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Volume 19

Proceedings of the meeting in Plymouth 28th and 29th June 1996

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Summer 1996 Meeting

Acknowledgements

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PROCEEDINGS OF THE HISTORY OF ANAESTHESIA SOCIETY

Volume 19

Papers presented at the Plymouth Meeting 28th - 29th June 1996

JOSEPH CHARRIÈRE'S CONTRIBUTION TO THE HISTORY OF ANAESTHESIA

Dr Marguerite Zimmer
Dental Surgeon, Strasbourg, & DEA, École Pratique des Haute Études, Paris.

In December 1846, William Green Morton requested his Parisian correspondent Dr Willis Fisher to deliver ether inhalers to five of the most famous Parisian surgeons - Jobert (de Lamballe), Velpeau, Blandin, Ricord and Maisonneuve. These inhalers were sent on a Cunard liner on 19 November, but unfortunately remained blocked in containers.[1] Fisher nevertheless passed on to Jobert and Velpeau the suggestion to experiment with the new concept.

Jobert (de Lamballe) decided to try the technique on a patient named Pierre Dihet, who had been hospitalised since 7 September in his ward at the Hospital Saint-Louis. These facts are reported in the *Gazette des Hôpiteaux Civils & Militaires* by Gogué[2] who at that time was house physician at the hospital. On 15 December, ready to remove a growth on Dihet's lower lip, Jobert entrusted the patient 'to the care of the American doctor, friend of Morton, in order to render the patient insensitive to the pain of the operation'. Gogué notes that Dihet 'was the first in France on whom inhalation of sulphuric ether was experimented, as a way of preventing pain in a surgical operation'. He adds: 'It is probably not without interest to note which apparatus was used in this circumstance by the American doctor, and friend of Morton ....'. He does not name this American doctor, but all the indications suggest that it was Willis Fisher.

The first French ether inhalers

The device described by Gogué, and published by Fisher[3] in the *Gazette des Hôpitaux Civils & Militaires* in February 1847, is similar to the first American ether inhaler. It consists of a glass globe containing saturated ether sponges, with two tubed apertures (Figure 1). One tube, left open, allowed airflow, while the other was placed in the patient's mouth. The nose was not occluded. It was recommended to inhale deeply so that the air loaded with ether vapour could rapidly penetrate the mouth and lungs. This well-made inhaler with no valves was produced in the Hospital of Saint-Louis, probably under the guidance of Willis Fisher.

M Dihet's operation was a success, but the etherisation was not really complete. During inhalation some non-saturated air entered through the nose, while expired air mixed with and displaced ether vapour in the globe. Several days later Jobert repeated the experiment, again using a double orifice inhaler. These patients were rendered completely insensible, but the surgeon quickly realised that the quantity of ether vapour produced was very limited. He restricted ether inhalation to minor operations or those of well-known duration. Even when the patients had no recollection on waking, in the days and nights following there was often a sense of general ill-health, severe headaches, hysterical attacks, restlessness, muscular spasms, sore throat or coughing.

Unfortunately Jobert did not immediately communicate the results of these trials. It was not until 2 February that he was given the opportunity to speak to the Academy of Medicine. This is the reason[4] that Malgaigne was the first to report the application of the new property of ether, which he announced to the Academy on 12 January 1847. At that time he had only conducted five ether inhalations. In 1847 Jobert (de Lamballe) was not yet Clinical Professor

(he did not get this post until 1854), whereas Malgaigne had been elected to the Chair in 1836. This helps to explain the precedence in presentation, and why Malgaigne, not Jobert, was the first to speak on ether anaesthesia in Frace.

For his first patient, Malgaigne did not use a double-orifice globe, but a simple tube in which he placed ether-soaked sponges, the patient holding the tube in the mouth. With the succeeding patients, he inserted the tube in one nostril, held the other closed, and instructed the subject to inhale through the nose and to exhale through the mouth. The naive simplicity of this process broadly explains the recorded failures. Only at the start was the patient capable of executing the necessary respiratory movements. The experiments were not really satisfactory, and contrary to what might be expected, Malgaigne's communication to the Academy of Medicine did not create any sensation.

Alfred Velpeau, in the Hospital de la Charité, had of course heard of the Boston demonstrations but had not dared to try the new technique. He waited for the meeting of the Academy. Now that Malgaigne had opened the way, he felt ready. As Jobert had done at Saint-Louis, Velpeau had an inhaler made at the Charité.[5] Roux at the Hôtel-Dieu, Landouzy at Reims, Maisonneuve, and Vidal of Cassis all tried ether inhalation - with a flask under the nose, a double-orifice globe, or by covering an ether-saturated sponge with a funnel. With these methods some anaesthesia lasting from 4 to 10 minutes was achieved.

Apparatus by Joseph Charrière

The surgical instrument maker Joseph Charrière, of 6 Rue de l'École de Médecine, Paris, manufactured his first ether inhaler for Maisonneuve on 14 January 1847. This was the same as the Willis Fisher inhaler, whose design Fisher had had the kindness to communicate to Charrière. On Thursday 21 January 1847, Paul-Louis Guersant and Gerdy performed the first really successful ether experiments with a new device made by Charrière. This inhaler still had the ether-saturated sponges, the tube for atmospheric air and the second tube with a mouthpiece. Charrière[6] added a tap to regulate the entry of air, a funnel to add more ether if necessary, and an inspiratory and expiratory valve near the mouthpiece. Within a few hours he had modified this inhaler by joining the two tubes into one, enabling the operator to control the inhalation with one hand. These new designs were no longer spherical, but had flasks with a large flat bottom, allowing greater evaporation of ether. The nose-pinches were made of cork plates (Figures 2 & 3).

On 30 January 1847, Charrière registered patent No.4982, *Ether inhalation apparatus, arranged as to be unexplosive.* This was followed by an addition on 1 February. The inhalers made until now had presented a very severe danger, being likely to explode in close proximity to a light or fire. To avoid such accidents he included metallic filters in the ducts for air and for ether.

On 2 February, Charrière constructed a new device suggested by Morel-Lavallée. Instead of the large flat-bottomed flask he used a small one which could be held in the hand, the body heat providing sufficient ether evaporation (Figure 4).

Ether anaesthesia now began to exceed all hopes, and Charrière improved his invention further. On 20 February he presented his famous apparatus with a 3-way tap and large

diameter tubing (Figures 5, 5a). Aspiration of atmospheric air, introduction of air into the container, and aspiration of ether vapour are centralized at one point and regulated with a transverse key. The aperture N introduces air to the respiratory tube, the orifice M allows filling with ether and the introduction of air into the container through the tube D. The orifice E admits the ether vapour to the respiratory tube. Rotation of the transverse key regulates the volume of ether vapour and the aspiration of atmospheric air - as one increases the other decreases. The diaphragm acted as a diffusing wick.

It is interesting to compare Charrière's inhalers to that of Hooper, made at Pall Mall on 19 December 1846, on the instructions of Dr Boott and Mr Robinson 4 days after the first French tests. The devices are very similar.

Of the patents taken out in early 1847, one must mention No 9207 of 11 March, by Antoine Brisbart-Gobert of Montmirail. He called his inhaler 'Atmocléïde'[7]. This apparatus (Figures 6 & 7), by an ingenious system of ball-valves, allowed quantification of the ether dosage and counting of the respiratory movements. These valves had been in existence for some time. Jules Gavarret (1816-1890) had used them since 1842, on a device constructed by Charrière, to measure the quantity of carbon dioxide exhaled by human lungs. It was however Brisbart-Gobert who first thought of incorporating them in an ether inhaler. Charrière agreed with Brisbart-Gobert to exclusively stock the 'Atmocléïde' in his shop and to adapt the spherical valves to his own inhalers.

Inhalers for chloroform

When Simpson introduced chloroform on 15 November 1847, the French surgeons Phillipe-Frédéric Blandin (1798-1849), Jules Roux (1807-1877), Jobert (de Lamballe) and Vidal of Cassis all investigated the effects of this new anaesthetic without delay. On 23 November Pierre-Nicolas Gerdy (1797-1856) at the Hôpital de la Charité himself inhaled chloroform manufactured at the central pharmacy by Eugène Soubeiran (1793-1858). Before using chloroform on patients, a group of physicians on 26 November tried on themselves inhalation procedures using Charrière's 3-way ether inhaler[8]. The results of all these tests were variable. On 27 November Charrière submitted to Pierre Manec (1799-1884) of the Hospices de la Salpêtrière a simple and portable apparatus, which by means of a screw connection, could be used with either a metallic chloroform container or an ether inhaler (Figures 8 & 9). The rim of the facepiece was equipped with a flexible metallic ring, which could be adapted to fit varying shaped faces of children and adults. The spherical valve is the one as used by Brisbart-Gobert. Using this inhaler Manec performed two major operations on elderly patients with complete success. The patients were perfectly asleep, without pain, and there was no coughing or vomiting.

Charrière constructed several different models,[9] which could be fitted with either a simple on-off tap, or a 3-way tap (Figures 10 & 11). He created devices which brought airflow through the base of the container without the help of valves (Figure 12).

He suggested substituting the normal tank with 'a small container, closed by a pierced cork, in the middle of which the duct could be introduced'. A chloroform-soaked sponge, or preferably a diaphragm of cotton could be placed in the container. Some devices made entirely of tin, had a container in the form of an upside-down acorn. This was divided in the

middle, the lower chamber being perforated like a sieve (Figure 13). Others were simplified, more portable, without valves or 3-way taps (Figure 14). Some could be used with ether; if the quantity of ether in the acorn proved insufficient, the inferior chamber could be submerged in an ether container, so the sponge or cotton again became saturated.

Charrière also invented collapsible metallic devices called 'cylindres rentrants' (Figure 15). These had an opening near the mouthpiece, letting in fresh air, and the perforated base held a flat chloroform soaked sponge, or even better, several layers of tissues or cotton discs. Patients breathed through the container without the help of valves.

He was pressed by several surgeons for an even smaller apparatus, which would be readily accepted by patients, and would not frighten them. On 7 December 1847 Charrière presented to the Academy a model made of silk, cylindrical in form, which opened out by means of a coiled spring like a Chinese lantern (Figure 16). When closed this inhaler could easily be held in a tobacco pouch. The facepiece, which could include either the nose and mouth, or only the nose or the mouth, was made with a very thin, flexible silver ring, easily adapted to every type of face. The base was formed by two metallic ferrules, which held 2 thick cotton discs of larger diameter than the ferrules. Inside there were 2 or 3 smaller cotton discs or pieces of sponge. It was enough to pour 6 or 8 grams of chloroform onto these discs and to inhale immediately. These inhalers, used with great success by the surgeons, were in fact inspired by the principle of Francis Sibson's first ether inhaler, published in the *Lancet* of 22 May 1847, as Charrière observed in his notices.(Figures 17 and 18).

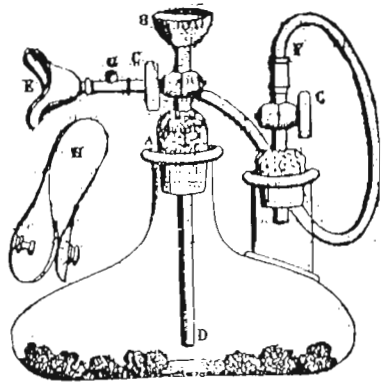
We have seen that as early as March 1847, Charrière began manufacturing apparatus which adapted Brisbart-Grobert's famous valves. He had realised that some patients were deprived of air, especially when the head was drawn backwards. It was necessary for the valve to follow the angle of tilt when the position of the head was changed during anaesthesia. The same inhaler could be used with ether-soaked sponges or with 4 or 5 chloroform-saturated discs. Figure 19 is an inhaler without valves. Figure 20 shows a variety of tin inhalers with valves. The second has a 3-way tap to control chloroform dosage; the last has an inlet for refilling with chloroform. All admit air from the base of the reservoir.

Conclusion

Joseph Charrière, born on 20 March 1803 in Cerniat, Switzerland, was an ingenious surgical instrument maker, whose work was approved by the Parisian Faculty of Medicine, by the War Ministry and by several foreign universities. In 1844, at the National Industrial Fair, he was decorated with the Legion d'Honneur. Two years later, his inhalers made major contributions in the early history of anaesthesia.

Figure 1. Design of the first apparatus published by Willis Fisher

Figure 2. First apparatus of Joseph Charrière



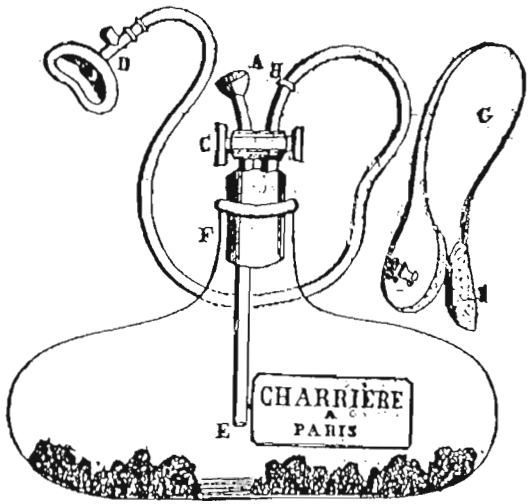


Figure 3. Second inhaler of Joseph Charrière

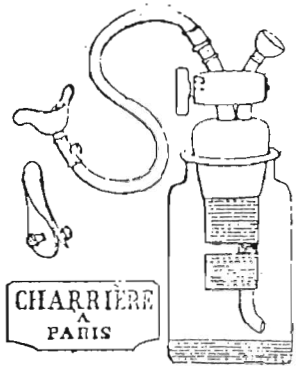
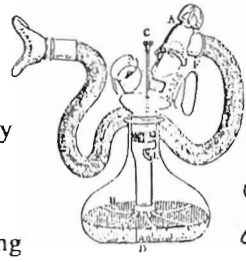


Figure 4. Charrière's ether inhaler, to be held in one hand



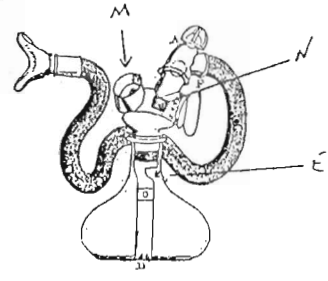


Figure 5. Charrière's 3-way ether inhaler

A: 2 spherical valves
B: diaphragm
C: stem for positioning the diaphragm
D: tube; air is introduced into the container through D and goes up through B then into the orifice E.

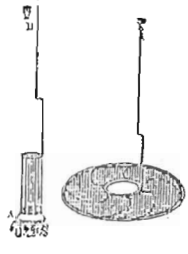


Figure 5a. System for placing the diaphragm through orifice E

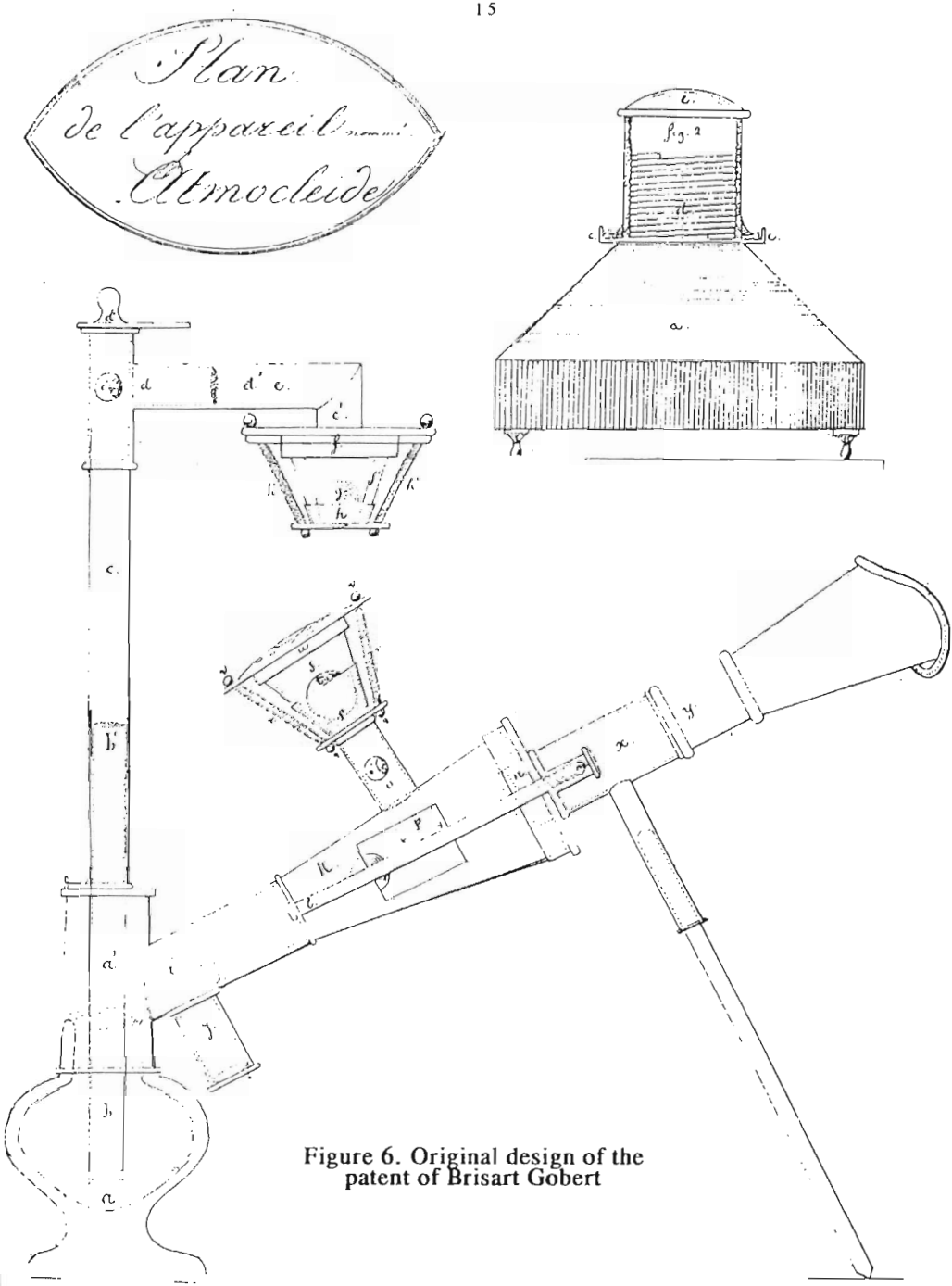


Figure 6. Original design of the patent of Brisart Gobert

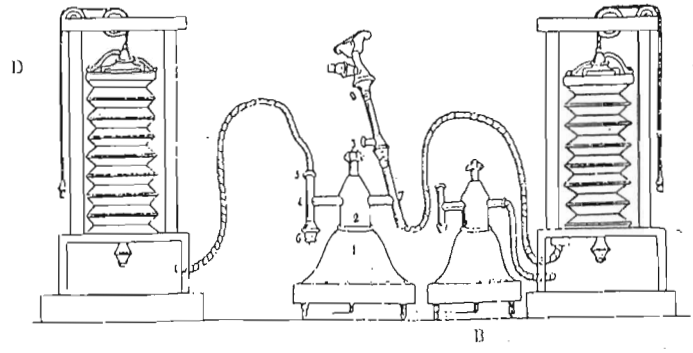


Figure 7. Brisbart Gobert's ether inhaler

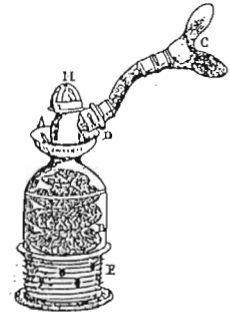


Figure 8. Charrière's apparatus for ether or chloroform inhalation

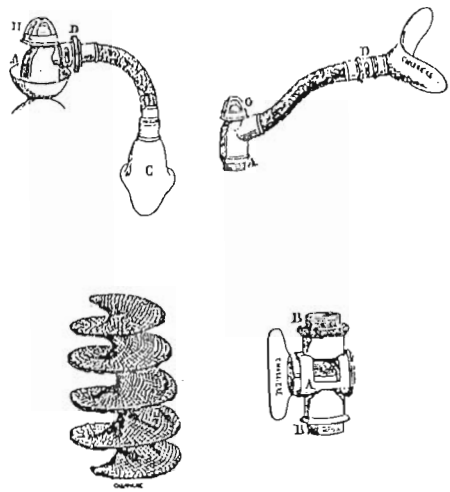


Figure 9. Dismantled pieces of the chloroform inhaler

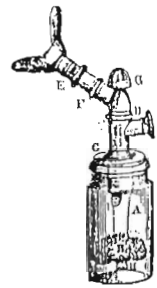


Figure 10. Glass flask with a simple on-off tap

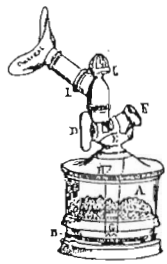


Figure 11. Tin container with a 3-way tap; air penetrates from the bottom to the top

Figure 12.
Glass container with a facepiece in tin and device which brought airflow through the base

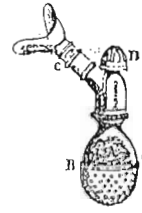


Figure 13.
Apparatus made of tin with multiple perforations. The hole C allows introduction of air

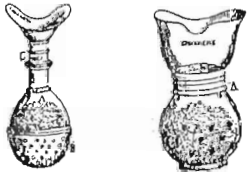


Figure 14.
Simplified devices

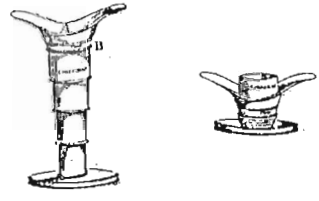


Figure 15.
Collapsible metallic devices called 'cylindres rentrants' with perforated bases

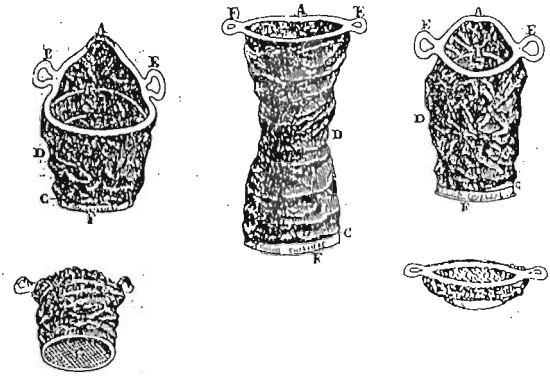


Figure 16. Models made of silk

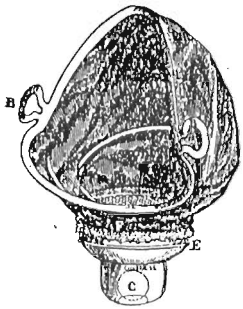


Figure 17.
Charrière's model inspired by the principle of Francis Sibson's first ether inhaler

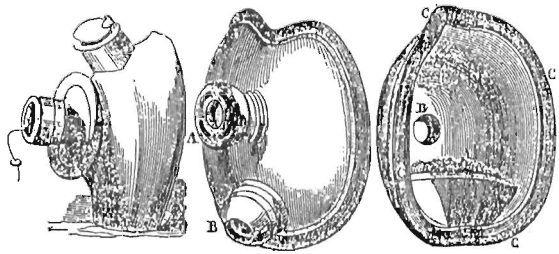


Figure 18. Sibson's ether inhalers

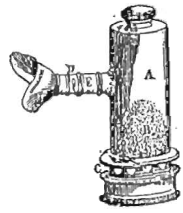


Figure 19.
Inhaler in tin without valves

Figure 20.
A variety of inhalers to cope with tilting of the head.
Valves in different positions, flexible breathing tubes
at differing angles

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HENRY HILL HICKMAN REVISITED

Dr R S Atkinson
President Elect, History of Anaesthesia Society

Ludlow, in Shropshire, is an attractive town with a castle and many old buildings. Every year in the last week of June and the first week of July, the Ludlow Festival is held. In 1995, this included an exhibition on Henry Hill Hickman to which the History of Anaesthesia Society contributed a section on the Hickman Medal. This medal is awarded every three years by the Royal Society of Medicine on the recommendation of the Section of Anaesthetics. The display included pictures of the distinguished medallists. On the Sunday afternoon there was a service in Bromfield Church to mark Hickman's life and contributions and the exhibition was shown in the church. Unfortunately, the Ludlow Festival clashed with the History of Anaesthesia Society's Summer Meeting in Glasgow, and few members of the Society managed to get to Ludlow in time for the service. I arrived too late for the service, but was able to see the Hickman exhibition and, later, to meet some of those who had helped organise the Festival and see something of Ludlow. My interest was aroused.

Information on Hickman is available in *The English Pioneers of Anaesthesia* by Dr F F Cartwright, published in 1952, and we must thank Dr Dennis Smith of Leeds for the several papers which he has written on Hickman in more recent times, and for the pamphlet he had specially written for the Festival Exhibition.

Every member of the History of Anaesthesia Society will know something about Henry Hill Hickman, but I doubt whether many will know much. He was born in Lady Halton in Bromfield and after medical study in Edinburgh and London he set up practice in Ludlow.

Hickman relations

A well-known Hickman family lived around Stourbridge from the 17th century. The family names Richard, Henry, Edward and Gregory recur. Many were clothiers while some were clergymen and Justices of the Peace. Some family members moved away as far as London, Gloucestershire and even Essex. Our Henry Hill Hickman has not been shown to be related to the Stourbridge Hickmans, but there are a number of coincidences which suggest that he was. Our Henry Hickman married Eliza Hannah Gardner, niece of a Jane Gardner who had herself married Edward Hickman (1765-?1851), son of Edward Hickman JP (1724-1802) of The Castle, Old Swinford, near Stourbridge. It is interesting that the Colonel commanding the county Yeomanry Cavalry in the early 1800s was called Other Archer Windsor, 6th Earl of Plymouth (1789-1833) and was related to the Hickman family in Essex.

Henry Hill Hickman's grandfather was probably a clothier and it was he who settled in the parish of Bromfield. His son, John, married Sarah Hill, and they had thirteen children, of whom Henry Hill was the seventh, born in the hamlet of Lady Halton, Bromfield, on 27 January 1800. Henry had an elder brother, Benjamin, baptised in 1792. Their father, John Hickman, had his name in the rental book held in the Earl of Plymouth's estate records between 1795 and 1829. John Hickman was Clerk to the Races (the Racecourse being situated between Ludlow and Bromfield) in 1800, as was one Benjamin Hickman in 1830.

'Suspended animation'

Little is known of the early education of Henry Hickman. He certainly studied in Edinburgh where he matriculated on 1 November 1819. However, although he joined the Royal Medical Society, a student body, he did not graduate in Edinburgh. Papers read before this body, while Hickman was a member, included a dissertation, *On Asphyxia*, by one Henry Goldwyer (later of Bristol) which may have done something to stimulate his interest in 'suspended animation'. Henry went to London and was admitted as a Member of the Royal College of Surgeons on 5 May 1820 (when he was 21 months under age).

On 21 June 1821 Henry married Eliza Hannah Gardner of Leigh Court near Worcester and set up in practice in Ludlow, Shropshire, probably at 14 or 114 Corve Street. While there he carried out his famous experiments on dogs, mice and other animals, probably at a place called Pouches Poole, now burnt down, near the Bromfield-Ludlow road. His method was to suspend animation by the inhalation of carbon dioxide or by the use of disoxygenated air. He was able to produce a temporary and reversible 'suspension of life' which would allow freedom from pain during swift operations with decreased loss of blood.

Hickman wanted to put the results of his experimental work before those with authority. Living nearby, at Downton Castle, was T A Knight, a Fellow of the Royal Society, and friend of Humphry Davy. Knight also had some official position in the Ludlow racecourse. Hickman wrote a letter to Knight on 21 February 1824. Later that year he left Ludlow, moving to Church Street in Shifnal. He there published a pamphlet *Letter on Suspended Animation*, dated 14 August 1824 and addressed to T A Knight. It appears that his ideas were never formally received by the Royal Society.

At that time Paris, rather than London or Edinburgh, was the centre of scientific thought. Hickman may have had some help in that direction from the Glover family; John Glover was an English painter who enjoyed the patronage of the French Royal Family. It is interesting also that Lucien, brother of Napoleon Bonaparte lived in Ludlow between 1810 and 1814. In April 1828 Hickman went to Paris to present a memorial *To His Most Christian Majesty Charles X King of France* which came to the attention of the Section of Medicine of the Academy on 31 August. Staying first at the Hotel des Ambassadeurs, Hickman then moved to No 7 Rue de la Ferme-des-Mathurins. The Academy met on 28 September. Again, he received little support for his ideas. Only Baron Larrey gave any encouragement.

Early death - late recognition

So Hickman returned to England, disappointed. He settled in Tenbury Wells in a house in Teme Street, which later became a chemist's shop and is now a restaurant. He died at the early age of 30 years on 2 April 1830. He was buried next to the graves of his grandparents in the churchyard of St Mary the Virgin at Bromfield, where he had been baptised.

Hickman might have been forgotten but, following the discovery of anaesthesia, attention to his work was drawn by Mr Thomas Dudley of Kingswinford in a letter to the *Lancet* on 6 February 1847, with a further letter in March following correspondence with Mrs Hickman. James Young Simpson also knew about Hickman's work, which he referred to in a letter of 9 March 1847. An article in the *British Medical Journal* on 13 April 1912 by C J S Thompson

did much to stimulate interest in Hickman, but it was on the centenary of his death in 1930 that he was remembered not only by a service in the church at Bromfield, but also at a reception held at the Wellcome Museum. Dr Henry S Wellcome was himself much concerned with the arrangements. The service at Bromfield was held on 5 April 1930 and included the unveiling of a Tablet by Sir St Clair Thompson with dedication by the Rt Revd the Lord Bishop of Hereford. The reception on 2 April at the Wellcome Museum was reported in the *British Medical Journal* on 12 April and in the *Proceedings of the Royal Society of Medicine* in June. The address was given by the Rt Hon Lord Dawson of Penn PC, GCVO, MD, President of the Society. Among those present were Lord Moynihan PRCS, Professor Burgess, President of the British Medical Association, Sir D'Arcy Power, Sir Francis Shipway and Sir Holbert Waring, and also two granddaughters of Henry Hickman, Mrs Betteridge of Tenbury and Miss Blanche Thompson of Birmingham. There were also memorabilia on display.

What memories of Hickman are with us today? The Hickman medallists have already been mentioned. There is a Hickman Society, formed by anaesthetists in the Midlands in the 1950s and there is a Hickman Professor of Anaesthesia in Birmingham. Descendants of Hickman are living in Britain, Canada and Australia. The Wellcome Museum possesses his waistcoat, some weights and a mortar and pestle. In 1982, Mr Hickman Phillis (a great grandson) presented an oak linen chest to the then Faculty of Anaesthetists. Around the same time, he presented Hickman's inkwell to the Ludlow Museum and a miniature of Hickman's wife, Eliza, to the Tenbury Wells Museum.

Henry Hill Hickman, disappointed in his own time, is recognised today for his achievements, and lives on in the writings and memories of many anaesthetists.

Acknowledgement: My thanks to Dr Dennis Smith, and to David Edwards of the Ludlow Festival organisation, Ann Waite and Howard Cheese of the Ludlow Museum Service.

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ETHERIZATION AS SEEN BY THE LOCAL PRESS

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January 1847 in the West Country saw two events reported which were to have a lasting influence. The railway, pressing ever westward, opened on the first day of January as far as Newton Abbott (for railway buffs it was loco hauled; the atmospheric system was not to be introduced for another few months). The effect of this was the opening up of the south-west to tourists, a certain amount of new industry, and improved trade with London - notably in fresh foods carried to the capital. On the same New Year's Day, a letter was written which was the first of many reports on the use of the vapour of ether by local medical practitioners for the relief of pain during surgical and dental operations.

I am confining this paper to the local press which was slightly different to that of today. The news included not only minor events which today would be found in the parish magazine, but national and international events. A large amount of space was taken up by the debates in Parliament, perhaps the forerunner of today's televised proceedings.

First report:

The first report to appear in the local press was a letter dated 1st January from a Mr Herapath, a chemist of Bristol. It is reprinted from the London *Times* and describes an amputation which had been undertaken using ether at the Bristol General Hospital the previous day, 31 December. This was published in the issue of *Western Flying Post* of 9 January, under the heading: 'The use of ether in surgery'. The report is in many ways unique:

> 'The operation was rather a long one; from several arterial branches having to be taken up, it occupied 15 minutes...'

We all know the speed at which the surgeons operated at that time; fifteen minutes would certainly have been considered lengthy. The report continues:

> 'He (the patient) afterwards stated himself to have been conscious of the amputation, but without pain, beyond that of a scratch; and during the operation it was found that with the assistance of wine on the one hand and the vapour of ether on the other, could be elevated or depressed with the most complete control, his absence of pain being continuous ...'

The letter continues:

> 'A common, but very large bladder should be fitted with a collar to which an ivory mouthpiece with a large bore can be screwed with the intervention of any stopcock .... pour in about an ounce of good common ether, and blow up the bladder with the mouth till it is nearly full; place the thumb on the mouthpiece, and agitate the bladder so as to saturate the air in it with the vapour; as soon as the patient is ready for the operation, close his nostrils, introduce the mouthpiece, and close the lips round it with the fingers.

> He must now breathe into and out of the bladder, and in about one or two minutes the muscles of his lips will lose their hold.'

So this first report showed full analgesia from the use of ether, the method of constructing the apparatus, and the technique of administration. The letter continues with details of some of the dangers inherent in the use of the vapour. In fact it was a textbook description of the use of ether, which any literate person, lay or medical, could replicate with ease.

Of course, like people everywhere, the local lay population would have said, how does this affect me? It was necessary for them to wait a further week for more details of this new, to them, wonder drug, and it is to *The West Briton and Cornwall Advertiser* of 15 January that we now turn. Under the heading 'Surgical Operations without Pain' we read of operations under ether at three London hospitals:

> 'On Saturday, the new process of producing insensibility by the vapour of ether to prevent pain of surgical operations, was practised at King's College Hospital, St Thomas's Hospital and Westminster Hospital in the presence of numerous medical men. Three patients were successfully operated on at King's College Hospital, and St Thomas's, also the finger of a boy was taken off without pain, but the operation at the Westminster Hospital was not successful.'

More local successes

The local people would have been more interested in operations which were carried out in their own area. For this they were to wait a further week when *The Plymouth, Devonport and Stonehouse Herald* of 23 January, under the heading: 'Surgical Operations without Pain', reported:

> 'On Monday, a tooth was extracted by Mr Bate, the dentist of this place from a patient under the influence of the inhaled vapour of sulphuric ether, without occasioning the slightest consciousness of pain...'

This would have been Monday 18 January. The patient was a maid in the employ of Mr Bate. We read later that she found the experience not unpleasant, and underwent a further extraction two days later. In the same news item a second paragraph reads:

> 'We have been informed that Mr Baldy, surgeon, Devonport, performed an operation this week, the patient being under the influence of ether. The operation is one of a very painful character, but on this occasion, the use of the knife produced not the slightest possible pain. The patient is, we hear, doing very well.'

So within a month of the first use of ether in London, the first dental and surgical uses had taken place in Plymouth. A week later, *The Plymouth, Devonport and Stonehouse Herald* of 30 January gave a much more detailed description of another case, under the heading 'Tavistock Painless Surgical Operation':

> 'A few days since, on the railroad of the Naphtha Company at Prince Town, Dartmoor, a carriage passed over the leg of John Stancombe, aged 16 years, and mortification

> having ensued, an operation became necessary. On Sunday last, Mr Sleman of Tavistock caused the ether vapour to be inhaled by means of an apparatus procured by him for that purpose and having considered a sufficient effect produced, Mr Willis of Horrabridge amputated the leg with the efficient assistance of Mr J G Mitchell, of Tavistock, Surgeon. The operation was skilfully performed in the usual manner, but there was an entire freedom from pain.'

The operation would have been on Sunday, 24 January. The Naphtha Company conveyed peat from workings at the head of its horsedrawn tramway to a gas extraction plant, on a site now within the confines of Dartmoor prison. Mr Sleman who administered the vapour was the nearest we in the west country have to a pioneer anaesthetist of the calibre of John Snow. We will shortly discuss some of his many letters to the press over the next few months which show how well he studied and understood the process of the etherisation.

Problems and controversies

Coincidentally, the 30 January issue of *The Plymouth, Devonport and Stonehouse Herald* also contained a cautionary letter:

> 'Be assured, sir, on the word of an old practitioner that this discovery, which I believe will prove of benefit to mankind, must be used with extreme caution, and in no case except in the presence and under the superintendance (sic) and watchful eye of a medical man.'

When we remember that Simpson's attitude to anaesthesia was to use the services of any person standing nearby, this was not only radical, it was very forward thinking.

The letter continues:

> 'I throw out this caution, because, should the practice become general of inhaling this vapour of sulphuric ether and be recommended indiscriminately and without judgement on every trifling occasion merely to escape a severe but momentary pain, I am persuaded that no great length of time will elapse before we shall hear of some alarming and, perhaps, fatal results.'

Some alarming results were indeed soon reported. *The Plymouth and Devonport Journal* of 25 February carried the heading 'Caution against the use of ether by candle-light'. The scene is a dental surgery:

> 'On setting the candle on the table, not in contact with any visible material, the room was immediately filled with flame, which attached itself to the apparatus and to the stone bottle in which the ether had been kept, and their explosion was the next result. The whole circumstance was transient, the work of a few seconds only, but sufficiently alarming to afford a caution which heeded, may possibly be the means of preventing still further disastrous results.'

Is this the first instance of an explosion in a dental or medical environment in England, caused by the use of an anaesthetic agent? Again by coincidence, the same paper contained another report under the heading 'The Ether Antidote to pain followed by death':

> 'On Friday last, at the Essex and Colchester Hospital, the operation of lithotomy was was performed by Mr R S Nunn,upon Thomas Herbert of Ulting, near Witham, while under the influence of the vapour of ether, in the presence of Mr Bransby Cooper, the eminent surgeon of London, and almost the entire medical staff of the town and neighbourhood. In the absence of pain, and its skilful execution, the operation was completely successful; and the patient appeared to be doing well for twenty-four hours afterwards, when unfavourable symptoms presented themselves, and death took place on Sunday evening, apparently from exhaustion - *Essex Standard.*'

The subsequent enquiry found no blame attached to the use of ether. This incident was more fully discussed by Dr Casale at the History of Anaesthesia Society meeting in Cambridge in 1992.

The columns of the papers of this period contained many letters referring to the use of valves in apparatus, for the venting of the expired breath. The letters appear to be equally divided as to whether of not such valves were necessary. The school of thought against, intimated that removing the mouthpiece periodically protected the patient from rebreathing carbon dioxide-laden air. Our Dr Sleman put forward his views on the subject in *The Plymouth, Devonport and Stonehouse Herald* of 13 February:

> 'In a properly constructed apparatus there are valves for the escape of the respired air which is not fit for inhalation. After a careful examination of many, I think the one designed by Dr Boott and Mr Robinson, the best; this is made by Mr Hooper, of Pall Mall East. I have suggested an improvement which will be adopted. Next in order is Squire's; this is cheaper but defective in one or two points. Weiss' is portable, but too small, Clendon's is advantageous, if pure ether be not at hand; Bell's is cheap; Snow's is complicated. To ?Snow's (the original is badly smudged), with ether highly volatilised, I object. Improvements will in time be made in all.'

Sleman obviously had the time and inclination to examine and evaluate the varieties of apparatus. But if we are looking for true simplicity - of apparatus, as opposed to the use of a saturated handkerchief - then we cannot do better than this item from *The West Briton and Cornwall Advertiser* of 22 January:

> 'Mr R Lucas, a veterinary surgeon of Liverpool, had to remove a tumour from a large Newfoundland bitch; and as an experiment, he placed a quantity of ether at the bottom of a jar which had been previously heated. The head of the bitch was then introduced into the mouth of the jar; and the animal in a moment became insensible.'

I feel we cannot really get any simpler than that.

On a final note, whom do we thank for the introduction of ether into surgical practice? Even at this early date the names were being shuffled. *The West Briton* of 5 March contained the first of three letters under the non de plume 'Facts' of Hayle, putting forward Morton for this

honour, in terms which lead one to consider that 'Facts' believed Morton should be canonised. The following week Mr Sleman gave his opinion:

> 'Inhalation of the vapour of ether. There is but little doubt that the merit belongs to Mr Horace Wells, a dentist of the the United States, America. This gentleman resorted to the use of Nitrous Oxyde and Sulphuric Ether in October 1844; subsequently he communicated the discovery to Dr Morton who treated it with incredulity.'

A week later, 19 March, there was a further letter:

> 'Perhaps it may not be deemed uninteresting to state that the inhalation of ether for the purpose of producing unconsciousness, and thus depriving the surgeon's knife and the dentist's instruments of their terrors, was first practised by an American dentist, a Dr Morton of Boston, who has been, until lately, supposed the discoverer; but by a letter recently received in this country, another individual, a Mr Jackson, a chemist of the same city, puts in his claim to that honour, stating that himself was the first to observe the effects of the etherial vapour, and as a friend, hinted the fact to Dr Morton, who to test its effects extracted teeth from parties under its narcotising influence.'

This letter was from a Dr Stephens of Truro. I shall conclude with his final paragraph:

> 'My one opinion is that all three of these gentlemen played a part in the introduction of ether into medical practice. As with many inventions and discoveries, one person's thoughts and ideas move on and are translated over a period into practical propositions.'

I would remind you that it was a west-countryman, Humphry Davy who, over forty years earlier, had put forward the view that nitrous oxide could be used as an anodyne for surgical operations.

THE USE OF CHLOROFORM BY THE BRITISH ARMY DURING THE CRIMEAN WAR

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[This is an abstract of Dr Connor's presentation - the full paper is to be published elsewhere. Ed.]

The use of chloroform by the British Army during the Crimean War was influenced by its availability and by medical opinion on its safety in injuries due to gunshot wounds. In the early part of the war chloroform may often have been in short supply, and medical opinion was probably influenced by Sir John Hall's directive which cautioned against its use: 'in the severe shock of gunshot wounds, as he thinks few will survive where it is used'. However, the official medical history of the war suggested that:

> '.... its use has been very largely and generally adopted in all the more important operations; indeed, it may be said that, during the military year 1855-56, no operations except very minor ones were done without it, unless at the request of the patient, or in some very rare and exceptional case .... and if some surgeons .... did not employ it, it was rather because, from the enormous amount of work they had to get through, the time necessary for its exhibition was deficient...'

This assessment is not supported by previously unpublished data in Sir John Hall's papers in the Royal Army Medical Corps archive at the Wellcome Institute. The three-monthly figures for major amputations between September 1854 and December 1855 show the percentage in which chloroform was used varied between 66% and 100%. Other evidence suggests that availability of chloroform was a major obstacle to its use during the first three-month period, and may have been a limiting factor until mid 1855, after which supplies were plentiful. Pressure of work cannot have been a significant impediment during the final period when the use of chloroform for amputations was lowest. The public outcry following publication of Hall's memorandum may have influenced the increased use in early 1855, but thereafter use of chloroform declined steadily and was the same at the end of the war as it had been at the beginning.

THE NAVAL CAREER OF THOMAS SPENCER WELLS

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Thomas Spencer Wells is usually remembered as a major medical figure of the 19th century, a pioneer surgeon and president of the Royal College of Surgeons. Less well known is that he spent much of his early career in the Royal Navy. Although Wells's Naval career has been the subject of previous publications[1-3] further research has revealed some inaccuracies, and some new information, making it worth while to revisit the subject.

Haslar

Wells joined the Navy as an acting Assistant-Surgeon on 20 September 1841[4] after passing the entrance examination, the results of which are preserved in Haslar library: 'Latin, anatomy, surgery, medicine, chemistry, materia medica and pharmacy all good'.[5] Whilst waiting for his first appointment he spent some time in the Royal Naval Hospital, Haslar, his name appearing in the visitors' book (now sadly missing) for the medical library, four times between 9 October and 22 November.

Malta

Wells was appointed to the Malta receiving ship HMS Ceylon as an additional acting Assistant-Surgeon but he spent the majority of his time working in the Naval hospital.[6] We get some idea of his work there from a paper he published jointly with the Deputy Inspector, W Martin, the officer in charge of the hospital, of the cases treated in the Naval Hospital for 1842.[7] The vast majority were medical in origin, mostly infections. The rest were as a result of trauma. Very few operations were carried out and these were mostly amputations of fingers and toes. Wells makes the point that the cases treated in the hospital were dependant on the individual medical staff of their ship. Some sent a large number of patients to the hospital, whilst others sent very few. Because of this, the paper is an imperfect representation of the health of the Navy on Malta at that time.

Whilst in Malta Wells carried out all of his own post-mortems[7,8] and sent a considerable number of pathological specimens back to Haslar. Of these, by 1900, only 19 survived and by 1967, only 6 remained. Using the information in his 1844 paper it has been possible to match the full clinical history with one of the pathological specimens in the collection. The case was that of a sailor who initially had a superficial infection in the temporal region of his head which went on to involve the skull, ultimately leading to a cerebral abscess. With the patient moribund, the skull was trephined, draining the abscess in a desperate and ultimately unsuccessful attempt to save the patient's life. The specimen Wells sent back to Haslar was the sphenoidal and temporal bones demonstrating the effects of the infection.

Wells was confirmed in rank in October 1842[9] and some 2 years later he was elected a Fellow of the Royal College of Surgeons.[1,10,11] This caused no little resentment amongst his colleagues, which was recalled in the *Lancet* some 12 years later: 'As a matter of course the heads of the medical departments of the Navy and Army were called upon to nominate some

of their officers for this honorary rank. A few Naval surgeons were named, but out of upwards of 250 Assistant-Surgeons Mr Wells was the only one selected by the Naval Medical-Director General as meriting this honour, a circumstance anything but flattering to the remaining assistants and productive of bitter feelings in the Mediterranean fleet'.[12] This blatant accusation of favouritism towards Wells by Sir William Burnett is entirely consistent with other accounts of Wells' charmed Naval career.

Throughout his time in Malta Wells continued to publish on a wide variety of subjects, from purely clinical reports[13,14] to more general epidemiological studies.[15] Much of the information he collected he did not publish until a considerable time after he had left Malta. Some of the cases formed the basis on which he was able, at a later date, to publish a personal series of rare problems. For instance, we find in 'Incomplete paralysis of the lower extremity connected with disease of the Urinary Organs', published in 1857,[16] a reference to his time in Malta: 'My attention was first directed to this disease in 1845 since then I have had 11 cases under treatment and have seen occasionally 30 others. A friend of mine attempted to commit suicide in 1847 from the distress of mind caused by his increasing debility. Yet he did his duty like a man against the Russians in both the Baltic and the Black sea'.

Wells continued to serve in the Naval Hospital Malta, and from 10 February 1845 in a full time capacity as an Assistant-Surgeon to the hospital.[17] Despite being appointed on 8 April 1846 to the Mediterranean Flag ship Hibernia,[18] Wells continued to be very active in the medical circles of Malta.[19]

Anaesthesia

When the news of the use of ether in London reached Malta on 9 February 1847,[19] Wells, always ready to try something new, together with Dr Burmester, experimented using an inhaler of their own design. Their experiments were only partially successful. After sending for a Hooper inhaler from London, Wells experienced considerably more success, giving his first anaesthetic on 6 March.

Over the next 9 days Wells gave three more anaesthetics, one for the removal of a finger nail which normally was 'an agonising thing under ordinary circumstances but now a mere bagatelle'. The two others were for the correction of squints. Although these are the only published accounts of Wells' initial experiences of ether, he must have used it on more occasions than these because he was able, at the meeting of the local medical society on 16 March, to observe that: 'weak persons and those worn out by sickness were very speedily affected while strong stout persons and those accustomed to drinking wines and spirits had to continue the inhalation much longer, in one case it had to be continued for 8 minutes'. He added that: 'he had seen no ill effects in any case in which he had employed it and he was convinced that the accidents that had occurred in England were due to the impurity of the ether, carelessness in the mode of application, or some disease in the patient which would lead more prudent men to decline to administer the anaesthetic'.[19] This latter comment is of interest for two reasons. Firstly, Wells must have already heard about the death attributed to ether of Ann Parkinson in Grantham on 10 March, although the result of the inquest was not reported in the medical journals until 19 March - some three days after the meeting.[20] Secondly, Wells used the term accidents, implying that Grantham was not an isolated incident.

Wells finished his presentation by anaesthetising two members of the audience. Neither demonstration was very successful although both doctors experienced some unusual sensations from the ether but neither of them lost consciousness, and both had severe headaches for some days after the event. The demonstration 'excited so much interest that the president proposed the nomination of a commission to study the effects of Ether inhalations on animals and human beings'. The suggestion was approved and three members, one of whom was Wells, were selected to form the commission and submit their report at the next meeting.[19] There is no evidence that the commission ever reported.

One of the more interesting accounts of Wells' use of ether in Malta comes from Mr Burmester, his colleague in his early experiments. When Burmester discovered that he needed a tooth removing he requested that Wells administer ether. He said: 'I can only compare the sensations I felt during the inhalation with those of a person in a pleasant but unconnected dream. A very agreeable state existed for some time afterwards, yet at 2.30pm (half an hour after the extraction of the tooth) I rode out to St. Julians and have since felt no ill effects whatsoever, not the slightest headache'.[19]

Wells published his experiences with ether in two papers. The major work: 'Remarks on the inhalation of Ether in 106 cases' was dated some 5 months after he gave his first anaesthetic.[21] The other, which pre-dates this paper by some two months, is a brief account of his attempt to use ether to control the convulsions of a Maltese woman with rabies,[22] a case he returned to several years later in a letter explaining how rabies was introduced to Malta.[23]

Wells finished his time in Malta on 10 February 1848[24] when he took up an appointment as the Surgeon, having recently being promoted,[25] on board HMS Trafalgar.[26] This appointment could only have been for his return to England because in the subsequent Naval list of 20 March no Surgeon was then appointed to Trafalgar. Somewhat confusingly, we find that Wells was again appointed to the Trafalgar at Sheerness in the Naval list of 20 June 1848. However there is no evidence that this was an active appointment.

Half Pay

Despite his apparent appointment to the Trafalgar, Wells was to be found in Paris in July 1848 following the insurrection of the previous month, and detailing his experiences and observations in a report to Sir William Burnett. It was whilst in Paris that Wells witnessed his first anaesthetic death.[27] Wells met several other English surgeons who were in Paris studying as he was. With one Dr Waters of Chester, Wells discussed ovarectomy, the operation for which he is most renowned, coming to the conclusion that as surgery stood, ovarectomy was not justified.[28]
On his return from Paris Wells continued to practise in London whilst on half pay from the Navy. He took some time out over the winter of 1849 and spring of 1850 to travel with the Marquis of Northampton, mostly through Egypt and Italy. It was whilst in Rome, at the request of the Marquis, who was suffering from consumption, that Wells used chloroform to control his symptoms: 'The effect of the inhalation was very successful and every repetition of its use was equally so; and during the remainder of the patient's life (about 7 months),

great alleviation of suffering was obtained from its use without any ill effects being observed'.[29]

HMS Modeste

Wells remained on half pay until he was appointed to the sloop HMS Modeste on 4 September 1851,[30] although it is curious to note in the previous September Wells appears in the Navy list with an appointment to a Navy hospital.[31] The hospital is not specified and it seems likely that he never took up this appointment.

Wells' appointment to the Modeste was comparatively short, lasting until 24 February 1853, and could not have been a particularly onerous one. Not only was Wells accompanied by an Assistant-Surgeon, which considering the small size of the ship must have been unusual, Modeste spent the whole time in the Mediterranean.[1-3] Wells, though, was no by means idle. He kept an extensive journal, and numerous reports, mainly epidemiological, were published.[8,32-34] During this time Wells became the editor of the *Medical Times and Gazette*, a post that he retained until 1858.

London

His return from the Modeste marked the end of his active Naval career and may have been precipitated by poor health. Wells was granted a year's sick leave from the Royal Navy, intending to live abroad, because of a chronic chest complaint. But he could only have spent a little time abroad because we find a letter in the *Medical Times* giving his address as 30 Brook Street, London, dated 24 July 1853.[35]

It was at this time that he married the daughter of the late Mr James Wright of Sydenham and settled in practice in the West End of London. Although there is some debate as to the exact date, Wells was elected to the post of Surgeon at the Samaritan Hospital, and was a Lecturer on Surgery at St George's Hospital.[28,36]

Wells didn't confine his activities to the Samaritan Hospital and was active in the Middlesex Hospital as well. It was in 1854 that he assisted at his first ovarectomy, the eighth that Mr Baker Brown had done. The patient died and he admitted afterwards that it had discouraged him. Interestingly, the other assistant for that operation was Mr TW Nunn a surgeon Wells had met in Paris during his studies there in 1848.[28]

Crimea

The advent of the Crimean War brought with it an acute shortage of Naval surgeons and many of those on half pay were required to return to active duty, Wells among them. It was a call that Wells never took up. It has been alleged that he was excused active duty because he had injured his finger during a post mortem.[12] This injury did not figure when he was found at a medical board in 1854 to be unfit for sea duties, and an appointment to HMS Furious was cancelled, because of his 'chronic lung inflammation'.[1] Neither of these conditions in fact stopped him from serving in the Crimea, as a surgeon in the civilian hospital in Smyrna,[7] in the line in front of Sebastopol, and in Renkioi hospital.[1]

By then Sir John Liddell had replaced Sir William Burnett as the Director General of the Medical Department of the Navy. He was considerably less sympathetic towards Wells and required him to both explain his actions and to return to England. On his return Wells was appointed to HMS Highflyer but he felt that because of the state of his health he would not be able to serve afloat again: 'If obliged either to serve afloat or resign his appointment as a serving Royal Naval Officer he would be compelled to follow the later course'.[1] His resignation was accepted on 6 August 1856.[38]

Conclusion

By the end of his naval career, Wells had a growing reputation as a surgeon. It was a reputation based to a large extent on the experiences he gained in the Royal Navy, most notably during his time in Malta.

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THE RESEARCH DEPARTMENT OF ANAESTHETICS THE ROYAL COLLEGE OF SURGEONS OF ENGLAND 1957 - 1987 THE BEGINNING AND THE END

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When the Faculty of Anaesthetists was established in the Royal College of Surgeons in 1948 an early proposal made by the Board of Faculty to the Council of the College was that a Department of Anaesthetics should be set up within the College. The proposal was accepted, space was made available on the 6th floor of the Nuffield College of Surgical Sciences and work was begun in the autumn of 1954. In this connection, under Faculty News, the *British Journal of Anaesthesia* reported in January 1955 (*British Journal of Anaesthesia* 1955; **27**: 39) that the work of building the new Department of Anaesthetics was making good progress and it was confidently anticipated that it would be available for use in about eighteen months time. Meanwhile, energetic steps were being taken to raise the money that would be needed for the maintenance of the Department, estimated at £12,000 per annum. To date, it was reported that the Faculty had received grants totalling £6,000 per year under covenant for seven years. Many of these had come from Fellows of the Faculty and the Board were confident that further substantial gifts would be forthcoming in the near future.

That would seem to have been the case, because the post of Director of the new Department was advertised towards the end of the year and Dr Ronald F Woolmer's appointment to the post was announced in March 1956. He took up the appointment at the beginning of the academic year six months later. At the time of his appointment, Dr Woolmer was already a distinguished senior anaesthetist, well known nationally and, indeed, he was an elected member of the Board of the Faculty of Anaesthetists. It was all the more surprising therefore that on his appointment he was asked to resign from the Board on the grounds that he was now an employee of the College and it would be inappropriate for him to retain his seat on the Board. Dr Woolmer apparently acquiesced since there is no record that he made any protest or attempted to have the decision reversed.

Structural work to meet Dr Woolmer's requirement was begun in January 1957 and an editorial in the *British Journal of Anaesthesia* in the following March (*British Journal of Anaesthesia* 1957; **29**: 97) made the point that the establishment of the new Department could not fail to give a new impetus to research in anaesthesia in the United Kingdom. It was claimed that the standard of clinical anaesthesia over the country as a whole was unique throughout the world, and that the five University Departments already in existence, together with the new Department which, unlike the University Departments, had the advantage of freedom from teaching and administrative commitments, would surely enable Britain to maintain its position in anaesthetic research.

Opening of the new Department

The Department was officially opened on 23 July 1957 by Sir Henry Dale OM GBE FRS Hon FRCS, in the presence of the President of the College, Sir James Paterson Ross and the Dean of the Faculty, Dr Frankis Evans, members of Council of the College, members of the Board

of the Faculty and a number of distinguished guests and benefactors as well as the staff of the Department and representatives from other College Departments.

From the beginning, it was clear that Dr Woolmer's approach was multidisciplinary as indicated by his choice of staff. His first assistant, Dr Gerald Graham, was a clinical physiologist, Dr D W Hill was a physicist and Dr J F Nunn was a research fellow in anaesthesia. The supporting staff included a mechanic and a laboratory assistant and other technical experts were appointed in due course. Essentially, the research was laboratory oriented with a well equipped workshop. Clinical access proved difficult but eventually an arrangement was made with the Department of Anaesthesia in the Whittington Hospital at Highgate Hill, North London, to allow the anaesthetists in the Department to have clinical attachments. In Dr Woolmer's case, his needs were met by this arrangement but Dr Nunn had greater difficulties and eventually he was given an honorary appointment in the Postgraduate Medical School at Hammersmith Hospital.

It is not clear when the Department of Anaesthetics became the Research Department of Anaesthetics nor who proposed the change of title, but the first published report to the Council of the College of Surgeons in October 1957 was entitled the 'Research Department of Anaesthetics' and so it remained. The following year, the British Oxygen Company made a grant of £150,000 to the Royal College of Surgeons to endow a BOC Chair of Anaesthetics and Dr Woolmer was appointed Professor with effect from January 1959 (*British Medical Journal* 1959; 1: 184). Following Professor Woolmer's untimely death in December 1962, he was succeeded by Professor J P Payne, who maintained the multidisciplinary approach but with emphasis on clinical rather than laboratory research. Thus, there was a greater need for clinical access and that had to be close at hand, preferably within walking distance of the Royal College of Surgeons. To that end, negotiations were started with University College Hospital through the good offices of Dr R W Cope, a UCH consultant and a member of the Board of Faculty. As it happened, the negotiations proved fruitless but it became widely appreciated that if an academic research department in a clinical subject was to thrive, it had to be actively associated with a teaching hospital group. In 1965 agreement was reached for a formal association with the adjacent postgraduate urological hospitals and the Institute of Urology. Much of the credit for that arrangement must go to Dr R I Bodman who, as one of the consultant anaesthetists on the staff of those hospitals, first proposed that such a link would be mutually advantageous - and so it proved.

A close relationship encouraged by the House Governor, Mr John Marshall, was soon established between the St Peter's Hospital and the Research Department. For all practical purposes, the clinical and the research units functioned as one, and the consultant anaesthetists on the staff of the hospital were not only encouraged to attend the departmental meetings but also had office accommodation provided within the College. Equally, the departmental staff were given honorary contracts with the Board of Governors and played a full part in the hospital's activities, accepting their share of hospital duties including committee work. At a junior level, all registrar posts were eventually upgraded to senior registrar and a rotational training programme established that allowed one year in three to be devoted to research.

Although limited in range by the nature of the specialty, the clinical facilities afforded by the hospitals provided exceptional opportunities for research and teaching. In particular, the

provision of a separate research area within the theatre suite in St Peter's Hospital allowed long term clinical research programmes to be developed which were further enhanced by the availability of a small recovery room.

As the research programme developed and the clinical commitments became stabilised, Professor Payne turned his attention to the political field. He declared his intention to stand for election to the Board of Faculty, notwithstanding the fact that his predecessor had been forced to resign from the Board on his appointment as Director of the Department. Basically, Professor Payne's argument was that as a long-standing Fellow of the Faculty, as an examiner for the Fellowship and as one of the few professors with a Chair in Anaesthetics in the United Kingdom, he was better qualified than most to serve on the Board of Faculty. As was to be expected, the Council took the view that it would be wrong for any employee to serve on a governing body of the College. Having searched the written constitution in vain for the evidence to support such an attitude, Professor Payne decided to challenge the decision and therefore sought legal advice.

The opinion given was that, after study of the Charters, the Bye-laws, the Standing Orders and the Regulations of the Royal College, and having taken advice about the Council's Standing Orders governing the method of election to the Boards of the Faculties, it was clear that there was nothing in the constitution of the Royal College, or in the general principles of law, which would render any employee of the Royal College with the necessary qualifications and experience, ineligible for election to the Board of the Faculty of Anaesthetists. Moreover, there was nothing illegal, improper or indeed unusual in a paid employee of an organisation being elected to, and serving upon, the controlling body of that organisation.

On the basis of that legal advice, Professor Payne made it clear that he was prepared to challenge the Council, in court if necessary. Subsequently, the Council's objections were withdrawn but, while accepting Professor Payne's right to stand for election, the Board of Faculty stated that it would for the time being regard with disfavour the election of such an officer to serve on Council. The practical effect of that resolution was to prevent Professor Payne being elected Dean or Sub-Dean. Perhaps that too should have been challenged, but at the time the right to stand for election to the Board of Faculty was the main issue; that right was achieved and in due course Professor Payne was elected to the Board in 1971.

Some problems and their solution

While these developments were taking place, it had become obvious that with the increase in commitments and the larger number of staff employed, all on grants, additional space was needed on the College site. This problem was also facing the adjacent Department of Pharmacology, but no funds were forthcoming from the Royal College of Surgeons. Accordingly, the heads of the two departments, Professor G V R Born and Professor Payne, made a joint approach to the Wellcome Trust for support to extend their space by building over the Department of Anatomy that lay at a lower level on the south side of the Department of Anaesthetics. The approach was successful and a substantial grant was obtained which provided more space and allowed the two Departments to reorganise the accommodation to their mutual benefit. One advantage of the additional space was the ability to extend the Department's interest in the application of computing to clinical medicine so that it was possible to create a medical computing unit within the Department. The computers

contributed to every aspect of departmental activities and teaching, research and patient care all benefited accordingly. Every member of the Department was encouraged to become familiar with computer operations and extensive use of the facilities was made by the technical as well as the scientific staff. In particular, the senior registrars in training in the Department were expected to acquire a basic knowledge of computers and some developed their interests sufficiently to become efficient programmers. This may not make too big an impact today but 25 years ago it was revolutionary, and attracted much attention, not least among the potential donors to the College.

It should be said that much of the research work undertaken by the Department was of a high profile nature and rarely a week passed when it was not visited by a delegation of council members and potential donors. In particular, the work in the mid-sixties on blood alcohol levels attracted much publicity and a substantial inflow of funds. Although little of these funds found their way to the Department, it seemed reasonable at the time to support other aspects of the College activities as long as the Department was capable of supporting its own research. It is also worth commenting that the studies on blood alcohol were generated by the Department's overall interest in clinical measurement techniques whether by gas chromatography and blood gas electrodes or the application of laser techniques, the use of transistors and indwelling catheters and other methods, including mass spectrometry, which are now commonplace.

Thus, despite the relative lack of internal funding, financial support was usually available albeit sometimes on the basis of commissioned research. By 1972, more than 40 people, admittedly some on a part-time basis, were employed in the department. The publication list for that year consisted of 24 papers covering a wide range of topics from the measurement of pain thresholds to the use of analogue telephone data links for the transmission of physiological signals, and the measurement of neuromuscular block which was ultimately to lead to the introduction of atracurium.

In the mid-seventies, a new problem was to arise. For many years, the re-organisation of the London Hospitals had been on the political agenda and the small specialist post-graduate hospitals were likely to be the first affected. In the case of the St Peter's Hospitals, it was proposed that these hospitals should be rebuilt on the London Hospital site at Whitechapel and incorporated into the teaching programme. Accordingly, the various academic departments in the St Peter's Hospitals were encouraged to cooperate with the corresponding departments in the London Hospital Medical College and a decision had to be taken about the future of the Research Department of Anaesthetics. It had been obvious for some years that the existence of a clinical department in a basic science environment with no hospital beds was not conducive to good research. The situation was not improved by the fact that the Department was expected to accept responsibility for covering lectures on the various courses without adequate representation at policy-making level. The problem was inherent in the system whereby the teaching programmes were organised by the Institute of Basic Medical Sciences of which the Research Department of Anaesthetics was denied membership. It was fortunate that at a personal level good relationships existed so that difficulties tended to be sorted out.

Whatever the future held, it was clear that the St Peter's Hospitals were not going to survive on their present sites and that they would be absorbed either by the London Hospital Medical

College or, it was rumoured, by University College Hospital. It was equally clear that, to survive, the Research Department needed a clinical outlet. On the basis of the previous unfortunate experience with University College Hospital, the decision was taken to transfer the Department's clinical attachment to the London Hospital Medical College. This link was formally established through the efforts of the Dean, Dr John Ellis, later to be knighted, Professor David Ritchie, Chairman of the Academic Division of Surgery, and Professor John Blandy, Professor of Urology and consultant urologist to the St Peter's Hospitals and a member of the Council of the Royal College of Surgeons. Shortly thereafter, Professor B R J Simpson, head of the Anaesthetic Unit, resigned his appointment and in 1977 Professor Payne was invited to succeed him as director of the academic unit of anaesthetics with the title of Professor in the University of London, with effect from 1 January 1979. In due course, Professor Payne was elected Chairman of the Academic Division of Surgery, probably the first time that an anaesthetist had become head of an Academic Division of Surgery. He was later to become Chairman of the Medical College's Academic Board, so that the integration had become consolidated with Professor Payne retaining the Chair in the Royal College of Surgeons and continuing his clinical practice with Professor Blandy in St Peter's Hospital.

After 1980, the political climate had begun to change and, more particularly, funding for teaching and research was becoming increasingly difficult. As a result, the Hunterian Institute, which had been set up in the Royal College of Surgeons to bring together the various academic departments in an attempt to overcome, among other matters, the problems of teaching, became in January 1986 a joint Faculty of the Royal College of Surgeons and the British Postgraduate Medical Federation in the University of London. In this way the Research Department became formally linked to the University at that time. The following year, negotiations which had been proceeding with BOC about the future financial support of the Research Department were completed with the company undertaking to provide £85,000 per annum for the next ten years. To allow the further development of anaesthetic research of particular value to the company, it was also agreed informally that particular projects could be commissioned and separately funded.

The end of the Research Department

On the basis that funds were available and with the approval of BOC, it was proposed that on Professor Payne's retirement in September 1987 the opportunity should be taken to establish a University of London Chair of Anaesthetics jointly between the Postgraduate Medical Federation (Hunterian Institute), St Bartholomew's Medical College and the London Hospital Medical College, and to establish a Joint Department of Anaesthetics between the two teaching hospitals. It was further agreed that the Joint Chair would become effective from the beginning of the academic year 1987-88. The new professor would be head of the joint academic department and would retain the research facilities at the Royal College of Surgeons.

In this connection, Professor Payne was asked to write what, in effect, was a job description for circulation to the applicants. Included in that description was an outline of the facilities available at the Royal College of Surgeons. It was stated that the Research Department of Anaesthetics which was self-contained in terms of cloakrooms, toilets and kitchen facilities, was located on one floor with an area of just over 4,000 square feet. Approximately 1,700 square feet provided accommodation for general and computer laboratories and a further 400

square feet were needed for technical staff. Professorial and secretarial staff occupied about 1,000 square feet divided into 8 offices of varying size and the remaining space provided library and teaching accommodation. However, unbeknown to Professor Payne and the staff of the Research Department, the Council of the Royal College of Surgeons had a hidden agenda, the avowed intention of which was to await the retirement of the professor in September 1987 and thereafter to re-allocate the research space for administrative purposes before the appointment of his successor. That may explain why the professor-designate refused to accept the appointment. Three years were to elapse before Professor Leo Strunin was invited to occupy the BOC Chair, by which time virtually all the research space had been converted for administrative use and the staff had gone. Members of the staff, some of whom had served the department since the time of Professor Woolmer, had apparently seen the writing on the wall and had either taken early retirement or moved on to other appointments elsewhere.

Looked at in retrospect, it can be argued that by 1987 the Research Department of Anaesthetics had fulfilled its purpose. When the BOC Chair was created in 1958, British anaesthetists had only recently found a corporate identity in their separate Faculty within the Royal College of Surgeons, academic anaesthetists were in short supply and there was a palpable sense of inferiority and insecurity. Thus the BOC Chair was a source of pride and satisfaction and much was expected of it. Today things are very different, anaesthetists have their own Royal College and each university hospital has its own academic department of anaesthesia, albeit not always with a professor at its head. Nevertheless, anaesthetists now make use of their local facilities and there is a greater sense of regional autonomy with less dependence on national organisations. The current requirement is for academic departments with the expertise and specialist knowledge to explore the fields which give rise to special problems of anaesthetic management.

What is still hard to accept is the insularity and high-handedness of the Council of the Royal College of Surgeons whose attitude had not significantly changed over the thirty years from the time that they were unwilling to accept, as a member of the Board of the Faculty of Anaesthetists, a Fellow who was also an employee of the College, to their reluctance to reveal their intentions to close the Research Department of Anaesthetics to the staff of the Department, presumably because they were also only employees.

As far as the staff of the Research Department of Anaesthetics is concerned, it had certainly served its purpose. There are many anaesthetists and scientists not only in the United Kingdom but scattered throughout the world, who are grateful for the opportunity they had to study, some for higher degrees, in the Department; it is probably safe to say that, to date, no other Department of Anaesthetics in Britain has produced three DSc degrees by examination.

ASPHYXIA AND PULMONARY BLOOD FLOW: SOME 19TH CENTURY IDEAS

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This subject would have had no meaning before the idea of the circulation of the blood, so it starts with William Harvey. In his second letter to John Riolan, in defence of his theory, Harvey wrote:

> 'I have several times opened the breast and pericardium of a man within two hours of his execution by hanging, and before the colour had totally left his face, and in the presence of many witnesses, have demonstrated the right auricle of the heart and the lungs distended with blood; the auricle in particular of the size of a large man's fist, and so full of blood that it looked as if it would burst.'[1]

Harvey was using this appearance as evidence that the blood circulates, and his explanation was that when respiration ceases at death, the lungs collapse and the minute pores which allow the passage of blood through them are closed. The heart, however, continued to contract for a while, but since there is no blood flowing through the lungs to fill the left side we find the left auricle and ventricle empty, as well as the arteries. This was how Harvey explained:

> 'The emptiness of the arteries in the dead body, which probably misled Erasistratus in supposing that they only contained aereal spirits .....'

From this came the idea that at least one of the functions of respiration was mechanical, that the rhythmical expansion and collapse of the lungs was necessary for the passage of blood through them. But Hooke's celebrated experiment in 1665, of opening the chest of a dog whose trachea had been intubated, making multiple punctures in its visceral pleura, and keeping it alive for hours by blowing a steady current of air through its fully inflated but static lungs, showed that movement of the lungs was not necessary, either for the continuance of the circulation or for life.[2]

The 18th century background

In the mid 18th century, Haller advanced the explanation for the post-mortem appearances in asphyxia, which soon became very influential, that during expiration the lungs empty completely and collapse, so that their blood vessels become extremely convoluted, as in the foetal lung, and so offer an extremely high resistance to blood flow. Hence, in the absence of normal respiratory movements, as in asphyxia, the circulation through the lungs would become obstructed. But one obvious implication of this was that blood would only flow through the lungs when they were expanded, during inspiration.

Haller also offered a theory to account for the heart beat. This was a variation of the idea of irritability which had been advanced by Glisson to explain the contraction of the gall bladder. Briefly, this was that when any hollow viscus becomes distended, its inherent irritability causes it to contract.[3] Haller asserted that the right heart was susceptible to the stimulus

occasioned by the influx of venous blood, which caused it to contract, while similarly the left ventricle is instigated to motion by the impelled blood from the lungs, from the same irritable nature. These two explanations, that the contraction of the heart chambers is due to irritable response to distension by blood, and that the lungs collapse completely during expiration, were generally accepted for the next fifty years or more.

Edmund Goodwyn, during the experimental work described in his brilliant essay which won the Royal Humane Society's Gold Medal in 1788, had observed these asphyxial post-mortem appearances, and he refuted Haller's theory of pulmonary collapse by showing both that a substantial amount of air remains in the lungs at the end of the profoundest expiration, and that the proportional difference in chest capacity between expiration and inspiration is quite small.[4,5] His explanation was that the blockage was at the left side of the heart. Blue or black blood in the chambers of the left side of the heart did not have the correct properties to stimulate contraction, so the blood was dammed back on the venous side.

The great French anatomist, Bichat, also described and discussed this in his great classic *Recherches physiologiques sur la vie et la mort*.[6] He performed a series of well devised and beautifully executed experiments, summarised here. He inserted a stop-cock into the trachea of a dog, and having exposed an artery and divided it between clamps, he then closed the stop-cock. Having thus prevented inspiration, he permitted blood to flow from the divided artery. At first it flowed in full stream, and was bright arterial in appearance, but it gradually lost its arterial character, until it resembled venous blood. The stream then became weak and slender and at length ceased. At the end of three minutes, even without great loss from haemorrhage, little blood flowed from the extremity of the divided artery, and in five minutes, even the slightest oozing had stopped. The point Bichat was making here was that the blood flow from the cut artery did not stop because of blood loss, nor because the heart had stopped beating, but from some other cause.

Post-mortem examination showed that the whole capillary system contained only dark fluid blood; the left auricle, ventricle and the arteries, were empty, but the venous system, especially where it emptied itself into the right heart, was engorged. The right ventricle and auricle and the pulmonary artery were distended to the utmost, with a dark fluid blood. Bichat himself concluded:

> 'I shall finish this chapter by the examination of an important question, and enquire into the reason, why, when the chemical functions of the lungs are stopped, the pulmonary arteries, the black-blooded cavities of the heart, and in a word all the venous system, are found so much more full of blood, than the aortic system. In such case the circulation appears at first to be interrupted in the lungs, and then in the other parts, according to their proximity to the lungs.[7]

He suggested two causes. First, that black blood circulating in the bronchial vessels weakens the different parts, impeding their action and, secondly, that when the chemical action of the lungs is interrupted, there is non-excitement of the lungs by vital air, which normally stimulates the mucous surfaces and keeps them in a sort of perpetual erythism, or irritability. As regards the circulatory state in asphyxia, he concluded: 'the obstacle commences in the lungs .... there is a greater resistance offered to the influx of blood'.

19th century ideas

So, at the beginning of the 19th century, explanations of the circulatory appearances in asphyxial deaths became bound up with the 'black blood' controversy, which is a separate issue, except where it impinges on the present topic. As indicated above, Bichat had postulated that the circulation of black (venous, hypoxic) blood through the arteries enfeebles the tissues, and eventually causes their death, starting with the brain; but that as long as the process has not gone too far, the asphyxial effects could be reversed by perfusion with red blood. Bichat did not claim that black blood was toxic, nor that resuscitation was impossible, and he clearly stated, as already noted, that in asphyxia there develops an obstruction in the lungs to the flow of blood.

But Bichat's ideas were carried much further by Benjamin Brodie. From experiments on animal hearts he concluded that:

> 'The effects produced by the circulation of dark-coloured blood are not merely negative. It operates like a narcotic poison, and even after natural respiration is restored the animal remains as insensible to external impressions, and as incapable of voluntary movements as if he were under the influence of opium, or the woorara.'[8]

This was elaborated by Humphry Davy's biographer, John Ayrton Paris:

> 'Bichat has shown that ..... dark coloured blood acts like a narcotic poison upon the brain: and no sooner, therefore, does it extend its malign influence .... than the deleterious effects are produced, and the animal .... speedily dies, *poisoned by its own blood*. We are much indebted to Mr Brodie for a series of experiments in confirmation of these views.[9]

But a careful reading of Bichat's book in a contemporary translation has not produced any evidence that this assertion originated there; on the contrary, Bichat clearly states, as already noted, that in asphyxia there develops an obstruction in the lungs to the flow of blood which, if not too far gone, is reversible.

In the United Kingdom the asphyxial post-mortem appearances were discussed by Dr David Williams of Liverpool. His paper contains one of the most vivid descriptions of the circulatory mechanics of asphyxia.[10] Williams opened the chest of an animal, and ligated its trachea. He observed that the blood became progressively darker, and that after the heart had ceased beating the right auricle and ventricle were so distended that when the pericardium was slit open it seemed likely that they would burst; yet, at the same time, the pulmonary veins were comparatively empty. Hence it was evident that the blood was obstructed in the course of its flow through the lungs, and that this obstruction was one of the principal causes of the emptiness of the arterial side of the circulation. From the distension of the cavities of the right side of the heart, and the gorged state of the cavae, it was evident that there was no obstacle to the return of blood through the systemic capillaries. After much thought, it seemed to him probable that blood could not pass from the pulmonary artery to the pulmonary veins without first being acted upon by pure atmospheric air.

He tested this theory with a similar experiment, towards the end of which he observed an irregular or fluttering contraction of the muscular fibres of the right ventricle, which continued for a short time, excited seemingly by the stimulus of distension, from the accumulation of blood in its cavity. After the irregular muscular action had ceased, he opened the pulmonary veins and showed that they were empty. The pericardium was then slit open, and the right ventricle soon became enormously distended, yet no blood flowed out of the punctured pulmonary veins. The pulmonary artery was then punctured, and instantaneously the blood gushed out and deluged the cavity of the chest.

So Williams had clearly demonstrated an obstruction to the circulation in the lungs, in the absence of lung collapse, and related to asphyxia. Also, as will have been noted, he had given an early description of ventricular fibrillation. Finally, he stated and discussed six conclusions, of which the first three and the fifth are most relevant:

1st - on suspension of respiration the blood is obstructed in its passage through the lungs, while its circulation through the other parts of the body continues;
2nd - the obstruction of the blood in the lungs, on the suspension of respiration, is not the effect of a mechanical cause;
3rd - the obstruction .... arises from a deprivation of pure atmospheric air;
5th - the obstruction .... is one of the principal causes of the vacuity of the system circulating arterial blood post-mortem.

James Phillips Kay, better known by the surname he adopted on his marriage, Kay-Shuttleworth, confirmed Williams' findings, and also devoted much time to refuting the claim that black blood was poisonous, a claim that he, too, attributed to Bichat. He conducted an inspired series of cross-circulation experiments in which animals' limbs were perfused first with venous then arterial blood and he showed, testing by electrical stimulation, that the effects on skeletal muscle were reversible up to one hour or more. Hence venous blood could not be poisonous *per se*. He reported this work in his influential essay on asphyxia which won the Gold Medal of the Royal Humane Society in 1834.[11] His conclusion was that:

> '....when venous blood enters those vessels which formerly conveyed arterial blood only, this degenerated fluid is unable to excite their action, and the circulation stagnates in the lungs.'

Kay repeated this, with slight variations of expression, in several places. For example:

> '.... deprivation of air is followed by a sudden arrest of the circulation. When oxygen is again supplied to the pulmonary cells the pulse and life return. These phenomena indicate surely that the circulation is arrested in the lungs.'

Anaesthetists' interest

This theory, and these post-mortem appearances, would have been well-known to doctors practising during the 1840s. Kay's work was certainly known to John Snow, who cited his demonstration: 'that venous blood has some power of supporting the functions of the brain ...' and shows how far physiology had progressed by adding: '... but this depends on some free

oxygen it contains ....'[12] Its implications are to be seen in the dispute between Simpson and others about the cause of Hannah Greener's death. When we read reports of post-mortem examinations during this period we find that the fullness or emptiness of the heart chambers and great vessels, and the presence or absence of cerebral congestion, are always recorded.[13] For a while it was believed that cerebral congestion was the cause of death in asphyxia, and blood letting to reduce this congestion was always part of the resuscitative measures.

Joseph Clover referred to it, too. Describing the induction of anaesthesia using his portable regulating ether-inhaler, he wrote:

> 'The plan of excluding fresh air until insensibility has been induced, and admitting it very sparingly afterwards, has now been extensively tried in various ways and, as far as I know, it is practically free from the danger of causing serious obstruction to the pulmonary circulation and over-distension of the right cavities of the heart.[14]

It is interesting to trace the fate of this theory in the textbooks. It was expressed very explicitly by Kay's teacher, and Simpson's colleague, William Alison, in his *Outlines of Human Physiology*. He gave a summary of Kay's works, observing that in the asphyxiated animal, as Kay has shown, the circulation ceases after a very few minutes because *the venous blood has failed to penetrate the substance of the lungs.*[15]

Later, the theory appeared in a rather degenerate form in Kirkes' *Handbook of Physiology*, first published in 1848. In this, it was attributed not to asphyxia, but to the carbon dioxide retention that occurs in respiratory obstruction. It is: '... as if blood charged with carbonic acid could not pass freely through the pulmonary capillaries'.[16] The problem was that in both the early and subsequent experiments there was no differentiation between asphyxia caused by breathing an hypoxic atmosphere, when carbon dioxide would not be retained, and asphyxia due to obstruction, when it would. In this book there are only two illustrations of apparatus, both manometers. Forty years later, in the 14th edition of Kirkes, edited by Halliburton, we see, from the copious illustrations, that physiology has made the enormous leap from the hydrostatic to the electromechanical age. Pulmonary hypoxic vasoconstriction still appears, but obviously only as a carry-over from earlier editions, because none of the many other physiology textbooks newly published during the 1880s and 1890s, by Michael Foster, Waller, McKendrick or Landois and Stirling, even mentions it.

The 20th century

However, it and associated residues are still to be found in the 1912 edition of Hewitt's *Anaesthetics and their Administration*. Hewitt speaks of the heart muscle being poisoned by asphyxial blood, and asserts that:

> '.... arrest of the respiratory pump from any cause will, after an interval varying with other circumstances present, be followed by lividity or cyanosis, an obstructed pulmonary circulation, general venous engorgement and, consequently, by a diminution in the quantity of blood entering the left heart.'[17]

As regards death from asphyxia, he says:

> 'Animals killed by pure nitrous oxide display post-mortem the usual signs of asphyxia, the right cavities of the heart being full, and the left comparatively empty. Sir G Johnson believed that the great difference in the fulness of the right and left chambers is to be ascribed to contraction of the pulmonary arterioles brought about by the non-oxygenated blood.'

And he continued with a page-long discussion of this point.[18] Soon, however, the phenomenon was forgotten, until rediscovered in 1946.

In that year, two very eminent pharmacologists, von Euler and Liljestrand, conducted a series of rather serendipitous experiments, the purpose of which was to see whether the pulmonary arterial blood pressure was subject to regulatory forces of a similar or different kind from those exerted on the general blood pressure.[19] They measured the pulmonary artery pressure in animals exposed to a variety of stimuli, including hypoxia, and found that even changing from pure oxygen to room air produced an increase in pulmonary artery tone, while greater degrees of hypoxia caused profound pulmonary vasoconstriction. This vasoconstrictor response to hypoxia is now recognised to be local, and peculiar to lung tissue. When only part of the lung is involved, as with a blocked bronchus, it has the effect of directing blood away from unventilated alveoli, so reducing shunting, or mixing of oxygenated and suboxygenated blood.

Although this reflex is still generally not very well known, not being described in most general textbooks of physiology, it has become familiar to anaesthetists, and also to paediatricians, because it is of some importance to them in two or three respects. In children with chronic upper airways obstruction caused by enlarged tonsils and adenoids there may be pulmonary hypertension as a result of the hypoxia, which may put a strain on the right side of the heart.[20-22]

Diffuse pulmonary vasoconstriction is also present in the early stages of respiratory failure, and has a significant role in the post-traumatic adult respiratory distress syndrome; and, of course, it is present in those types of congenital heart disease that are associated with hypoxaemia. All this provides an additional important reason for ventilating the asphyxiated patient with oxygen in preference to air. But, rather unhelpfully, the reflex is inhibited by atropine, and by certain anaesthetic agents. Some of the earliest work on this was done by Sykes,[23] and it has more recently been extended to the newer agents by others.[24] The role of nitric oxide in the mediation of this reflex is under investigation.

The information still hasn't penetrated into some quarters. In forensic medicine, for example, it should be obvious that the post-mortem appearances of death from asphyxia, the great venous congestion, and so on, are due to pulmonary vasoconstriction, not to the traditional causes that are given of struggling for breath, and trying to exhale against a closed larynx, and that the same explanation holds for Tardieu's spots, the minute sub-pleural haemorrhages that are found especially in the young. Surely the explanation of the post-mortem findings in death from asphyxia should be brought up to date.

In conclusion, this account of a post-mortem appearance, and a reflex, recognised during the last century then forgotten for almost one hundred years, is surely evidence that one can learn from history.

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FREDERICK SILK

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Frederick Silk's influence on our specialty was not the most spectacular, but was none the less important. His publications include two textbooks and several papers on nitrous oxide and oxygen anaesthesia and the use of ethyl bromide, but his two most important contributions were his insistence that anaesthetics should be systematically taught to medical students and his belief that meetings and discussions should be regularly held by those giving anaesthetics.

John Frederick William Silk (he usually signed himself J.Fredk.W.Silk) was born in Gravesend on 24 January 1858, just six months before John Snow died. His father, John Alexander Silk, was a retired solicitor, and his mother had been Jane Clare before her marriage with, curiously enough, the same maiden name as Frederic Hewitt's wife. There were three sons of the marriage, Frederick being the eldest. He was educated at Cranbrook School and at the age of 15 he won the second prize in chemistry, the first going to a much older boy. Later the same year he gave a lecture on 'Nitrogen' to the school scientific society. A contemporary was Victor Horsley.

In 1875, at the age of 17, Silk won a scientific exhibition given by the Clothworkers' Company, to King's College, London, and to King's College Hospital, then in Portugal Street behind the Royal College of Surgeons. As a student, he won prizes in materia medica, physiology, obstetric medicine and divinity. Alumni of King's College will recall that it has a faculty of divinity, but other students can take an examination in divinity which entitles them to put the initials AKC after their names - Associate of King's College. Silk qualified LSA in 1879, MRCS in 1880 and MB in 1881, with honours in obstetrics and forensic medicine. In 1884, he obtained the MD, and was married the same year.

After two house jobs at KCH, he went to Leeds, where he was house physician for two years. It was here that he learnt to give ether with Clover's inhalers, to which he was always attached. One of the surgeons, Pridgin Teale, was an enthusiastic devotee, using the inhaler with the complete exclusion of air, believing that the resulting cyanosis was desirable and free of danger![1]

Silk left Leeds to return to London and engage in general practice, but he also became Registrar in Anaesthetics and, later, Anaesthetist to the Great North Central Hospital (now the Royal Northern) and to the National Dental Hospital. In the following years he also had appointments to the Hospital for Epilepsy (now the National Hospital, Queen Square) and to the Royal Free Hospital.

In 1888, Silk produced a textbook: *A Manual of Nitrous-oxide Anaesthesia*. In this he stressed that other textbooks devoted relatively few pages to this subject, most concentrating on ether, chloroform and other vapours. He stated:

> 'In the first place, it must be laid down as a rule which admits of no exception, that the administration must occupy the sole and undivided attention of one individual or, in other words, must not be undertaken by the person who is to perform the operation.'[2]

He was referring especially to dental anaesthesia, in which he was particularly interested. It is significant that it was nearly a hundred years before this advice was generally accepted. The book was considered very valuable and completely up-to-date when a new dental school was opened at Guy's Hospital in 1889.

A year later, Silk followed this book with a paper on anaesthesia for naso-pharyngeal operations, with particular reference to the problems of nasal obstruction. He detailed the advantages and disadvantages of different anaesthetic agents and stressed the importance of employing the supine position in patients receiving chloroform. He continued to be a great believer in Clover's inhaler when giving ether or nitrous oxide and ether, but used an open mask or a Skinner's inhaler for chloroform. Although he used the ACE mixture, he felt that it had the disadvantages of its constituent, chloroform.[3] It was in the same year, 1890, that he finally gave up general practice to concentrate on anaesthesia and became Assistant Anaesthetist at Guy's Hospital, where he was asked to organise a staff of anaesthetists. At the same time, he instituted regular instruction in anaesthetics for the students, gave lectures on the subject, and appointed clerkships. Four years later, he became Senior Anaesthetist.

About this time Silk became interested in the use of ethyl bromide as an anaesthetic agent. It was first used by Nunnelly in Leeds in 1849 and had become popular abroad, particularly in the United States and Germany, where it was used in dental surgery. In 1891, he gave a paper to the Society of Odontologists of Great Britain, citing 94 cases. Although induction was rapid and pleasant for the patient, the agent had serious disadvantages, being rather unstable, with a tendency to cause slow recovery, vomiting and hypotension. Deaths had been reported, although he had had none himself. He reported another 36 cases, but was unenthusiastic about its use.[4]

Silk designed a celluloid facepiece for use with nitrous oxide and a face mask for ether anaesthesia. Both were lighter than most and the facepiece had the advantage of being transparent. The face mask, which was based on Rendle's mask, was thicker and more opaque.[5] Later, he designed a more hard-wearing metal version for hospital use.[6]

But a paper which Silk read to the Thames Valley Branch of the British Medical Association and which was published in the *Lancet* in May 1892 was his most important. It was entitled: *Anaesthetics: A necessary part of the curriculum - a plea for a more systematic teaching.*[7] He divided it into three sections:

a) the nature and character of the instruction in anaesthetics at present offered to the student;

b) reasons for thinking that this instruction should be improved and

c) a brief indication of the direction in which it is possible to make an improvement.

At that time, very few hospitals taught anaesthetics in a systematic way and many doctors gave their first anaesthetic only after qualification. Silk claimed that the administration of

anaesthetics was an essential detail in surgery and should be taught with as much care - yet many anaesthetics were given very casually. Forty-two deaths due to anaesthetics had occurred in 1891 alone, mostly from those administered by young, untrained anaesthetists.

He therefore proposed that proper evidence of instruction should be required on qualification, of having at least attended a number of lectures and demonstrations, and of having personally administered anaesthetics in a number of cases; that students should be appointed as anaesthetic clerks, just as for surgery and medicine, and should keep records, and that resident anaesthetists should be appointed to give anaesthetics when the honorary anaesthetist was not present. All this sounds axiomatic nowadays, but it was very new in 1892. There is no question that many anaesthetists, Dudley Buxton, Frederic Hewitt and many others, were of the same opinion, but Silk was the first to publish this view.

The Society of Anaesthetists

At 8.30 pm on 15 June 1892, Silk called a meeting of well-known anaesthetists at his rooms in 29 Weymouth Street. He wrote:

> 'I accordingly placed myself in communication with the leaders of the profession of this branch, by whom the suggestion was received with much favour.'[8]

Woodhouse Braine of Charing Cross, G E Norton of the Middlesex, I P Stallard of Manchester and Silk were present. Hewitt, Dudley Buxton, Henry Davis of St Mary's and Alexander Wilson of Manchester sent their regrets. A second provisional meeting was held in October at which Woodhouse Braine took the chair. Silk was provisional honorary secretary and Dudley Buxton provisional treasurer. Three women, Dr Frances Dickinson Berry of the Alexandra Hospital for Diseases of the Hip in Queen Square (now defunct), Mrs Caroline Keith and Miss Evaline Cargill, both of the New Hospital for Women (now the Elizabeth Garrett Anderson), applied for admission. However, the committee said they had no power to state whether they were eligible, but they were elected to the Society early in the following year.

A special general meeting was held on 19 October, when the election of Woodhouse Braine as President, Silk as Secretary and Dudley Buxton was Treasurer was confirmed. The objects of the Society were:

1) to encourage the study of anaesthetics and

2) to promote and encourage friendly relations among the members by means of debates, discussion, or by the reading of short papers.

The entrance fee was half a guinea (52½p) and the annual fee was the same. There were 40 original members and the first regular meeting was held on 16 November at the Royal Medical and Chirurgical Society's house at 20 Hanover Square. Dr George Oliver of Harrogate opened the discussion by reading a paper on the size of the radial artery under anaesthesia.

In 1896, Silk accompanied the President, then Carter Braine (the son of Woodhouse Braine), also of Charing Cross, to ask Sir Joseph Lister to deliver an oration to the Society on the occasion of the 50th anniversary of the introduction of chloroform. Lister replied that he saw no point in such a celebration, since the introduction of anaesthesia (presumably he meant of ether) was much more important. In the event, Silk gave the oration himself. Silk became President in 1899 to 1900 and wrote to the General Medical Council concerning the desirability of having anaesthetics included in the curriculum. Their education committee replied that, while agreeing that proper instruction was desirable, they did not think it should be compulsorily included.[9]

I do not know what the relationship between Silk and Hewitt was, but on some matters they disagreed. In 1895, Hewitt and the surgeon Marmaduke Sheild gave a paper on posture in anaesthesia to the Royal Medical and Chirurgical Society. It happened that Hewitt had been given the papers of the recently deceased Guy's anaesthetist, George Sheppard. Silk wrote to Hewitt, asking him if he had come across a copy of a very similar paper which Sheppard had given to the anaesthetists at Guy's Hospital a short time before he died.

Hewitt replied that he had not found one, but he no longer had the notebooks; he had referred to a paper by Sheppard on posture under ether anaesthesia which had appeared in the *British Medical Journal* in 1891. Silk wrote again on the subject, but unfortunately his letter is lost. It seems most unlikely that he made a charge of plagiarism, but in his reply Hewitt evidently took umbrage and asked Silk to refute the implied charge, or else to allow their correspondence to be placed before the Council of the Society for investigation of the matter.

In his reply, Silk was obviously astounded at Hewitt's reaction, saying that he had no wish to make any such charge, and was very sorry that he should have thought so; he declined to have their private correspondence to be so placed. Hewitt wrote, rather stiffly I feel, that he was glad there could be no charge of plagiarism, but that he was not alone in his interpretation of Silk's letters - apparently Marmaduke Sheild had agreed with him. I was interested to see in the papers at the Wellcome Institute that Silk had obviously drafted an account of his side of the affair as an intended statement, in case it should have proved necessary.[10]

Again, in 1911, when Frederic Hewitt was active in pressing for legislation on the question of anaesthetics being given only by the medically qualified, he wrote a letter to the *Lancet*, stating that the profession, and a considerable section of the public, expected some action by Parliament.[11] Silk wrote to the *Lancet* some weeks later, expressing the opinion that Hewitt's unsuccessful four years' hard work suggested that there was little enthusiasm for legislation and that its benefits were imaginary rather than real.[12] Hewitt's reply in another letter included the following sentence:

> 'None are so blind as those who will not see, and if Dr Silk prefers to keep his shutters up, and miss a sunrise which many of us hope in our declining years to look back upon with pleasure, he is perhaps to be more pitied than blamed.'[13]

Since Silk was described as a quiet, unassuming man, who did not seek the limelight, but was concerned only for the good of the public, it is difficult to believe that he was not sincere in his views or was motivated by any personal antagonism.

In 1898, Silk retired from Guy's Hospital, where he had been much appreciated, and from his other appointments, to devote his time to King's College Hospital. He was very active on the Building Committee of the new hospital at Denmark Hill and was secretary of the staff supervising its plans[14] In 1914, he published a second textbook, *Modern Anaesthetics*, based on his own practice. It was well reviewed and a second edition appeared in 1920. In 1915, at the age of 57, Silk joined the Royal Army Medical Corps with the rank of Lieutenant-Colonel and was posted first to Malta and later to the Home Command. He was demobilised in 1919 and returned to King's College Hospital, but retired in 1921 to live in Dartmouth.[15] He died in Newton Abbott on 18 November 1943 at the age of 85, and was buried in Torquay Cemetery. His wife lived until 24 December 1957, when she died aged 93, and was buried in the same grave.

Frederick Silk's great contribution to our specialty was to be the first to state publicly that anaesthetics would not advance unless proper education and instruction in the subject were given to students and doctors, and to found the Society of Anaesthetists which, as the late Peter Dinnick pointed out,[16] became in 1908 the Section of Anaesthetics of the Royal Society of Medicine, which begat the Association of Anaesthetists in 1932, from which came the Faculty of Anaesthetists and, now, our Royal College. We owe him, therefore, a considerable debt.

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SAMPSON GAMGEE 1828-1886: THE MAN AND THE TISSUE

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Medical eponyms can be dangerous. Every medical student knows the story of 'coudé', the catheter, the elbow-like bend of which was described as a surgeon. My paper is about a surgeon who was described as a tissue. Sampson Gamgee invented a surgical dressing in 1880. It became known as Gamgee tissue. He did not plan its use in anaesthesia but for a period of over seventy years, from 1912 to the mid 1980s, British textbooks on anaesthesia described the use of his tissue to convert the 'open drop' method of anaesthesia to the 'semi-open' technique. Its use was well illustrated, for example, in Macintosh & Bannister. But they rob the tissue of its personality, spelling Gamgee with a small g: 'The concentration of ether vapour can be increased by inserting a gamgee pad underneath the mask,....'. Yet Macintosh & Bannister were keen on personalities; their book had a separate Index of Personal Names, but it did not include Gamgee. Like many others, they did not acknowledge Gamgee as a man's name or that the words 'GAMGEE TISSUE' were a registered trade mark.

Through the years, the authors and editors of books on anaesthesia have been divided in their treatment of the name Gamgee. The earliest reference I could find to the use of the tissue in anaesthesia was in Hewitt's 4th edition of 1912. He used the small g. Dudley Buxton was critical of Hewitt's use of the tissue because: 'it is readily permeable to any ether leaking upon it'. Buxton used a ring of 'spongiopiline' instead. Ross Mackenzie in 1946 used a sheet of oiled silk under his pad of Gamgee (spelt gamgee) tissue. Goldman in 1941 described the use of the tissue (g) as a mouth pack in dental surgery, adding a note that the technique was introduced by Dr de Caux. Gordon Ostlere, as befits such a versatile author, uses both spellings - Ostlere 1949 (g), Ostlere and Bryce Smith 1972 (G). Wylie and Churchill-Davidson mention the tissue right up to the 1984 edition, and always with a small g. Minnitt and Gillies (1919-1948), Hadfield (1931), Nosworthy (1935), Lee/Lee and Atkinson (1947-1973), Campbell and Spence (1965, 1978), Vaughan (1969) and Ward (1975) all omit the capital. The number of texts I found with the correct spelling are depressingly few - Woolmer (1941), Evans (1949), Evans and Gray (1959, 1965), Thornton (1965, 1974), Laycock and Foster (1966) and Zuck (1969). Ronald Woolmer, in his book *Anaesthetics Afloat*, was the most precise. He used the man's name and specified the thickness required: 'Two pieces of Gamgee tissue (Robinson's medium) will be required'. Woolmer is the only one to refer to Robinson's grades of Gamgee tissue. None of these books has a footnote on Gamgee the man.

The introduction of Gamgee tissue

Gamgee's invention was important. It displaced the use of oakum pads as wound dressings. Oakum was made of the loose fibres obtained by picking old rope to pieces. This rope came from ships, dockyards and coalmines, and the picking was done by convicts. Gamgee replaced it with a soft, clean, absorbent dressing.

Processing of the materials used to make his dressing was all-important. Raw cotton-wool, as picked from the cotton plant, is naturally oily. A piece placed on the surface of water floats

for days and scarcely becomes wet. But, in 1879, Messrs W G & J Strutt of Belper, Derbyshire, introduced a process which degreased it and made it absorbent. When Gamgee made his first pads he covered this absorbent cotton with fine unbleached gauze, similar to that used by nurserymen (under the name tiffany) to shade their conservatories. But this gauze proved unabsorbent and prevented the cotton from taking up fluid. When the gauze was bleached it all became absorbent. He described this new dressing in the *Lancet* in 1880[1] and paid tribute to the manufacturers, Messrs Robinson & Son of Chesterfield, for their help. The demand for the tissue was so great that, within a month, it was necessary to enlist the help of the larger manufacturing chemists, Messrs Southall Brothers & Barclay.[2] Gamgee was granted the Patent in 1883, and he assigned the rights to Robinson for £400. Robinsons later registered the name 'GAMGEE TISSUE' as a trade mark.

Gamgee the man

Gamgee is an unusual name and Sampson Gamgee most unusual. He was born in Italy, but both his parents were born in England, as were his grandparents. They lived in Essex, near Saffron Walden, where his great-grandfather was the farm bailiff on the Elmdon estate, and his grandfather a wheelwright. Sampson Gamgee's father, Joseph Gamgee, began work at an early age. At 9 years, he was working on the farm from dawn to dusk. When a little older, he went to work in the stables of the Puckeridge Hunt, in Hertfordshire. His good work brought him to the notice of the master of the hunt, Mr Sampson Hanbury, a wealthy member of an old Quaker family. He was also a brewer, being part of the firm of Truman, Hanbury, Buxton & Co and he had business connections with English army officers stationed in Italy. One of these, General Richard Church, wrote to Mr Hanbury saying that an Italian nobleman, Prince Petrullo, needed a huntsman. Mr Hanbury offered the post to the 19 year old Joseph Gamgee. He accepted, and went to Italy where he prospered. When his first son was born he named him Sampson after his benefactor.

Sampson Gamgee had two brothers. John became a famous veterinary surgeon and inventor, while Arthur became a professor of physiology and Dean of the Manchester Medical School. As to Sampson's two sons: Ernest, in his youth, misbehaved and was sent to Australia where he made a fortune. He later endowed the Sampson Gamgee Gold Medal in Surgery at the Birmingham Medical School. Leonard was industrious and became a professor of surgery.

Sampson Gamgee, like his father, began work at an early age. When he was 9 years old he accompanied his father by ship to England to buy bloodstock. They returned to Italy over the Simplon Pass leading the string of horses they had bought. At 16, his translation of an Italian scientific paper into English was published in *The Veterinarian*. At 18, he came to London, entered the Royal Veterinary College and qualified MRCVS in 1849. His teachers advised that he should read medicine. He entered University College Hospital and qualified in 1854. Whilst a student, he shared lodgings with the future Lord Lister, and they remained lifelong friends. During the summer vacations Gamgee visited the main medical centres in Europe. He gained much from these visits because he spoke Italian, German and French like a native, and Spanish fluently. At University College Hospital he gained the Gold Medals for anatomy, physiology, surgery, clinical medicine and clinical surgery, and was awarded the Liston Prize for a surgical essay. After a year as house surgeon to Mr Erichsen at University College Hospital, he was asked by Guthrie to be Surgeon of the British Italian Legion, one of the three foreign legions raised for the Crimean war. A few years later he organised medical aid for

Garibaldi's army, and in the Franco-Prussian war he was made Secretary of the British Society for Aid to the Wounded. Many years later, his methods were praised by Joseph Trueta, the famous surgeon of the Spanish Civil War.

Gamgee and Birmingham

For a short time Gamgee was an Assistant Surgeon at the Royal Free Hospital in London, but he was not content. He applied for a post at the Queen's Hospital in Birmingham. This was the teaching hospital of Queen's College, a forerunner of the university. The College was dominated by its Faculty of Theology. Its Royal Charter (1847) vested the power to elect the clinical teachers of the College, that is, the medical and surgical staff of the Queen's Hospital, in a College Council dominated by the Anglican faction. The hospital staff recommended the appointment of Gamgee, but the College Council asserted its authority and appointed a less experienced surgeon. Birmingham was then the stronghold of English nonconformity. Public interest was mobilised and the pressure from the town was so great that eventually the Council of the College agreed to appoint Gamgee as well as their chosen appointee. One of Gamgee's first major operations at the Queen's was the amputation of a leg weighing 99lbs, which was two-thirds of the patient's body weight. His brother Arthur was the anaesthetist.

An enduring memorial

Gamgee had a special affinity with the skilled manual workers of Birmingham and with them established a Working Men's Fund to support the hospital and to give them a say in its management. A *British Medical Journal* editorial said of this work:

> 'Many of our readers are possibly unaware that the Hospital Saturday movement, which has since been copied in many towns in the United Kingdom and colonies, was first worked to a successful issue in Birmingham by Mr Sampson Gamgee.'

Gamgee House, the modern home of the Fund, stands as a memorial to this work. It also stands in an area from which Tolkien derived some of the features of the fantasy world described in *The Lord of the Rings*. Tolkien spent some of his early years at the nearby Birmingham Oratory. Between the Oratory and Gamgee House there are two towers. To Tolkien they were the *Towers of Mordor*. To us they are just a water tower and a folly used as an observatory. To Tolkien, Sampson Gamgee was Samwise Gamgee or Sam Gamgee, a companion of Frodo Baggins in *The Ringbearer*. Sam Gamgee was a hero; he saved Frodo's life on many occasions. Tolkien's Sam Gamgee still lives on, for he sailed to the *Undying Lands*. In the so-called real world Sampson Gamgee died in 1886, aged 57 years, of Bright's disease and a fractured femur. His worldly wealth was only £800. But I like the way Tolkien treats him. The man may be dead but his tissue survives. It is still supplied by the original manufacturers, Robinsons of Chesterfield, it is listed in the current edition of *MIMS* and they print his name with a capital letter.

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WHO INTRODUCED THE CIRCLE SYSTEM INTO CLINICAL PRACTICE?

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Hospital St Elizabeth-Stift, Damme, Germany

As early as 1850 - only four years after the first successful demonstration of ether anaesthesia by William T G Morton - the ingenious John Snow (1813-1853) recognised that ether and chloroform were partially exhaled unchanged with the expired air. To re-use these unchanged vapours in the following inspiration, thereby prolonging the narcotic effect of a given amount of anaesthetic vapour, he converted his ether inhaler into a to-and-fro rebreathing system. The apparatus was equipped with a face mask without inspiratory or expiratory valves and a large reservoir bag containing pure oxygen was attached to the air inlet; a spiral chamber was filled partially with an aqueous solution of caustic potash which was used as the carbon dioxide absorbent. In several experiments performed on himself, Snow succeeded in demonstrating that rebreathing of the exhaled vapours was possible following carbon dioxide absorption, and that it resulted in a pronounced prolongation of the narcotic effects of the volatile anaesthetics.[1] Furthermore, Snow performed experiments on animals using a really closed system for evaluating carbon dioxide production during anaesthesia.[2]

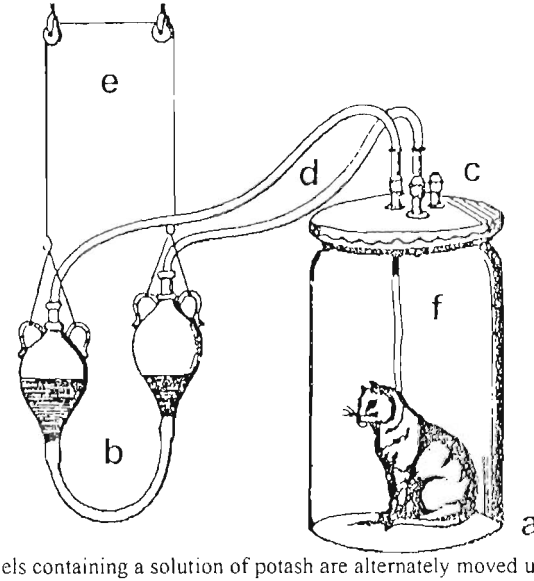

Figure 1

Snow's apparatus to measure CO_2 production

In Figure 1, the two glass vessels containing a solution of potash are alternately moved up and down. The changing fluid levels result in circulation of air from the jar, and absorption of the exhaled CO_2. And yet, the principle of rebreathing exhaled air after elimination of 'noxious vapours' had long been known. In 1727, Stephen Hales (1677-1761) described a rebreathing circle system by means of which 'sulphureous steams' could be absorbed, destroying the 'elasticity of the air' and thus rendering possible free ventilation.[3] His circle system, (Figure 2) which he recommended for rescue purposes, consisted of a gas reservoir made of a bladder into which four diaphragms of flannel soaked with a solution of highly calcinated tartar were placed, a wide-bore syphon, and unidirectional inspiratory and expiratory valves.

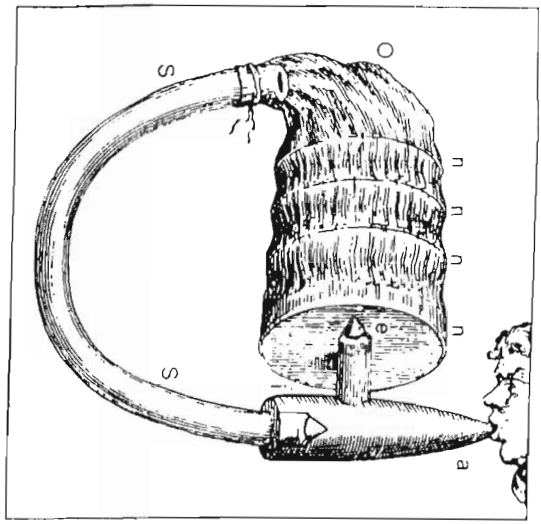

Figure 2. Hale's circle system: e and i are the unidirectional valves; n marks the four linen diaphragms soaked with calcinated potassium bitartrate.

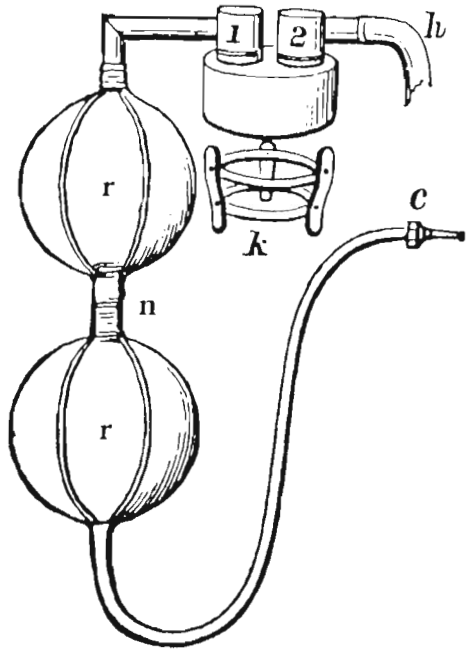

Figure 3. Coleman's 'economising apparatus': c is the adaptor for the N_2O cylinder, n the uni-directional valve, k the frame supporting the 'economiser' box on the top of the cylinder. From Duncum.[6]

Alfred Coleman (1828-1902) was the first to use a rebreathing system with carbon dioxide absorption in clinical practice (Figure 3). Nitrous oxide was delivered to a pair of reservoir bags connected by a unidirectional valve. From the proximal reservoir, the patient inhaled the gas which had passed through a tin box filled with slaked lime, via wide-bore tubing to a face mask. During expiration the air was expired back into the proximal reservoir bag, again passing through the box where the carbon dioxide was absorbed. By using of this to-and-fro system Coleman wanted to decrease nitrous oxide consumption as the expense of the gas was a serious impediment to the spread of nitrous oxide anaesthesia.[4,5] As the patient got pure nitrous oxide, this technique could only be used in very short procedures. Although Coleman strongly advocated the use of his 'economising apparatus' this technique was not generally adopted.[6]

It is almost unknown that in the same year a German dentist, Carl Sauer (1835-1892), described the clinical use of a quite similar to-and-fro system.[7] Unfortunately, there is no illustration of Sauer's device.

Franz Kuhn (1866-1929) was the first to publish constructional details on the concept of an anaesthetic circle system which incorporated a unidirectional valve and two canisters for carbon dioxide absorption (Figure 4). These canisters of alkali hydroxides, called Kalipatronen, were already commercially available and manufactured by Drägerwerk in Lübeck as part of a mining rescue rebreathing apparatus. However, this system was never put to clinical use, since the flow resistance and the dead space of the breathing system were too great. In addition, Kuhn feared that the chemical reaction of chloroform with the absorbing material (caustic soda) might possibly do harm to the patient.[8]

In 1915, Dennis E Jackson (1879-1980) introduced a closed anaesthetic circle system with carbon dioxide absorption which he tested successfully in animal experiments. (Figure 5). The animal inhaled gas from the reservoir via the face piece. Gas was continuously drawn from the reservoir by an air pump, purified by a wash jar of concentrated sulphuric acid, and returned via a second wash jar containing a strong aqueous solution of sodium and calcium hydrate for carbon dioxide aborption. Nitrous oxide and oxygen from the gas cylinders were fed into the system in just such an amount to keep constant the filling of the reservoir bag. Fluid ether or chloroform was delivered directly into the system from a burette. Neither the apparatus nor the method met with any interest, although the use of this technology saved considerable amounts of anaesthetic gas and the apparatus itself worked reliably. [9,10]

In 1916, Jackson described a wonderfully simple cheap to-and-fro system for experimental anaesthesia (Figure 6), in which a cake pan covered by a shower cap, partially filled with an aquous solution of soda lime, was used for absorption of exhaled carbon dioxide.[11]

It was Ralph M Waters (1883-1979) who introduced the technique of anaesthesia with a closed rebreathing system into routine clinical practice in 1924.[12] In his to-and-fro system, a metal canister filled with sodium hydroxide granules served as the carbon dioxide absorber, through which the respired gases passed to and from the reservoir bag. Adequate oxygenation was achieved by intermittent oxygen supply whenever the patient turned slightly blue.

The gynaecologist, Carl J Gauss (1875-1957) and the chemist, H Wieland (1877-1957) were protagonists of the use of purified acetylene, called Narcylene, as an inhalation anaesthetic.[13]

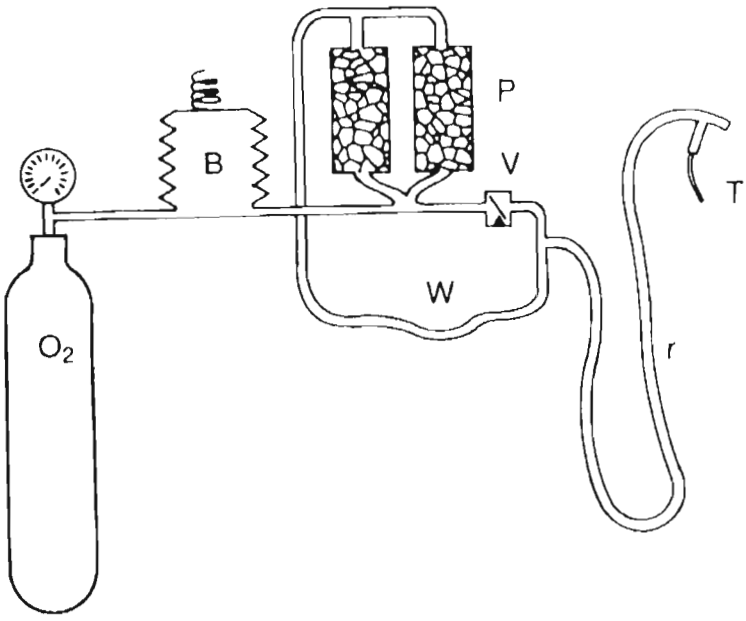

Figure 4. Concept of a circle system designed by Franz Kuhn, 1906. From Rendell-Baker.[9]

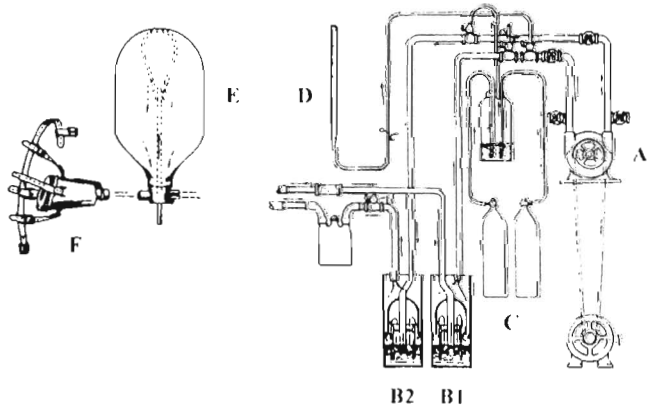

Figure 5 Jackson's circle absorption system: A is the pump, B1 and B2 the wash bottles, C the gas cylinders, D the burette of liquid anaesthetic, E the reservoir bag and F the animal face mask

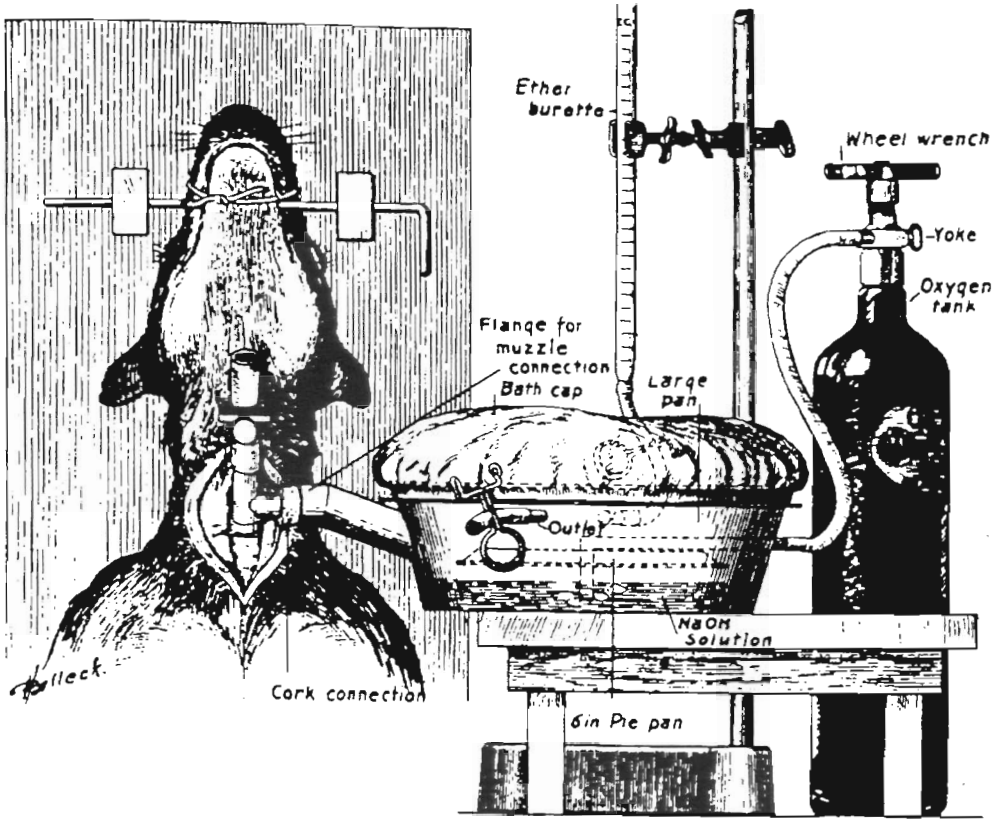

Figure 6: Jackson's To-and-Fro System made from parts bought in a 'ten-cent store'. The absorber, vaporiser and gas reservoir consist of a pie-can, a cake-pan and a bathing cap.

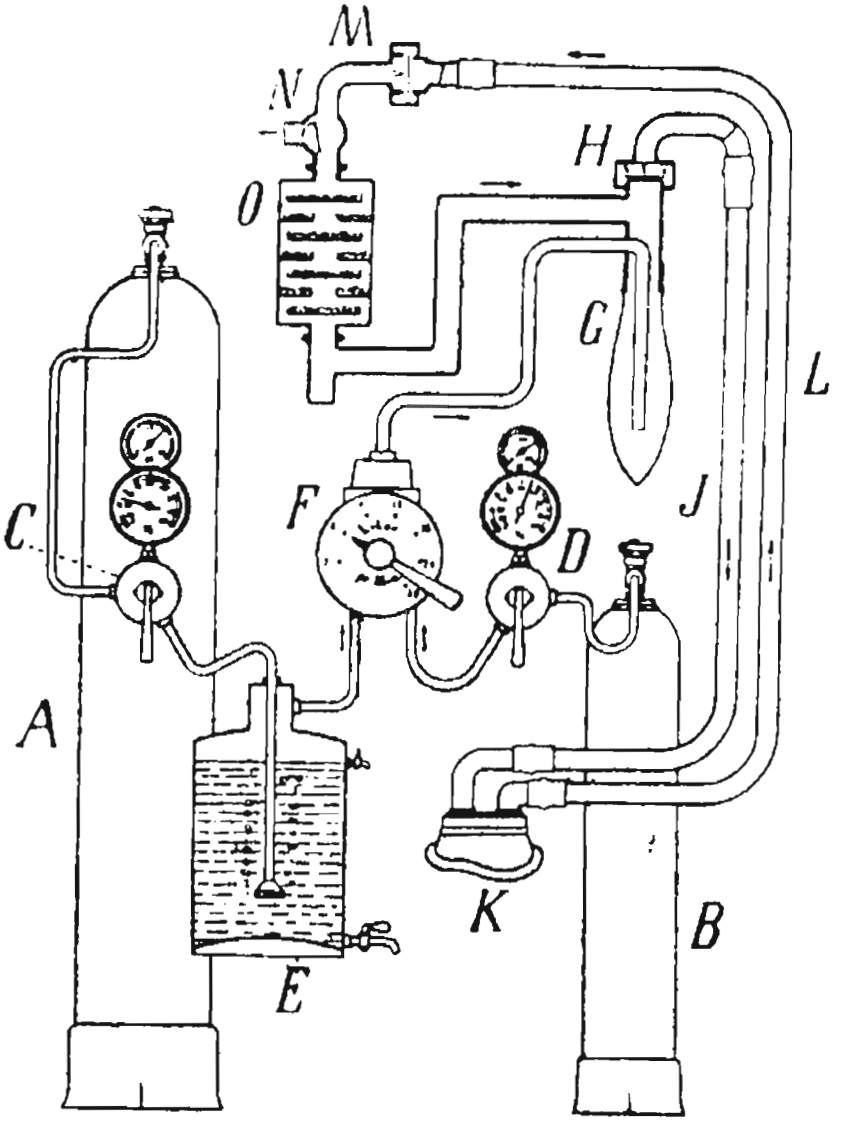

Figure 7. Narcylene apparatus from Gauss and Wieland.[13] A Narcylene cylinder, B O_2 cylinder, C & D Pressure regulators and flowmeters, E wash jar to remove acetone from Narcylene, F gas blender, G reservoir bag, H inspiratory valve, K fade mask, M expiratory valve, N spill valve, O CO_2 absorber.

In co-operation with the German engineer Bernhard Dräger (1870-1928), the first anaesthetic apparatus equipped with an anaesthetic circle rebreathing system was developed and put into clinical practice in 1924. After carbon dioxide absorption, the exhaled gas was blended with fresh gas and routed back to the patient. This first anaesthetic circle system (Figure 7) already featured low resistance valves, a canister filled with carbon dioxide absorbent and an overflow valve. The rebreathing technique reduced the consumption of expensive anaesthetic gases and significantly decreased the discharge of the strange smelling and highly explosive Narcylene.

Bernhard Dräger applied for a German patent for an anaesthetic circle system on 2 October 1925 which was granted on 26 January 1927.[14] Together with Paul Sudeck (1866-1945) and Helmut Schmidt (1895-1979) he developed another apparatus equipped with this circle system for use with oxygen and nitrous oxide. This machine became commercially available as the 'Lachgas-Narkose-Apparat Modell A' from 1927 onwards.[15-17]

As was recently revealed by Richard Foregger,[18] the son of the famous engineer Richard von Foregger (1872-1960), it was not until a few years later, between 1928 and 1930, that Foregger and Brian C Sword (1889-1956) constructed a similar circle absorption system in the United States,[19] following recommendations from Hans Killian (1892-1982) and H Schmidt.

Despite frequent claims in the Anglo-American literature, it was not Sword but Gauss, Wieland and Dräger who were the first to introduce the circle system into clinical practice.

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'THE LATE DR PROUT'

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The late Dr Richard Ellis, in his introduction to John Snow's treatise *'On Narcotism and the Inhalation of Vapours'*, directs our attention to the regular weekly appearance of the original articles in the *Medical Gazette* commencing in 1848. He contrasts this to the long delays and irregular intervals which preceded and accompanied the final parts (Nos 16, 17 & 18) in 1851.

These latter articles reported the results of experimental laboratory work together with the reasoning for such research - much being devoted to the metabolic aspects of carbon dioxide production and the early concepts of rebreathing anaesthesia. Much of the delay, occurring as it did whilst Snow was still engaged in heavy clinical duties devoted to cholera, could well have been associated also with the greater attention being paid to the scientific background to the work. These later articles are more prestigiously and more frequently referenced than those which precede them, having almost twice the number of references per page.

Among these references is one highlighting the work of 'the late Dr Prout' who, some 40 years previously had performed metabolic studies demonstrating the reduced production of carbon dioxide in subjects receiving alcohol. As this work considerably pre-dated the studies of Regnault and Reiset in 1849 elucidating the respiratory quotient, the relatively obscure Prout seemed worthy of further investigation.

West Country background

The name Prout is frequently found from the mid-17th century onwards in the records of several neighbouring South Gloucestershire parishes at the western end of the Cotswold escarpment, an area much concerned with the indigenous woollen trade. The original Prouts are thought to have been Flemish, settling in the locality as refugees in the 17th century, initially as peasant labourers, but through inter-marriage with local families, raising their status to that of yeomen farmers.

Although they became substantial landowners, the intricacies of family inheritance prevented John Prout from acquiring considerable property which passed back to the Lord of the Manor in 1788. This caused some Prouts to seek their fortune in North America and thus we find the sudden disappearance of the Prouts of Wickwar from the parish records. John Prout was sufficiently endowed with land to ignore any inviting accounts of the good life to be had in Washington. He settled in Horton, married Heather Lumbrick and had three sons. The eldest, William, our physician and scientist, was born in 1785. The youngest died within two months of birth in 1788 while the middle son, John, born in 1786, maintained the farming tradition until his death in 1862. John, the father, died in 1820 from lockjaw (tetanus), leaving the Horton estate to the eldest son. William, now a London physician and having no interest in farming, made over his rights to his bachelor brother, who in due course willed the estate back to William's two eldest sons.

William Prout's humble origins precluded him from a formal structured education. His early instruction was at a Dame school in Wickwar, some 6 miles to the north-west, followed up to the age of 13 by the Chantry school at Badminton (5 miles to the east of Horton). His education then apparently ceased until the age of 17 when from 1802 to 1804 he attended a boarding school at Sherston under the tutelage of the Reverend John Turner who was Rector of Horton and Luckington (beyond Badminton). This arrangement ceased somewhat abruptly, and at the age of 20 Prout took the unusual step of advertising in a local Bristol paper (*Farley's Journal*) for advice in the prospects of further education. A reply came from a Reverend Thomas Jones who ran a classical seminary at Redford, Bristol, and which Prout entered forthwith. This period did not synchronise with the tenure of Humphry Davy as superintendent of the Pneumatic Institute at Hotwells in the adjacent parish, but the astute Prout would doubtless have been aware of the pneumatic medicine movement in general and the activities associated with Thomas Beddoes' enterprise in particular. We do not know by what means he derived his inspiration or motivation but Prout was sufficiently interested in matters relating to the field of electro-chemistry to follow the Reverend Jones' advice to become a doctor. Edinburgh was probably the sole option available to a man of such a social background and he entered the University there in 1808. In a noteworthy tribute to his stay in Bristol and his admiration for the Reverend Jones, Prout would in due time christen his youngest son Thomas Jones Prout.

There are several interesting aspects of his time at Edinburgh but little is known about the details of his undergraduate career. Firstly, he had been given letters of introduction by Jones to a teaching friend, Dr Alexander Adam, Rector of Edinburgh High School. Prout, during his stay in Edinburgh, was to inculcate further friendships within the Adam family resulting in his eventual betrothal in 1814 to Adams' daughter Agnes. Secondly, the academic standard achieved by Edinburgh University at this time had been raised to unparalleled heights by the presence of such prestigious medical men as the Munros, Hamilton and Cullen, as well as eminent philosophers and theologians. Thirdly, Prout's progress in medical school seems to have been characterised by some degree of aloofness and general detachment from the mainstream. It may be that this was a manifestation of a chronic ear affliction to which frequent reference is made in his later career, or a depressive illness from which he clearly suffered intermittently throughout his life.

Qualification - and research in London

He qualified MD in 1811 and immediately left Scotland to return to agriculture in Horton, and later Westbury-sub-Mendip in Somerset (the farming estate of his revered teacher, Thomas Jones). During this period of several months, he was soon able to rid himself of any intention of becoming a country physician or general practitioner. In October 1811 he rented rooms in Leicester Square. There he conducted nocturnal experiments while during the day he walked the wards at St Thomas' and Guy's Hospitals. It is presumed he taught basic medical sciences from his premises in Leicester Square. Within a year he had established himself in practice in Arundel Street having become a Licentiate of the Royal College of Physicians in 1812. Then followed a period of great depression for him, mainly due to his pre-existing social status and failure to attract patronage.

To elevate his status intellectually and to attract general recognition, he published two short papers in the *London Medical Journal* and he delivered at his house during 1814 a course of

lectures in animal chemistry. Amongst his 'students' at this time was Sir Astley Cooper, by then in his 46th year. The course had been advertised in the *Annals of Philosophy* to which Prout subsequently submitted his research. By means of such respectable academic connections he eventually became a Fellow of the Royal Society in 1819. He was somewhat dismayed by this long waiting period for acceptance by the Society, and it is noteworthy that his aspirations to membership of the exclusive Chemical Club were always to be denied him. He did however achieve election to the Medical and Chirurgical Society of London in 1814, serving on its Council from 1817 to 1819 and as Vice President in 1823 and 1833-35.

He married Agnes Adams in 1814. Probably as a result of direct personal recommendation by Humphry Davy, their honeymoon was spent in Paris where they were given a private view of the treasures looted by Napoleon.

As an FRS he served on the Council from 1826 to 1828, and he received the Copley Medal in 1827 for his supervision of the construction of the Society barometer. He was elected FRCP in 1831 and delivered the Gulstonian Lecture in three parts, on 'The Application of Chemistry to Physiology, Pathology and Practice'. He was particularly at pains to point out in these lectures the need by physiologists for a sound knowledge of chemistry. This and other statements caused much controversy, leading to his academic eclipse. Prout was forced into reclusion, aggravated no doubt by his deafness. He progressively withdrew his patronage from the affairs of the Royal College of Physicians, the British Association for the Advancement of Science and the Royal Society. He even declined a Founder Membership of the Chemical Society in 1841. In 1848 he fell victim to cholera, and never regained his health. Although he was able finally to visit Horton, he died on 9 April 1850 at his home in Southampton Street, only a few minutes walk from the famous Broadwick Street.

Prout published extensively in the fields of chemistry, medicine and physiology. His observations on 'the quantity of carbonic acid gas emitted from the lungs during respiration' were of particular interest to John Snow. They were important forerunners to Snow's own studies of CO_2 production during anaesthesia, the employment of techniques to absorb CO_2 and the resulting concept of safe re-breathing of anaesthetic vapour. Of more general interest was Prout's hypothesis that the structure and relative densities of all elements was determined by the weights of their atoms. This gave considerable reinforcement to the atomic theory then being currently promoted by Dalton. Prout was also the first to isolate urea, and to recommend iodine in the treatment of goitre. This remarkably varied output has achieved less recognition than perhaps it deserves, but there is little doubt that early scientific development in anaesthesia derived great benefit from the pioneering work of William Prout.

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SOME PROBLEMS OF HERALDRY IN ANAESTHESIA

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Heraldry is a multidisciplinary form of communication. It symbolizes with art and poetic words the history, the associations, the functions and aspirations of an individual or a group - in this case, an academic body.

My comments* are influenced more by the exploration of interdisciplinary concepts in pain relief work than by a special knowledge of heraldry. The booklet *Anaesthetists and Non Acute Pain Management*, published jointly in 1993 by the Association, the Royal College of Anaesthetists and the Pain Society, recommends that an interdisciplinary approach be taken to the treatment of chronic pain; so it may be of some general interest to comment on the three heraldic emblems on the cover of this booklet, using fundamental interdisciplinary principles.

Figure 1

Arms of the Association of Anaesthetists of Great Britain and Ireland

The art work is clearly defined and balanced. The motto *'IN SOMNO SECURITAS'* is a good practical reference for both general and local anaesthesia, although local anaesthesia is not otherwise represented in the design. The main problem is the standing figures; their function is to support the shield but the shield supports them! Somnus the god of sleep and his son Morpheus, the god of pleasant dreams are portrayed as a couple of Roman soldiers asleep or drunk on duty. This is symbolically inappropriate to anaesthetists, to the gods and to Roman soldiers. Somnus does not normally carry a torch of knowledge but is depicted with wings, or a wing and a bunch of grapes issuing from his head. If it is to respect the academic knowledge of the profession, the torch should surely be held in the normal upright position. The torch as depicted is not only hazardous, but the flame of an inverted torch does of course move upwards. Perhaps it would be more appropriate for the supporters to be represented on one side by Hippocrates the father of clinical measurement and on the other by Morpheus holding a chalice of opiate.

Figure 2

Arms of the Pain Society of Great Britain and Ireland

The motto *LAUDATUM EST OPUS* translates as 'The work is praiseworthy' and is questionable. Should any medical work automatically be described as praiseworthy? The anaesthetist can offer expedient relief of physical pain, which is of value in diminishing suffering and sometimes in promoting healing. But within this multi-dimensional subject there are serious problems of interpretation, measurement and therapy. One quotation from the 1993 booklet highlights the problem: 'Many treatments are of doubtful value and some carry significant risk of morbidity if not mortality'.(4.8)

Reference to the initial coat of arms and motto proposed for the Pain Society in 1984 and designed by an anaesthetist, illustrates very well some of the demands of symbolism and the problems of integrating multidimensional and multicultural concepts.

Figure 3

Early proposal for the Arms of the Pain Society

The Taoist symbol and the motto *AD MUNDUM SINE DOLORE* - 'Towards a world without pain' - were rejected by the members because the Society is not predominantly Taoist in its philosophy, while the motto was not realistic and did not respect the value of being able to feel pain. The standing figures look like two children in fancy dress and do not appropriately portray the great sky god Horus and an Angel of Mercy. It is not customary for heraldry in Western medicine to use Egyptian mythology. Normally Horus was placed opposite Seth the god of the underworld, who swallowed Horus' all-seeing eye for one day each year. Together they represented the conflict deemed necessary for maintaining the balance of forces in the universe. To place an Angel of Mercy opposite Horus disrupts this symbolic balance.

The Pain Society motto was changed to *DIVINUS EST OPUS SEDARE DOLORUM* - 'Divine is the work of subduing pain' - which also was questioned and withdrawn. Later, in 1990, the College introduced its motto *DIVINUM SEDARE DOLORUM* - 'It is a divine thing to alleviate pain'. These two similar statements may well be true, but are they mottoes? Certainly they demand a definition of the 'divine' and need to be related to the technical work involved and the principles of clinical and scientific measurement. What is and what is not divine in clinical practice? Obviously the 'mystical' should be represented on the Coat of Arms of a clinical and academic body, but should anaesthetists not focus mainly on measurement and vigilance in their mottoes and leave professional consideration of the 'divine' to the priests and the psychiatrists? The motto of the Royal College of Psychiatrists is *LET WISDOM GUIDE.*

Figure 4

Arms of the Royal College of Anaesthetists

The College of Heralds considers this artwork to be satisfactory, but there are serious problems of disproportion and imbalance in the design. The crest, wreath, helmet and mantle are all too heavy and the scroll is too small. The two standing figures are unbalanced in both form and colour: their facial expressions are too harsh, their bodies disproportionate and their feet need to be 'grounded'. Joseph Clover's feet are particularly crudely drawn and he appears to be on tip-toe.

While the artwork could be improved, the further question arises - should the shield and the motto be modified? Anaesthetists now cover four main fields of work, anaesthesia, intensive care, resuscitation and acute and chronic pain relief. Should these be depicted on the shield? Should the motto be more abstract, and cover all aspects of the work?

Hippocrates was reputed to have distanced himself from the divine, and to have emphasised the rational interpretation of meticulous observation. So I will conclude this contentious paper by quoting the first sentence of a treatise from the Hippocratic corpus entitled '*The Sacred Disease*'. The author is unknown, but it was probably written between the 5th and 3rd centuries BC. Although the text refers to epilepsy, the quotation is at least worth considering in relation to the motto *DIVINUM SEDARE DOLOREM* ..... : 'I do not believe that the 'Sacred Disease' is any more divine or sacred than any other disease but on the contrary has specific characteristics and a definite cause'.

* The dates of my first official comments on the problems of heraldry mentioned in this paper were:

1984 - The Intractable Pain Society (later the Pain Society) of Great Britain and Ireland.
1990 - The College (later the Royal College) of Anaesthetists
1991 - The Association of Anaesthetists of Great Britain and Ireland.

ADVENTURES IN RESPIRATION

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'Adventures in Respiration' is the title of a book[1] by Yandell Henderson, Professor of Physiology at Yale from 1911 to 1937. He was not medically qualified but was interested in the application of physiology to clinical practice, and had some influence on anaesthesia and resuscitation.

The use of carbon dioxide in anaesthesia

Early in his career, Yandell Henderson noticed that severe circulatory failure could be induced by vigorous hyperventilation. Indeed, some animals died before he could begin measurements. He got better results by adding carbon dioxide or by using rebreathing techniques. He formulated an hypothesis about the connection between what he called acapnia (we would call it hypocapnia) and the features of shock, and wondered whether this had any clinical application in surgery and anaesthesia in trauma and other serious conditions. He speculated that some deaths under anaesthesia could be caused by acapnia, followed by respiratory arrest, although Goodman Levy, in his book on chloroform, was not impressed.[2] Henderson presented a paper[3] at the British Medical Association meeting in Toronto in 1906, and expanded his ideas in a series of papers in the *American Journal of Physiology,* but he met some opposition of the 'If these things be true, how is it we have not observed them?' variety. In one presentation, at Johns Hopkins, criticism by the Professor of Physiology was particularly devastating.

Despite the criticisms, Henderson believed that CO_2 had therapeutic posssibilities, and he tried to persuade the manufacturers to produce cylinders of oxygen and CO_2 mixed, and emergency rooms to carry them. Some people did take up his ideas. The first was probably Ettore Levi, in Florence who, in 1910, used CO_2 intra and postoperatively in several hundred cases.[4] There were others in America, among them Gwathmey of New York, whose influence is acknowledged by Boyle, and who favoured restoring CO_2 balance by rebreathing, and McKesson,who had read Henderson's papers and designed a machine in 1912 with an adjustable rebreathing bag.

Henderson got access to patients in 1917, and in 1920 he published a paper on the use of CO_2 postoperatively.[5] Minute volumes of up to 70 L/min were recorded, but the state he describes - patients conscious within half an hour, pink with good venous filling, generally hilarious, but sometimes angry, as they would have been after a few drinks - was probably better than the untreated state which he reported as gruesome. Those not given CO_2 were flaccid, cyanotic, pallid or grey, with empty veins, weak peripheral pulses and depressed respiration; it was 1 to 3 hours before consciousness returned and this was followed by nausea, vomiting and retching for some time afterwards. He hoped to reduce the incidence of postoperative pneumonia, which caused 1 death in 240 major operations and which he thought was preventable.

Henderson had some nice things to say about our specialty. He took an enthusiastic part in the founding of the New York Society of Anesthetists in 1905. He saw that in the field of anaesthesia, to a greater extent than in any other of the whole range of medicine, there was an opportunity to demonstrate the service that the physiology of respiration could make to modern medicine and surgery, and he expressed considerable appreciation of the help he had received. In a lecture at the Royal Society of Medicine in 1925 he said that anaesthesia was one of the most beneficient of the applications of science, and one of the greatest achievements of modern medicine.[6]

In this lecture, which was published in the *British Medical Journal*, he extolled the virtues of carbon dioxide. Archie Marston, who wrote the history chapter in the first edition of Frankis Evans' *Modern Practice in Anaesthesia*, says that this lecture, together with a discussion on oxygen and carbon dioxide led by J S Haldane[7] the following year, was influential in the addition of CO_2 to the 1927 model of the Boyle's machine.

Other uses of carbon dioxide

Another field in which Henderson was involved was resuscitation from carbon monoxide poisoning. This arose from his membership of a committee set up by the Bureau of Mines. Despite rock falls and explosions, the majority of deaths in mines were due to CO poisoning. The recommended treatment was the Schaefer prone method of artificial ventilation, combined with oxygen and CO_2 from the HH (Henderson and Haggard) Inhalator.[8] This led to an approach from the American Gas Company. With several hundred deaths per year from domestic carbon monoxide poisoning, they provided a round-the-clock service with five emergency trucks carrying inhalators with trained crews. The idea spread to rescue crews of the fire service and the police so that, by 1923, there were over 2,000 inhalators in use, with 300 in New York. They were probably better equipped than ambulances or emergency rooms at the time.

In 1926, the *Chicago Herald Tribune* reported that: 'fire crews were saving many new babies that otherwise failed to breathe'. Henderson had wanted to investigate the use of CO_2 in neonatal asphyxia as early as 1913, but lacked confidence because of the respiratory acidosis. There were reports of its use by Raper in Manchester and in 1927 by McIlroy[9] at the Royal Free Hospital. Henderson designed a simpler inhalator for neonates, without valves and consisting of the oxygen/carbon dioxide cylinder, breathing bag and mask.[10] Although intra tracheal insufflation was used in resuscitation and it was known that the opening pressure for neonatal atelectatic lungs was high, there was a reluctance to use IPPV for fear of damaging the lungs. Henderson did however suggest a few gentle surreptitious squeezes of the rebreathing bag. Treatments such as swinging, spanking and dipping in cold water were hopefully being replaced. He would like to have made CO_2 inhalation for 10 minutes three times a day legally enforceable, as some states had done with the application of eye disinfectants. It was interesting to discover that CO_2 inhalations were used in the management of the Dionne quintuplets, born in 1934 in a remote part of Canada. It was given before feeding, and in the management of dyspnoeic and cyanotic attacks.

For completeness, other areas in which CO_2 therapy was canvassed were pneumonia, pertussis, angina, intermittent claudication, uterine inertia, persistent hiccough and alcohol intoxication.

Other activities

In 1911, Henderson spent five weeks on Pikes Peak in Colorado at a height of 14,100 feet with Haldane, Douglas (of the bag) and Schneider. There had, of course, been earlier altitude studies but they were the first to use Haldane's recently described technique of alveolar air sampling, and they were unacclimatised, having been pushed up by a steam engine.[11]

He is accepted as a pioneer in respiratory physiology, but he also made significant contributions in the cardiovascular field. One of his earliest papers in 1906 described an experiment in which he constructed a chamber from a child's rubber ball, placed it round a dog's heart and connected it by a wide rubber tube to a tambour made from the tin lid of a tobacco jar. He noted that the ventricles filled before atrial systole, which was not accepted teaching at the time. This work was quoted in 1937 by a Pennsylvania group who were trying to get a ballistocardiograph technique off the ground; but a greater accolade was to have his name coupled with those of Frank and Starling in an editorial of the *American Heart Journal* in 1960.[12] This related to a paper of his in 1914 concerned with the maintenance of a constant blood volume in the lungs.[13] He said: 'The experiments here reported, show the controlling influence of the diastolic distending pressures in the ventricles upon their tidal volume.' He was, in his own way, stating Starling's law four years before the Linacre lecture was published.

In 1926 he lectured on Starling's home ground at University College Hospital - 'coals to Newcastle' as he called it. He was trying to devise a non-invasive clinical method for measurement of cardiac output using the Fick principle, which involved inhaling ethyl iodide, a less volatile substance than its relative, ethyl chloride. Some plausible results were obtained, but there was a flaw concerning the metabolism of ethyl iodide and the technique was not developed. He apparently had an enthusiastic research worker in his department who was willing to have his heart punctured, but he could not find anyone to do it. Henderson would have been fascinated by the cardiorespiratory problems thrown up by the modern intensive care unit.

He was involved in numerous other matters. When the first road tunnel was built under the Hudson River in 1920 he advised on safe carbon monoxide levels, as Haldane had done in the London underground in 1895. In 1923 he wrote that the air in the city streets could be contaminated above health standards, and he proposed vertical exhausts as are today used on many trucks. He was a member of a committee looking into anaesthetic explosions, just after ethylene came into clinical practice. He recognised that his shocked animals had leaky capillaries and that saline infused intravenously could waterlog the tissues. It seems that he had identified the third space 50 years before it became fashionable. As early as 1911 he wrote a paper on 'Clinical physiology - an opportunity and a duty'[14] and he may well have invented that term.

Yandell Henderson died in 1944. In reviewing his career, one laments the lack of decent obituaries, but the *Lancet* in its Annotations section had an affectionate few paragraphs: 'To a host of friends, he and his wife dispensed hospitality with great kindliness and good humour. His work remains, and with it happy memories of a great American'.

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CHLOROFORM AND SNAKEBITE

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The first death from chloroform occurred ten weeks and five days after its introduction to clinical medicine. We in Australia imported everything from the United Kingdom at this time and it was not long before chloroform came our way. The first anaesthetic with chloroform in Australia was reported in the *Sydney Morning Herald* on 12 April 1848. We did slightly better than the mother country because our first death was some 14 weeks later. It occurred in Windsor, a town 20 miles north of Sydney, and again we have to thank the *Sydney Morning Herald* for the information, published on 19 July. As with all disasters, the doctors involved were well and truly listed. The *Australian Medical Journal* had folded financially at this stage, and for a nine year period until 1856 there was no colonial journal. So there was no official recording of things anaesthetic, but the papers somewhat repaired this deficiency, and published little gems from time to time about progress with drugs such as chloroform.

Chloroform took Australia by storm, and some 27 years elapsed before enlightenment took place. My old home town of Adelaide was at the centre of this enlightenment, which happened in the following way.

Enlightenment on the dangers of chloroform

In 1872, Dr B Joy Jeffries from Boston visited London and addressed the College of Ophthalmologists on the Bostonian method of administering ether. This demonstration was extremely good, so good in fact that he was asked to show it in London hospitals, and he demonstrated in 17 hospitals in the London area. Among these was University College Hospital, where the first resident chloroformist, one John Davies Thomas, was ensconced. Thomas was very impressed by the demonstration. He was a careful, astute and competent young man who had had a couple of disasters with chloroform and was somewhat wary of it. He emigrated to Australia in 1875 and went to work in Clunes Hospital in Victoria. While there he delivered a paper to the Medical Society of Victoria, comparing ether and chloroform.

This long paper, giving a reasoned evaluation of the properties of the drugs as known at the time, was highly thought of (*it was described in some detail by Dr J M Lewis at the History of Anaesthesia Summer Meeting in Glasgow last year. Ed.).* At this meeting it was decreed that the paper should be printed and distributed to all hospitals in the Colony. Early in the same year, on 25 January and 3 March 1875, the first chloroform deaths were recorded at the Adelaide Hospital. It was fortuitous that J Davies Thomas was that August appointed Senior House Surgeon at the Adelaide Hospital. Here, over a period of some months, he gave 50 successful anaesthetics using ether. Fifty does not sound like a great number, but this was before asepsis, which did not arrive until the early 1880s. With the few operations being performed, Thomas' record was exceptional.

Thomas taught ether by the Bostonian method. He taught the hospital Residents and anybody else who wished to learn. The net result was benefit for the people of South Australia and

particularly of Adelaide, because all the anaesthetics given at the hospital were now with ether.

I looked into the chloroform disasters which had occurred in Australia during the 27 years from 1848 until the enlightened work by Thomas in 1875. Between those dates I found 134 articles referring to chloroform deaths. I believe this number was the tip of an iceberg. Reports to coroners in those days were vague, and not much regulated, while the criteria for anaesthetic death were somewhat elastic. The anaesthetists, if they could be so called, were underpaid, under-recognised and told what to do by the surgeons; and most of the time they were told to give chloroform. They were a mob of lost sheep, lacking any cohesion.

The first meeting for Australian anaesthetists did not take place until 1929. In September of that year the all-powerful body of the British Medical Association which ruled Australian medicine allowed their Annual General Meeting to include a section on anaesthesia. This meeting, at Sydney Hospital, was well attended by those interested in anaesthesia, who came from far and wide. Among those who presented papers were four I would like to briefly mention. Gilbert Brown became the first President of the Australian Society of Anaesthetists in 1935, and he was ably assisted by Francis H McMechan, the visionary from Ohio who was trying to unite all English speaking anaesthetists under the same umbrella. Geoffrey Kaye, then a very young man, gave a paper at this meeting. His chief, one Dr Fain, was to deliver the paper, but he had a major infarct just before the meeting and gave the job to Kaye, which brought the young man some fame. He reviewed the pathological findings in deaths under anaesthesia in Melbourne between 1919 and 1929 - 107 cases which again I would say were the tip of an iceberg. He found 18% of them were due to chloroform, and he denigrated the agent as really unsuitable in most procedures.[1] My father's cousin, John William Rollison, reviewed for the meeting the anaesthetic deaths at the Adelaide Hospital in 1928. As medical registrar he had been given the task of investigating anaesthetic deaths at the hospital, because some parliamentary comment had suggested there were too many. Of 6,062 general anaesthetics for the year there were 6 deaths. Of these, none had been given chloroform, all were over 40 years of age and: 'in every instance it had been recognised that anasesthesia was risky'.[2] I think he was extraordinarily lucky to produce such a low figure. The senior members of the hospital staff and the Board must have been very satisfied because it gave them a splendid springboard to attack the parliamentary questioning. Rollison went on to become Director of the Royal Adelaide Hospital, and later Director General of Health for South Australia. He was awarded a CBE for his public services. But it all started at that 1929 meeting which for him was a big win.

Two personal episodes

My own experiences with chloroform have been relatively limited. As a medical student I was in the Labour Ward at the Royal Crown Street Hospital in Sydney when a very senior obstetrician who was pouring something on to a mask on a patient suddenly turned to me, handed me the bottle and said: 'keep pouring it on, laddie'. That's exactly what I did while he vanished to the other end, did something obstetrical which fortunately very quickly relieved the mother of the baby. I stopped the anaesthetic, and the patient woke up. That was my first anaesthetic and I was very glad it was over. Some years later, in 1956, I was working in the University College Hospital in Ibadan, Nigeria in the middle of a large outbreak of smallpox. In the labour ward was a lady with obstructed labour who had smallpox, and I was asked to

give her an anaesthetic. I decided that to take a machine into that infected environment was out of the question. Her respiratory passages were too irritated to consider ether, and the pustular eruption eliminated the possibility of a local block. I elected to give her chloroform. I went and got the bottle, and took it down to the labour ward where, to my great relief, the sister told me that she had delivered. I took the bottle back, put it on the shelf and never touched it again. I fetched my camera and photographed the favourable outcome - the mother and baby both having survived without my chloroform anaesthetic.

Snakes

Australia has plenty of snakes, and some are pretty bad. The taipan is one of the most feared - swift and deadly. Others such as the Eastern Brown Snake and the copperhead are similarly bad news.

In 1893 a Dr James Barrett wrote a paper concerning chloroform deaths in Melbourne.[3] He was an ophthalmic surgeon who became Sir James Barrett with a string of letters after his name. Like most of his surgical brethren he was happy to write about anaesthetic matters. He was friendly with the local coroner, and from the coroner he got some interesting figures about anaesthesia, chloroform and snakebite. His paper includes this little gem: 'Consequently, chloroform on the whole throughout the colony is rather more dangerous to life than snakes since the death rate from snakebite for the whole of the colony and chloroform for Melbourne are about the same'. This is a lovely piece of *Reader's Digest* statistics. For a start the coroner hadn't the faintest idea how many people really died from chloroform in any given period, nor any idea how many people died of anaesthetics as a whole because they were not reported. Secondly, the chances are remote of anyone knowing much about how many people died of snakebite in the whole of Victoria. The State is about the size of England and Scotland together, and those in the outback who were most at risk would have been furthest from any official reporting. Barrett's statistical comment took my fancy and accounts for my title. If truth be known, I think that chloroform, the famous new agent which had been so enthusiastically taken up by Australia **was** infinitely more dangerous than the poor old snake. The only really accurate statement in Barrett's paper is: 'The number of times that chloroform has been administered during the same period can only be a matter for conjecture'. That would be absolutely right; but in Melbourne in 1893 chloroform was still very, very fashionable.

Since I have painted a pretty ghastly picture of the early days of Australia, let me finish on a brighter note. Enlightenment really has taken place in the 103 years from 1893 to 1996. Considering Melbourne only, the population then was about 450,000 and today is 4.6 million, so there are more than ten times the number of people. In the last 3 years there have been 22 deaths from anaesthesia; whatever were the true figures in the 1890s, this must be a considerable improvement. The other improvement relates to snakes and snakebite. Barrett quoted 9 deaths from snakebite in 3 years. There is now one death from snakebite in Victoria every 3 years.

So if you are thinking of immigrating I would like you to consider it seriously, because Australia needs anaesthetists, we no longer use chloroform, and the snake population must have been significantly reduced.

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ASPECTS OF PLYMOUTH MEDICAL HISTORY

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In this paper I have picked out snippets of Plymouth medical history which might be of particular interest to anaesthetists. If there is a theme it is that very often, when we regard a subject as topical and new, a quick look at history will tell us that the various arguments have all been gone through before.

Early medical men

Elliot Square, a Plymouth surgeon chronicled the lives of many Plymothians. According to him, the first medical man of whom any record can be found is James Yonge. In 1658, at the age of 11, he was apprenticed to a ship's surgeon and by the time he was 16 he had completed his apprenticeship and was working as a surgeon on a warship. He was captured by the Dutch, imprisoned in Rotterdam, and after many adventures he eventually settled down as a civilian practitioner in Plymouth in 1671, saying that he had suffered so much from cold and exposure that he was determined never to embark again. He developed an extensive practice among the crews of ships, and soon after the opening of what is now Devonport Dockyard in 1691, he obtained a warrant to be a surgeon to the Navy and to the Yard. While in Plymouth he published many papers. He was the first surgeon since Heliodorus in the first century to describe in detail the use of a flap to cover an amputation stump instead of the old circular procedure and he reported the case of a 4 year old boy who recovered after treatment of a depressed skull fracture associated with extradural haemorrhage. A local physician, Dr. Durston disputed this, quoting authority that wounds of the brain were invariably fatal. A prolonged dispute between the surgeon and the physician ensued and the language was even more vehement than that which might be used today. Durston said that Yonge was one of a company of ignoramuses fit for nothing but to cut corns, Yonge retorted by comparing the physician's intelligence with that of a sheep from which the brain had been removed!

Not all physicians from this area were similarly stunted. George Baker was the son of the vicar of Modbury, a small town about 10 miles to the east of Plymouth. He practised in London where he was revered as an excellent clinician. He has the distinction of having described the use of digitalis in heart failure (*Medical Transactions* - College of Physicians in London, Vol III, 1785, pp287-308) before William Withering's famous publication. However he is best remembered locally for his discovery that colic in Devonshire cider drinkers was due to lead in the vessels in which it had been fermented. By changing the utensils the problem was solved.

Recently, Sir Kenneth Calman, the Chief Medical Officer, spoke in the Plymouth Medical Centre about the importance of looking after our junior doctors and other health service staff, emphasizing that such things as kindness, encouragement, decent on-call accommodation and well organised work rotas need not be prohibitively expensive. It was said of George Baker that, even with his many distinguished honours - Harveian Orator, Physician to the King, President of the Royal College of Physicians: 'he was particularly kind to the rising members of the profession, whom he encouraged and informed with .... interest'.

At about this time the Plymouth Medical Society was founded. This has the distinction of being the fourth oldest medical society in England which is still in existence - in 1994 we celebrated the bicentenary. The portrait of the first president, Robert Remmett, a highly qualified physician who also involved himself in rather rumbustious political activities, hangs in the foyer of the Medical Centre. Among the other founder members was Charles Yonge (whose portrait hangs in the Georgian dining room at Buckland Abbey) the grandson of James Yonge, and Richard Dunning who was a friend and supporter of Edward Jenner. Jenner acknowledged that it was Dunning who had first used the term vaccination, deriving this from the Latin word for a cow. This is why the Centre also has a portrait of Jenner.

One of the main early activities of the Plymouth Medical Society was to maintain a library. We possess many interesting old books. You will remember that after the death of John Hunter* his brother-in-law and protégé Everard Home (who had previously been a surgeon at the Royal Naval Hospital) destroyed all Hunter's manuscripts including the notes from which he read his annual course of *'Lectures on the Theory & Practice of Surgery'*. It was therefore particularly exciting when in 1981, in a cupboard where they had apparently been put for safe keeping during the blitz, a collection of books was re-discovered among which was a volume, handwritten by John Clarke which was a complete record of lectures from 200 years earlier. John Hunter's signature appears on the first page effectively certifying that the notes are a true account of the lectures. These notes are now on permanent loan to the Royal College of Surgeons' Library.

John Clarke went on to become a distinguished obstetrician and paediatrician in London. Clarke seems to have been ahead of his time. He strongly encouraged what we would now call formal continuing medical education and he criticised the establishment of the Royal College of Physicians for neglecting the specialty of paediatrics and in his words: 'failing to remedy the prevailing ignorance and not enlarging the knowledge of the diseases of women and children'. Two hundred years later, in 1996, the separate College of Paediatrics and Child Health is in the process of being set up.

Other local medical societies also started up about the same time, but unlike the Plymouth Medical Society they have not lasted. In 1848 Dr John Butter described how he had been president of the Western Medical and Chirurgical Society from 1824 until 1832 when: 'the cholera appeared, and broke down his own health, killed some, and drove away other members, so that this society, like the fatal disease died a natural death'. The cholera epidemic hit overcrowded Plymouth particularly hard in 1832 and, with the exception of Bilston in Staffordshire, the disease was more prevalent in Plymouth that anywhere else in England. Cholera returned in 1849 and this was a stimulus for Plymouth to adopt the Public Health Act which eventually happened in 1854. Before then there was fragmentation in the arrangements for public health, for example corpses lay rotting in houses whilst the sanitary committee and the guardians of the poor argued over who was responsible for their removal. I suppose this is what we would now call a purchaser and provider split. The members of the new Health Board soon decided that because of the inefficiency of the previous system, using private contractors, they would administer and provide the apparatus for town cleaning themselves. Indeed, the sanitary committee was forced to deduct thirteen pounds and one

* Hunter's portrait in the Royal College of Surgeons was painted by Joshua Reynolds, who was born locally and had his first studio over the milliners' shop of his sister in Devonport

shilling from the bill presented to it by the previous contractor when it was pointed out that there were parts of the town which had not been cleaned. As a matter of interest, a couple of years ago the cleaning services in our hospital were handed over to a private contractor.

Hospital development

The nineteenth century was a time of marked development of hospital services in Plymouth. What is now Plymouth was really three separate towns: Plymouth proper (or Sutton) at the mouth of the river Plym, Plymouth Dock or Devonport which is the Naval base at the mouth of the river Tamar, and between them the separate district of Stonehouse which contained the Royal Naval Hospital. The Plymouth Dispensary was begun in 1798 and its building, at what was then the edge of the town, was erected in 1809, chiefly as a result of a legacy from Charles Yonge (James Yonge's grandson). This was supplemented by the first proper general public hospital which was opened in 1840 and this in turn effectively amalgamated with the dispensary. A bigger hospital was soon needed, and in 1881 a foundation stone was laid at Greenbank, again at the edge of the expanding town. There was also a workhouse founded in 1630 known as the hospital of the Poor's Portion which seems to have been a pretty squalid affair. It was recorded that great mortality prevailed here amongst the medical officers - several had died through their arduous trials. It was lamentable to think that any well educated man could be found to attend 1,800 patients, including 60 midwifery cases, accidents, operations, medicines and attendance by night and day for a salary of £40 which is barely fivepence halfpenny a head. In 1858 the workhouse moved to the edge of the town to a spot next to where the battle of Freedom Fields had been fought during the civil war. This in turn was next door to the voluntary hospital at Greenbank. In 1929 the local government act allowed the Poor Law institution - the workhouse - to be turned into a hospital and soon after Greenbank and Freedom Fields Hospitals on either side of a main road developed into one institution. There was also a public dispensary at Devonport which had been established in 1815. This evolved into the Royal Albert Hospital, which served both Devonport and the civilians of Stonehouse where there was also the Royal Naval Hospital. Florence Nightingale was responsible for the arrangement of the wards in the Royal Albert.

I here digress to mention one later development at Devonport. Eric Angel was a west country general practitioner before the 2nd World War. In 1939 he joined the RAF as a medical officer and was soon spotted by the adviser in anaesthetics, Air Commodore MacIntosh, and he was put in charge of anaesthetics at the RAF hospital in Iceland. While in the RAF he met Bernard Lucas. After demobilization in 1947 he lunched at University College Hospital where Lucas had just opened the first pain clinic (or nerve block clinic) in Great Britain. This intrigued Angel, and when in the next year he was appointed as a Consultant Anaesthetist in Plymouth, he almost at once started a pain clinic in one of the theatres at Devonport. This was the second pain clinic in the United Kingdom. Many other pain clinics soon followed and when in 1971 those involved decided to set up The Intractable Pain Society of Great Britain and Ireland it was not surprising that the first Honorary Secretary of the Society should be Dr Mark Churcher who had succeeded Eric Angel at the Plymouth Pain Clinic. Angel retired in 1968, but he enjoyed an active life and died only last year.

The hospital in Devonport continued to provide excellent services right up until 1981 when it was closed, and moved as the first phase of Derriford Hospital. During the last few years the

services at both Greenbank and Freedom Fields have gradually transferred to Derriford and once again the hospital services are concentrated on the edge of the built-up area.

Miscellany

We can trace medical events in Plymouth by looking at reports of the proceedings in the years when the annual general meeting of the British Medical Association was held in the town. The first was in July 1848 when the BMA was still known at the Provincial Medical and Surgical Association. In his address of welcome the president, John Butter: 'congratulated all present on their professional zeal in coming so far ... especially those from the east on their safe arrival over the South Devon Railway which opened to Laira on the 6th May last. He would not expatiate on those mighty powers - steam, atmospheric pressure and electricity, to which they were indebted'. The engineer Brunel, had installed a suction tube between the rails from Exeter to Totnes to draw the trains - the 'Atmospheric Railway'. It was a disaster because the pipe kept leaking, and it was abandoned after the end of August in that year. Butter went on to talk about aetherisation. During the previous year, 1847 the president had been concerned in two important operations on patients who had consented conditionally, provided that they could be aetherised and deprived of sensibility for a time: 'In both instances aether thus inhaled had intoxicated the patients to such an alarming degree that the operations were delayed and performed ultimately without its aid. Subsequently he had tried chloroform on several instances with the readiest effects. He merely gave the result of his own experience without further comment and thought that it never ought to be exhibited except by a medical practitioner'. After the presidential address various clinical cases were shown including a Mr Cross whose right thigh had been amputated at the hip joint two years before by Mr Whipple. This was in fact the third time a successful amputation of the hip had been carried out in England. The first had been done in Plymouth in 1812 by Mr Brownrig.

After the business of the day there was a dinner in the Royal Hotel in Plymouth and then in order to keep the balance between Plymouth and Devonport the evening finished at Mr Swain's house in Devonport when the members were gratified and instructed by witnessing several valuable microscopical demonstrations.

The next British Medical Association Meeting in Plymouth was in 1871 and this time John Whipple, the surgeon who had amputated at the hip, was in the chair. Incidentally the patient was still going strong - in fact he outlived his surgeon. Whipple's presidential address consisted of a long discourse on the general history of Plymouth; and then there were four full days of meetings, held each day in either Plymouth or Devonport, and also a special dinner held in Stonehouse during which the services of the band of the Royal Marines were engaged for the occasion. Once again the special railway arrangements seem to have been important. Return tickets at a single fare for the double journey were available to members of the British Medical Association on production of their membership card and the railway company promised to convey any instruments, medical and surgical appliances etc. at half the usual fares. Just as now, excursions were laid on to various country houses including Buckland Abbey and to Plymouth Hoe. However, unlike the History of Anaesthesia Society meeting, the river trip was not an optional extra after the papers but instead: 'A steamer will be engaged to make short trips daily, and at stated hours, during the visit of the Association, thus enabling those members who may not be desirous of hearing the delivery of certain papers, to spend their time agreeably in viewing the rich scenery of the port of Plymouth'.

Towards the end of the nineteenth century there were several interesting happenings in Plymouth. The Budds were a well known medical family in Devon - the name is remembered in Budd-Chiari Syndrome. Arthur Conan Doyle met one of the Budd family, George Budd, when he was a final year medical student at Edinburgh University. A few years later Budd, by then a general practitioner in Stonehouse, telegraphed Conan Doyle, then working as an assistant in Birmingham, offering him a partnership. Conan Doyle jumped at the offer and travelled down, as he did so seeing for the first time Dartmoor, the setting for Sherlock Holmes' most famous case. Unfortunately, George Budd was the black sheep of the family and he turned out to be a swindler who deprived Conan Doyle of his income. It was probably this brief stay in Plymouth that persuaded Conan Doyle to turn to writing to help to pay the bills. Several years later he left medicine altogether to follow his most famous vocation. Budd was a strange disinhibited character with grandiose ideas. Conan Doyle portrayed him in his semi-autobiographical *Stark Monroe Letters* published in 1895. Although the practice was in Stonehouse, Budd lived in fashionable Elliott Terrace on Plymouth Hoe. He roared and shouted at his patients, scolded them and pushed them about. He advised one woman complaining of a sinking feeling to swallow a cork. During the 1880s there was controversy about the best type of armour to protect warships from enemy shells. Budd produced a radically different solution which he offered to the Admiralty for £1,000,000. He proposed that powerful magnets of his own invention should be placed at the ends of the ships to deflect incoming missiles. The Admiralty did not adopt his proposal.

At about the same time there was another much more worthy physician working in the town, Dr E L Fox, who became president of the Plymouth Medical Society. He described the first case of myxoedema treated in Britain by taking extract of thyroid by the mouth. Before then myxoedema was treated with inconvenient hypodermic injections of thyroid extract. Fox decided to try oral treatment instead. He devised a simple form of maintenance therapy, telling the patient to obtain sheep's thyroid from the abattoir and lightly fry it and mince it, and take half a thyroid with currant jelly once a week. This was highly successful.

In the middle of the Nineteenth Century one of the general practitioners, Dr William Eales was particularly renowned for his large midwifery practice. He was said to have attended more than 500 confinements in a year but his interest did not end at the confinement. He played an active part in the welfare of his babies and he introduced an easily digested infants' biscuit containing cornflour, fat, malt and sugar which dissolved in milk. The baker of this biscuit was someone called Farley who bought the rights to manufacture the biscuits. Farley's Rusks continued to be manufactured in Plymouth until a few years ago when the new owners of the factory transferred production elsewhere and the site became the inevitable supermarket.

The next meeting of the British Medical Association in Plymouth was in 1938 (in the Guildhall). That meeting was dominated by discussion of the implications of the influx of European doctors mainly from Austria, not as a result of legislation from Brussels but because Hitler had just annexed that country. In addition to the medico-political side of the meeting, there were various clinical discussions. Anaesthesia was part of the section of pharmacology. There were particular sessions on the teaching of anaesthesia, carbohydrate metabolism in anaesthesia, anaesthesia in cardiac surgery and anaesthesia in thoracic surgery. Cyclopropane was advocated as a particularly useful agent in thoracic surgery and this was reported in the *British Medical Journal*. However, with the storm clouds of the second world war

approaching, the local and national press seemed to be more interested in an alternative use for cyclopropane, calling it a 'peace gas'. Dr Falkner-Hill thought that it would only be necessary to spray the enemy with it and then capture them during the recovery period 'as for some hours you neither desire to make nor are capable of making any resistance'.

The presidential address to the section of pharmacology, therapeutics and anaesthetics that year in Plymouth must be of particular interest to members of this society. Professor Clark pointed out that the development of the subject was not as sudden as the events of 1846 suggest. He talked about the regular use of stupefying agents such as opium in both classical and medieval surgery but this knowledge seems to have been lost in about the renaissance period. He especially mentioned that the discovery of the pharmacological actions of nitrous oxide had special local interest since it was closely associated with the west of England. Sir Humphry Davy was of course born and bred near Penzance and began studying for medicine by being apprenticed to a surgeon apothecary there. He moved to Bristol and published the result of his work on nitrous oxide in 1800. However his suggestion was almost completely ignored for 40 years. As a professor in Edinburgh, not surprisingly, Clarke in his address went into great detail about chloroform. He concluded by discussing the balance between the beneficial effects of an anaesthetic and the chance of the production of some rare but unpleasant side effect and he advocated carefully organised large scale trials in order to address these points.

A message worth remembering

When the various old hospitals in Plymouth closed in order to open Derriford Hospital some of the old ward names were transferred here. One name that was not transferred was that of Rooker Ward at Greenbank Hospital. This was named after a Victorian Alderman, Alfred Rooker who was an advocate of public health measures, in particular better sanitation. However at that time, as now, many people complained about high taxes and were reluctant to spend money. In a lecture to members of the Plymouth Health of Towns Association in 1873 Rooker said that he felt compelled to make the point that people who complained about this should remember: 'Nothing is really dear which is worth much more than it costs'. I think that this is something which we should remember today.

Guest Lecture

HISTORY OF THE ROYAL NAVAL HOSPITALS

Surgeon Vice Admiral A Revell, QHS, Surgeon General

Some relevant anaesthetic history

As Dr Glew reported to this meeting, Thomas Spencer Wells probably gave the first Naval anaesthetic in 1847. By 1852, chloroform had been added to the list of drugs allowed by scale supplied to the Naval hospital and ships, and I believe it was then widely used both in the Army and Navy despite a growing list of deaths attributed to anaesthesia. Even in 1884 caution was still being urged by influential opponents, like Dr John Hall, Principal Medical Officer for the Army who advised his medical officers bound for the Crimea:

> 'The smart of the knife is a powerful stimulant and it is much better to hear a man bawl lustily than to see him sink silently into the grave.'

It is not surprising, therefore, that the use of both ether and chloroform in the Naval hospitals caused little or no comment and I have been unable to find any significant references. Certainly the use of chloroform is recorded in a case of 1852 at the RNH Haslar. Perhaps its use had become relatively routine by this time, but it is more likely that the explanation is that little surgery was done in the Navy hospitals. The majority of patients were admitted for medical reasons, most surgical procedures having been carried out at sea. The old traditions also persisted and 'bleeding' was considered a universal panacea. In 1869, we learn from an instruction from the surgeon at Haslar to his juniors:

> 'There are few afflictions of the human today, whether considered with reference to derangements of function, absolute disease or accident requiring operations, in which the free and frequent extraction of blood may or may not be necessary and in which, too often, is the practice avoided for fear of succeeding debility, or that the adoption is unsanctioned by custom or by books. In hernia and other dislocations, you bleed largely.'

Against this background it is hardly surprising that anaesthesia was only slowly introduced.

The origin of the Naval hospitals

But this talk is about the history of the Naval hospitals. Why was it felt necessary to build hospitals specifically for the Royal Navy? The lot of the sailor has never been a happy one. At best, in the earliest times, he was 'volunteered' by the Parish to make up a 'quota' on the instructions of the King who wished to set up a Fleet for exploration, to wage a war or for mere piracy. At worst, he was an 'impressed' man, victim of the press gangs and legally snatched from his family and friends, or a criminal committed to service at sea by a magistrates court or, indeed, directly from prison as part of his sentence. As regards the sailor, the 13th up to the 19th centuries, has been described as 'one long story of social depression and loss of privilege'.

Dr Johnson admirably summed up this situation when he said in 1759:

> 'No man would be a sailor who has contrivance enough to get himself into jail; for being in a ship is being in a jail with the chance of being drowned. A man in jail has more room, better food and commonly better company.'

When reminded that some people, not a lot, actually liked being sailors, he replied:

> 'I cannot account for that any more than I can account for other strange perversions of the imagination.'

It has to be said that Dr Johnson was particularly miffed because his servant had just been taken off to sea, a victim of the press gangs.

The average sailor was totally expendable and was usually from the dregs of society. He was discharged from service when the war or voyage of discovery ended and, if he had survived his wounds or diseases such as scurvy, was expected to make his own way home. The laws of Oleron set up by Eleanor of Aquitaine in 1149, and later incorporated into the Black Book of the Admiralty, did set out recommendations for the treatment of sick sailors at sea, but did nothing for him once ashore. In medieval times the various religious establishments were able to offer limited food and sustenance and a degree of first aid for the returning sailor, but otherwise he was on his own. Two such establishments exist today, namely, the St Cross Hospital in Winchester and St Mary's in Chichester. Even this assistance disappeared when Henry VIII dissolved the monasteries and abbeys. Little was done in the ensuing centuries because, frankly, the need did not arise. Most of the major naval engagements were away from the shores of England and, of course, the voyages of exploration were usually to the other side of the world. If you were sick or wounded, then you either died at sea or survived through the efforts of Mother Nature, to tell the tale back home.

The situation changed dramatically in the 17th century, when sick and wounded seamen and prisoners of war presented an acute problem which demanded an answer on practical, if not humanitarian, grounds. For the first time, wars deliberately provoked by the government in pursuance of trade, were fought off the southern and south eastern shores of England. The first of these, the so-called Dutch Wars, extended from 1652 to 1674 and presented the Commonwealth Parliament with a nightmare scenario - literally thousands of sick and wounded sailors and prisoners of war were deposited at all the southern and south eastern ports.

To a certain extent, the government had anticipated the problem and had formalised the system that existed at the time, whereby organisations and individuals were invited to look after the sick and wounded. This was called the Contract System. Under this scheme anyone who formally agreed to give them assistance was paid by the government, approximately one shilling (2½p) a sort of rudimentary care in the community programme. The government also requisitioned civilian hospitals in London and set up formal sick quarters and sick lodgings throughout the south of England. Even St Bartholomews and St Thomas's in London, announced on 3 January 1653 that they were:

> '...in a condition to receive presently wounded and sick mariners to the number of fifty if there shall be urgent occasions.'

Within a year of the start of the Dutch wars the whole system was in danger of collapse. The organisation was overwhelmed by the sheer weight of numbers, corruption and, above all, shortage of government funds (not an unusual feature of our history).

The Admiralty Board appointed a Dr Daniel Whistler from the Royal College of Physicians to investigate the situation in Portsmouth in 1653. Whistler was horrified and wrote to the Admiralty telling them that the only way to solve the problem was to build Naval hospitals at the sea ports. The Admiralty partly took note of the recommendations and set up a group of inspectors to assist Dr Whistler and to make formal recommendations. The Commissioners for the Board of Sick and Wounded Seamen was the result, and this body remained in existence from 1653 until 1806. One of the earliest Commissioners was the essayist John Evelyn. Evelyn joined Whistler and was even more horrified to find over five thousand sick men dying on the shores of Kent. He wrote a report in 1665:

> 'His Majesties subjects die in our sight without our being able to relieve them which must needs rebound to His Majesty's great dishonour and to the consequences of losing the hearts of our people.'

He went on, again, to propose the introduction of specifically Naval hospitals and lobbied the then Secretary to the Navy, Samuel Pepys. Pepys records in his diary:

> 'Away to Mr Evelyn's to discourse on our confounded business of prisoners and sick and wounded seamen wherein he and we are so much put out of order.'

Everyone at the time agreed with Evelyn that hospitals were the answer to the problem but, as he said:

> 'They were all earnest that it should be set about speedily: but I saw no money.'

The reason the government did not act on these proposals seemed to be that, when a decision was about to be made, the war came to an end and the requirement no longer existed. But the contract system, the care in the community scheme, was doomed to failure. In addition, the huge numbers of patients, the corruption and lack of funds, produced a new and serious feature - thousands of men deserted as soon as they could walk or crawl away.

Successive Commissioners called for hospitals but it was not until 1744, ninety years after Evelyn's plea, that yet another petition made to King George II in Council by John Earl of Sandwich the First Sea Lord, achieved the desired result. Part of this petition read:

> 'The want of such hospitals is so sensibly felt, and Your Majesty's Service suffers so greatly from the loss of seamen, either by death or desertion who are sent on shore for the cure of their distempers, that we think it our duty humbly to renew our former application made to Your Majesty on that subject. When the folly of the poor men is considered intoxicating themselves with strong liquors in the height of their distempers, the great numbers that are swept away by such intemperance and the desertion of such

> great numbers as recover, both compassion to them and the interest of Your Majesty's Service requires the putting of a speedy stop to an evil of such pernicious consequences which can in no way be effectively done but by building hospitals.'

Georgian society in the 18th century was a curious mixture of elegant wealth based on brutal poverty, but a social conscience was stirring. Foundling and waif homes were being set up everywhere. In this atmosphere who could refuse such a cri de coeur? An Order in Council from King George II dated September 1744 was issued for the building of Naval hospitals at Portsmouth, Plymouth and Chatham. Not, it should be noted, entirely on humanitarian grounds, but mainly because of the loss of seamen through desertion. In other words, to keep them in hospital virtually as prisoners.

Three Naval hospitals

The following year a site had been selected and building actually started at Haslar followed by Chatham. The site of Haslar hospital was to be on a promontory at Gosport in Portsmouth where there had been a castle in medieval times. Access for patients at that time was ideal because they came from the ships anchored off Spithead. Today, it is probably the worst site for a hospital - stuck out on a promontory some miles from the main south coast motorway. Nothing happened at Plymouth until 1756, when a piece of land called 'No Place Field' was purchased by the Commissioners for the Sick and Wounded Seamen. This was found to be too small for the hospital and later became the Naval Burial Ground. A further two years passed before a larger piece of land, belonging to Lord Edgcumbe, between 'No Place Field' and Stonehouse Creek, was bought by the Admiralty for £2,239 17s 6d and work began on the hospital. In medieval times there was a monastery or abbey on this site owned by Buckland Abbey, and the remains of this had to be demolished before building began. We believe that the delay in building the Naval Hospital in Plymouth was deliberate. Official policy seems to have been that the results and experiences of Haslar should be studied and mistakes rectified. One of the big problems was that Haslar was supposed to have cost £38,000 but in fact the cost soared to £100,000 and the fourth wall of its quadrangle was never completed. But the delay was a wise decision because the hospital at Plymouth proved to be a novel design widely regarded then as the finest in Europe and far in advance of its time.

Haslar's architect was the talk of the town, having just completed the Foundling Hospital in Bloomsbury - one Theodore Jacobsen. Jacobsen was an amateur architect. His plan for Haslar was based on that of the Foundling Hospital, and both showed a remarkable resemblance to Greenwich Palace, designed by Inigo Jones some 100 years before. It consisted of a double row of buildings, one within the other, each communicating at intervals. This design is now known as the Pavilion system of hospital design and ensured maximum ventilation and natural lighting to all the wards. It was well ahead of its time and copied widely. But not in Plymouth. Sadly, the history of Stonehouse Hospital is not as well recorded as Haslar. We do know however, that as early as 1756 a London architect attached to Greenwich hospital, Alexander Rovehead, was appointed 'overseer' of the building to be in constant attendance. It is generally believed, however, that William Robinson, a distinguished London architect, actually designed the buildings. His design was unusual and quite different from Haslar. It consisted of eleven large buildings and four smaller, the whole forming a square but detached from each other and capable of

accommodating 1,250 patients in 60 wards and the extensive cellars. As an early description said:

> 'This design admitted freer circulation of air and also allowed the classing of the several disorders in such a manner as to best prevent the spread of contagion.'

This latter point was of the utmost importance. Although the reasons for the isolation of certain conditions was not known or understood, the principle was well recognised.

All three hospitals were entirely enclosed by walls 18ft high in places and with only one main gate - designed to keep the patients in rather than others out. The unusual design in Plymouth drew admiration from all over the world. In 1787, Tenon and Coulomb were sent to study hospital buildings with a view to replacing the Hotel Dieu Hospital in Paris. They immediately came to Plymouth to see the 'most up-to-date hospital in Europe if not in the world' as it was described to them. They were delighted with the design and the fact that it could accommodate 1,250 patients. They reported back to the Commissioners in France:

> 'In not one of the hospitals in France and England, we would say in the whole of Europe, except the Plymouth Hospital, are the individual buildings destined to receive patients as well ventilated and as completely isolated.'

The Royal Naval Hospital Plymouth was to be the rôle model for hospital building for over 100 years; indeed, the pavilion or block principle was to be used in hospital design for much longer.

The hospital at Plymouth was completed by 1762, catching up with Haslar, although part of it was open for the reception of patients in 1760. There was obviously a dire need for accommodation as a result of the 7 years' war, because patients were being housed in a building at the bottom of George Street, which was an overflow from the hospital ship HMS Canterbury. This vessel was finally decommissioned as a hospital ship in 1762.

Initially, the Plymouth hospital was run by the Physician, a civilian (one Dr Farr) and a Council comprising the senior officers, the Agent, and the Steward. This body was responsible to the Sick and Hurt Board in London. There was a surgeon, Mr Geach, who was highly respected, but very old. At Haslar, one of the first Physician Administrators was Dr James Lind of scurvy fame. Civilians all, you will note. John Wesley, the evangelist and philanthropist, visited the hospital in 1785 and declared:

> 'I never saw anything of the kind so complete; every part is so convenient and so admirably neat. There seems nothing wanting but a man of faith and zeal to watch over the souls of the poor patients and teach them to improve their affliction.'

Notwithstanding these comments, the Naval Hospitals in the last decades of the 18th century were veritable sinks of iniquity and squalor. The seamen patients were treated like common criminals which, to be fair, they often were, and all were anxious to escape as soon as they could walk or crawl, from the horrors of serving at sea. Every method of escape was tried, including dressing up as washerwomen, climbing into the sewers or simply throwing ropes

over the wall. Parties of marines had to patrol the hospital regularly. As regards the nurses, John Howard, the great philanthropist, said after a visit:

> 'All the nurses are women which is very proper as they are cleanly and tender and they more easily pacify the patients who are rough seafaring men.'

In actual fact, the nurses were really ward orderlies and that is flattering them - they were no more than prostitutes, many of them blackmailers not averse to assaulting patients for their valuables, and changing their wills. An extract from the Council minutes of 1783 reads:

> 'A complaint was lodged against Jane Brown, nurse of the middle centre ward, for going to bed with three or four sailors and infecting one with the foul disease. Recommended she be instantly dismissed.'

A memorandum dated 1785, discussing the use of cubicles in wards, has this warning:

> 'If the nurses are not more careful than the generality of nurses are, each cubicle will become a repository for a great deal of nastiness.'

From civilian to Naval administration

It was this situation that greeted Thomas Trotter, Physician to the Fleet, when he visited the hospital in 1794. The fault was not that the doctors had no time for administration or, indeed, that they were bad at it, but that they were usually absent seeing private patients. After all, the Physician's salary was £200 a year. Trotter was incensed:

> 'When I hear of the medical attendant of a public institution having accumulated thirty or forty thousand pounds by the private exercise of his profession; by an irresistible impulse of the imagination, the ghosts of so many thousands of brave men rise to my view, who have fallen into premature death by unprincipled neglect.'

He went on:

> 'At the beginning of this war a seaman fell from the top of a ship fitting out in Plymouth and was wounded dreadfully. He was immediately conveyed on shore but nobody could be found to open the gate of the hospital. At last access was obtained but not a surgeon could be found - he was attending a gentleman of great fortune in Cornwall.'

His recommendations were quite emphatic:

> 'We strongly recommend the appointment of a Governor to be taken from the list of Captains of the Royal Navy who with the assistance of a Lieutenant should have the inspection and superintendence of the whole. From his general knowledge of the habits and dispositions of seamen we conclude this appointment would be attended with many advantages.'

As a result of this, the management of the hospital was taken away from the doctors. In Plymouth, a Captain RN, one Richard Creyke, was appointed. It is from Creyke that we

learn much about the hospital because he was an avid diarist and he ruled the hospital from 1795 for no less than 31 years until his death. He was man of vigour, strict yet humane whose first instructions within 48 hours of joining were:

> 'Gave an order to the Physician and Surgeon and other officers to attend Divine Service and to cause their assistants etc to attend also.'
>
> 'Gave an order that all the medical gentlemen on the establishment to conform to the regulations for restraining private practice.'

There is no doubt that Creyke was a great success as an administrator who ran the hospital as he would and, indeed, had run a ship. He died in office in 1826 and was succeeded by another Captain RN and then a series of Inspector Generals, Rear Admirals and, latterly, Surgeon Captains who, I have to say, have been as successful. A Captain William Yeo was appointed to Haslar and his mandate was quite clear, he was to:

> 'Superintend the internal economy of the hospital, not only in assuming the proper attention to the sick, but by preventing, in the most effective manner, the inconveniences which have frequently been felt from a want of proper discipline and subordination in the said hospital.'

The days of civilian administration were obviously over!

The buildings have changed little since Creyke's and Yeo's time. The high walls, designed to keep the patients in rather than others out, are Grade 2 listed, as are the whole of the central cores of the both hospitals. If the ancient buildings of these hospitals could talk, they would sadly tell of brutality, ignorance and corruption in the early days of their existence. But they were built some five years before Nelson was born and have taken patients from every war and battle from Trafalgar to the Falklands, Gulf and Northern Ireland. They have undoubtedly fulfilled their original mandate:

> 'To treat the diseases and relieve the sufferings of our seamen and marines.'

To bring this story up-to-date, I have to tell you that Chatham Hospital closed in 1960, last year the Royal Naval Hospital at Plymouth was closed, and Haslar in Portsmouth is now the Royal Hospital, a tri-Services hospital. These changes are a reflection of the government's policy on Defence and the result of a review of the threats to this country in the latter part of the 20th century. Global war is not considered to be an option and, indeed, it is difficult to imagine who could initiate such an action. Accordingly, the numbers of medical staff in uniform have been quite dramatically cut and those that remain can be 'contained' in one single Service hospital, together with three special military units in the General Hospitals at Peterborough, Frimley Park and here in Derriford. It is interesting to note that the reason the government were tardy in building the hospitals in the first place some 230 years ago was that the requirement came and went as a war with our European neighbours started or abruptly finished. Today, the perceived requirement for specifically Naval hospitals has gone - war is not a likely option and as much as we mourn their passing, we have come full circle.

THE 150TH ANNIVERSARY CELEBRATION OF W T G MORTON's FIRST DEMONSTRATION OF ETHER AT THE MASSACHUSETTS GENERAL HOSPITAL

Dr J Rupreht

This three-day event was organised chiefly by the staff of the Massachusetts General Hospital (called by all Bostonians MGH). In the background were the Wood Library-Museum of Park Ridge, Illinois, The American Society of Anesthesiologists and the Anesthesia History Association, but it was predominantly an MGH undertaking. Chairman of the Celebration Committee was Elliott V Miller of the MGH, of Harvard Medical School and of the Wood Library-Museum. The organisers are to be congratulated on the very successful management of the programme. About two hundred delegates attended, most of whom were in the older age group. Disappointingly few younger colleagues stood watch in remembrance of the grand event of 1846.

On the first day, Tuesday 15 October, under the proverbial blue sky, participants were guided through the Ether Dome at the MGH, taken by bus to the Ether Monument in the Boston Public Garden, and later to the Mount Auburn Cemetery. It was a crisp, radiant afternoon and the famed New England autumn colours were at their very best. The graves of Morton, Holmes, Jackson and Bigelow were all visited. Time was all too short for full enjoyment of this unique cemetery which is world famous for its collection of trees. It is indeed a place of beauty and tranquillity for the living, as well as eternal repose for the departed.

A cocktail reception followed at the Countway Library, Harvard Medical School, where an exhibition of paintings pertaining to the Ether Day of 1846 could be enjoyed.

On Wednesday 16 October, delegates to the Sesquicentennial gathered at the remarkable Faneuil Hall, the centre of historic Boston. The two-day scientific programme was too extensive to be described in detail. The first day topics were all of interest to students of the history of anaesthesia. Highlights were Professor Gravenstein's presentation on Henry K Beecher and his role in making anaesthesia a university subject, and especially Gwen Wilson's talented communication of her historical findings on the spread of anaesthesia throughout the world.

The programme for the second day included the cream of recent scientific achievements at the MGH. This was rather high-powered, and oriented towards the future rather than the past. Subjects covered included organ transplantation, the revolution in national health, cancer growth, computers, genetics and memory. Outside the weather was fine, and the number of delegates inside Faneuil Hall dwindled.

Only two speakers were from overseas. Gwenifer Wilson of Australia spoke as the first Laureate of the History of Anaesthesia, the prestigious award bestowed by the Wood Library-Museum. There were also few delegates from overseas, and they mainly had personal connections with the MGH. An exception was the strong delegation from Britain and the

Netherlands, representing the History of Anaesthesia Society - Dr Atkinson, President, Dr Boulton, Past President, Dr Bennett, Dr Padfield and myself. Words of greeting were given by Dr Boulton, and gifts of the newly published *Essays on the History of Anaesthesia*. This volume proved to be a great success, and sold well. Leaflets on the forthcoming Fourth International Symposium on the History of Anaesthesia were eagerly accepted.

The Sesquicentennial of Ether in Boston gave me the impression of being a rather isolated event. Nevertheless I fully agreed with Gwen Wilson's sentiment: 'There is no place in the world where I would like to be more, on this 16th of October, than Boston'.