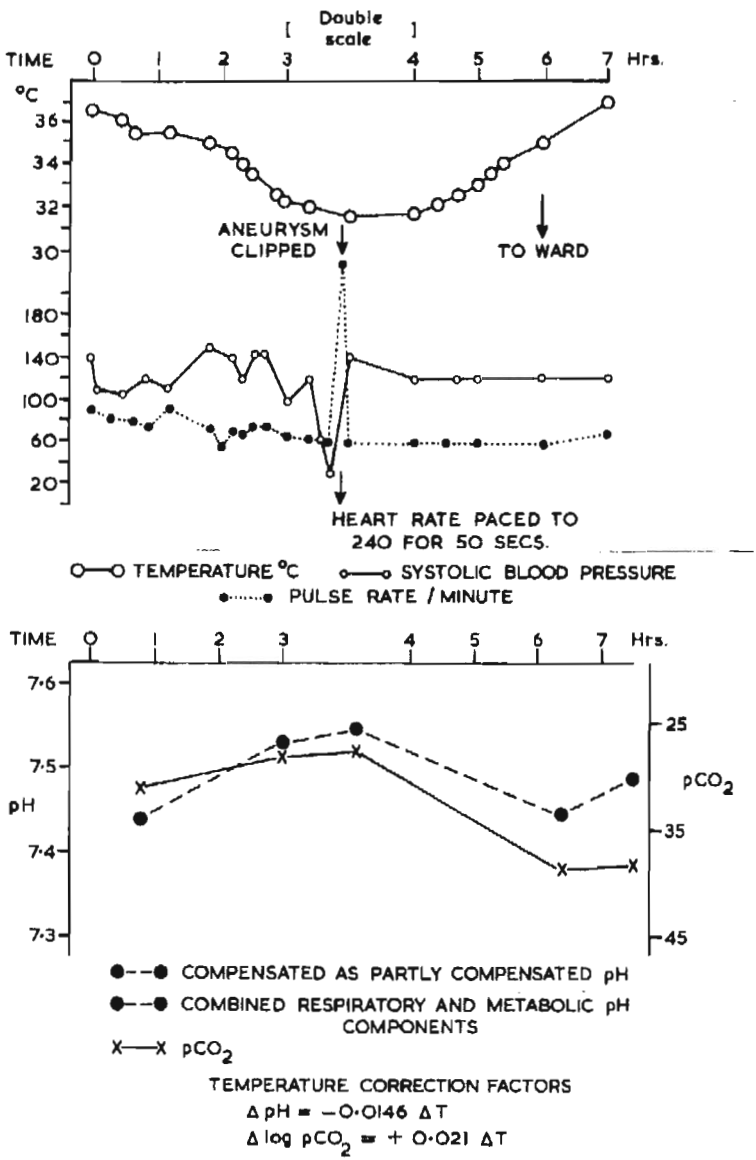

Figure 1 A typical operation record

There was continuous blood gas analysis throughout each procedure using the Micro-Astrup and Radiometer equipment and corrections made for body temperature with the Severinghaus blood-gas calculator. End-tidal CO_2 was estimated with a Severinghaus CO_2 electrode. Base deficits were corrected with 8.4% sodium bicarbonate and the end-tidal pCO_2 maintained between 35-40mm Hg by varying the amount of CO_2 in the inspired gases. Figure 1 shows a typical operation record.

This technique provided a rapid controllable hypotension, speedily reversed which produced a relatively bloodless field for short periods to enable the surgeon to clip, ligate or wrap the aneurysm.

All the patients survived the procedure but two patients who had been subjected to prolonged hypotension and ventricular fibrillation died in the postoperative period.
A patient who had a middle cerebral aneurysm and multiple neurological deficits, died a month after operation of a recurrent subarachnoid haemorrhage and a patient with an anterior communicating aneurysm died in a few days from widespread cerebral ischaemia.

The technique was eventually discontinued for the following reasons
1. The safe working time for the surgeon to secure the aneurysm was very short
2. High ventricular rates and prolonged hypotension could produce ventricular fibrillation
3. The drop in cerebral blood flow with sudden hypotension may give rise to ischaemia in the "watershed areas" of the brain due to failure of vasodilatation and opening up of anastomotic channels.

Antero-lateral tractotomy (cordotomy)
with the patient awake for neurological testing

Cordotomy is the surgical procedure where the pain conducting tracts in the spinal cord are disabled, so as to relieve intractable pain due to cancer or other problems for which there is no other cure. Before percutaneous cordotomy was available the procedure required a cervical laminectomy.

The neuroleptanalgesic drugs were of particular interest for the anaesthetic technique for this procedure, where the patient was required to wake up during the operation and be fully alert while neurological assessments were made. The procedure was fully explained to the patients who were anxious to have something done to relieve their pain.

After premedication with haloperidol 25mg and atropine 0.6mg, anaesthesia was induced with thiopentone, the airway maintained with a nasopharyngeal airway. Anaesthesia was maintained with nitrous oxide, oxygen and phenoperidine 0.25-1mg as necessary, the patient breathing spontaneously with a Ruben valve in the Magill circuit. The operations were performed with the patient prone on the Dott operating table.

When the spinal cord had been exposed and the surgeon was ready to cut the spinothalamic tracts, the nitrous oxide was discontinued and the airway removed if necessary. The patients awoke almost immediately. They were alert and unconfused and could answer questions clearly because the airway was not obstructed. Thus it was possible to carry out sensory testing so that the surgeon could know when the spinothalamic tracts had been adequately cut. The anaesthetist usually carried out testing since the patient was accustomed to their voice.

When the surgeon was satisfied, the nasal airway was reinserted, and anaesthesia continued as before, sometimes with the addition of halothane to the inspired gases.

Lumbar air encephalography

Before the advent of the CAT scanner and MRI, one of the ways of diagnosing supra- and infratentorial space-occupying lesions in the brain was to outline the ventricular system with fractional replacement of cerebrospinal fluid with air by the lumbar route with the patient in the sitting up position, a method first introduced by Dandy in 1919.[10]

This procedure could cause intense nausea, headache and discomfort which was alleviated by neuroleptanalgesia.

Droperidol 2.5mg (diluted to 1mg/ml) and phenoperidine 1-2mg were given slowly intravenously with the patient in the recumbent position prior to positioning for the lumbar puncture and air studies. It was important that the patient was not too drowsy and able to hold their heads up for easy entry of air into the ventricular system. Should nausea occur, cyclizine 25-30 mg was given. This technique was also used for children down to about 10 years of age. Smaller children required general anaesthesia. Since respiratory depression and apnoea can occur in the presence of a raised intracranial pressure, particularly in infants, facilities for immediate ventricular tap via the anterior fontanelle or a burr-hole were always available in the adjacent operating theatres. [11]

Conclusion and Acknowledgements

These were interesting and exciting times, which required teamwork. Much of this paper has been prepared from notes that I made during this period. I wish to acknowledge the contributions made my anaesthetic colleague Dr Allan Brown. by the surgeons Professor John Gillingham, Mr Phillip Harris and Mr John Shaw, the neuroradiologist Dr Tony Donaldson, the cardiologists Dr Arthur Kitchin and Dr J. Bath, and the biochemist, Dr Christine Thomson,

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PAIN RELIEF AT THE END OF LIFE: SOME HISTORICAL CASES

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The decade of the 1930's was an influential one for Anaesthesia. The introduction of barbiturates for induction, the development of flow-meters and the establishment of the Chair at Oxford are some of the significant changes along with the formation of the Association of Anaesthetists and the setting up of the DA examination. It was also a decade of change for medicine in general and this paper will review some of the events related to pain relief and the end-of-life.

Dr Bodkin Adams

A case which came to court in the 1950's is significant to this period. It was that of Dr Bodkin Adams who was tried for the murder of a patient and was acquitted. What is the connection? The first complaint about his actions in his practice was made in 1935. This shows that this doctor was arousing concern to some people twenty years before the law became involved.

Dr Adams had treated his patient in such a way with morphine and heroin that led to their addiction, along with using other drugs. He treated her for the last ten and a half months with largish doses for a post-stroke patient. She eventually died. The police were looking at a number of other deaths of patients but took no action after the acquittal in this case. The estimate of these is 8-15 but the press reported it was up to 400. The case was considered extraordinary for a number of reasons. The difference of opinion between the Crown's medical witnesses, the publicity and the fact the trial judge wrote a book about it. The number of cases in which deaths were being investigated as there were concerns about Dr Adams's actions, is reminiscent of another, more recent case. In this the doctor was convicted of murder of fifteen patients and the report of the inquiry into his case concluded he was responsible for the deaths of two hundred more.

The doctrine of double effect

Now it has always been possible for doctors to treat pain and distress as necessary using doses of drugs which may seem large and to some eyes possibly to speed death.
The courts have recognised this and would not wish to interfere. The issue is that of intent and so long as the intent is to relieve pain and distress the practice

is legal. If the intent is to hasten death, that is illegal. The concept of this treatment is known as the doctrine of double effect. Although considered legal on a case basis it was not formally recognised until a recent consultation paper from the Law Commission.

The 1930s

So let us return to the 1930's. Three issues will be touched on, abortion, eugenics and euthanasia.

Abortion

The last which came into the open was the issue of abortion. At this time there were 50,000 to a 100,000 unlawful abortions per annum. The 1938 case of *R v Bourne* in which a respected doctor aborted a girl who had been raped opened the debates which led to the 1967 Abortion Act. He was acquitted on the basis that the life of the girl was endangered by her pregnancy affecting her health. Health and life were intertwined.

New Societies

Two societies considered issues which opened vigorous discussion. The Eugenics Society was the simplified name for a Society founded in 1907. The Voluntary Euthanasia (Legalisation) Society was founded in 1935. The organisers and officers of these societies were not fringe members of professions.

Eugenics Society

The membership of the Eugenics Society included eminent figures in society including one archbishop,
four bishops, two Prime Ministers, other MPs, a medical peer, Presidents of two Royal Colleges, a BMA division and BMA hierarchy.
What were its aims? Eugenic betterment overall and specifically birth control, and sterilisation of vulnerable groups. Some members went further and advocated euthanasia of 'weak groups'. One of the reasons it came to prominence was the concept of negative eugenics of the First World War.

Voluntary Euthanasia (Legalisation) Society

This was founded in Leicester by the Medical Officer for Health, Dr Killick Millard who was the Hon. Sec. Other executive committee members were the

Chairman Mr CJ Bond, Consultant Surgeon to the Leicester Royal Infirmary, Dr AV Clarke, Honorary Physician at the same hospital, two Canons, the first principal of the University College Leicester and his successor and two peers. The President was Lord Moynihan, The Consultative Medical Council had many leading figures in Royal Colleges and the Royal Society as members. There was also a literary group with members such as HG Wells, L Housman and H Havelock Ellis. George Bernard Shaw was a Vice-President.

This society's aims were the legalisation of euthanasia. Whatever one's feelings on this, there was heavyweight support. It is interesting to think of whether euthanasia and assisted suicide is 'right'. If one remembers the cowboy and other adventure or war films of the 30's -50's it was not uncommon for words to be used with the meaning 'don't leave me to be captured and tortured. Shoot me or leave me a gun so I can kill myself'. Of course some of these were made when suicide was a criminal offence.

Suicide was assisted by governments during the same period by supplying secret agents with cyanide capsules, sometimes implanted into teeth. So, there was official acceptance of this practice.

Euthanasia

What about euthanasia? During the 30's a case was discussed which has now entered the ethical literature . Unfortunately nobody knows if it was real. It's known as 'the burning lorry' or 'policeman's dilemma'. Briefly, a police officer in the USA comes across a burning lorry at an accident site. The driver is trapped and there is no hope of freeing him before he burns to death. He asks the policeman to shoot and kill him. "Is that right?" is the question always asked. It was used during the discussion last year of Lord Joffe's Bill on Assisted Dying for the Terminally Ill and a senior church figure commented that he saw some reason why this was understandable.

Finally, by chance I came across a real case. In 1931 the city of Napier in New Zealand was almost totally destroyed by an earthquake. As a result the city was rebuilt in the Art Deco style and is a place to visit for those interested in this period. The cathedral collapsed and caught fire. A lady was trapped and would have been burnt to death. A general practitioner was called who, taking the situation in, administered a **deliberate** overdose of morphine. His account of the event makes it quite clear his intent was to kill. It was publicly reported in newspapers at the time but no action was taken either by the law authorities or in relation to his registration. He was in fact appointed a police surgeon in Napier. He wrote a book about his experiences which was published in 1961.

In conclusion the events of the 1930's were significant both to anaesthesia and medicine in general and continue to affect us today.

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WAS IT REALLY AMYLENE WHICH KILLED JOHN SNOW'S PATIENTS?
(with a note on Dr Thudichum)

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Two deaths under amylene

Between 10th November 1856 and 30th July 1857 John Snow used amylene vapour as a general anaesthetic on 238 occasions with 2 deaths (the 144th and 238th cases).[1-4] He had his own opinions on the cause of these two deaths, which I will discuss shortly, but first I will consider some of the other explanations which were proposed.

Purity of amylene

Thudichum

In 1864 Dr JLW Thudichum described how, after the downfall of amylene, a chemist friend of his had purchased a batch at a cheap price "from one of the first manufacturing houses in London" and had, on analysis, found it to contain a mixture of amylic alcohol and undetermined hydrocarbons but not the slightest trace of amylene.[5] According to Thudichum there was "no question of fraud or mistake. It was some of the same reputed amylene which had been sold and used largely, under the impression that....it was pure and fit for use." Thudichum then suggests that Snow's fatalities were probably not due to amylene but to amylic alcohol, "a known poison", and that amylene was as safe an anaesthetic as Snow had originally supposed. Thudichum obviously trusted the word of his chemist friend and, as Thudichum was himself a very able chemist, it seems reasonable to assume that the friend was thoroughly competent.

Kidd

Thudichum was not the first to question the purity of amylene preparations. In 1859, just two years after the second fatality, Dr Charles Kidd wrote that tests on amylene available in the shops had shown it to contain "very variable but large proportions of free chlorine, and probably in the form of chloroform." Kidd went on to assert that all recent experiments with animals using what was thought to be amylene had, in fact, been made with amyl alcohol.[6]

Richardson

However Snow's friend and biographer, Sir Benjamin Ward Richardson, subsequently dismissed any suggestion that the deaths had been due to impurities. Writing in 1893 Richardson claimed that Snow had administered amylene from the same supply in many other cases without any untoward effects and that he himself (Richardson) had "experimented with a little that remained from the same store, without producing any dangerous symptoms, or detecting any peculiarity of composition."[7] Richardson attributed the fatalities to the insolubility of amylene in blood[7] so that "bubbles of gas" obstructed blood flow "in the minute circulation".[8] He claimed that Snow had not fully appreciated this danger until he, Richardson, had shown him "separation of amylene in the blood, a separation which looked like the formation of minute plugs."[9] Richardson does not give details of the experimental circumstances in which he was able to produce these "minute" plugs, but it is difficult to imagine how amylene would come out of solution unless there were some very marked changes in physical parameters such as ambient pressure or temperature. Because of the low temperature at which amylene evaporates, Richardson subsequently used it as a local anaesthetic,[7] presumably using the same apparatus which he had previously described when using ether for this purpose.[10]

Europe and Britain

Concern about the purity of amylene preparations extended to mainland Europe. The French surgeon Giraldès, who was one of several enthusiastic users of amylene on the continent, wrote in 1859 that "if it had been abandoned this is only from the difficulty in obtaining it pure."[11] In 1887 von Mering introduced trimethylethylene[12] which, it was claimed, was a pure form of amylene. It was also known as β-isoamylene and in 1892 it was marketed as Pental.[13] Despite some early adverse publicity when an obese opera singer died suddenly while a molar tooth was extracted under its influence,[14] it was widely used in Germany for short operations.[12] In Britain there was no definite consensus when its use was discussed by the Society of Anaesthetists in February 1896,[15] but Buxton later concluded that its advantages were more than outweighed by its dangers.[12]

Snow

The meticulous Dr Snow was, of course, perfectly well aware of problems with the purity of amylene preparations. Writing in 1857, before his first fatality, he described the preparation of amylic alcohol by distillation from fusel oil.[3] The amylic alcohol was then distilled with zinc chloride to produce amylene,

paramylene and metamylene, and further distillations were then made to separate the amylene from the other two compounds. Snow explained that it did not matter if some paramylene and metamylene remained because neither was sufficiently volatile to be inhaled. He noted that the boiling points of the amylene preparations which he tested were not quite steady, implying that they contained other hydrocarbons of a similar composition and he suspected that one of these might be butylene. Snow was not concerned that his amylene was not absolutely pure because all "the numerous specimens of amylene" with which he had been supplied at that time were "uniform in their physical properties, and in their effects."[3] He exchanged samples with colleagues in Paris, and both he and his Parisian colleagues were satisfied that they were working with the same substance.[3] He was, however, aware of one London hospital that had been supplied with a brownish liquid which bore no resemblance to amylene and of another where the amylene had been diluted with spirits of wine.[3] Snow also investigated other hydrocarbons produced during the manufacture of amylene and which boiled at a temperature between the boiling points of amylene and of paramylene. In animal experiments these substances caused debility and dyspnoea but neither unconsciousness nor anaesthesia.[3]

The purity of amylene could have been enhanced by increasing the number of distillations, but this would have made it too expensive for clinical use, for which purpose Snow was content with "a product approaching purity",[1] though he hoped that the price would fall if there were sufficient demand.[2]

Snow's method of administration of amylene

Snow knew from his animal experiments that 15 per cent of amylene vapour was required to produce and maintain anaesthesia and that a lethal effect required a concentration approaching 40 per cent. He also believed that the cold produced during its evaporation would, using all the ordinary methods of inhalation, prevent the air from taking up a toxic quantity of vapour.[3] By making a small modification to his chloroform inhaler to allow for the greater quantity of amylene which was required, Snow reasoned that he could give amylene with a greater margin of safety than when he used chloroform. Soon after his second fatality he wrote that "I had every reason to trust that the plan which had succeeded so well with chloroform would succeed also with amylene."[4] Only later, and shortly before his death, does he indicate that he had now concluded that the deaths occurred because the patients had, at some point, inhaled air containing more than 30 per cent of amylene vapour, and that this had been a consequence of the unsteady boiling point of amylene.[1] Snow explained that an increase in the boiling point would cause the preparation to give off more

vapour at the beginning of its evaporation than towards the end. He does not state that he actually measured the boiling points of the batches used in either of the deaths but this is the implication. In a paper written in 1857[4] Snow concluded that amylene was safe if given in appropriate concentration and that this could be guaranteed by administering a measured quantity of amylene in a bag of known size. This was the method which he had used with chloroform on a few occasions in 1849[16] and which was subsequently developed by Clover.[17] Snow stated that he did not use this method because he was confident that his modified inhaler would work as safely with amylene as with chloroform and that "to introduce a troublesome and cumbrous method would hardly be practicable with a new agent, when it is not required for one already in use."[4] What Snow omitted to mention was that his confidence in his inhaler was justified only if his amylene preparations had a reasonably steady boiling point. In 1858 he wrote that in future cases in which he used amylene he would indeed administer it from a bag.[1] This statement tells us not only that, had he lived, Snow intended to use amylene again but also that he was convinced of its safety provided that the concentration of vapour was controlled. Clearly, therefore, he did not accept Richardson's suggestion that the danger of amylene lay in its relative insolubility. Snow knew exactly how high concentrations of amylene killed because, in his two fatal cases,[3,4] the loss of the pulse long before any failure of respiration was identical to the cardiac deaths which had occurred with 40 per cent vapour in his animal experiments.[1]

As for Thudichum's suggestion that it was not amylene but amylic alcohol which killed Snow's patients, this seems improbable. There were certainly preparations available which masqueraded as amylene when they were not, but it is most unlikely that Snow would have used them. Not only did he use a trustworthy supplier, but amylene has a characteristic odour, "somewhat resembling that of naptha".[2] Moreover, its anaesthetic properties were distinctive. Its analgesic effect was apparent when the level of consciousness was only slightly impaired, it caused some muscular rigidity, it had to be repeated frequently, a little every half minute or so, because its effect wore off so rapidly, it did not increase salivation and it did not cause vomiting.[1] It is scarcely credible that such an experienced anaesthetist and such an astute observer as Snow would not have noticed if the character of anaesthesia had differed from his usual experience of amylene. Until the pulse ceased there seems to have been nothing which caused him any anxiety in either of the two fatal cases, and in the 94 cases in which he administered amylene after his first fatality he "never had occasion to feel a moment's uneasiness about it."[4]

Dr Thudichum

If Dr Thudichum considered these points before making his suggestion he must have decided to overlook them in favour of a story which nicely illustrated a point he wished to make at that time about the dangers of impure medicines. Thudichum had come to England in 1853 because he was unable to obtain work in his native Germany. He had supported the republican cause in the revolution of 1848 and, although he had subsequently served under von Esmarch as a volunteer surgeon at Kiel in the German-Danish War of 1853, his name was still blacklisted.[18] He would probably have met Snow at the Medical Society of London, of which they were both members. Snow's Case Books show that he administered chloroform to Mrs Thudichum in her first labour in 1855 and then again in her second the following year.[19] The second pregnancy ended with a forceps delivery, the forceps being applied and the baby delivered by the father! Thudichum must have been grateful for Snow's presence, not just as chloroformist, but as an expert on neonatal resuscitation[20] because the baby was born "in a state of asphyxia" and Snow applied "mouth to mouth inflation" for an hour before the baby breathed regularly. Two days later Snow recorded that mother and baby were both "going on well".[19]

Thudichum was a considerable polymath and innovator. He pioneered the treatment of nasal polyps by electro-cautery[21] and his name became familiar to generations of medical students because of his eponymous nasal speculum. As a pioneer of the application of spectrum analysis to biological materials he made important discoveries in the chemistry of cerebral tissue.[21] A demonstration which he gave of spectrum analysis at the Medical Society of London was witnessed by Charles James Fox.[22] In 1868 Fox had operated under nitrous oxide which was administered by Clover using the single bottle of liquid gas which TW Evans had brought from Paris, but he had never been able to obtain further supplies of bottled gas even though he had written to the manufacturer in Paris. When he attended Thudichum's demonstration he saw the large iron bottles of compressed oxygen and hydrogen which Thudichum used to produce Drummond's limelight as the source of a continuous spectrum for spectrum analysis. Fox then persuaded Coxeter's, who supplied the compressed gases to Thudichum, to fill some of their cylinders with nitrous oxide, thereby making it more readily available in dentistry and surgery.

Four months later Thudichum wrote to *The Times* newspaper appealing for funds to purchase bottles of nitrous oxide to anaesthetise soldiers wounded in the Franco-Prussian War.[23] He suggested that nitrous oxide was easier than chloroform to administer to recently wounded soldiers and that the lack of vomiting was a major advantage in these circumstances. He also claimed that

because of its disadvantages chloroform was used only rarely for minor surgery in military practice and that it was never used for painful dressing changes, and that nitrous oxide would obviate these problems. His proposal was opposed by Dr Charles Kidd and by *The Lancet* who argued that none of the surgeons in the field would know how to administer nitrous oxide.[24,25] Nevertheless, by the end of September the Nitrous Oxyd [*sic*] Fund had received £220[26]and it was reported that Coxeter's had sent 2000 gallons to Paris and 3000 gallons to the tented hospital[27] which Thudichum and Dr John Simon had set up at Bingen on the Rhine.[28] However, I have found no evidence that any of this nitrous oxide was actually used, either at Bingen or elsewhere. No mention was made of nitrous oxide in reports about the hospital at Bingen in either the *British Medical Journal*[29] or the *Lancet,*[30] and there is no reference to it in the minutes of the meetings of the Medical Society of London at which Thudichum spoke of his experiences during the war.[31] He did, however, refer elsewhere to chloroform as an anaesthetic which was used at Bingen[32] and it seems likely that nitrous oxide only finally entered military practice more than 40 years later during World War I.

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MURDER BY CURARE?

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The sentence to various terms of penal servitude of three out of the four persons who were recently charged at the Old Bailey with conspiring to murder two Cabinet Ministers brought to a fitting conclusion a story of rancorous plotting against persons in authority, of perverted ingenuity, and of fatuous recklessness, such as we are accustomed to associate with the cruder novel of crime or with cinematograph exhibitions.[1]

Such rhetoric is fortunately now unusual in *The Lancet*. This extract refers to an account of an alleged attempt on the lives of David Lloyd George, Prime Minister, and Arthur Henderson, Leader of the Labour Party, by firing curare tipped arrows at them from behind a bush on Walton Heath Golf Club, in early 1917.

The so-called Lloyd George murder plot

The Ministry of Munitions

Lloyd George had been Head of the rapidly expanding Ministry of Munitions, but was now Prime Minister and responsible for the introduction of conscription.[2] The government was having problems with the non combatant labour force, and was tackling this by going for individual leaders rather than addressing specific problems. The Ministry of Munitions was developing its own primitive secret service network, and was infiltrating the workers organizations to root out trouble makers. They were expecting trouble in Derby, so they sent a spy, codenamed Alex Gordon to see what was going on.

The spy – "Alex Gordon"

Gordon, discharged from the army, and working as a journalist, was recruited as a Ministry of Munitions spy and had reported from Sheffield that all was calm when the Sheffield tram strike started, so was in danger of loosing his job. It is said that he was mentally unstable,[3] and he was certainly known to Scotland Yard under several names,[4] so it is a fair assumption that he had "previous". His real name was William Rickard, or Francis Vivian. Told, by his equally suspect boss, Herbert Booth,[5] that he must get a good story, with exciting copy,[6] he went to the Clarion Club in Derby, claiming to be a conscientious objector, and was sent to a safe house for the night.

The Wheeldon family

This was 12 Pear Tree Road, the home of the Wheeldon family: Mr and Mrs Wheeldon, and their daughters Hettie and Nellie. William, the son, a conscientious objector, was in hiding, and Winnie, the other daughter, married to Alfred Mason, lived in Southampton. Mr Wheeldon and Nellie do not feature in this tale. The family was very highly thought of by friends and neighbours.[7] Hettie and Winnie were highly intelligent literate women, who had trained as teachers at Stockwell College. The female members of the family were atheists, had been suffragettes before the war and were implicated in the burning of Breadsall Church, although it is likely that this was not arson.[8]

Hettie was stepping out with a small but attractive Irishman, Arthur McManus who *was an effective agitator, with a very persuasive way of speaking at meetings, volatile and witty.*[9] He had been involved in riots in Liverpool and on the Clyde, from where he had been deported, and was in hiding in Derby. He had had a face to face argument with Lloyd George, in Glasgow,[10] and had been tried before by the Attorney General, F E Smith.[11] Mc Manus was being watched carefully.

The seeds of discontent

Following the dreadful losses of life on the Somme, attitudes to the war were hardening, Lloyd George's conscription was very unpopular. Mrs Alice Wheeldon, Hettie and Winnie were part of the No Conscription Fellowship, of which Hettie was secretary. Alice was part of the Underground Train, a network actively sheltering conscientious objectors who were on their way to Liverpool to get to America. She always freely admitted that she was breaking the law in this way. Her son, Willie was in hiding, probably in Southampton, where his sister Winnie lived, but he was later interned. The whole family hated Lloyd George, as they felt that he was responsible for a great many deaths.

Because Winnie lived in Southampton the women wrote to each other daily, and after Gordon entered their household, their letters were intercepted, copied and then sent on to them.

Winnie wrote, of Lloyd George
"Now that d-d buggering Welsh sod's got into power. Gott strafe his blasted iz".
Their letters were usually well spelt, and beautifully written, but sometimes they wrote like this as a deliberate affectation. None of the letters in their original handwriting in the records at Kew is written in this fashion, only the ones that

have been copied and typed. They also sometimes wrote in code; actually I (AF) am sure that this started as fun - Winnie found the code in a book in the library. In a poem by Mason, sent to Alice,[12] the key to the code was
"We will hang Lloyd George from a sour apple tree".

Alice, another day, wrote
"What the Lloyd George is wrong with the post"
and " Lloyd George is not fit for Heaven nor Bloody Hell".[13]

The plot

Gordon fastened onto this hatred of Lloyd George. He asked Alice for help to spring three of his imaginary friends from an internment camp, and get them out of the country. He told her that the camps were protected by guards, who were bribable, but also by dogs. This was a fiction on Gordon's part, there were no dogs.[14] Gordon wanted her to get poison from her son in law for the dogs. He then claimed that she had suggested that he get a job as a caddy to Lloyd George, at Walton Heath Golf Club, and, carrying a syringe of curare in his pocket, fall against Lloyd George, and inject it.[15] Gordon anxious for a good story, to save his skin, told his boss, Herbert Booth that there was a plot to murder Lloyd George.

The poison

Alice's son in law, Alfred Mason, was a dispensing chemist and a lecturer at Hartley College in Southampton. One of his jobs as a chemist had been to destroy stray dogs; rabies was still a threat. He reckoned that he had killed several thousand, using prussic acid hidden in meat. He was also an expert on curare, and had some in his possession which he had got from a dealer, and which he had demonstrated in his lectures. It was available in physiology laboratories at this time.[16] He agreed to supply poison, but was unhappy sending prussic acid through the post, so he supplied strychnine, and, rather as an afterthought, some curare. His logic was, that if they could get near the dogs then they could feed them bread or meat with strychnine on it, but if it was impossible to get close to them, then a curare tipped arrow from a walking stick gun just might do the trick.[17] This important point about getting at the dogs has been ignored in all previous accounts that I (AF) can find about this "plot".

A parcel arrived in Derby, which was intercepted and opened by another dubious employee of the spy service, de Valda, who later wrote that he was "delighted to be mixed up in something hot".[18]

The parcel was then resealed and sent to the Wheeldons. Alice gave it to Booth, who had now taken over from Gordon. It contained, according to a later analysis by Dr Spilsbury

Phial A	$7^1/_2$ grains hydrochlorate of strychnine (2 or 3 doses) < 500mg *(Fatal dose 1 – 2 mg/kg body weight)*
Phial B	Solution of hydrochlorate of strychnine
Phial C	Brown paste of "curare"
Phial D	Solution of "curare"

Both C and D have have paralyzing effect similar to that produced by curare - Mr Webster and Dr Spilsbury "with rabbit".[19]

The instructions that came with the poisons[20] included the words
- "a dart …from an air gun (walking stick gun)"
- "As long as you have a chance to get to the dog, I pity it". and
- "Powder A on meat or bread is OK.".

Neither of these last two sentences can possibly refer to a murder plot for the Prime Minister. No one can have thought that the PM would pick up and eat a piece of bread laced with strychnine which he just happened to find lying about on Walton Heath Golf Club.

A letter from Winnie next arrived including the term
" I hope it all right abaht them things for the dawg".
There is no correspondence in the files between family members linking Lloyd George with the poison.

The arrests

Booth told his boss at the Ministry of Munitions about Gordon's revelation, and about the poison, and after discussion, Chief Inspector Parker arrested Mrs Wheeldon on a charge of conspiring to murder the Prime Minister. The Masons were arrested, and so was Hettie.[21] The Mason's house was searched, and his small chemistry collection taken away.[21] Alice, Hettie, Winnie and Alfred were tried for the attempted murder of the two ministers. The case was adjourned and sent to the High Court in London.

The Court Case

FE Smith the Attorney General, was counsel for the prosecution with Sir Archibald Bodkin the chief prosecutor. Bell later wrote of Smith:
"It is doubtful if a more spiteful hateful enemy of the workers ever existed".[23]

The only person that could be found for the defence was Mr Riza, who was totally unknown and who demonstrated himself to be woefully incompetent. At the end of the trial he requested that the convicted people undergo trial by ordeal.

They did not call Gordon as a witness; it was said, by Smith, to be too dangerous for him, but it is obvious from reading the recently released files at Kew, that they did not trust him; he would not appear without coercion[24] and would have been a very unreliable witness. They packed him off to South Africa out of harms way.[25]

It is obvious from reading the files at the National Record Office[26] that the Home Office started this prosecution even though individuals were unhappy about it. It developed a momentum that they were unable to stop, so they needed a conviction in order to discourage others from trying something similar. An article appeared in *History Today* in May of this year which does give a good account of why the trial was such a terrible farce,[27] so this will not be discussed further, although all 350 pages of the transcript have been carefully scrutinized (byAF). The trial has been described as an MI5 set-up.[28]

Alice was given ten years penal servitude, Alfred seven and Winnie five. For Hettie there was *insufficient evidence to prove guilt* but they tried to find an excuse for re-arresting her.[29]

The aftermath

Alice repeatedly went on hunger strike in prison, and when they tried to force feed her, shocked them with her command of Anglo-Saxon. After a year she was near death so was released, this being dressed up as being *On the express orders of the Prime Minister* but actually was a request from the Home Office to the PM as she was well on the way to becoming a martyr.[30] This case had back-fired badly on the government, as their use of spies as agents provocateurs was very unpopular, and the spy covers had been blown.[31] The Masons were released soon afterwards.

What happened to the main players

Hettie married McManus and died in childbirth, Winnie and Alfred lived unhappily ever after, but were watched by the Home Office. Willie went to Russia, and was shot in one of Stalin's purges. Alice died of Spanish flu, a year after her release, and is said to haunt the passages under the Guildhall in Derby. She was buried in Nottingham road cemetery in the same grave as Elizabeth

Gossage, her older sister. John Clarke, who was on the run at the time, gave a sensational oration at the graveside, describing Alice's death as a *climax of one of the world's most poignant tragedies ... a judicial murder.*[32]

Smith became an Earl, and wrote a book,[33] Lloyd George eventually resigned over a cash for honours scandal, and wrote several books; Parker[34] and De Valda[35] wrote books.

Assessment

What this sorry tale indicates is that in *the political climate of the time ... the unproven word of an absent agent provocateur was more reliable than the testimony of socialist feminist opponents of war.*[36]

Human death by curare

The question remains, is it possible to kill a full sized human using a curare tipped poisoned arrow?

Waterton in his book describes the death of a dog following a hit by a curare tipped arrow,[37] and the death of an ox after the insertion of several arrows,[38] and gives a second hand account of the death of an Indian hit in the arm by his own arrow which he had fired too vertically.[39] In the *British Medical Journal* in 1889 an article describes a servant girl who fell on a poisoned arrow while cleaning, and required artificial respiration, but survived.[40]

In order to get a therapeutic dose approaching 30mg into a full sized adult, one would, assuming say 10% absorption, require the amount of crude, or the amount of crystalline curare shown in Figure 1 (actually boot polish and cream of tartar).

In South American Amazonia the arrowheads are grooved, longitudinally on the flat side, circumferentially on the rounded side, and the curare paste is put in the grooves, so is not pushed off by the skin as the arrow enters the animal (Figure 2). Administering a lethal dose of curare to an adult would require a huge arrowhead, which would be immediately obvious, and therefore impossible to use as an effective murder technique. Indeed, in South America, curare is not used for large animals such as a tapir, but a large flat blade is used parallel to the ribs to cause a tension pneumothorax.[41]

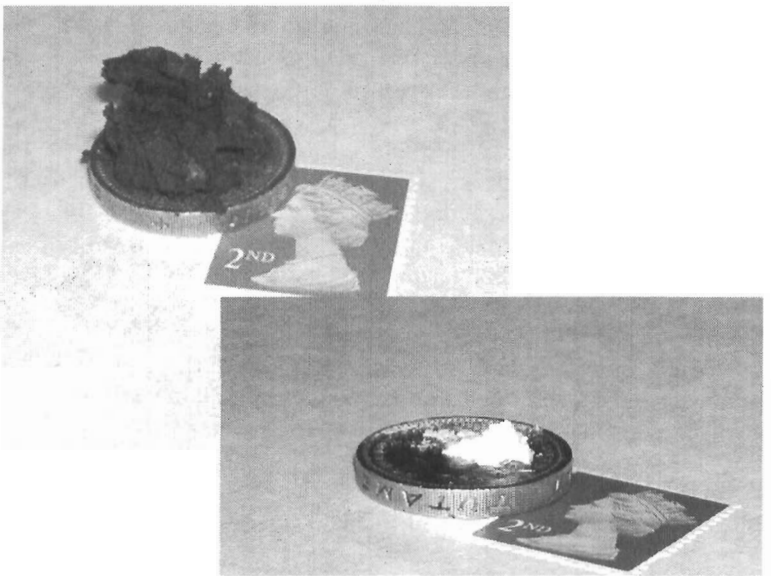

Figure 1 Amounts of "curare" paste or crystalline curare required to kill

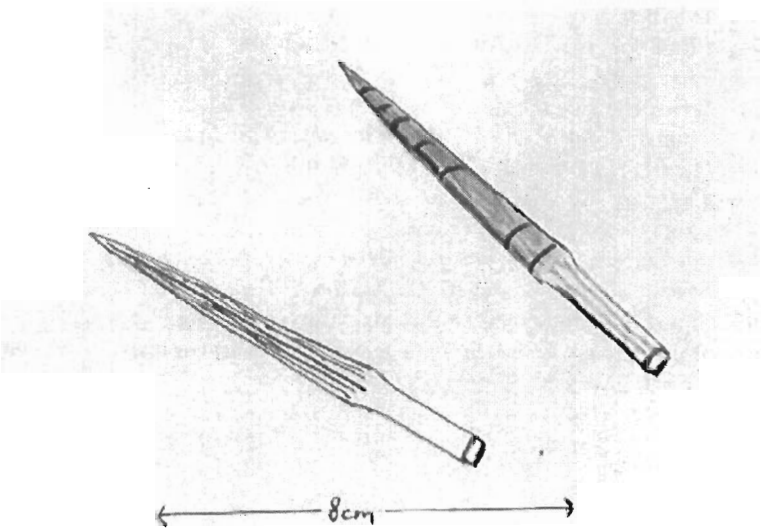

Figure 2 Arrow purchased in Brazil showing longitudinal grooves on the flat side and circumferential grooves on the rounded side

Although there must have been murders using curare in some way, only one has been found in *The Times*, a surgeon in Hackensack, who killed 13 patients, but using ampoules and a syringe.[42] Since then one nurse has killed using atracurium.[43]

In literature Conan Doyle wrote one story in which a boy tried to kill his baby brother with a poisoned dart from Peru, the story was nearly right, but he practiced on his dog first, and Holmes suspected that curare had been used because the dog was still partially paralysed four months later.[44]

In a Metro Goldwyn Mayer film, *Murder Ahoy*,[45] curare is mentioned near the start as coming from the African Boxwood tree, and then a girl is killed in a most dramatic and painful way by curare on the end of a mouse trap hitting her on the finger. This is instantly diagnosed by a brisk young GP.

To conclude, as a murder weapon, curare is a non starter, but poison darts will certainly still be used in ever more ingenious ways.[46]

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THE LAST DEATH FROM A STATIC ANAESTHETIC EXPLOSION IN GREAT BRITAIN?

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Background

In 1953 the Ministry of Health set up a working party with Professor Stead as Chairman to "consider the causes of anaesthetic explosions in hospitals and to make recommendations for their prevention" [1]. This working party took over from one previously set up by the Medical Defence Union and the Faculty of Anaesthetists which had already started to look at this problem. 31 serious explosions had been reported since 1947 resulting in three deaths. This was from a total of nearly 49,000 operations. The most common cause was a static spark and the second the use of diathermy. Bronchoscopy in children carried a particular explosion hazard. Two of the incidents were probably caused by the anaesthetist smoking! [2]

In 1954 the committee was informed of another serious explosion resulting in the death of a victim of a road accident. It happened at the Royal Salop Infirmary and the anaesthetist involved was Dr James (Jimmy) Polland. Jimmy told me of the nightmare scenario which is described below.

The explosion

In the bitterly cold winter of 1954 on 26th January at 2.50 pm a skidding lorry struck a Mr John Hopley, a senior stoker at Cosford RAF Station. He had been riding a motorcycle on his way back from work and was parking it on the side of the road at Cripples' Hill Madeley. Approximately eight hours later at eleven pm the extremely ill patient was taken to theatre. On nitrous oxide and oxygen he was restless and it was impossible to keep him adequately oxygenated. To keep the blood pressure up and to deal with the hypoxia Dr Polland switched over to cyclopropane and oxygen. When he disconnected the anaesthetic circuit to change over to a closed circuit there was a loud bang with bits of anaesthetic equipment scattered everywhere. Smoke was seen to be coming from the patient's mouth. The patient was initially resuscitated but died soon afterwards. Both the anaesthetist and the surgeon received minor cuts.

At the inquest held on 29th January 1954 the houseman said that he had difficulty listening for patient's heart because he still had ringing in the ears from the explosion.

The Inquest

The incident was extensively reported in the local paper[3] and even made it into *The Times*[4]. The pathologist Professor Webster was of the opinion that, although Mr Hopley's injuries were serious, he would have expected him to survive. Describing the injuries resulting from the explosion, Prof. Webster said: " The deceased had typical appearances of blast injury such as one saw in the war in bombing." The expert witness at the coroner's inquest said that there was a 100 000 to one chance of the explosion happening and that the static spark was probably due to a low atmospheric humidity estimated at 20% at the time of the explosion. He also stated that the prolonged spell of extremely cold weather, and a ventilation system which was out of action, were to blame, but that the explosion could easily have been avoided by wet mopping the floor between cases. As shown in Figure1 the coroner's court gave the primary cause of death as shock from the blast effects of an anaesthetic explosion.[5]

1. Name of deceased:
PERCY JOHN HOPLEY

2. Injury or disease causing death: (4)
1a. Shock
b. Blast effects of an explosion.
II. Injuries received in an accident. Fracture of pelvis. Bruises and lacerations.

3. Time, place and circumstances at or in which injury was sustained : (5)
About 2.50p.m. 26th January at Cripples Hill Madeley deceased was knocked down and injured by a skidding motor lorry and trailer. Skidding being due to icy conditions of the road. About 11p.m. same date deceased was taken to the operating theatre at the Royal Salop Infirmary for the repair of his injuries. On the Anaesthetist's changing the anaesthetic from open to closed circuit there was an explosion in the anaesthetic apparatus. The shock from which extended to the lungs.
4. Conclusion of the jury/coroner as to the death:
Accidental

Figure 1 Report of coroner's inquest

Dr Polland told me that during the day there was usually a cloud of steam coming from the sterilisers, situated in the prep room between the two theatres, which helped to keep the theatres humid. As it was 11pm, these were not being used. To make matters worse the hospital had ordered and obtained some antistatic tubing. After a brief trial it was found to be too cumbersome to be used and had been returned to it's box awaiting further action.

The dangers of sparks from any source were well known. The Ministry of Health had sent circulars as early as 1935 to all hospitals[6] and also to borough and county councils[7]. The recommended way to stop static explosions was to have high relative humidity levels of at least 60%. This requirement was in the textbooks and "earthing" chains on anaesthetic machines, as a solution to anaesthetic explosions, were even described in the *Sunday Express* in 1936 (see Figure 2). Antistatic precautions should have been standard practice.

EXPLOSION FEAR AT OPERATION

TABLES EARTHED BY CHAIN

Causes of explosions in operating theatres, to which attention was drawn by the Middlesex Hospital mishap on Friday, are revealed in this article.

By the Chairman, Anæsthetics Committee, Medical Research Council :—

EXPLOSIONS in operating theatres are more frequent than they were a few years ago.

This is because of the amount of electrical apparatus associated with the modern theatre, because of complicated machines often employed by anæsthetists, and because of air-conditioning.

Till this last "improvement" static electricity was unknown as a source of danger in British theatres. The air here was too moist and cool. In America 'static' had for some time been recognised as a potential danger, and theatres were especially constructed to avoid it.

Floors were made with strips of brass inset so that the operating table and persons on the theatre floor were earthed.

Figure 2 ***Sunday Express*** **3 May 1936**

Outcomes

Mrs Hopley decided to sue for Mr Hopley's ten hours of suffering and loss of wages and took combined action against, the owners of the lorry, the Regional Hospital Board, and Dr Polland.[8] The case dragged on and finally came to the High Court Queen's Bench Division six years later.

The lorry driver was found not to be guilty of negligence. Dr Polland was exonerated as he had enough to do in keeping the patient alive and was entitled to assume that the humidity was correct. It was Dr Harker, who made the mistake of calling himself the "senior anaesthetist", and had offered to accompany Jimmy to London to give him moral support, who found himself at the mercy of the court. The poor man ended being grilled at length and found himself, as the agent for the Hospital Board, held responsible for the low humidity levels because of the faulty equipment. The widow was awarded £3,147 in damages against the Hospital Board.

This case was of legal importance and was reported by one of the legal teams in *The Lancet* under the heading: "A Hospital Board's Responsibility"[9]. The article describes the incident and the important judgement that the anaesthetist was **entitled** to assume that the humidity was correct.

Conclusion

The working party reported in 1956 – see Figure 3. The report included a safety code for equipment and installations which affected anaesthetic practice for years to come. Had the code been in place in 1954 this death might have been prevented.

Acknowledgements

I thank the many individuals who have helped me to find the material for this paper. A special thankyou must go to the late Dr Polland, Dr J McCloy, the staff at the Shropshire Archives, the library staff at the RSM, and the staff of the National Archives.

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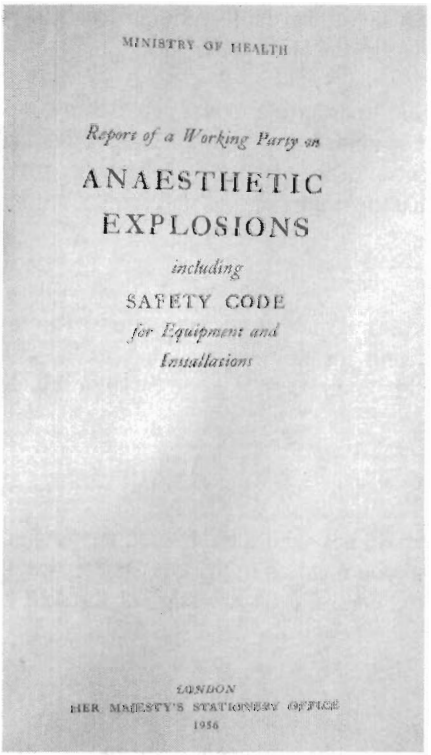
MINISTRY OF HEALTH

Report of a Working Party on

ANAESTHETIC EXPLOSIONS

including

SAFETY CODE

for Equipment and Installations

LONDON
HER MAJESTY'S STATIONERY OFFICE
1956

Figure 3 Report of Working Party on Anaesthetic Explosions, 1956

SIMPSON'S LAST ILLNESS*

Dr David Wright, Retired Consultant Anaesthetist, Edinburgh
Iain Milne, Librarian Royal College of Physicians of Edinburgh

Sir James Young Simpson died on May 6th 1870, after being unwell for some months. His nephew Robert, a young lawyer, spent much time with him in the last few weeks of his life and made notes about his illness. These notes were drawn on by Dr Duns when he wrote a memoir of Simpson, which was published in 1873, and their existence was noted by Simpson's daughter Eve in her book on her father written in 1896.

In August last year Robert Simpson's notebook turned up in a Shelter charity bookshop in Edinburgh and it's now in the possession of the Royal College of Physicians in Edinburgh.

This paper provides a brief description of the note book and uses its information to provide a summary of Simpson's last illness. This includes a brief review of his symptoms and their relief, of his anxieties and the steps that were taken to deal with them and of the friends and relations who helped to look after him.

*Abstract only, at author's request

SHACKLETON, HIS SURGEONS AND DUNDEE

Dr Aileen K Adams, Cambridge

In 1916 on Elephant Island, a remote rocky outcrop in Antarctica, under an upturned dinghy that provided some protection from snow and wind, Dr Alexander Macklin gave chloroform to Percy Blackborow, a stowaway, for Dr James McIlroy to amputate his frost-bitten toes.

This was not the first operation under anaesthesia to have been performed in Antarctica, an earlier one during Shackleton's *Nimrod* expedition in 1909 had been carried out, but this was in the comfort of a ship, warm enough to vaporise the chloroform, not marooned on a bleak and freezing island.

Exploration of Antarctica[1]

The seas surrounding Antarctica were explored by James Cook in the 1760s when he circumnavigated the continent without actually seeing it. He was followed by James Clark Ross in the 1840s, who went much further south exploring the Ross Sea and did see land. The mainland was first penetrated by a French expedition under Admiral Dumont d'Urville and a British one under Carsten Borchgrevink, who in 1898 was in 1898 the first to over-winter on land

.

Discovery expedition (1901-4)

Captain Scott set his heart on reaching the South Pole. His first voyage in 1902 was in *Discovery*, a ship purpose-built in Dundee which had had whaling ships working in the Antarctic for at least 10 years. Ernest Shackleton was a member of Scott's expedition. They sailed south to Ross Island, where their Discovery Hut still remains, close to the present American year-round base named after Scott.

A three-man team of Scott, Shackleton and Edward Wilson, the latter a doctor by profession but a naturalist by inclination and a gifted artist, left to reconnoitre a route to the South Pole, first using dogs to pull their sledges and later man-hauling them to within 150 miles of the Pole. They turned back exhausted, but also showing signs of scurvy. Shackleton was worst affected and he also suffered from severe cough and breathlessness[2]. Scott tended to blame their failure on Shackleton for holding back the expedition, although in fact they had turned for home several days before he became sick. Scott sent him back to New Zealand, to Shackleton's intense annoyance.

Sir Ernest Shackleton (1874-1922)

Shackleton and Scott were incompatible characters. Shackleton was a born leader and could never be happy in a party led by someone else. He led three more expeditions himself, the first an exploratory one in *Nimrod* in 1907, when he travelled about 70 miles further south than he had done with Scott, the second in 1914 in *Endurance* and the third in 1921 in *Quest.*

***Endurance* expedition (1914-16)** [3]

Scott had reached the Pole in 1913, albeit second to the Norwegian Roald Amundsen, so Shackleton looked for a different goal. He decided to attempt to traverse the Antarctic continent, starting from the opposite side, but he never reached land, for his ship *Endurance* was trapped in the ice of the Weddell Sea, crushed and sunk, leaving him to extricate his party of 27 men from a place thousands of miles from human habitation, hundreds of miles from any shipping route, with minimal food and shelter, marooned on an ocean of moving ice in the most inhospitable climate in the world and of course no radio.

This might have defeated any other man, but not Shackleton - his comment when he abandoned ship was 'chaps - we've lost our ship and most of our stores, now it's time to go home'. He was never one for looking backwards, to him the past was past. He got his party home. They spent 6 months helplessly drifting on the sea-ice which was constantly moving, camping on the ice and hauling sledges carrying their three lifeboats laden with the stores they had rescued from the ship. In the summer when the ice opened up they sailed and rowed their boats for 7 days before fetching up on Elephant Island, a rocky outcrop covered with snow and ice, called after the Elephant Seals who, along with penguins, frequent it in the summer and provided some sustenance for the party. It is so remote that, although first sighted in 1819, no-one had visited it before Shackleton, and in 1976 Chris Furze landed to search for traces of Shackleton's party and found none. It is now on the tourist route and I landed there on my first visit to Antarctica in 1994. It was Christmas Eve and in cold damp weather it was a strangely atmospheric place.

Shackleton's only hope of survival was to attempt to sail one of their dinghies to somewhere inhabited. There was a permanent whaling station on South Georgia 800 miles away, and the direction of wind and waves meant they had some chance of reaching it. He embarked in the *James Caird,* the largest of their boats, taking four men and leaving 23 behind, including both surgeons, to survive as best they could. It seemed a forlorn hope but *Caird* got there, thanks to the navigation skills of Frank Worsley who used his sextant in the tossing

boat on the rare occasions when there was a glimpse of the sun. They were blown onto the wrong side of the island and had to climb an unmapped 10 000ft mountain range to get to the whaling station and find rescue. It was 1916, Britain was in the midst of war and did not help. Eventually, Shackleton persuaded the Chilean Navy to send a tiny vessel the *Yelcho* to rescue his men.

The *Yelcho* took them to Chile, where they received a riotous welcome. Back in England the reception was different, the war was going badly and no-one was interested in Antarctic explorers, for the heroes of the day were the men in the trenches. At once the *Endurance* survivers were dispatched to the front line on active service, several were wounded and two lost their lives.

Endurance surgeons

Two surgeons travelled with Shackleton, Alexander Macklin and James McIlroy. Both went twice, first in *Endurance* and later, after the war, in *Quest*.

Whilst recruited as doctors they were no exception to the practice that on expeditions everyone has to be prepared to do anything, however menial. On the voyage out Macklin wrote 'I have learned all about seamanship and could do most of the seamen's duties, and I learned about the dogs who joined us at Buenos Aires'. Both became expert dog-handlers and once had to chloroform a dog to treat an eye injury sustained in a fight.

Alexander Hepburne Macklin (1889-1967)

Macklin kept detailed journals of both the *Endurance* and the *Quest* expeditions. These are now in the Scott-Polar Research Institute (SPRI) in Cambridge[4] [5]. They are detailed, factual and only occasionally does he express his emotions. He did not keep individual case records of his patients, though he mentions what and whom he treated. The men kept well, with few infections other than gastro-intestinal, but sustained a variety of injuries and occasional medical conditions.

Macklin[6] was born in 1889 in Melrose in Scotland and brought up in the Scilly Isles where his father had became a GP. During his childhood his spare time was spent in small boats and later he did a gap year as a seaman. Educated in Plymouth, he studied medicine in London and Manchester, where he qualified. He became interested in polar exploration after reading *Furthest North* by Nansen in which he describes his attempts to reach the North Pole.

Macklin went to see Shackleton in London and says he was met by 'a living

avalanche on the stairs', who noticed he was wearing spectacles and asked him what was wrong with his eyes. Macklin replied 'nothing - but many a wise face would look foolish without spectacles'. He was signed on in spite of being short-sighted and always needing glasses. Macklin was described by one of his colleagues as seeming older than his years, tall and thickset, giving an impression of stolidity and of concealing his emotions. He became an important though low-key member of the expedition, partly because he was one of the few who had some influence over Shackleton, to whom he became both friend and medical adviser. He was also the best football player in the party, a useful talent.

After surviving the Antarctic he was appointed to the Royal Army Medical Corps (RAMC) and immediately posted to the front in France, later he volunteered to go to Arctic Russia.

Macklin was awarded the Military Cross, the Polar Medal, the Territorial Decoration and was twice mentioned in dispatches. He was elected Fellow of the Royal Geographical Society (RGS) and the Russians awarded him the order of St Stanislav. Perhaps he would most appreciate that Mount Macklin in South Georgia is named after him.

James Archibald McIlroy (1879-1968)

James Archibald McIlroy did not keep a diary *. He was a wanderer who left few footprints.

He was born in 1879. His father was an Ulsterman who moved to Birmingham where James went to school and university. After a house-surgeon post he went overseas, practising in Egypt, the Far East and as ship's doctor with the East India Line. When on leave in London he heard of Shackleton's expedition, went to see him and was accepted. He contrasted with Macklin, of slight build, handsome, sardonic, somewhat Mephistophelian, with a wicked sense of humour. His personality seems to have helped in cheering the crew when morale was low.

He too was sent to the western front where he was badly wounded at Ypres and invalided out of the Army. He recovered well enough to be sent later to the Russian front in the Arctic. He was elected Fellow of the RGS and received the Polar Medal[7].

***Quest* expedition (1921-2)**

Shackleton had an unhappy time during the war, he wanted a decent job but

instead he was sent, first on a goodwill mission to South America, and later to the Arctic in charge of transport in Murmansk, where he met both his surgeons again. After the war he was jobless, short of money, still in debt from the *Endurance* trip, drinking and smoking heavily and hankering after the Antarctic. Eventually he raised enough funds to purchase another ship, the *Quest*. His scientific objectives for the *Quest* voyage were vague, he just seemed nostalgic to go south again, a nostalgia shared by his colleagues, for both doctors and six others from his *Endurance* party signed on again, a tribute to his charisma and qualities of leadership[7].

Quest sailed in 1921 and stopped in Rio de Janeiro to pick up stores. Here Shackleton fell ill, suffering chest pains and almost certainly had a myocardial infarct. He was only 47. He refused to allow Macklin to examine him, as indeed throughout his life he had always refused medical examination. He recovered sufficiently to insist on proceeding to South Georgia. On his arrival there at the whaling station at Grytviken he went ashore, spending a nostalgic day revisiting his old haunts and enjoying showing them to the newcomers in his party. He returned to the ship, but during the night he sent for his doctor again. Macklin's diary records 'I was taking the 12-3am anchor watch when I was attracted by a whistle from the Boss' cabin. He told me that he was suffering from pains in the back and bad facial neuralgia. He wished some drug that would provide immediate relief. He said he had taken 3 tablets of aspirin and they had done him no good . . . I left him and went to the medicine cupboard and got 10 minims of chlorodyne which I gave him in water. He did not take it at once but said "put it down while I talk to you . . . . what is the cause of this trouble of mine?" and I told him as I had told him many times before that he had been overdoing things and that it was no good expecting any single dose of medicine to put him right but that it was much more important to try and lead a more regular life, get sleep regularly and have a good daily routine . . . He replied "you are always wanting me to give up things, what is it I ought to give up?" I replied "chiefly alcohol Boss I don't think it agrees with you" . . . he then said "I can feel the pain coming on again give me the medicine quickly. He swallowed it but immediately had a very severe paroxysm during which he died. I stood by him till I saw that all was hopeless and then went to tell McIlroy" .' [5]

The two surgeons carried out a postmortem and found extensive atheroma of the coronary arteries. His friends planned to send his body back to England, but at the instigation of his wife, after a service in the little church in Grytviken, he was buried on South Georgia in the tiny cemetery of the old whaling settlement. Macklin wrote 'Grytviken is a romantic little spot and a fitting resting place for this great explorer . . . we felt that after all this is as he himself would have had it'.[5]

Was his breathlessness when with Scott in 1907 premonitory of cardiac disease? Huntford[7] states that Shackleton had a heart murmur, though he gives no reference to support this. Those who knew Shackleton well noted that occasionally he became out of sorts and lacking energy, though this never lasted long. He smoked heavily and it was observed that on a short hike he 'was troubled by a bad cough and seemed pretty tired with the walk'. Eric Marshall, doctor on *Nimrod*, had refused to sign on for the later *Endurance* trip, because he felt that Shackleton would not be up to climbing the Trans-Antarctic Mountains. If indeed he had cardiac disease in 1907 it is extraordinary that he survived the rigours and exertions of his later expeditions, for he was a leader who shirked nothing. No doubt he denied cardiac symptoms to himself as well as to his doctors.

Post-war careers.

After the war McIlroy reverted to his former varied life[7]. He had a period in Nyasaland cotton-farming, a rather tame occupation for such a man, until Shackleton asked him to join the *Quest* expedition.

After *Quest* returned home he went back to the East, at one time becoming tutor to the King of Siam. In 1949 Lansing, in his book on *Endurance* , tells us that he talked at length with McIlroy.[8] He had gone back to sea, becoming Chief Surgeon in the Orient Line. During the Second World War his ship *Oronsay* was torpedoed off the coast of West Africa and he survived an open-boat journey of 5 days before being rescued and taken to Senegal by a French ship the *Dumont d'Urville* - a strange coincidence as D'Urville was the first Frenchman to explore Antarctica.

McIlroy never married though he was reputed always to enjoy female company. He spent the last 20 years of his life living in Epsom with a lady he first met on a cruise (personal communication, Dr J Horton), whose daughter, as a child, remembers him as being very charming and good-looking and telling her that on Elephant Island they even had to eat their dogs! He died from cancer in 1968 aged 89.

Macklin, after the war,[5] returned to Manchester where he wrote an MD thesis on the transport of casualties. After the *Quest* expedition he became chloroformist to the Royal Infirmary in Dundee, though his expertise was wide-ranging. He was scholarly, with a curiosity to learn about everything he encountered. His

publications in *The Lancet* on scurvy, snow-blindness and frost-bite were important. Anaesthetists will be most interested in his paper describing how he developed an anaesthetic technique using nitrous oxide as sole agent. He found it more satisfactory than ether or chloroform.[9] He seems to have been advocating the secondary saturation technique promulgated by McKesson in America.

SPRI also has letters from Macklin to Raymond Priestley, the geologist on Scott's last expedition[10] and EJC Kendall, a physiologist.[11] He wrote that he believed that scurvy was a major cause of the death of Scott's polar party, not just exhaustion and cold. He clearly understood far better than Scott's doctors what were the earliest signs of scurvy and how to prevent it. No doubt this is at least partly why scurvy did not occur on any of Shackleton's expeditions.

When the Second World War started Macklin was called up as a reservist in the RAMC, he served as Colonel and commanded a Field Ambulance. After the war he returned to Dundee where he married aged 58 and had two sons. He was disappointed to find his careful anaesthetic records in Dundee had not been properly preserved. Later he moved to Aberdeen where he ran the student health service and the radiography centre and became a Council member of the Aberdeen Medico-Chirurgical Society.[6]

Although officially retired he never stopped working. Alec Adam, consultant orthopaedic surgeon at the Aberdeen Royal Infirmary, says that Macklin was the best houseman he ever had, quiet, unassuming, meticulous, he could not fault him. He never talked of his past and Adam regrets he did not press him to do so (personal communication, Mr A Adam). Aged 77 he was employed as a locum house-surgeon. One evening when he was on duty he became ill, went home and died the same night from a heart attack, leaving all his patients' notes up-to-date.

These two surgeons were very different from each other, but perhaps it was this very difference that made them ideal companions on arduous expeditions. Both made their own individual contribution to what has become known as the heroic era of Antarctic exploration.

Shackleton himself has always been regarded as one of the greatest of explorers. If he did indeed suffer from well-concealed cardiac disease for most of his life, it makes his achievements even greater.

Acknowledgment

I thank the staff of SPRI in Cambridge for their help with archival material.

* In discussion Charles Swinthinbank said from the audience that McIlroy had actually kept a journal of the *Endurance* voyage but had abandoned it at their precipitous departure from Elephant Island.

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ANAESTHESIA IN ANTARCTICA*

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Terra Incognita was first seen in 1820 and was not settled until 1890. Although explorers had been searching for the mysterious Southern continent since the Seventeenth Century, it was James Cook in 1775 that made the first circumnavigation of the continent. It would be seal and whale hunters who were the first to see the Antarctic as they searched for their valuable stores of oil and whalebone, moving ever southward.

Landings on the continent were infrequent from the first in 1821 until what has been termed the 'heroic age of exploration' between 1895 and 1922 when Shackleton died on South Georgia. With the advent of mechanised exploration in 1928 when Sir Hubert Wilkins flew over Graham Land in a plane that had been shipped by boat to the continent, exploration was to change. Gradually expeditions were to spend more and more time on Antarctica and bases started to develop. By the end of 1955 Argentina, Chile and UK had 21 permanent stations there. Since this time more stations have been created and hundreds of men and women live all the year round on Antarctica.

Anaesthesia was well developed by the time of the major expeditions to Antarctica and supplies of anaesthetic drugs were taken by several expeditions.

This paper will outline some of the anaesthetics administered in Antarctica from then until the present day. It will be apparent that those who administered or received anaesthesia in such circumstances were and are very different from the average anaesthetist and the patient who is familiar to ourselves.

*Abstract only, at author's request

GUEST LECTURE

TO THE ANTARCTIC WITH SCOTT AND THE *DISCOVERY*

Michael Wilson B.Ed., B.A. Tour Guide on RRS *Discovery*,
Executive member, Dundee Centre of the Royal Scottish Geographical Society

Although the early explorers, such as Admiral Hong Bao of the Chinese 'Treasure Fleets' in 1422 and Amerigo Vespucci, Ferdinand Magellan, and Francis Drake in the mid 16th century, had travelled the southern regions, none had ventured south of the Antarctic Circle. It was to be another two centuries before Cook penetrated south of latitude 66½°S. By the middle of the nineteenth century, most of the attention had been directed to the north polar regions, and still very little was known about the vast area of the world south of the Antarctic Circle.

The first scientific expedition to the Antarctic

The driving force behind the setting up of the first scientific expedition to the Antarctic was Sir Clements Markham, President of the Royal Geographical Society. Together with the Royal Society, they began the arduous task of raising money to fund such an expedition. Funds were slow in coming forward. There were many contributors but the most noted are; Sir Alfred Harmsworth £5,000, the Misses Dawson Lambton £1,500, the Royal Society £1,000, the Government of Queensland Australia £1,000, the Royal Geographical Society £3,000. In March 1899, a last minute donation of £25,000 was received from Llewellan Longstaff, a wealthy Hull businessman and Fellow of the Royal Geographical Society, meeting the target to secure the promised grant of £47,000 from the British Government, and raising the funds to a total of £92,000. The expedition now had adequate funding.

Purpose-building of the *Discovery*

From the outset Sir Clements Markham felt that a special, purpose-built wooden ship would be necessary: a) to penetrate the three hundred miles of pack ice known to exist south of the Antarctic Circle, and b) to withstand the enormous pressures of ice they would encounter in the Antarctica.

The Dundee Shipbuilding Company was awarded the contract to build the *Discovery*. They had a long history of building wooden whaling ships for operation in polar waters and although they had turned to constructing ships of steel, they still had the expertise to build ships of wood.

The *Discovery* was designed by naval architect Mr William Smith, based on the design of a tried and trusted Dundee whaler with some important modifications, such as a steeper raked and steel reinforced bow for ice breaking, a curved and overhanging stern to protect the rudder and propeller from damage in the ice, and a propeller and rudder that could be raised or lowered for protection in the thick ice. The total cost of the *Discovery* was £54,000, including £10,000 for the engines built at Gourlay Brothers engineering works in Dundee.

Early in June 1899, Sir Clements Markham had a chance meeting in Buckingham Palace Road in London, with a young Royal Naval First Lieutenant, Robert Falcon Scott. He was so impressed with this young man that he encouraged him to apply for the post of Commander of the expedition. He applied and was accepted.

Work began on the ship in March 1900, when the keel was laid at the Dundee Shipbuilding Company's yards. Sir Clements Markham, William Smith and Commander R.F. Scott visited Dundee on a regular basis to monitor the progress of the construction. They stayed at the Queen's Hotel in the Nethergate in Dundee on more than one occasion.

On 23rd March 1901 the *Discovery* was launched by Lady Markham and towed the short distance into Victoria Dock to be fitted with her engines, boilers and masts. After her sea trials off Arbroath in May 1901, she finally sailed out of the River Tay on the 3rd June 1901, bound for London to take on supplies and her expedition crew.

Voyage to the Antarctic

Commander Scott, with his contacts in the Royal Navy Channel Squadron, had no difficulty recruiting men for the expedition from the many Royal Navy volunteers. One of the four merchant seamen to be appointed was Merchant Service Officer Ernest Shackleton. He was invalided home on the relief supply ship the *Morning* in February 1903. He returned to the Antarctic in 1909 and again in 1916. He died of a heart attack on board the ship the *Quest* on another expedition to the Antarctic in 1922.

Doctor Edward Wilson was appointed zoologist, expedition artist and second ship's surgeon, but failed his medical due to a scar on his lung from an earlier TB illness. He was so keen to go that he signed on at his own risk. He returned to the Antarctic with Scott in 1912 and died with him in the tent on their return from the South Pole.

The *Discovery* left London on 31st July 1901 arriving at Cowes on the Isle of Wight on Monday morning 5th August during 'Cowes Week', where King Edward VII and Queen Alexandra visited the ship to give the expedition their good wishes. The *Discovery* sailed on the 6th August 1901 bound for Lyttleton in New Zealand via Portsmouth, Madeira, Cape Town and Macquarie Island.

On 21st December 1901, the *Discovery* was given a rousing send off from Lyttleton, heavily laden with additional crew, more supplies and forty-five live sheep, but tragedy was to strike almost immediately. Able Seaman Charles Bonner, who had climbed above the crow's nest to wave farewell to friends on the quayside, fell to the deck to his death. After dealing with the fatality the expedition was finally on its way. As a mark of respect, Scott postponed the Christmas celebrations on board the ship until the 21st June 1902, mid-winter in the Antarctic.

They journeyed south to the Ross Sea area of the Antarctic, breaking through the 270 miles of pack ice, then sailed east along of the Great Ice Barrier of the Ross Ice Shelf mapping and sounding their route and searching for suitable 'Winter Quarters'. They stopped at an inlet in the 'Barrier that they named Balloon Bite, where Scott then Shackleton ascended in a hot air balloon. Scott found the balloon flight a rather unpleasant experience and vowed never to go up in a balloon again. Shackleton, during his ascent, took an aerial photograph of the ship from the balloon at six hundred and fifty feet. This was the first aerial photograph taken in the Antarctic.

Trapped in McMurdo Sound

Returning west along the edge of the Great Ice Barrier, they finally settled in 'Winter Quarters' in McMurdo Sound beside the active volcanoes Mount Terror and Erebus. Here they constructed huts and set up weather stations and laboratories and began preparing for sledging journeys to carry out geological surveys and to explore and map hitherto unexplored regions of the Antarctic. In 1903, Scott, Wilson and Shackleton embarked on a 'Great Southern Sledge Journey', trekking nine hundred and thirty miles in ninety days, suffering terrible hardships, hunger, frost-bite and scurvy.

It was their intention to remain over winter and return to New Zealand in February 1903 when the ice in McMurdo Sound broke up. But the ice remained fast round the ship and they lay trapped in the ice for a second year. Scott and his men tried sawing the ice and blasting it to free the *Discovery*, all to no avail. During this time the scientists continued with their work.

Thomas Hodgson, expedition biologist, developed a system for dredging beneath the ice and discovered many hitherto unknown species of marine life, including sea spiders and sea cucumbers.

Reginald Koettlitz, botanist and senior ship's surgeon, found new species of red fungi growing in crevasses in the ice.

Charles Royds, meteorologist, organised two hourly weather recordings day and night, summer and winter at several stations positioned throughout the area.

Edward Wilson, zoologist, artist and second ship's doctor, prepared animal and bird skins for taxidermy to be sent to museums. He is most noted for producing many accurate colour paintings of the animals, birds and atmospheric phenomena they encountered. These proved to be a valuable source of information since the photographs were black and white. They were the first human beings to find an Emperor Penguin rookery and to lay eyes on Emperor Penguin eggs. They also brought an Emperor Penguin chick aboard the ship to study, but found its appetite too hearty to satisfy.

Louis Bernacchi, physicist, studied magnetism and identified unusual magnetic disturbances that coincided with the appearance of the Southern Aurora. He believed that there must therefore be a causal link between the two. This of course, is accepted today.

Hartley Ferrar, expedition geologist, discovered the existence of granite rocks, confirming that Antarctica was indeed a continent. He also discovered deposits of coal and fossil plants in the rock strata in the mountains and postulated correctly that the climate of Antarctica must have been very different and suitable for rich vegetation and dense forests in the geological past, yet the theory of Continental Drift which now explains the difference in the climate, was not proposed until the 1950s. While studying the glaciers he also recorded that they had receded by several miles and suggested that the climate must be changing and that this would have global significance in the future.

Return from the Antarctic

In February 1904 two ships, the *Morning* and the *Terra Nova* arrived with orders to try to free the *Discovery* or if that failed, to abandon her. The ice finally broke up in February 1904 and the *Discovery*, the *Morning* and the *Terra Nova* returned to New Zealand, then to Britain with a wealth of scientific

information and new discoveries which were analysed into twelve volumes of scientific papers.

Further voyages of the *Discovery*

The *Discovery* had an illustrious 35 year sailing career; as a cargo vessel for the Hudson's Bay Company; she was also used during the First World War to supply troops in Europe and to supply the White Russian army during the Russian Revolution of 1917. In 1916 she was called upon to return to the Antarctic to rescue Shackleton and his men, but a Chilean ship was used for the rescue before the *Discovery* could get there.

She was given a major refit at Vosper's Yard in Portsmouth in 1924 in preparation for more expeditions to the Antarctic in the late 1920s and early 1930s, studying the migration of whales for the whaling industry.

Old photographs showing the main deck, wardroom mess deck and other features of the ship can be compared with the ship as it is today. Visitors regularly comment on the sense of atmosphere aboard the ship as they walk round.

Credit to the *Discovery*

The fact that the *Discovery* survived the tremendous pressure of the ice for two years is a credit to its designer and builders. Many ships, including Shackleton's *Endurance*, have been crushed and sunk in the Antarctic. Even today, modern ships are still being crushed and sunk by the pressure of the ice in the Antarctic. In 1989 Roger Mear and Robert Swan organised an expedition entitled 'In the Footsteps of Scott'. Their ship, the *Sea Quest,* a modern specially strengthened ship, was crushed and sunk at almost the same spot where the *Discovery* lay trapped for over two years.

***Discovery* retired**

London and Greenwich

The *Discovery* was docked in East India Dock in London from 1936 until 1972 and used as a training ship for Sea Scouts and Naval Cadets. By 1972 the Admiralty could no longer justify the cost of the upkeep of the ship. The Maritime Trust took over responsibility for the ship and she was moved to Greenwich and opened to visitors. By the early 1980s The Maritime Trust were looking for someone to take over responsibility for the ship. The Dundee

Heritage Trust was formed to raise the necessary funds to bring the *Discovery* 'back' to Dundee.

Dundee

In 1984 she was transported to Dundee on the back of a ship called the *Happy Mariner* and given a rapturous welcome by the people of Dundee with spectators lining the roads and viewpoints from Arbroath to Dundee. She was docked in Victoria Dock and opened to visitors while the old Tay Ferries harbour nearby was completely redesigned as a purpose built dock and visitor centre, and renamed Discovery Point.

In 1993, the *Discovery* was de-masted to enable her to be brought under the Tay Road Bridge and into her new harbour.

In 1995 the Dundee Heritage Trust bought the *Discovery* from the Maritime Trust for £1. A 1901 one pound note was handed over at the ceremony. Since arriving in Dundee, £2.5 million has been spent restoring her and a further £588,000 is being spent on the present phase of the restoration programme.

Now, only 500 metres west of the slipway where she was launched in March 1901, many people feel she has finally 'come home'. She is a major Five Star attraction with visitors coming from all parts of the world, even Peru!

During the 2001 Centenary celebrations, descendants of the original crew came from all over the world to Dundee to join the celebrations. We had the opportunity to meet and talk to Falcon Scott, Captain Scott's grandson. Louis Bernacchi's granddaughter, Edward Wilson's great nephew Dr David Wilson, Able Seaman James Dell's great-granddaughter and many others.

For me it is a great privilege to be part of this historic vessel and to have the opportunity to delve into its history through the diaries and journals of those who were part of the 'Heroic Age of Polar Exploration'.

Suggested Reading

Scott, Robert Falcon. The Voyage of the Discovery, Vol I and II
Savours, Ann. The Voyages of the Discovery. The Illustrated History of Scott's Ship.
Wilson, D.M., & Elder, D. B. Cheltenham in Antarctica. The Life of Edward Wilson.

Bernacchi, Louis. Saga of the Discovery.
Fiennes, Ranulph. Captain Scott.
Scott, R.F. Tragedy and Triumph, The Journals of Captain R.F.Scott's Last Polar Expedition.
Mear, Roger and Swan, Robert. In the Footsteps of Scott.
Solomon, Susan. The Coldest March.
Shackleton, Sir Ernest. South, Journals of His Last Expedition to the Antarctic.
Richards, R. W. The Ross Sea Party, 1914-1917.
Menzies, Gavin. 1421, The Year China Discovered the World.

GUEST LECTURE - SUMMARY

MURDER BY CHLOROFORM

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In 1847 chloroform was found to be anaesthetic in animals by Pierre Flourens, and in humans by James Young Simpson, who immediately adopted it in his obstetric practice. Before long, criminal use of chloroform began to be reported.

A famous case was the death of Thomas Edwin Bartlett in 1886. He had had a disharmonious relationship with his wife, Adelaide, partly due to the foul odour from his decaying teeth. As the circumstances were suspicious, a necropsy was arranged: chloroform was found in the deceased's stomach. It was established that Adelaide had obtained the chloroform, and she was charged with murder. In the event of the trial, the jury found insufficient evidence for a conviction and Adelaide was acquitted.[1]

Arthur Conan Doyle, the creator of "Sherlock Holmes", featured criminal use of chloroform in three of his novels: *The Disappearance of Lady Frances Carfax* (1911), *His Last Bow* (1917) and *The Adventure of the Three Gables* (1926).

In 2002 a trial for murder by chloroform took place in Edinburgh. The body of the female victim had been found in a garden in 1999, and the cause of death was initially declared to be self ingestion of amphetamine and suffering hypothermia. However, her former lover boasted to friends that he had chloroformed her, and 18 months later one of them informed the police. The case was re-opened and chloroform was found in samples of blood (25 mg/l) and liver (massive quantity). The man was tried for murder, found guilty and jailed.[2] However, there has been an appeal consequent on an error in the liver analysis.[3]

The range of chloroform concentrations in blood during anaesthesia is 20-200 mg/l;[4] recorded levels in homicide have been 2-130 mg/l.[5] Over time (in the living body) there is a huge redistribution of chloroform from blood to the tissues. A major problem in forensic investigation is that normal pharmacokinetics cannot be applied to post-mortem blood levels.[6] This problem is also relevant to discussions on possible inadequate anaesthesia in lethal injection (containing muscle relaxant) for execution.[7]

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3. http://news.scotsman.com/edinburgh.cfm (accessed November 2007)
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5. Nashelsky MB, Dix JD, Adelstein EH. Homicide Facilitated by Inhalation of Chloroform. *Journal of Forensic Sciences* 1995; **40**:134-8
6. Pounder DJ. The nightmare of post-mortem drug changes. In: Wecht CH ed. *Legal Medicine*. Salem: Butterworth, 1993; 163-91
7. Heath MJS, Stanski DR, Pounder DJ. Inadequate anaesthesia in lethal injection for execution. *The Lancet* 2005; **366**: 1073-4

BOOK REVIEW

Anaesthesia and the Practice of Medicine: Historical Perspectives. Sykes K, Bunker JP. London: Royal Society of medicine Press Ltd., 2007. ISBN 978-1-85315-674-8. Paperback, 303 pp, illustrated, indexed, £15.95.

This book is an enjoyable review of developments in anaesthesia, from beginnings to present, and their influence on other branches of medicine. The story in 23 chapters flows well and one is compelled to consume it from cover to cover.

The book is divided into 5 parts. Part 1 "Anaesthesia: the first 100 years" is a succinct account of the landmark events in the history of general and regional anaesthesia, including the development of the anaesthetic machine and tracheal intubation.

Part 2 "Professionalism in anaesthesia: the reluctant universities and the Second World War" constitutes about one third of the book. There is a good description of the creation of an academic base for anaesthesia – led by Waters and Lundy in USA and Macintosh in UK. Next it is shown how World War II necessitated team work and improved management of shocked patients, while the study of pain in wounded soldiers by Beecher and Bonica instigated the development of pain management as a discipline. The combination of these factors paved the way for anaesthetists' journey out of the operating theatre into acute medicine and pain management. Three chapters are devoted to the history of curare, its use for ECT and tetanus, and transformation of anaesthesia.

Part 3 "New horizons: the scientific background to anaesthesia and the emergence of intensive care" is again about one third of the book. After a chapter on controlled hypotension, there are 3 chapters on how IPPV came to the fore in the 1952 polio epidemic in Copenhagen, followed by the rise of ICUs with concomitant provision of mechanical ventilators and blood gas analysis. Next is an interesting chapter on the development of open heart surgery with particular focus on the Hammersmith Hospital. Then there is a chapter each on the development of CPR and the National Halothane Study. Deference to safety is given by a recount of the Harvard Critical Incident Study, CEPOD and NCEPOD with the introduction of patient and equipment monitoring devices. Surprisingly there is no mention of the paper *Deaths under Anaesthesia* by Macintosh in the BJA 1948-49; this would have presented another example of the time lag between concept and practice. The last chapter in this part is on the rise of sedation techniques and day case surgery.

Part 4 is "The relief of pain in childbirth and the care of the newborn". It starts with the work of Simpson and proceeds through self-administered inhalation analgesia and then regional analgesia. The controversy of whether religious objections to Simpson's initiative were a myth is side-stepped; also only the Church of England is mentioned, ignoring the more immediate relevance to Simpson of the Church in Scotland. Next there is a well organized account of advances in anaesthesia for obstetric procedures in the UK, emphasizing the influence of the CEMD, and in the care of the newborn, revolutionised by Virginia Apgar.

Part 5 "Anaesthesia yesterday, today and tomorrow" describes the differences in anaesthetic staffing between USA and UK. It brings the reader right up to the minute in terms of the two major challenges in the UK: the staffing crisis due mainly to the EWTD but also expansion, and the decline of academic departments.

A book by two authors must have an inherent problem of reconciling differences in style. In this case the editor is to be congratulated as the style is uniform throughout. The authors' inside information and experiences enable interesting anecdotes in most chapters. For example, contacts between Macintosh and Lord Nuffield (leading to the benefaction of a chair of anaesthetics) arose from mutual membership of a Golf Club – just like modern times! The book is lavishly illustrated with an excellent choice of photographs, line diagrams and charts. All the chapters are well referenced and in 11 there are suggestions for further reading. Errors are remarkably few. In Part 3 the introduction of total spinal anaesthesia for induced hypotension is attributed to HWC Griffith instead of Griffiths. This error is carried through to the index, where the page references to HWC Griffiths are listed under H(arold) Griffith. Also in the index Macintosh is given the first name of Ralph instead of Robert.

The authors' aim, expressed in the Preface, was to show how advances in anaesthesia had become incorporated into mainstream medicine. Keith Sykes, in a preview published in HAS Proceedings Volume 36, stated that they modified their approach to make the book suitable for a medical and para-medical readership. I believe they have succeeded on both counts.

This book will appeal to anyone with an interest in medicine. It is also a good choice for a first read of the history of anaesthesia and would make a most acceptable Christmas present.

Alistair McKenzie