The Invisible Light

UKRC
BIRMINGHAM
June
9 – 11 2002

Number 17: June 2002

The
Journal
Of
The Radiology History and Heritage
Charitable Trust
Registered Charity: 1012505

www.rhhct.org.uk
Editor: Dr Adrian M K Thomas

Contents

Editorial Notes

It is with sadness that the deaths of three major figures in the world of medical history are recorded.

The first to announce is Dr Edmund "Ted" Burrows (1927-2002) died on the 9th February 2002. Ted was a neuroradiologist at Southampton and wrote widely on historical topics. Ted was a member of the Radiology History Committee that became the RHHCT and was author of the classic "Pioneers and Early Years – A History of British Radiology" (Colophon 1986). I was able to attend the Memorial Service on the 16th March at Romsey Abbey and passed on the condolences of the RHHCT to his family. Prof. Ian Isherwood read the reading at the Memorial Service.

Roy Porter (1946-2002) died on the 3rd March 2002. His death is a great loss. Although there are only about 6 pages on radiology and medical imaging in his book 'The Greatest Benefit to Mankind – A medical history of mankind from antiquity to the present' (Harper-Collins 1997). There are few that are capable of such a book with its breath of cover of medical history. I like the first sentence: "These are strange times, when we are healthier than ever but more anxious about our health."

The third death is that of Prof. Montague Cohen (1925-2002). He was a physicist and after working in the UK he went to McGill University. On retirement became the curator of the Rutherford Museum at McGill University. I was privileged to hear him speak on Ernest Rutherford in 1995 at the Röntgen Centenary Congress.

Dr John Calder leaves the committee of the RHHCT to be replaced by Dr Bobby Corbett as the Scottish Radiological Society Representative. We welcome Bobby Corbett and thank John Calder for his many contributions.

I hope you enjoy these articles. They are all of interest.

And finally apologies for the absence of illustrations in this edition of our little journal however I am in the middle of a major failure of my computer!

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The RHHCT web site

The RHHCT web site is to be found at:

www.rhhct.org.uk

I am always interested in material for the web site. Please send me material which I will consider for inclusion.

Letters and e-mails

These two letters from Dorothy Mayo were received in response to a request for memories in one of a series of articles "The 1940s X-ray Department" in Synergy plus.

(Dear Dr Thomas)
I am a Life Member (of COR) and retired in 1988. I qualified in November 1950. I think I might have some memories of "Olden Times" you may find interesting. In 1947, only 2 years after the end of World War 2, student grants in my Local Authority were non-existent. You apprenticed yourself to a Hospital and worked Monday to Friday as 'Student and General Dogsbody'. Lectures were all day Saturday at Manchester University. My Hospital had a 200 beds, no Casualty Department and a Single Handed X-Ray Department with no Dark Room or Clerical help.
I got no wages - but was provided with free lunches!! After 18 months, I was covering for the Radiographer's absences - The Hospital realised that because I wasn't paid, then I could walk away at any time, so I was then paid 10 shillings (50 pence) a week. I cost me 11 shillings and 9 pence a week to get to work on the train (I used my bicycle to save the money - 11 miles each way).
I remember scrubbing metal film frames clean with permanganate of potash sustaining stained fingers.
I remember hanging wet films to dry on strings across the darkroom - drying cabinets were never big enough - and the films dripped on your head while working.
Radiographers were recognised around the Hospital by their scruffy shoes - due to chemical drips when processing.

Used fixer was stored in carboys, to be collected for silver extraction - a fair amount of fixer always landed on floor - and feet.
If these are the sort of memories you want, please let me know and I'll dig in my brain cells for some more.
Dorothy Mayo (nee Jordan) 5th January 2002

Hello Adrian Thomas
Glad you enjoyed reading my old memories. To answer your queries - I was student at West Park Hospital, Macclesfield, Cheshire, under the aegis of Radiologist Dr. J. Blair Hartley and Superintendent Miss A. Stirling-Fisher. Dr. Hartley was God-like and terrified me!! He was treated like Royalty and I did not speak to him unless he addressed me!. He and Miss Fisher were very well known in the NorthWest. Part way through my training they left West Park to open the then new St. Mary's Hospital in Manchester and I got a new Radiologist - Dr Arthur Griffiths - a great change from dapper Dr. Hartley. He was a real character, quite eccentric - and a lovely man!! In the last couple of months before my final examinations, he would set me a question paper to answer whilst he did the Barium Meal session unaided. (I did have to clear up afterwards though!)
I cannot at present find my student notebooks. I have had a quick look in the lift but do not have much spare time as my husband and I are off on Friday (11th.) on a Cruise to celebrate our 45th. Wedding Anniversary. I will however look for them when I get back.
Incidentally, you addressed me as Dorothy Jordan - that was my single name - My married name is ----
Dorothy Mayo. 9th January 2002

Friedrich Regler

The Verband der Freunde und Absolventen der Technischen Universität Wien celebrated last year the hundredth anniversary of the birth of Friedrich Regler best known for his books on X-rays.

Friedrich Regler (1901-1976) was born in Vienna, Austria, obtained Ph.D. in 1924 from the University of Vienna, founded the Experimental Institute for X-ray Materials Testing (1929-1938), nominated professor in Freiberg 1942-1947 and Rector in 1945-1946. He returned to Vienna as director of the Institute of Experimental Physics at the Technische Hochschule. He was nominated Dean (1952-1954) and Rector (1958-1959). He authored:

- *Grundzüge der Röntgenphysik,* 1937
- *Verfromung und Ermüdung metallischer Werkstoffe im Röntgenbild,* 1939
- *Einführung in die Physik der Röntgen- und Gammastrahlen,* 1967
- *Licht und Farbe*, 1970
-

The president of the "Verband" is Professor Hans Kirchmayr, a former student of Regler, and his successor on the Chair of Experimental Physics at TH Wien.

The Association of the Friends and Graduates of the Technical University in Vienna. Address: Karlsplatz 13, A-1040 Wien, Telefon (0)1/5 88 01-1 37 11, Fax (0)1/5 88 01-1 37 98, e-mail: alumni@pop.tuwien.ac.at

Memories of Marie Sklodowska-Curie: The Marie Sklodowska-Curie Museum.

Permanent exhibits at The Marie Sklodowska-Curie Museum, 16 Freta Street, Warsaw, Poland
An interesting account of the museum devoted to Marie Curie and to her life written by Jane de Burgh appeared in the Lancet in their Christmas issue (Saturday December 22/29, 2001, p2178). Marie Curie (1867-1937) is one of my heroes. The museum opened 100 years after her birth and is on the exact spot in Freta Street where she was born.

Books

The History of the Royal Society of Medicine. London: RSM Press, 2001 (505 pp, ISBN 1-85315-497-0; £50)
This excellent book gives a good account of the history of the Royal Society of Medicine. Anyone at all interested in the history of medicine in the UK should obtain a copy. There is much general medical history in the book. For radiologists there is told the story of the Electrotherapeutic Section which became the Section of Radiology in 1931. In the review in the RSM Journal by T J David (J Roy Soc Med 2002 95:105-107) I was interested to read that the reviewer felt that 'for pure fascination it is hard to beat the radiograph of Dr John Hall-Edwards' hand, taken a few days before the hand and arm had to be amputated because of radiation damage.' Hall-Edwards presented his own case to the Section of Electrotherapeutics in 1908.

Articles

Euroson 2001 – The Historical Exhibit. John E E Fleming. BMUS Bulletin, Vol. 10 no. 1 February 2002 44-46
This is an interesting account of the Euroson 2001 exhibit by John Fleming the BMUS Historical Collection Coordinator. This is an account of the demonstration at the meeting of working items from the BMUS historical collection. The group had working examples of the Diasonograph and the Siemens Vidoson. The article illustrates the apparatus , the apparatus demonstrated by Hylton Meire, Joe Joseph and Richard Soldner and examples of the images obtained. I am sorry that I was not there to see the action!

Interesting Web-sites

"Do You Believe: Spirit Photography 1868-1935"
found at www.photographymuseum.com

I came across this in the "Independent on Sunday: The Sunday Review" for 23rd December 2001 in an article written by Matthew Sweet.

There was a tradition of spirit photography in 19C America partially started by William Mumler in Boston, USA. In the late 19C and early 20C there was a fascination with contacting the spirits of dead loved-ones that is difficult for us to appreciate now. In the UK Sir Arthur Conan Doyle, the creator of Sherlock Holmes, wrote about the photography of fairies and the physicist Sir Oliver Lodge wrote about contact with his dead son. The images on these web pages were collected by Bill Becker, a former television news editor from Detroit. In the article, Matthew Street writes:

"It was no coincidence that the first surge of interest in spirit-rapping was contemporaneous with the development of telegraphic technology which could tap Morse-encoded messages across continents; or that the late-19th century boom in paranormal research coincided with experiments with radio waves and x-rays. Sham techniques practised by photographers and mediums promised something only marginally more miraculous than the undersea cable to India, or Wilhelm Roentgen's radiographic images of the human skeleton. When Mumler declared, in 1875, that he was 'an humble instrument in the hands of the invisible host that surrounds us for disseminating this beautiful truth of spirit-communication', it did not inspire instant ridicule. In 1894, one year before Roentgen's discovery of X-rays, one advocate of spirit photography was even suggesting that psychic mediums possessed 'some fluorescent compound in the eyes' which allowed them the discern entities beyond the range of normal human vision. Arthur Conan Doyle asserted in 1922, 'I look forward with confidence to that day, when all this talk of fake and fraud shall be no more, and when the psychologist and scientist shall combine the investigation this vital phenomenon.' The distinction between science and pseudoscience is an imposition of history."

I find this all very interesting. From the earliest days of X-rays there is the idea that they show something that should be hidden from human view. This is taken further in the classic film by Roger Corman "X - The man with the x-ray eyes" and starring Ray Milland (1963). Dr Xavier, the hero of the film, has his sight extended by his experiments and finally in his vision at the end of the film sees what no one should see and he destroys his own eyes.

The International Society of the History of Medicine

The International Society of the History of Medicine (ISHM) was founded in 1920, with its headquarters based in Paris. Between then and 1938, eleven International Congresses were organised in different cities in Europe. There was then a gap due to the Second World War, before Congresses resumed, in Amsterdam, in 1950. Since then, an International Congress has been held every two years, the last in Galveston, Texas, in 2000. The next Congress, the 38th, is to be held in Istanbul, Turkey from September1-6, 2002.

The society has an international membership drawn from those interested in the history of medicine whether as historians or health professionals, from more than 60 different countries.

Since 1995 the official journal of the society has been Vesalius, with papers published in English or French. Membership of the ISHM, for those living in Britain, is available for an annual subscription of £35. This includes the subscription to Vesalius,

which is published twice a year and also entitles members to a substantial reduction in the registration fees for the International Congress.

Subscriptions are forwarded to the ISHM by Dr. David Wright, the British Society for the History of Medicine's National Delegate to the ISHM and those interested in becoming members are invited to contact him.
(Dr David Wright, 20 Lennox Row, Edinburgh EH5 3JW, email dr.david.wright@virgin.net)

The ISHM has a web site http://www.bium.univ-paris5.fr/ishm/eng , which has further details, including information concerning, and registration forms for, the meeting in Istanbul in September.

50 Years on - What it was like to be a radiography student in 1946

by

Miss Mavis V Reynolds M.S.R.

Miss Reynolds was the author of an amusing booklet: "How to Succeed as a Radiographer". Grahame Mountford writes: *The booklet "How to Succeed as a Radiographer" was published by Gevaert Ltd. in the mid 1950s. Gevaert NV (Belgium), the parent company, was taken over by Agfa in 1964 and became Agfa-Gevaert. Many requests to the Medical Division HQ in Antwerp for this book were unsuccessful and it has been out of print since about 1960. The last comment from the advertising department in Belgium was that it was "of no interest to radiographers who had only known automatic processing." Copies of this book have been considered "gold dust" for many years. Its 60 pages could be photocopied, but it would lose the attraction of the many coloured cartoons and diagrams.*

On a chilly morning in September 1946, I crossed the road from Whitechapel tube station to the London Hospital. A smell of malt (from Charrington's Brewery) hung in the air and the hands of the huge clock above the entrance jerked forward towards 9 o'clock and my first day as a student radiographer.

Inside the hospital, the prevailing smell was of disinfectant. Tall lifts glided silently up and down, and mauve-uniformed nurses hurried by. I found the In-Patient Department in the basement - I was not unfamiliar with the hospital as my father had been a radiographer there before the war. In those days all radiographers were men, and learned the job while working in the Department, with no formal training. I had also been there more recently for an interview with the Matron. Quite a few well-off girls took up radiography then, and as I waited on a bench in the corridor the mother of one of them looked me over and remarked "Caroline's at Queen Anne's Caversham". I was at a County Grammar School and got a grant. I never saw Caroline again.

I eyed my fellow students - three about my age (18) and two older - one an ex W.A.A.F., the other a London Hospital S.R.N.. She would get her training free - the rest of us paid 50 guineas (£52.50), for the two year course. We were wearing the uniform - dark green skirt, white blouse, green tie, green blazer with the hospital

badge, brown lace-up shoes and stockings (in 1946 only ballet dancers wore tights). All students were female - a new set started every six months.

Our Sister Tutor, a forceful personality, gathered us up, and we were kitted out in ill-fitting double-breasted mauve overalls - mauve seemed to be a London Hospital colour. We then sat in a small classroom to hear Sister's lecture on hospital etiquette - we must call the doctors Sir (they were very important people) and on no account address each other by first names when on duty. Make-up was forbidden.

I spent the rest of that day in the In-Patient Department, trying to look unobtrusive, being stared at coolly by the senior students. Everyone tended to gather outside the darkroom, where the wet-developed films were pushed through the wash-tank in metal carriers. The films frequently fell out of their channel hangers and it required some dexterity to replace them, especially the 17x14's (inches, not metric). Wet films were taken in to show to the radiologists - those very important people, who sat in a dim smoke-filled room in front of viewing-boxes.

There were two x-ray rooms and a screening room. Different sized metal cones were attached to the x-ray tube which ran along a floor-track, according to the size of film to be covered - this was long before the advent of the ceiling-mounted tube or light-beam diaphragm. Screening was done in total darkness, a dim red light coming on when films were taken. If over-couch films were needed, a sharp tug on ropes changed the contacts. Getting in and out of the room to fetch patients or take films to be developed had to be done with maximum speed in order not to incur the wrath of the radiologist.

Two sisters were in charge of the patients and laid up trolleys when needed. On my first day an arteriogram of a hand took place - a great event apparently, which I was not allowed to watch. In a room at the back of the Department was a small steriliser, and woe betide any student who forgot to switch it off and let it boil dry. At the other end of the Department was a dark cavern where the orderlies and office staff brewed tea, and the legs of people walking by outside could be glimpsed through iron railings. Dark room chemicals were made up (by the junior student, naturally) in buckets in a sink and the ghost of the Elephant Man was said to walk there at night.

Several of the staff were recent graduates of the School of Radiography which had begun in 1943. The senior students did a lot of practical work unsupervised - going off on the wards with a junior student in tow (to carry the cassettes), or battling with minor injuries or a fracture clinic on a G.E.C. portable.

After a fortnight the student moved on to another room or Department, and at the end of our first fortnight one of our set left.

"I am afraid Miss - is no longer with us," said Sister, through compressed lips.

Life in the Out-Patient Department was altogether more relaxed - the patients were less ill and more mobile. Routine chest and spine x-rays were done there, also A.P. Refills (for TB) and I.V.P.'s. The junior student was dispatched first thing each morning on the long trek through the underground tunnel (it was easy to get lost) to the theatres in the main hospital to get the injection tray. Radiographic technique

lectures, given by Sister, took place in Out-Patients, using a patient who was waiting, and taking films of them, which were examined afterwards.

"Do you ever sit opposite someone in the train and think about how you would x-ray them," she would ask. Well, we didn't, but under her tuition gradually learnt how to deal with patients, and to treat them with courtesy and consideration.

After lectures we trooped off to the Alexandra Nurses Home for coffee (bitter, and served from a huge urn) and bread and Marmite, or peanut butter. This was off the ration, unlike jam - food was rationed for some time after the War ended in 1945. Hospital food was stodgy - Friday lunch was always fish and chips, followed by chocolate pudding and sauce, so we often went down the road to the Express Dairy, a small crowded shop frequented by medical students.

Other lectures were given by radiologists or outside specialists - Apparatus Construction was quite incomprehensible. Sister sat behind us in the classroom, scribbling away in large notebooks, watching for any lapses of concentration on our part, or levity from the lecturers.

At that time equal parts of the training were spent in Therapy and Diagnostic - some of the radiotherapy patients were very ill and had vast fields treated called "Abdominal baths". Another department where the student of 1946 spent time was the Light Department where patients came for treatment of such diseases as Lupus - an unpleasant sight when most of the nasal tissue had been eroded. The Department was presided over by a fearsome sister, and a terrifying process called "Striking the Carbon Arc" took place under her disapproving eye. There was also a superficial x-ray department where local Whitechapel lads came for treatment of ringworm.

A week of night duty made a welcome break from routine for the student, who was on duty from 5pm until midnight, with one radiographer, the radiographer then being on call until 9am. Accommodation for the student was provided in a bleak attic room in the Grocers Wing. Some of the resident students also had rooms there - the winter of 1947 was particularly arctic and shampoo froze in the bottles.

Queen Mary was patron of the hospital then, and when she came to visit, everyone off duty gathered in the garden round the statue of Queen Alexandra. Sometimes there was a long and cold wait until the V.I.P. Party appeared, when everyone clapped.

Part One was taken after one year, part Two (Radiotherapy and Radiodiagnosis) after the second, and revision courses took place at Kodak's in Kingsway and Ilford's in Tavistock Square. Some revision was done in the shops in Oxford Street, though few students had any money, and clothes were still rationed (until 1949). Most students passed the examinations (potential failures had long since been weeded out) and at a later date Diplomas were presented at a ceremony in the Medical College library. Sister had another *bon mot* - "We at the London are accustomed to receive our certificates at the hand of royalty", and so it was - not Queen Mary but her daughter the Princess Royal of the day - a sad lady in shapeless clothes, somewhat hampered in her task by having her arm in a sling.

So the mauve overalls were replaced by pristine white ones, and as a band played

tunes from "Brigadoon" and "Carousel" we received the M.S.R.. Some joined the staff, some went abroad, some got married and never x-rayed a patient again.

Fifty years have now gone by, and in that time young people have become infinitely more sophisticated and self-assertive, medicine has advanced spectacularly and radiography has become highly technical. I retired in 1988 after a varied career but I still remember vividly those early days at the London and look back on them with affection and nostalgia.

The Turn of the Century Electrotherapy Museum.

This large web-site is devoted to electrotherapy. The author is Jeff Behary.

He writes:

Adrian, I have a special offer to you and your colleagues. I am ready to unveil a finished reproduction of the original Tesla High Frequency X-Ray Apparatus in 1897, The Kinraide Coil. There are no known originals to exist in the U.S., where they were first manufactured. This device was the most efficient Tesla Coil ever designed, and this new reproduction that I have created is over 150% more efficient. The early photo seen below is made from 1890s materials and no modern technology, yet is more efficient that anything electronic built today. It produces a full 16" spark between the terminals. This coil marks an epoch in not only Tesla technologies, but also introduces a method of manufacture for portable X-Ray apparatus that has been passed over in history, only now to be reinvented.

I am the ONLY person in the world capable of manufacturing such an apparatus, as I am the only person with details of the original apparatus, as well as the equipment and technique to physically construct such. The final cost of this apparatus is ca. $2500.

Jeff Behary, c/o
The Turn Of The Century Electrotherapy Museum
http://www.electrotherapymuseum.com

The Centenary of the founding of the British Electro Therapeutic Society.
1902-2002

By
Dr Adrian M K Thomas

Notes for a talk at a meeting at the RSM to celebrate 100 years since the foundation of the BETS.

The Royal Society of Medicine (RSM) was founded in 1907 with the coming together of 15 individual medical societies.

The 1st Meeting of the executive committee of the new Electrotherapeutic Section of the RSM was held on Friday 21st June 1907. The Council included Dr G H Orton, Dr Dawson Turner and Dr A H Pirie, all well-known radiologists of the time. The first meeting of the Section took place on Friday June 12th 1907 with meetings to be held on Friday evenings every month from October to March with one provincial meeting in April or May.

The Electrotherapeutic Section had its origins in the British Electro Therapeutic Society (BETS).

A preliminary meeting of the BETS took place on the 13th December 1901 initiated by Dr Chisholm Williams. In his preliminary notice he said "it is intended to form an electrical society for duly qualified Medical practitioners who are interested in the application of all forms of electricity to diseases". The first meeting took place on January 10th 1902 at 11 Chandos Street at the house of the Medical Society of London with 58 in attendance and Dr W S Hedley (of the London Hospital) in the chair. At this meeting Dr Hedley was elected the first president. It was reported in the Lancet of 18th January 1901 when it was stated that there was an annual subscription of one guinea, that a journal was to be published and "medical men desirous of joining should send their names to the honorary secretary".

A Council meeting of the Society was held on the 14th January 1902. "Mr E. W. Shenton was granted permission to read a short paper on 'A diagnostic time about the hip-joint'". It was agreed to hold a meeting at Manchester during the British Medical Association's week. Mr Hall Edwards was granted permission to show electrodes for vaginal, cervix and urethra (male) for use with high frequency currents. The second meeting of the society was on the 14th February 1902. Dr Samuel Sloane showed and described his "Faradimeter". "Mr Hall Edwards showed 3 electrodes for vagina, cervix and the male urethra for use with high frequency currents".

The next council meeting was held on the 7th March 1902. "It was agreed that arrangement be made for an exhibition of Electrotherapeutic apparatus be held on May 2nd. That each exhibitor be charges one guinea for space. That tea and coffee be provided." The 3rd meeting of the society then followed. Dr Lewis Jones described the use of a lamp for the production of Ultraviolet Rays and Dr G H Balter exhibited a "Rectifier".

At the Council meeting on the 20th March 1902, a motion was proposed by Dr James Allan: "That Registered Medical Students of three years and upwards, shall be eligible as Associates of this Society, they shall pay an annual subscription of 10/6. They shall enjoy all the privileges of membership, voting and holding office excepted". This motion was subsequently carried unanimously at the 5th meeting of the society on 2nd May 1902.

The 4th Meeting was held on Friday 4th April 1902. Dr Hugh Walsham read a paper on "The Diagnosis of Thoracic Aneurysm by the X-rays" illustrated by a large number of skiagrams shown through the lantern". Dr Sequeria read his paper on "The Finsen Treatment" in Lupus, Rodent Ulcer etc. which was illustrated by many cases, photographs and lantern slides.

At the 8th meeting Dr Graham showed the latest Finsen Reyn Lamp and fully described its working advantages over the other versions. Mr Bokenham exhibited a simple Finsen lamp.

In 1903 the President was Dr Lewis Jones. The Council included members from all over Great Britain (Swansea, Liverpool, Wolverhampton, Glasgow, Taunton, Edinburgh and Harrogate).

At the 11th Meeting on the 27th February 1903 Dr George Herschell spoke on Polyphase Currents and gave an exhibition of apparatus. Dr Somerville from Glasgow spoke on H.F. treatment with benefit of some diseases.

Council of 9th March 1903 was held at Dr Lewis Jones rooms at 143 Harley Street. The question of publication of transactions was discussed. Dr Hedley was the current editor. This was further discussed at a sub-committee on 14th March and the size of the proceedings was increased from 8 pages to 12 pages.

At the 12th Meeting Dr Donald Baynes gave a paper on "cataphoresis" and Dr J A Codd (Wolverhampton) gave a paper on "The Electric Series Bath".

Council on 7th April 1903 following a letter from W F Brook Esq. FRCS VP instructed the Secretary "to inform him of the willingness of this society to do all in its power to further the objects of the subsection of electrotherapeutics at the annual meeting of the British Medical Association at Swansea. The following programme was suggested:
1st Day: "The results of Treatment of Malignant disease by Electrical Methods".
2nd Day: "The treatment of tuberculous disease by electrical methods".
3rd Day: "Papers"

The 13th Meeting was on the 24th April 1903. Dr Donald Baynes spoke about the needs of the members to support the journal in which our transactions are printed. There were two papers: Dr Cowen on "The treatment of constipation by electrical methods" and Dr Samuel Sloan on "The therapeutic value of alternating currents applied to the abdominal sympathetic".

At the 14th Meeting (22nd May 1902) Mr Chas. A Clark described and demonstrated a new dental X-ray tube and Mr Donald Baynes showed an electrical vaginal douche and vaginal coil.

At the 17th Meeting (18th December 19030 there was organised an Exhibition of electro-medical apparatus and a conversazione. The exhibitors were: K Schall, A E Dean, Sanitas, Cossar, Isenthal, Cox, Davis, Martingale and the Medical Supply Association. An address was given by Sir Isambard Owen.

The 2nd annual Meeting was on 22nd January 1904. "Dr Browne-Caithew showed two cases of lupus and sarcoma which had been treated with Radium, the first to be presented to this society."

At the 19th Ordinary Meeting (26th February 1904) Dr Reid "showed an interesting case of recurrent carcinoma of side of neck treated with x-rays but more recently under his care by means of Radium".

At the 20th Meeting (25th March 1904) Mr Williams showed an X-ray tube shield and Dr Donald Baynes spoke on "The Electrical Treatment of Gout and Rheumatism". Physical methods in the treatment of soft tissue and joint diseases were common.

A Council Meeting was held a 143 Harley Street W on Friday 15th July 1903, Dr Lewis Jones in the chair. "Secty read a letter from Dr Reginald Morton re laymen at the meetings of the society. Secty directed to answer that the council wish to draw the attention of members that only medical men & those distinguished in any branch of Natural Science and at the Annual Dinner only members of the learned professions may be invited as guests".

27th January 1905. An Annual Exhibition and Conversazione took place.

1905 Dr John Macintyre of 179 Bath Street Glasgow elected honorary member.

28th Ordinary Meeting March 24 1905. Dr J Macintyre wrote and thanked the society for their kindness in electing him an honorary member. Mr Robert Donald (75 Clyde St, Dunedin, New Zealand0 was unanimously elected as an ordinary member of the society. Mr Hall Edwards showed lantern slides of a new diaphragm compressor and a handy screen holder, explaining their uses and advantages. Mr R Donald showed some radiographs of the urinary tract of a cadaver injected with bismuth, in which the normal positions of the ureters were clearly shown. Mr A D Reid showed a new and improves x-ray diaphragm, built on the principle of the Iris diaphragm, but with very thick plates so as to efficiently cut off extraneous rays. Mr J Hall-Edwards then read his paper "The X-ray treatment of Rodent Ulcer & cancer" which was illustrated by lantern slides especially prepared by himself.

Synopsis of paper:

> Further experiences in the treatment of Rodent ulcer.
> Late & early recurrence after X-ray treatment.
> Reasons of recurrence
> Surgical help in inoperable cases.
> (sepsis) in X-ray treatment
> Action of X-rays in superficial 7 deep seated cancer.
> Toxaemia following X-ray treatment.
> The advisability of early application of x-rays after the removal of cancer of the breast
> Further research into the effects of the X-rays upon cancer is urgently needed .

A Council Meeting took place on the 27th April 1905: "The case of the practice of Guy's Hospital inviting practitioners to send paying patients to their Actino-therapeutic department was discussed and the Editor of the Journal instructed to deal with the matter as seems most advisable. The case of Alexander Lane MD of Bideford was also discussed and the Secretary was instructed to confer with Dr Bateman of the Medical Defence Union. The matter of Guy's Hospital was again

discussed at the Council of May 19th 1905 and it was referred to a sub-committee of the BETS. Dr Alexander Lane was again discussed and it was agreed to call a special meeting to deal finally with the case. At that same meeting Mr A D Reid brought up the suggestion of amalgamation with the Röntgen Society that had been put forward by members of the Röntgen Society. Mr Reid was asked to reply to the effect that: "while having a good feeling towards amalgamation in the abstract – they fail to see how negotiations can have any value so long as the constitutions of the two societies are so widely different". Dr Lewis Jones reported regarding the proposed configuration of medical societies of London and this was referred to a special committee.

Dr Ironside Bruce (of the Charing Cross Hospital) was elected to membership in May 26th 1905. He became well known and his early death for the effects of exposure to the effects of Radium was a national scandal.

A special meeting of the society was held on the 16th June 1905. The president moved: "That the name of Dr Alexander Lane, late of Bideford Devon, and now of Newcastle-on-Tyne be expunged from the roll of members of the British electrotherapeutic Society". Dr Bateman from the Medical Defence Union came to explain the facts and Dr Lane appeared in person to speak in his own defence. An account of evidence in the case of Pearson verses Lane at the Exeter assizes in February 1905 was given. It was brought out in evidence that Dr Lane had used X-rays in one in five cases on his books. It was testified by Drs Batten and Kearton that "their experience in previously similar circumstances that such proportion was excessive". "It was thus shown that Dr Lane had been making use of X-ray treatment in such a way as to be unjustifiable".

The practice of therapy continued to exercise the council. In the June 16th 1905 council meeting the attention of Council was drawn to an advertisement in the British Medical Journal for June 17th date headed "Bournemouth". In this advertisement a practitioner as a member of the BETS put an advertisement in the BMJ: "Remarkable successes achieved in inveterate chronic cases. Extensive modern equipment ensuring precision of dosage and delicacy of application also freedom from all risks". This caused considerable concern. The secretary was asked to ascertain the name of the member and communicate with him, especially on the use of the Society's name.

At the 33rd Ordinary meeting on the 27th October 1905 the attitude of the society regarding the proposed union of medical societies was discussed. It was resolved: "That the British Electro-therapeutic society is in favour of joining the proposed union of medical societies, but would like to see the establishment of a special Electrotherapeutic of Physiotherapeutic subsection in such a united society – for the reason that such a subsection would be a meeting place for members interested in a well defined sphere of medical work". This resolution was put by the president and carried unanimously.

November 1905: A E Barclay and James Stanley Bythell accepted into membership.

December 15th 1905: Dr Graham wrote expressing the view that a provincial member should be elected to the chair for the next year. The President for 1905-06 was Dr J Hall Edwards.

At the council meeting of February 6th 1906 the following was agreed to be put on the agenda of the next meeting of the society: "considering that the medical use of Röntgen rays may cause grave accidents -: that certain practices may create a social danger & that only medical men are capable of interpreting the results obtained from the point of view of diagnosis & of the treatment of disease; this society is of opinion that the medical application of the X- & other rays should only be permitted to reputable medical practitioners".

At the 34th ordinary meeting of the society on February 23rd 1906 the president John Hall-Edwards proposed the motion: "It having been established that the use of the x- & other rays by persons without a registered qualification constitutes a grave social & public danger, & that medical men alone are capable of administering such rays to the public benefit; this society is of opinion that the use of X-and other rays should be by act of parliament confined absolutely to registered medical practitioners & dental surgeons in their practice of dental surgery". This proposal was carried unanimously. At the council meeting on March 23rd 1906 the President (John Hall Edwards) read letters from various Members of Parliament regarding this motion. This ultimately resulted when the Society of Radiographers was formed in the 1920s in the prevention on non-medically qualified practitioners from working independently and reporting radiographs

38th Ordinary Meeting on March 1906: Dr C Thurstan Holland (Liverpool) was elected an ordinary member.

Dr Howard Pirie (radiation pioneer and ultimately martyr to the effects of x-rays) appointed editor of the Journal "Medical Electrology and Radiology" on April 26th 1907.

43rd Ordinary Meeting: Announced that the May meeting is the last of the society.

44th and last meeting at 11 Chandos street Friday may 24th 1907 at 8.30 PM. At the council meeting before that meeting a letter was read from Dr J Macintyre of Glasgow giving his consent to become an ordinary member of the new section of the Royal Society of Medicine. At an Extraordinary General Meeting after the meeting the following resolution was proposed and carried unanimously: "That in pursuance of the decision of the British electrotherapeutic society in with other societies in forming the Royal society of medicine which has now been granted a Royal Charter from His Majesty the king, all the property of every kind whatever of this society be & is hereby transferred to the Royal society of medicine & the Treasurer and council are hereby directed forthwith to transfer to the Royal Society of Medicine all sums of money standing in their names or at the credit of this Society at its Bank".

The British Electro-Therapeutic Society was innovative and successful with meetings, exhibitions, a respected journal and was concerned with furthering clinical governance (although they would not use that language! They would have called it good clinical practice), education and research into the applications of electricity to medical diagnosis and therapy. It has been a privilege to research them. They suffered for their patients and many experienced harmful effects of radiation (Such as Ironside Bruce, John Hall-Edwards, and Howard Pirie).

I salute them!

Thursday, 17 January 2002

THE GOOD OLD DAYS
(Says who?)

by
Thomas Charles Tipler.

I was born in Liverpool in 1931. During my childhood one or other of my relatives was usually a patient in Walton Hospital, Liverpool, as a result of which I occasionally accompanied my parents as a visitor to the hospital. I remember walking along long corridors and having glances into the x-ray Department. I was fascinated by the chrome and black coloured equipment and amazed at the radiographs that people in white coats held up to the viewing boxes. From those early days I decided that I wanted to become a radiographer.

My father and grandfather realized when I left school at the age of 14 years, that my ambition was serious and not just a juvenile whim. As I was too young to enter the profession they advised me to gain experience in the electrical or nursing field, as a basis to build upon for future reference.

After attending Walton Junior Technical School, Liverpool, studying electrical engineering and becoming an armature-winding apprentice, I took a post as a student nurse in Denbigh Sanatorium, North Wales. Whilst in this hospital I managed to pass my preliminary nursing training Part 1.

It was now 1949 and the King required that I and thousands of others at the age of 18 years should join his armed forces. "National Service" was the order of the day (pity it was ever scrapped). In the November, I attended the Army Recruiting Office in Liverpool. I told the recruiting sergeant that I would like to do my statuary service in the Royal Army Medical Corps, as I wanted to become a radiographer. I restrained my laughter when he suggested that to pursue such a profession, I would be better off joining the Royal Signals Regiment (He as a sergeant in one of the Guards Regiments). He was never the less well trained as he told me that to ensure joining the Corps of my choice I would have to "sign on" in the Regular Army for 5 years with the Colours and 7 years with the Reserves; even then I may not be selected to become a radiographer. At the time recruits were being drafted into the Catering Corps, so he said. I will never know whether or not he conned me but I decided to "grasp the nettle" and go for it. From then on I was a number 22305729 RAMC.

I was posted to the RAMC Depot, Queen Elizabeth Barracks, Crookham, Hants, where all the "square bashing" and basic achievement test were carried out including a Nursing Orderly Class 111 examination. I was successful at passing a "Selection Board" and was recommended for training as a radiographer. I was then transferred to the Royal Herbert Hospital, Woolwich, where the Army X-ray School was based.

After serving a short period as a Nursing Orderly on the wards, I was allocated a place on the radiography course. It was in the September 1950, when I first entered into the Army X-ray School as a student radiographer. There in front of me stood the chrome and black coloured X-ray sets that had fascinated me all those years ago. As far as I was concerned I had at last achieved an aim in my life.

The instructors were all qualified Members of the Society of Radiographers (MSR). Sgt Harrison taught physics, Sgt Parrot, photography, S/Sgt Ramsey, anatomy and physiology. The equipment was all Watson's, MX11, MX111, Mobilex and an R11, (all stationary anode targets. The MX111 had a dual focus – all mod cons). Each set was housed in its own room. There was a communal "dark room" plus a classroom with room for about 30 students. The main books we studied were Positioning in Radiography by K.C.Clark; Medical and Clinical Photography by Longmoor; X-ray Physics by Schall. S/Sgt Ramsey from Gray's Anatomy compiled the anatomy notes. In addition to the normal radiographic instruction a S/Sgt from the Royal Electrical and Mechanical Engineers (REME) instructed on equipment maintenance which included maintaining the control panels. One had to bear in mind that we may not be able to send for a Watson's or any other X-ray engineer when we were in a foreign country or attached to a remote "Field Ambulance Unit".

During the initial training, we practiced on "volunteer" patients from the wards in the hospital (I use the word volunteer loosely!) The number of times they were allowed to attend was strictly monitored. This initial course of 3 months duration consisted of the daytime lectures and practical
Training from 9am to5pm but after the evening meal it was an unwritten law that you were expected to attend evening sessions when the school reopened from 6pm to 10pm. These sessions were supervised by one of the instructors "on call" and the number of times you attended in your free time was placed on your record. Needless to say that most of us students who wanted to be radiographers were back every night apart from week ends. At the end of the course a written, practical and oral examination was set for successful candidates to be graded as Army Radiographer, Class 111 (War). I managed to pass these examinations which enabled me to take up duties as a basic training radiographer under the supervision of a qualified radiographer in military hospitals.

I was posted to the Cambridge Military Hospital, Aldershot. The qualified radiographer was Sgt Bull; the radiologist was Major Webster. After 4 months doing all types of examinations, including pelvimetery from the Louis Margaret married families' military hospital, I returned to the X-ray School for one month. This enabled me to undertake further training, take further examinations in order to pass as an Army Radiographer, Class 111 (Peace).

Armed with this "cherished" qualification I returned to the Cambridge Military Hospital, where I eventually became second in command and was promoted to the rank of Corporal (after taking further examinations in military law and drill procedures). My ex instructor, Sgt Harrison (Physics) had taken over from Sgt Bull who had left the army during my absence at the X-ray School. I am assured that it was nothing I had said or done that caused him to leave, he had simply served his time.

In November 1951, I passed my Part 1 of my MSR(R). In February 1952, I boarded the "Empire Trooper" troopship bound for Korea and Japan. After 6 weeks at sea we eventually arrived at Pusan, South Korea. On arrival at Pusan, I was ordered by a Sgt/major in an Infantry Regiment, to collect all my kit and disembark. I got off the ship with hundreds of other soldiers, who eventually loaded into army vehicles and drove off bound for somewhere in Korea. I was left standing on the dockside and was admiring an American army band that had greeted the disembarked troops by playing a selection of marches. I remember thinking how smart they looked in their bright polished helmets, when a bulldozer, driven by an American soldier went past and pushed a line of about 10 jeeps off the dockside into the harbour. He must have noticed the look of utter disbelief on my face; as he reversed the bulldozer he simply said "No spares Buddy".

As I realized that I was the only British "medic" on the dockside and the troopship had by now pulled away from the dockside, I had better look for the Regimental Transport Officer (RTO) and find out where I was supposed to be. The RTO is normally the person who knows all about troop movement orders, as I had none I presumed he would know where I was to report. After about an hour I realized that there was no RTO to be found so I asked an American Sgt if he had any idea where I could find a British Officer. He called another American soldier, who turned out to be a Captain, over to hear my plight. He told me to go and get some refreshments and have a rest in one of their army huts on the dockside. After the refreshments I must have fallen asleep because it was the next day when the Sgt/major who had originally instructed me to get off the boat aroused me. He asked me what I was doing there and why I had left the boat? (In actual fact the boat left me) I told him the he had ordered me to disembark. He then asked me what sort of an excuse was that for a corporal to give to a Sgt/major? I was taught very early on in my service career that you do not argue or question a senior rank (not until you are out of that service). I noticed that the troopship had returned to the dockside and I would like to have thought that I was important enough for it to have returned just for me. I did think that this was the case until I saw plenty of equipment and other troops embarking at the same time.

The ship sailed from Korea and arrived at Kure, Japan. I was posted to the x-ray department of the British Commonwealth General Hospital in Kure. This hospital catered for the entire Commonwealth troops involved in the Korean Campaign (commonly known as the "Forgotten War"). I relieved an RAMC Sgt Smitton (I think that was his name). He was returning to the UK having completed his tour of duty in Kure. I was promoted Sgt on taking over the department. Captain P. Conlon RAMC was the radiologist. The remaining staff consisted of an army radiographer, Ralph Marks RAMC, three Japanese, one was a radiographer, one a darkroom assistant and a female clerical assistant. During my posting Capt Conlon returned to the UK and was replaced by Lt.Col Fowler. The Officer Commanding was Col Menezies and the Company Commander turned out to be my old anatomy instructor Sgt Ramsey who had left the medical side of the RAMC and joined the administration side and had now been promoted to the rank of lieutenant.

The department consisted of four rooms, a general office, radiologist's office, darkroom and one large room which housed three X-ray sets; an MX11, an MX111 and a main static set of unknown origin which I think came out of the arc. Sometimes the Potter Buckey worked mechanically other times it did not; consequently we had to

resort to setting its timer for a longer time than the actual exposure and pulling a string to release it, then making the exposure, to ensure the Buckey was moving throughout the exposure. All types of examinations were carried out within this room.

The MX11, being portable, took the brunt of the work, as quite a lot was done in the operating and plaster theatres due to the nature of the casualties being brought back from Korea. It was not unusual to receive up to 20 to 30 stretcher cases on an evacuation convoy, which normally arrived in the evenings by hospital train and army ambulance. Such convoys would come in three or four times a week after the conflict finally ended then the numbers gradually decreased. When the casualties did arrive Col Menezies and the senior surgeon Major Wright assessed them in the reception area. Those that were considered to be in need of immediate X-ray and surgery were X-rayed with the MX11 in the reception area. The other patients were sent directly to the wards to rest and be attended too later. I know it may sound like a "War Story" but it is not, when I say that there were times when the bellows in the tube head of the MX11 expanded so much with the heat from the X-ray tube, that as a precaution, we filled a waterproof pillow with ice from the kitchen and placed it on the tube housing to cool things down. When you consider the number and length of exposures (15 mA on a 12 second mechanical hand held exposure timer, sometimes twice around the clock to get through thick plasters) it is all credit to the designers and construction of this little "workhorse" that never once let us down.

As far as I can remember the outputs of the equipment were as follows: -

(i) MX11 – 85 kV at 15 mA for Radiography. 3mA for Screening for a maximum time of 3 minutes which could be repeated after a 10 minute rest period,

(ii) MX111 – 90 kV at 20 or 30 mA, depending on whether fine or course focus was selected. (I am not too sure of these factors as it was so long ago and the memory can play tricks on me).

(iii) The main set, which I think came out of the arc and was as far as I know inherited from the Japanese after the 1939 – 1945 war – 95 kV at 30 mA

I have been asked on a few occasions to recall what sticks out in my memory regarding my service at the British Commonwealth General Hospital, Kure. There are a few memories that stick in my mind: -

(i) Just how much physical punishment the human body can endure,

(ii) The entry wound of a bullet or other missile, sometimes, gives absolutely no indication as to where in the body the missile will actually be finally located,

(iii) One case in particular leads me to believe that I have witness a true miracle. A patient came into the department straight of a convoy from Korea. He was encased in a plaster cast, which covered his head and chest. There were holes in the cast to enable him to breathe and speak. His eyes were concealed within the cast and there was heavily blood staining in the region of his right eye and mid chest. A radiograph of his chest revealed a couple of fractured ribs on his left side and a partially collapsed left lung but no foreign body. A PA and right lateral radiograph of his skull revealed part of the pointed part of

a bullet lodged in the upper part of the right eye socket. I expected to see some form of entry wound elsewhere in the skull as the pointed part of the bullet was facing to his front. I could not see any sign of an entry wound made by this bullet. The department was "blacked out" as for screening with only the red screening light illuminating the room. A surgeon was called and the plaster encasing the patient's head was removed. The right eye was covered in a heavily bloodstained "field dressing". The left eye did not appear to be injured and the patient told me he could see me with this eye. The "field dressing" was removed from his right eye and the area cleaned up with warm water. On removing the bloodstains a small puncture wound could be seen just below the eye socket. The surgeon gave a local anaesthetic into the skin near the eyebrow, made a small incision an removed the bullet fragment and gave it to the patient who to our amazement informed us that he could see us out of both eyes. It can only be assumed that the bullet was at the end of its "flight" or was a ricochet that had only been powerful enough to penetrate the skin beneath the eye and had traveled around the bony orbit and come to rest above the eyeball, without actually causing any damage to the patients sight. The chest wound had an entry and exit, which together with the fractured ribs eventually healed, and his lung expanded. He was eventually discharged and returned to the UK.

(iv) Other ranks were not expected to fraternize with female officers (I met my wife a lieutenant in the Queen Alexandra's Nursing Corps QARANC who was a "Sister" on a surgical ward at the hospital – someone once said that rules were made for the absolution of most and for the guidance of others!)

(v) We did not wear film badges to record whether or not we had received any radiation. (I have two grown up daughters and four grandchildren).

(vi) Mass Miniature Radiography on the repatriated prisoners of was performed. After exposure the 35mm film was wound around a 15 x 12 hanger with the emulsion side facing outwards and simply placed in the developer, ensuring the fluid level was above the top loops of the wound on film. A crude system but if there were any doubtful images the person involved was recalled for a full size image to be taken in the department.

(vii) The comradeship of all the forces and ranks involved was fabulous. Everyone simply got on with his or her jobs. It sickens me when I read that there is an essence of "Bullying" especially within the field of radiography. I would have thought that allegedly intelligent people would be above that sort of behaviour.

In October 1953 I returned to the UK on the "Empire Orwell" troopship and passed my MSR(R) part 11 (Finals) in the November. I was then posted to Cowglen Military Hospital, Glasgow. This was a single-handed post in a hospital that was simply made up of "Nissan Huts". One of these huts contained the X-ray department. The radiologist was Dr Urquart who was a civilian who came in once a week to do barium meals and IVPs. It was whilst in this post that I receive a request form from one of the wards requesting that an ECG be carried out. I rang the sister on the ward and

told her that the form had been sent to me by mistake. A short time later I was informed by one of the medical officers that after a 30 minute course of instruction from him I was qualified, as far as he was concerned, to carry out ECG examinations. I recall that when doing an EGG on the wards one had to ensure that nobody else used any of the power sockets otherwise the graph reading may indicate a cardiac disorder. I hasten to add that this is the only hospital in which I carried out an ECG examination.

After a couple of months at Cowglen I was posted to the Army X-ray School as a Sgt Instructor (Anatomy – Physiology and Positioning) where I remained until demobilization in November 1954.

After my demobilization leave t took up a post as a basic grade radiographer in Walton Hospital Liverpool. After working for a month I was presented with a cheque for what amounted to be just above what my fortnightly pay was in the Army. When I realized that this cheque represented a months pay I handed in my notice straight away. Like most soldiers leaving the Army I had to seek employment with comparable opportunities to the forces. I decided to join the Police Force.

I joined the Liverpool City Police, but by now my wife had found accommodation in her part of the country (Durham). I did not have enough service in to transfer so I resigned and joined Durham Constabulary in May 1955. I served in this constabulary for 30 years, eventually reaching the rank of chief inspector. After the normal probationary period and beat duty, I served in the Fingerprint Branch, the Serious Incident Squad as both an enquiry officer and a scene of crime examiner. From 1965 to 1980 I was seconded to the Home Office Forensic Science Laboratories at both Newcastle and Wetherby as senior police liaison officer.

In 1980 I returned to Durham Constabulary and eventually became officer in charge of the Durham Constabulary Scientific Aids Training. This school trained personnel from all over the world in the subjects of fingerprints, photography, scene of crime examination and the collection and submission of samples to the forensic science laboratories.

In 1985 I retired from the police service and have since undertaken, one day a week, voluntary work in the X-ray department at one of the local community hospitals. Due to letting my “State Registration and Membership to the Society of Radiographers” lapse, I no longer X-ray the patients. However I do the darkroom and clerical duties and thoroughly enjoy my time back in the radiographic environment. Due to the generosity of the radiographer at the hospital, who lets me have sight of radiographic magazines, I manage to theoretically keep up to date with what is happening in the “modern world of radiography”.

I am sometimes asked what are some of the things that I find different in radiography since I started to that of the present day. It goes without much comment that CT, MRI, Ultra Sound, Nuclear Medicine and such like were not available in my time. Apart from such things I will outline a few of the more mundane practices which differ.

In the 1950s patients produced an X-ray request form at reception. The particulars were copied, by hand, into a "main register and results book". The examination was given a consecutive number in the year concerned. This number was written on the request form, which was then handed to the radiographer. The patient was X-rayed and the form would be clipped to the cassette (in the case of more than one cassette it would be clipped on the top cassette and a note of the number of cassettes used recorded on the request form). In the darkroom the patients name and consecutive number would be pencilled onto one edge of the film. The film would be placed in a hanger, then into the developer (making sure that the liquid level was high enough to cover the top of the film and the film was not scratched by a metal silver recovery plate already in the tank). Agitation of the film was important to ensure that there were no air bubbles adhering to the film surface. Development time was usually 5 minutes at 65 degrees Fahrenheit. The film in its hanger was removed from the developer and allowed to drain, then into a rinse spray or tank, then into the fixer tank for at least 5 minutes. After fixation the film and hanger would go into the wash tank for about 20 minutes. The film would then be removed from its hanger and be hung up in a drying cabinet until dry (usually about 30 minutes). The whole developing to dried film process took something in the region of an hour.

When the films were dry the name of the patient, consecutive X-ray number on the request form plus the date were written in white ink along one edge of the film. This task (and it was a task) was usually carried out by the radiographer on call. The films would be married up with the request forms together with the X-ray envelope with the patient's particulars (hand written) on it. This package would all be set out for the radiologist to report on. He would write his findings on the back of the request form and the radiographer sitting in with him (part of the learning process) would copy the radiologist's report, by hand into the appropriate space in the "main register and report book". The leaves were detachable and could be clipped back into the book designed for the purpose; this ensured that the booking in of new patient was not interfered with. The request form containing the report was the returned to the doctor who requested the examination.

Sometime in 1951, a small curved guillotine device was introduced into the darkroom equipment. This machine was used for "rounding the corners off" on the hitherto squared cornered films. This was supposed to enable the films to be inserted into the envelopes without the danger of the sharp corners of the film ripping into to envelopes. In addition to this a small printing box was introduced which enabled a card with the patient particular printed on it to be photo-stated onto an unexposed corner of the film. This necessitated the insertion of an adequate sized piece of lead into the cassettes in front of the front intensifying screen. In the case of non-screen film you had to mark the corner where you had placed a piece of lead so that the person in the darkroom would know which corner to photo-stat the particulars onto (you hope they remembered after they took the film out of the envelope).

In those days there were only two types of film for us to use; screen and non-screen. The screens were coated with calcium tungstate. They came in pairs; the thinnest screen was placed in the front of the cassette and the thicker one at the back. The thicker screen was placed at the back in order to compensate for the radiation having passed through the front screen and the film before reaching it (at least that is what I was taught). The screens were secured in the cassettes with double- sided sticky tape,

but it was a wise move to leave at least one known cassette with a loose front screen. This enabled you to insert an extra film between the back of the front part of the cassette and the back of the loose front screen in addition to a normal film between the screen. When such a technique was adopted one exposure gave you a normal radiograph plus a "soft tissue" picture. I used this technique on a number of occasions in Kure, Japan, when it was essential to localize foreign bodies prior to their removal.

The exposures used in those day were multiples of second as opposed to fractions of seconds used on high mA and kV equipment used these days. The darkroom chemicals all came in powder form and had to be thoroughly mixed with water and allowed to reach the correct temperature prior to use.

Radiographs were copied by means of placing the radiograph to be copied, in register with an unexposed film, in between the intensifying screens. The unexposed film was in register behind the one to be copied. An X-ray exposure was made which resulted in a "negative" image being produce on the originally un-expose film. After development this film would be placed in front of a second unexposed film, the procedure repeated, resulting in a second "positive" image being produced. A crude method I know but we did not have modern day copiers. These second copies were usually made at the request of one of the doctors for his personal file and served their purpose.

Film in use my day were 15 x 12, 12 x 10, 8 x 6, 6 x 4, occlusal and dental. As far as I am aware 17 x 14 and 17 x 7 films did not exist (forgive me for quoting the sizes in inches after all I am a bit long in the tooth).

There are many things that have improved the lot of today's radiographer such as the daylight image intensifier, daylight automatic developer units, developer and fixer chemicals in liquid form, light beam diaphragms, floating table tops, fast and fine grain cassettes, personal film badges, automatic "cut off" devices when an optimum radiation has been obtained, high m A and kV equipment. All these things plus CT and MRI techniques are all, as I see it, on the plus side of the profession. I have to say that there are things that I consider are on the minus side, such as reading about "Bullying taking place amongst allegedly intelligent X-ray staff" and the growing fear of "Litigation cases in the medical profession"

Lise Meitner, Austrian Physicist

By
Leslie Ramsey, Felixstowe, Suffolk

Lise Meitner, originally Elise, was born in Vienna on 7th November 1878, the third child of eight children of a lawyer father. The family was Jewish and the father had been one of the first Jewish men who were free to study and practice law, following a legal relaxation, some few years before Lise was born. As a family they distanced themselves from their Jewish past and all the children were later baptised as Catholics or Protestants.

Girls were excluded from university by law and also all university preparation courses. Lise left school at age fourteen and took to preparation for teaching French, a subject that did not require university education. However, by the time she completed this course the law was changed, so she compressed the missing preparation into two years of hard study and qualified for university entry in 1901.

She studied physics with Professor Franz Exner, a friend of Professor Röntgen from student days, who made Vienna an early centre for research in radioactivity, and she was fortunate in her
second year to study with Professor Ludwig Boltzmann, as he fully accepted female students at a time when many academics and male students treated woman students very badly. Among the reasons put forward for the rejection of female students were that they would become prey to mental illness and infertility, and that they would be a threat to the social and intellectual character of the university. However, Lise completed her course in 1905, began research for her doctorate, and was awarded this in the year following."

At the suggestion of a colleague, she devised apparatus to study the question whether alpha particles were scattered or simply absorbed in matter, and published her report in June 1907. Despite these successes there seemed no future for her as there were no women academics in Austrian universities, nor in the women's colleges.

At this time, aged 28, she asked her parents permission to go to Berlin for a few terms, as she was unaware that women were also excluded from Prussian universities. Her parents consented and she arrived in Berlin late in 1907.

She had met Max Planck in Vienna when he visited there following the suicide of Professor Boltzmann, and she managed to obtain special permission to attend his lectures. A naturally shy and reserved woman, in the all-male environment these traits were intensified. However, it was here she met Otto Hahn, a radio-chemist the same age as herself, and with a less formal manner which suited her shyness. Among her friends she could be lively and witty, but she never lost this innate shyness. At this early date in Berlin she was somewhat embarrassed by the Austrian accent of her spoken German but Hahn reassured her by relating his own faux pas when speaking English during his stay in London. Their academic interests were the same, and their respective strengths in physics and chemistry being complementary, they began what was to become a long-term collaboration and friendship.

Recognising that simply attending lectures was insufficient use of her time, she gained permission to work in a carpenter's former workshop in the basement of the Chemistry Institute, entering and leaving only through a separate outside entrance. She was not allowed to enter any other part of the building, even the laboratory where Hahn was working.

The following year she went home to Vienna, was baptised as a Protestant, and requested her parents' permission to return to Berlin for another year. They consented and in that year she and Hahn published three major articles, and six more in the year following.

She lived frugally in a succession of rented rooms, with her work punctuated by little else than her love of music, of flowers and gardens and of long country walks. To supplement her small allowance she wrote regularly for a popular scientific journal. The editor of an encyclopaedia was impressed by these articles and invited her to contribute, but on learning that he was dealing with a woman, a Fraulein Doktor, withdrew his offer.

In 1908 she met Rutherford, who was on his way home from having received a Nobel prize, and the following year she was invited to lecture at a scientific congress in Salzburg on her discovery of two new groups of beta emitters. Following her address she met Albert Einstein, who also lectured on his concept that matter should be thought of as condensed energy.

Later, Max Planck, who was always kind to her, appointed her his assistant, the first woman in such a post, and her first salaried position. In 1912 she and Hahn were given charge of the radioactivity section of the newly built and set up Kaiser Wilhelm Institute for Chemistry at Dahlem, suburban Berlin.

When war broke out in August 1914 she went immediately to Vienna, to see her brothers off to the war, and to enquire of the Red Cross of their need for nurses, but the training courses were all full. In September she returned to Berlin and signed up for training as an x-ray technician. No result came from this and she continued working in the laboratory. However, by the summer of 1915 she discovered that Marie Curie had set up a mobile radiological service behind the lines in France, so in July she returned to Vienna and volunteered as an x-ray nurse/technician in the Austrian army.

Within a short time she received training and in August was sent to a military hospital in Lemberg, then in Galicia (now Lvov and in the Ukraine), near the Russian front. Here she worked in the local Technical Institute“ ’converted into a hospital, and assisted with operations until the x-ray unit was serviceable. When no x-ray work was required she continued to assist at operations, giving
anaesthetics and general help, such as repairing broken electrical and other apparatus. The reality of war came to her as a profound shock. She had followed with admiration the early successes of the German armies in France and Belgium, and had seen Austrian soldiers in festive mood leave Vienna for the front in 1914, but work in the hospital changed her attitude.

When the fighting died down in 1916 she requested a transfer and was eventually sent to Trento, then in Austria (now in Italy), but work was still scarce. As a result of a new Russian offensive she was returned to the Eastern front at Lublin in Poland, but by September returned to the Kaiser Wilhelm Institute in Berlin.

In January 1917 she was promoted head of section and, together with Hahn, who almost all this time was serving in the German army in Belgium, submitted a paper in March 1918 on the mother substance of Actinium, a new element they proposed should be called Protactinium.

In the autumn of 1918, when the war ended, she worked for a time with Albert Einstein, who since 1914, had been Director of the Kaiser Wilhelm Institute for

Physics. In the summer of 1919 she became Director of the physics section of the Chemistry Institute, with the title of Assistant Professor, being the first woman in Prussia to receive this title.

During the 1920s she continued working on beta radiation, winning a number of awards, and in 1926 became Professor of Berlin University, the first woman university professor in the whole of Germany. Another chemist, Fritz Strassmann, came to the Kaiser Wilhelm Institute in 1929 and subsequently Meitner and Strassmann became good friends.

In 1933/34 the Nazis came to power in Germany and this caused increasing difficulties. Party members were given priority for all public offices, Jews were ousted from their jobs, which were given to Party members, often regardless of their qualifications or suitability. Lack of sympathy for the Party or implicit opposition was punished, and Strassmann was demoted and reduced to half pay. Later, during the second war, at great risk to themselves, Strassmann and his wife hid a Jewish friend in their apartment for some months. Meitner was banned from teaching, but was allowed to continue research. She was in some degree fortunate in that she was of Austrian, not German nationality, and also that the Chemistry Institute was private and not a government organisation.

In 1932 James Chadwick had discovered the neutron, thus resolving the conundrum of the differences in size between the atomic number and the atomic weight of an element. In 1933 the Joliot-Curies in Paris had made the first artificial radio-isotope and in 1934 Enrico Fermi bombarded many elements with neutrons and found that neutrons which were slowed or moderated were more effective in action. In this work Fermi believed that the changes which occurred in the material bombarded produced new elements, not found in nature, heavier than uranium and which he called trans-uranium elements. Fermi's findings inspired Meitner and Hahn to recommence their collaboration, and Strassmann was asked to join their team.

In 1936 Max von Laue, supported by Eisenberg and Planck, (whose son was later executed by the Nazis) nominated Meitner and Hahn for a Nobel Prize, but shortly afterwards German nationals were forbidden to accept them. Following the German Anschluss with Austria in March 1938 Meitner realised the end was near. In Vienna, where some of her family still lived, the notorious Adolf Eichmann began a career of expropriation, extortion and transportation to death camps against all Jews.

Meitner would have been welcomed in the USA, but was disinclined to go there; she was commended to Professor Lindemann at Oxford, but this came to nothing, possibly because he was said to be unsympathetic to women; she applied to Copenhagen, but the Danes, like other small countries bordering Germany, were nervous, and refused her a visa on the ground that they no longer recognised her Austrian passport. Holland was unsuitable as university posts were unavailable to foreigners, but then the imminence of the enforcement of a policy of preventing all scientists leaving Germany, forced her hand. With the aid of Dutch friends she was helped across the Dutch border and travelled on to Stockholm. In August 1938 the Nazi Minister of Education, unaware that she had gone, wrote to dismiss her from her professorship, referring in the letter to her Jewish blood, which to the Nazis was inherently tainted. Hitler himself would seem to have had a special aversion to atomic

research, sometimes referring to nuclear physics as Jewish physics, and this possibly helps to account for the lack of Nazi effort for producing a nuclear bomb.

Meanwhile Hahn and Strassmann continued working on irradiating uranium with slow neutrons, resulting in what they believed were two successive alpha processes and in isomers of radium. This they completely failed to understand. In November 1938, Niels Bohr invited Hahn to Copenhagen, at the same time as Meitner from Stockholm, and they met secretly. Meitner was astonished at these results, told Hahn they were a physicist's nightmare, and urged he and Strassmann rigorously to re-examine their findings. Meitner's opinion carried so much weight that the necessary extra work was immediately undertaken.

The two chemists were then startled to find that what they had thought was radium was in fact barium. This was startling because current conventional scientific wisdom was that neutron irradiation changed elements only one or two places, and it was held impossible for them to be broken into large fragments as the change from 92 to 56, uranium to barium, implied. It was this conviction that had forced Fermi (and later others) to believe that he had created transuranium elements. Hahn then sent these amazing results to Meitner. She considered Bohrs concept of the nucleus of an atom as a liquid drop, and that neutrons might cause the nucleus to break up in a similar way. Supposing the analysis for barium to be correct, with uranium at 92, and barium at 56, this would produce another element at 36. Krypton is a rare gas of atomic number 36, that Hahn could very easily have overlooked. Following the analogy of a drop of water, which breaks in two when its size is large and its surface tension is low, the theory began to seem tenable. She raced to see her nephew, Otto Frisch, with whom she was spending the Christmas holidays, and calculated the energy released by the loss of mass involved in the division. They were awed by the enormous energy in the answer. How this amount could have remained unnoticed, they could explain only by the very small quantities in use. Frisch was persuaded, and set about checking by practical means whether such energy was released.

When Niels Bohr was told of these events, he immediately agreed their reasoning must be the true explanation, and said they must publish at once. To speed publication they submitted a note locally and then a letter to Nature, which was published on 11th February 1939. Frisch then confirmed the chemical findings with physical evidence, a report of which was published in Nature on the 18th February, band asked a biologist what name biologists gave to the process of living cell division into two parts. The answer being binary fission, Frisch proposed the use of the word fission in the nuclear context. Fission giving rise to enormous energy naturally raised the possibility of creating a neutron chain reaction from the excess neutrons liberated and therefore a super bomb.

Bohr went on a visit to the USA, and talked to Albert Einstein (who had left the Berlin Physics Institute in 1933, as another Director, Professor Peter Debye was soon to do likewise). Following discussions among other physicists, Einstein wrote to President Roosevelt in September 1939 about the potential danger of the Nazis creating a nuclear bomb. The danger had become more pressing, as early in 1939 Germany had gained control of the whole of Czechoslovakia, which included the uranium mines of St Joachimstal (now Jackymov, in the Czech Republic). President

Roosevelt took the threat seriously and this led eventually to the Manhattan Project and the atomic bomb.

From 1938 Meitner worked at the Nobel Physical Institute and in the spring of 1945, the war in Europe over and the bomb dropped on Hiroshima, the National Broadcasting Company of America asked Meitner to agree to a broadcast interview with Mrs Roosevelt, the recently bereaved widow of the late President. Fortunately, she was able first to question a man from USA who had followed the atomic bomb programme there, as she knew nothing of this until the first public announcements. She asked first whether heavy water had been used, and how did they obtain sufficient uranium 235.

The interview with Mrs Roosevelt however, covered no technicalities, only such matters as the responsibilities of women and world control of nuclear power. The NBC interviewer said it was difficult to believe that this sprightly small person, with brown eyes, a friendly smile and boundless energy was 66 years old.

During the war, in 1944, Otto Hahn had been awarded the Nobel Prize for chemistry, although the award was not made until 1947, when Meitner attended the ceremony, and in the same year she moved to work at the Royal Swedish Academy of Engineering Sciences.

She retired in 1960 at eighty-one years of age, as a Swedish citizen, and came to live in England, mainly to be near some of her relatives, in particular Otto Frisch, who had become Director of Nuclear Physics at the Cavendish Laboratories in Cambridge. She was a foreign member of the Royal Society and in 1965, jointly with Hahn and Strassmann, was awarded the Fermi Prize.
She died in October 1968 and was buried in Bramley, near Basingstoke in Hampshire, where her younger brother Walter also lay buried.

More than twenty years after her death it was proposed that a particular element should be named in her memory, and in 1997 this was approved. With the symbol Mt, element atomic number 109 is now called Meitnerium, and will serve as a permanent memorial to her life and work.

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7. Nature, L Meitner and O R Frisch, 143, (11th February 1939) p. 239-40. Disintegration of uranium by neutrons: a new type of nuclear reaction.
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9. The Times of London, 28th October (1968) Obituary

Cuthbert Andrews

Notes from the papers of the late Derek Guttery.

I have been very pleased to have received copies of papers fron the late Derek Guttery given to me by his son. The following relates to the late Cuthbert Andrews, past-President of the British Institute of Radiology and a pioneer manufacturer of X-ray apparatus. These notes have not been edited and I am sure that Derek would have wanted to change them for an article.

When Cuthbert Andrews died in 1972 at the age of ninety, he was, without question, the *pater familias* of the British X-ray industry despite coming from a family with a background of several successive generations of publishers and printers and the intention that he too would become a printer in his father's small steam printing works at 31 Museum Street, Bloomsbury. When his father died, Cuthbert was obliged at the early age of 17 to take over responsibility for running the business. When it failed about five years later, he secured himself a position at 30 shillings a week in the microscopical department of Watson & Sons of High Holborn, a long-established manufacturer of microscopes and other scientific instruments. During 1896, Watson's had also started a small basement department – always identified in the company's early catalogues as Department No.7 – for the supply of X-ray apparatus. From time to time Andrews was called upon to assist in this department and many years later described how he used to load a "growler" or four-wheeled horse-drawn cab with an induction coil, an X-ray tube and a set of accumulators and travel to a patient's home to undertake contract radiography for a now long-forgotten concern called the Clinical Research Association. Andrews left Watson's in 1903 – by which time he had become by his own account a very competent microscopist and photomicrographer and a slightly less than competent radiographer – and spent the next six years as a travelling salesman for the pharmaceutical products of an American company.

In 1909, Geoffrey Pearce – a personal friend and former colleague at Watson's and later to become a leading figure in the British X-ray industry himself – introduced Andrews to C.H.F.Müller, a highly-respected Hamburg X-ray tubemaker, who was looking for someone to start a small factory to assemble and eventually to manufacture Müller tubes in Britain. A similar local manufacturing facility for Müller tubes was already in operation in Paris. Until then, all Müller tubes sold in Britain had been imported from Germany through X-ray trade houses such as Watson & Sons, Newton & Co. and Harry W. Cox. Andrews' salary as manager was to be £3 a week with an added inducement of commission according to the results achieved. In June, 1910, with an initial capital sum of £100 advanced by Müller, Andrews equipped a small workshop in the basement of Number 35 Hatton Garden where he assembled some of the primitive manufacturing and test equipment himself. Müller sent over a vacuum specialist and two skilled glassblowers from Hamburg to train the English workers in the art of tubemaking and in October 1911 the business moved to more commodious premises at 47 Red Lion Street, High Holborn. By March 1912, Andrews was able to proclaim in his press advertisements that "all Muller tubes for the British and Colonial market are now made in London".

In January 1914, Müller published his first and only British catalogue of X-ray tubes – a rather fine quarto production in dark grey-green wrappers containing 68 pages of text and six full-page Autochrome colour plates and no doubt benefiting from Andrews' earlier experience as a printer. Barely six months later the First World War was declared and the company almost immediately confiscated by the Custodian of Enemy Property. Rather surprisingly, the three skilled German workers were left more or less unmolested by the authorities and continued making tubes throughout the duration of the war. By 1915 Andrews had managed to raise the £250 needed to buy back the company from the Custodian and for the next 35 years it continued as a wholly-owned family business engaged in the design, manufacture and marketing of X-ray tubes and associated accessories for medical applications. By the time the vacuum tube side of the business was sold to the General Radiological Company in 1948, Andrews claimed to have made over 30,000 tubes of 75 different types and ratings; in fact, from about 1930 onwards, his little company was virtually the only manufacturer of conventional sealed-off glass-envelope X-tubes in the British Empire.

Aside from his business activities, Andrews was also deeply involved with the Röntgen Society – of which he became a life member in 1913 – and with its successor, the British Institute of Radiology, being elected to Council in 1920, to the Presidential Chair in 1953 and to Honorary Membership two years later. He was also a very committed and important member of the first Committee on Radiation Protection from its inception in 1923 until its demise in 1953.

Cuthbert Andrews (1882 - 1972) Elected Röntgen Society 4 February 1913; paid life subscription 3 March, 1917

1903 - 1907. Cuthbert Andrews employed in Microscopy [No.2] Department of W Watson & Sons, 313 High Holborn. X-ray [No.7] Department was then situated in the basement at the rear of the building. Staff included Geoffrey Pearce [from 1903], F D Owen-King [from c.1904] and, Arthur C. Gunstone [from 1906; later to work for X-rays Limited, Solus Electrical and Philips Electrical].

Watsons imported C.H.F.Müller tubes from Hamburg from about 1903 and marketed them with paper label 'Supplied by W Watson & Son' pasted on tube neck. Standard 6-7" Müller-manufactured tube subsequently sold without Müller trademark as Watson 'Penetrator'. Harry W Cox appears to have sold identical Hamburg product during same period as his own Gold Medal 'Record' tube.

In 1909, Geoffrey Pearce introduced Andrews to Müller of Hamburg who wanted someone to start the manufacture of tubes in London. A similar local manufacturing facility was already in operation in Paris. C.H.F.Müller is not known to have ever visited England. Did Andrews perhaps go to Hamburg? Or was the 'introduction' to the company rather than to the owner?

Pre-1910 Müller advertisements state that Muller tubes - 'as hitherto' - may be obtained through any of the leading dealers in London and the provinces.

January 1910 Müller advertisement offered 12 different models of tube

In June, 1910 Andrews equipped a small workshop in the basement of 35 Hatton Garden with an initial capital of £100 provided by Müller.

July 1910. C.H.F.Muller announcement in *Journal* 'In order to more adequately deal with our increasing British demand, and to overcome difficulties of transit, repair, etc., we have established a depot at 35, Hatton Garden, London, E.C. where a full stock is carried, and where every attention is given to order and enquiries. Telegraphic address: 'Florenzius, London' (Florenz was one of C.H.F.Müller's Christian names). Similar announcement in 2 July issue of *The Lancet*. With publication of this advertisement, and forever thereafter, Muller becomes Anglicised by removal of the umlaut from 'u'

C.H.F.Muller of 35 Hatton Garden first appears in London Post Office directory

Mammoth tube introduced in July 1911

October 1911 announcement in *Journal* and *Archives* 'in consequence of the greatly increased demand for Muller Tubes, the business of our English branch has been removed to our new premises 47, Red Lion Street, High Holborn, W.C. [Damaged by incendiaries during second World War]

1911 announcement in *Archives* that Muller tubes now available with new Lindemann glass window.

'Glass and X-ray Tubes - An important advance in glass manufacture for scientific purposes has been made in connection with tubes for radiographic work. It is well known that glass containing a large proportion of lead absorbs the rays, and so is useless for the construction of the tubes, and for this reason it is used to make spectacles to protect the eyes of X-ray workers. Soda glass has been used up to the present time for the tubes themselves, and also for the many other vacuum tubes now employed in physical and astronomical measurements. It has now been ascertained that glass made with lithium instead of soda is about twice as transparent to the X-rays that are responsible for the formation of the photographic image. Special tubes have been made by Messrs Müller which are provided with a lithium glass "window," through which the rays are discharged from the anti-cathode. The window is about 2in. diameter, and is fused into the bulb immediately opposite the anti-cathode. The result is that by using these tubes the exposures necessary for radiographic work are reduced by about 50 per cent. This is an important matter owing to the danger of dermatitis from exposure to the rays, and more especially from the operator's point of view. Any decrease in exposure also tends to increase the possible technique in the photographs, as even with the very rapid modern apparatus it is often difficult to give sufficiently short exposures to secure images unblurred by movement on the part of the patient.'

TIMES Engineering Supplement, Wednesday, December 27, 1911. page 15c.

The above mentioned announcement is also noted as abstract 133 in *The Journal of the Society of Glass Technology*, 4 (1920)
Duncan (George Sang) *Bibliography of Glass (from the earliest records to 1940).* Dawsons of Pall Mall for the Society of Glass Technology. 1960.

It is interesting that in 1911 H J Powell of the Whitefriars Glass Works undertook experiments in 'windows' for X-ray 'bulbs' ; the most successful glass contained lithium borate. *(A Flint-Glass Works Manager's Notes, 1875-1915)*

November 1912 announcement in *Archives* 'We have now completed arrangements for the Manufacture (under Patent Rights), in our English Factory, of Muller Tubes with Wolfram (Tungsten) Targets, The types to be made include our Rapid, Cyclop and Mammoth Tubes' [Previous standard targets were platinum on nickel or copper backing. Iridium, osmium, palladium, rhodium, gold, silver, nickel, copper and tantalum targets were also available to order for special applications]

A Catalogue of Muller X-ray Tubes Manufactured in London. Undated but advertised as 'now ready' in January 1914 issue of *The Journal of the Röntgen Society*. Title page carries Müller trade mark with windmill and Anglicised legend 'Original Muller X Ray Tube' within a roundel . (cf. 'Original Müller Röntgenröhre'). Factory and offices 47, Red Lion Street, High Holborn. 50 different types and sizes of tube offered. *Catalogue* contains six full-page coloured plates of 'gas' X-ray tubes exhibiting different degrees of fluorescence. During telecon with Richard Andrews on 13 December, 1988 he referred to illustrations being made by an artist in water colour. However, Cuthbert Andrews states in *Half a Century of Shadows* (Welbeck Memorial Lecture, 1956) 'I was rather proud of having produced, I think in 1912, colour photographs of tubes actually working - which, you will I am sure realise, set up a slight problem. The plates were destroyed during the war but the colour prints on the table will give you an idea of how an X-ray tube looked at that time.' [The preface to the 1914 catalogue also states 'The coloured plates showing tubes working in different conditions are all from actual photographs of Muller tubes.'] [The only colour system readily available at that time was the starch grain 'Autochrome' process invented by the Lumière brothers in 1903 and first marketed in 1907. The clearly visible lenticular screen on the printed illustrations would seem to confirm that the original photographs were made with Autochrome plates. The Institute of Metal was the first British learned society to use the Autochrome process to illustrate a technical paper. (see *Engineering - An Illustrated Weekly Journal*. Vol.XCII (1911), page 734b (Dec. 1), s.v. 'Institute of Metals'.] The same illustrations of tubes were used with expanded descriptive text in Andrew's post-war catalogues (c.1920 - 24) and, with his permission, also published elsewhere. Andrew's early use of colour to demonstrate the different patterns of fluorescence characteristics of 'gas' tubes in operation had previously been used in textbooks such as W A Pusey & E W Caldwell's *The Practical Applications of the Roentgen Ray* (1903); M K Kassabian's *Roentgen Rays and Electro-Therapeutics* (1907) and Sinclair Tousey's *Medical Electricity, Röntgen Rays & Radium* (1910). The usual method of producing photographs of energised 'gas' tubes was to use the light of fluorescence in conjunction with a pinhole camera and is the technique adopted for the monochrome illustrations of energised X-ray tubes in Seth Hirsch's *Principles and Practice of Roentgenological Technique* (New York, 1920).

War declared 4 August 1914

A separate trading company, Males & Andrews, established at Walworth Road [?Iliffe Yard] to manufacture tube metalwork. [Building was *neither damaged nor*

destroyed by bombing during 1939-45 war; it was the Lorrimore works that was damaged]. [Andrews Collection at Science Museum contains 4pp leaflet (c.193-) 'Males and Andrews. Scientific instrument makers' What else did they make? Perhaps microscopes/optical instruments? Was this the progenitor of Premise Engineering (James)?

"The word parlous aptly describes the condition of the English glass trade before the war...

"The unfortunate condition of the glass trade was attributed by men of science to ignorance and want of initiative on the part of the manufacturers; but by the manufacturers it was attributed to free trade, unfair trading conditions, and to the gulf dividing industrial from academic chemistry....

"French and German soda-glass could be purchased at 3¾d. per lb...[prior to 1914]

"In justice to the English manufacturers it must be remembered that the German and Austrian furnaces and pots were and are adapted for melting a leadless glass, whereas the English furnaces and pots were adapted for melting a glass containing lead..." Powell (H .J.) *Glassmaking in England.* Cambridge, 1923: Chapter XV 'Glass-Making during the War, 1914-18'

Immediately after the outbreak of war, the Registrar of the Royal Institute of Chemistry informed the Secretary of State for War that a number of Fellows and Associates of the Institute, with special knowledge were available for scientific work on behalf of the country. Subsequently, a Glass Research Committee was appointed to consider what steps should be taken to ensure a satisfactory supply of glass and porcelain apparatus and filter paper and to undertake research in the Institute's laboratories and prepare formulae for alumina-soda glasses which would be made freely available to manufacturers. The research was to be under the direction of Professor Herbert Jackson and Mr T.R.Merton and undertaken at Kings College, London. Glass companies or tube makers involved included:
A.C.Cossor; James Powell (Whitefriars); Wood Bros, Barnsley; L.P.Casela (*Proceedings the Royal Institute of Chemistry* 1914-15)

Professor W E S Turner set up a Department of Glass Technology at Sheffield University during 1914-18 war to apply science to glass making. Subsequently led to formation of Society of Glass Technology. Glass Research Association, subsidised by Government, also founded

An inaugural meeting was held on November 9, 1916 in the Chemistry Lecture Theatre of the University of Sheffield to consider the formation of a Society of Glass Technology.

The Vice-Chancellor in his welcoming address referred to the fact that the glass industry had, amongst others, suffered in the past by its detachment, wholly or partially, from its scientific aspects.

Dr W.E.S.Turner outlined the steps that led up to the formation of the Society and said that 'There was the desire amongst manufacturers everywhere for closer

association with one another and for contact with science and men of science, by which means alone the deadening influences of generations past could be overcome.'

At the second meeting of the Society on December 14, 1916, the Edinburgh and Leith Flint Glass Company exhibited electric lamp and X-ray bulbs.
Journal of the Society of Glass Technology, Vol.1, 1917*
*[Vols 1 - 43, 1917 - 1959. Science Museum Library TS 332 A]

A history of the origin and development of the Society of Glass Technology is at pp.146 - 220 of *Glass Technology*, Vol.7, No.5 (October 1966). Science Museum Lib. JG 775 BQ

1915. London branch of C.H.F.MULLER purchased from Custodian of Enemy Property [?for £200] [Enemy Trading Act, 1915. (cf. Sanitas Electrical Company of Soho Square)]. Cuthbert Andrew's nephew, John Dedrickson FRYE (1893-1981), joined company and thereafter learnt his trade as a tube designer. London trade mark changed to roundel with legend 'Andrews Rapid X Ray tubes' encircling outline drawing of stationery anode and telegraphic address to 'Exrayze'

2 November 1915 Cuthbert Andrews exhibited at a General Meeting of the Röntgen Society a Mammoth or Moment type X-ray tube for heavy discharge work; a water-cooled X-ray tube for use above or below the couch; and a heavy anode tube 'made of British glass, having all the characteristics of the best German glass. These tubes showed the characteristic green fluorescence, and were manufactured throughout in London' (Jnl. Rön. Soc. Jan., 1916, p.10)

Andrews often-quoted aphorism 'an X-ray tube is a sphere of glass entirely surrounded by profanity' would appear to have originated at a General Meeting of the Röntgen Society on Tuesday, May 1, 1917 during the discussions following Geoffrey Pearce's address 'The Future of the British X-ray Industry' The meeting was held at the Cancer Hospital (Free), Fulham Road.

During same discussion, Andrews stated 'there are in this country only four firms who actually manufacture tubes on a commercial basis' [presumably, he was thinking of Andrews, Newton & Wright, A.C.Cossor and ? A E Dean. If so, what about G C Aimer, H Helm (66 Hatton Garden), J.J.Hicks (8, 9 & 10 Hatton Garden), Reynolds & Branson (13 Briggate, Leeds), Baird & Tatlock (14 Cross Street, Hatton Garden) and other small British X-ray tube makers of the period?] 'Prior to the war, a large number of these instruments were imported from Germany, France and America, and those made in this country were dependent upon Germany for their material. On the outbreak of war very great difficulties arose in this connection, but fortunately we were able to surmount these, and now, with one exception, everything required for the manufacture of X-ray tubes can be produced in Great Britain' The exception was a satisfactory quality of tungsten. Andrews later refers to the interest of the Ministry of Munitions in the question of tube production and the formation of a sub-committee of most tube manufacturers to work in conjunction with the Optical and Glassware Section of the M of M. A laboratory under the supervision of Professor Herbert Jackson had also been established with the object of carrying out research work for the improvement of manufacturing methods.

Armistice, 11 November 1918

Tests undertaken for the Controller of Optical Munitions and Glassware in December 1918 of 6 samples of X-ray tubes submitted by Cuthbert Andrews, A C Cossor, A E Dean and Newton & Wright. 6 sample tubes of Macalaster-Wiggin and Machlett manufacture also tested. (Results of tests announced in *Archives* February 1919)

A Catalogue of Next-Ray Tubes. 24-page jeu d'esprit (illustrated by *PUNCH* artist Geo[rge] M[orrow]). Mailed so as to arrive in first post on 1 April 1919. (Jnl. Rön. Soc., July 1919, p.68). One of many similar productions. (See Andrews Collection in Science Museum)

X-RAYS LIMITED [Incorporating High Tension Company (Mortimor Codd 1902), F R Butt & Company Limited, and X-ray Tubes Limited (operating independently at Queens Park, Kilburn)]. Founded 1919 with Head Office at 11 Torrington Place, Gower Street, W.C.1. and factory at Devonshire Grove, Old Kent Road.
Chairman Sir Henry Outram Bax-Ironside KCMG (former career diplomat)
Managing Director J W Mason
Research [Director] Mortimor A Codd
Director and Works Manager J S Cooper
Director & Technician A C Gunstone
Director and Chief Engineer F D Owen-King.
Works Manager (from 1921) Fred Butt (following incorporation of Frederick R Butt Ltd)

Gunstone and Owen-King joined X-rays Limited in January 1920 (Both were ex-Watson's where they had worked from early 1900's.) Owen-King left X-rays Limited in about April 1924 following a major disagreement with other directors and later joined GRSA (founded March 1924) where, in 1928, he succeeded H Rocky as M.D. Gunstone later joined E J W Watkinson's Solus Electrical Company of Judd Street. In September 1925 [following one of several financial crises] 'the Directors of X-rays Limited placed responsibility for the conduct of their business in the hands of Mr Cuthbert Andrews, who has been connected with the industry for many years, and uninterruptedly since 1909' Thereafter, 'the entire organisation was under [his] personal supervision' until enforced liquidation in 1933. Andrews also produced at least one illustrated catalogue in his characteristic style containing personal reminiscences. By 1929, offices, showrooms and service department were at 47 Red Lion Street, High Holborn W.C.1. (From where Andrews had operated since October 1911)

X-rays Limited marketed Andrews 'gas' tubes ('Self-rectifying', 'Leviathan', 'Therapex', and 'Annulex') together with 'electron' tubes by Candex, Coolidge, Müller and Philips ('Metalix').

Andrews bought residue of X-rays Limited stock following liquidation

A Catalogue of Andrews X-ray Tubes manufactured in London by Cuthbert Andrews (c.1920): p.18, compares the relative virtues of hot-cathode and 'gas' tubes [Coolidge and Lilienfield] 'Unfortunately, all attempts by British X-ray manufacturers to obtain facilities for the production of hot-cathode tubes in this country have proved

unsuccessful, so that this type of instrument remains a foreign product, and owing to the extraordinary operation of the patent laws, British X-ray tube manufacturers are obliged to remain under the stigma of being "unenterprising," "incompetent," or whatever other adjective suits the fancy of the critic at the moment.' [?Coolidge tube manufactured in England by B.T.H. under licence from G.E.] B.T.H. Coolidge tube patent (1913) expired in June1928. B.T.H. applied for an extension which was opposed in Chancery on 25 July, 1929 by Newton & Wright, Cuthbert Andrews and A E Dean. However, Mr Justice Luxmore granted an extension for one year. (*Electrical Review*, 02.08.29, p.201).

1929 Richard Andrews joins company.

April 1929 BJR carries advertisement for 'new' [British made self-protected] **CANDEX** 'trough focus' hot cathode tube. Available as 6 or 8 kW. @ £35.0 0; 10kW. @ £38 10 0. Radiator [air] or water-cooled.

16 May 1929. Cuthbert Andrews showed tube at General Meeting of the BIR and announced that the fact it had been produced by 'a little back-room worker in a slum off High Holborn', [i.e. 47 Red Lion Street] was not going to be exactly popular in some quarters. Patent applied for. Gave credit to 'fellow conspirator' John Frye 'for detail work which brought the apparatus to its present condition'. Showed record of a series of practical tests by Frederick Melville [a well-known radiographer of ?University College; Secretary of the Society of Radiographers 1927-54]. 'Trough focus' indicates Otto Goetze line-focus principle. Tube subsequently advertised in June 1929 BJR as Andrews **PROTEXRAY** tube and exhibited in November 1929 on Andrews' stand at BIR Autumn Meeting Exhibition at Central Hall Westminster.

Andrews claimed to have made 30,000 tubes of something like 75 different types and ratings during the period 1910 - 1948. Andrews certainly dominated the U.K. market for 'gas' tubes during the period 1914 - 1929 and this is confirmed by the high percentage of Andrews products amongst gas tubes sold at Christies scientific instrument sales during the past five years or offered for sale by dealers elsewhere. From 1929, and the more or less general adoption of 'electron' or 'hot-cathode' tubes by even the most conservative of radiologists, there was increasingly strong competition from overseas companies such as GE (Coolidge), Machlett, Siemens (e.g. the Multix), and Philips (Metalix). The Andrews tube manufacturing business was sold in 1948 to Solus Electronic Tubes at 56 High Road, Bushey [part of General Radiological].

Addresses: Engineering works: Iliffe Yard, S.E.17. (?Same premises as those later occupied by BATRAY (Lisle) and/or WINDINGS LTD. (Smith)
Walworth Road [?Lorrimore Works] [Is this the same as Ilife Yard? Both Amelia Street and Iliffe Street run off Walworth Road, S.E.17]
Stores: 35 Red Lion Street, W.C.1.
14 Woodland Road, Bushey (Temporary Offices, 1946 following destruction of Red Lion Street premises by enemy action
Tube works also (1946) partly at Highfield Road and Chalk Hill, Bushey.)
Lorrimore Works, Walworth (1946)

F D Owen-King)

J Cayley-Mann)
L F Szilagi) Directors at various times of General Radiological
C N Rocky)
H Rocky)

Cayley-Mann later founded deaf-aid manufacturer Fortiphone. Son worked for Prof Steiner at Hammersmith Hospital

Frederick R Butt & Co. Ltd. 8 Stanhope Street, N.W.1. Established in 1908 following liquidation of H W Cox . Subsequently incorporated in X-rays Limited Meanwhile, H W Cox re-formed as Cox Cavendish.
Fred Butt (died 1 August 1937 @ 60) Business associate of Cuthbert Andrews. First started work with Harry W Cox

Tube makers: G C Aimer (from 1903) .] Mortimor Market, Tottenham Court Road. [Brothers H J B and G C Aimer.] H.J.B. died in January 1951 at age of 62. Six fingers amputated as consequence of radiation injury. G C Aimer apprenticed to A E Dean, Hatton Garden where he was involved in glass blowing. H J B was known personally to Cuthbert Andrews. [C A was probably instrumental in arranging for the pension H J B received from the Electrical Benevolent Association] Aimer was still advertising 'gas' tubes in 1929. (Company still trading as scientific glass blowers: Aimer Products Limited, Unit 6, Plaza Business Centre, Stockingswater Lane, Brimsdown, Enfield, Middlesex, EN3 7PH. 081 804 8282)

Harry W Cox (c.1870-1937) Pioneer X-ray equipment manufacturer 1901-1909. Two sons. One son was Stanley Cox who later formed own X-ray company Stanley Cox Limited at 39 Gerrard Street, W.1. H W Cox reported to be commemorated in Hackney Town Hall but memorial not found.

Schall & Schall [*Archives,* September 1917], established 1887
Schall & Son [*Archives,* November 1917], established 1887.

Norman Cordingly (Newton Victor) (Died just before Christmas 1993) *From a Cat's Whisker Beginning* 1988 (Merlin Books, Braughton, Devon)

And finally:

As promised a few interesting (?) web sites that I thought you might find interesting.....

Phil (Hollaway)

General (in no particular order)

http://www.atomicrocks.com/
http://www.mtn.org/quack/devices/radium.htm
http://www.mtn.org/quack/devices/devindx.htm
http://www.orau.com/ptp/collection/quackcures/quackcures.htm

http://www.ratical.org/radiation/KillingOurOwn/
http://tis-nt.eh.doe.gov/ohre/index.html
http://www.quackmedicine.com/
http://www.lvstrings.com/menu6.htm
http://www.orcbs.msu.edu/radiation/radhistory/radfiguresmain.html
http://www.umich.edu/~radinfo/introduction/50yrs.html#top

http://edison.rutgers.edu/patents/00865367.PDF
(this is a copy of Thomas Edison's patent for the X-ray light bulb!)

http://perso.wanadoo.fr/daniel.giroux/a-rayon.htm#radiologie
http://www.radiantslab.com/quackmed/Deanbio.html
http://radiantslab.com/quackmed/
http://www.arcsandsparks.com/
http://www.nukes.org/MAp/museum.html
http://www.runet.edu/~wkovarik/hist/radium.html
http://128.227.67.137/other/histmed/klioze/index.html
http://www.umich.edu/~radinfo/introduction/timeline.html
http://www.voltnet.com/
http://my.ecplaza.net/sgw/
http://www.netcomuk.co.uk/~wwl/geissler.html