The Invisible Light

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Editorial Notes

I hope everyone likes this second issue of 'The Invisible Light' in this our 20th Anniversary Year. Our Radiology History Committee was founded back in 1987. Do please consider getting involved in our committee. Contact me if you are interested. I would be delighted to include any of your articles in the next issue of 'The Invisible Light.' Please send me any material that you have. This journal is available on-line to members. If you wish to receive it in that way please contact Jean Barrett jean.barrett@ntlworld.com

It is a particular pleasure to have the articles by Noreen and Muriel Chesney. I took the photographs of the Chesney's at UKRC in Birmingham in 2006.

Ian Isherwood has written for us on the origins of CT. Ian's papers are now lodged in the Special Collections Library of the The John Rylands University Library in Manchester. Ian says "the papers are quite extensive and include details of the first commercial CT brain scanner in the world and the first general purpose scanner in Europe, both of which were in my department in1973 and 1975 respectively, together with the first commercial cryogenic MR unit in 1983. The paper contain a lot of information on the History of Radiology generally, including Schuster, Barclay, Twining and a record of the fist carotid angio in 1933." A grant was obtained from the Wellcome Institute to archive all the papers.

The AGM and annual lecture of the BSHR is to be held at the BIR on February 25th 2008. Liz Beckman will be speaking on "Sir Godfrey Hounsfield - the man who gave us Medical Imaging for the 21st Century." We welcome Liz as a trustee of the BSHR.

Adrian

Dr Adrian M K Thomas BSc FRCP FRCR FBIR
Wednesday, 28th November 2007

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The British Society for the History of Medicine.

The Society has no individual membership, membership of an affiliated society automatically makes one a member. It is governed by an officers and representatives committee which meets annually, and is comprised of the officers and one or more representatives of each affiliated society.

I attended the Officers and Representatives Meeting of the British Society for the History of Medicine held during the 22nd Congress at the West Park Centre, University of Dundee on the 5th September 2007. John Ward stepped down as President and David Wright became the new President. Fiona Davidson is the new Secretary and Tina Mathews continues as Treasurer. Sue Weir was elected Vice-President and Geoffrey Davenport was elected as the ISHM (International Society for the History of Medicine) representative. The web site is www.bshm.org.uk and we were encouraged to visit it. The next Officers and Representatives Meeting will be on the 25th March 21008 to coincide with the Poynter Lecture. The 2008 Poynter Lecture will be given by Martin Webb who is Professor of the History of Art at the University of Oxford. His subject will be Leonardo da Vinci. The lecture is to be held on the 25th March 2008 and will be at the Wellcome Trust building in Euston Road at 6pm with refreshments at 5pm. There may be a visit to the Wellcome Collection organised at 3pm. The meeting will have no charge.
The 23rd Congress of the BSHM will be held in Belfast in September 2009.

Recent books and articles on the History of Radiology

An Illustrated History of the Royal Northern Hospital 1856 - 1992

The Royal Northern Hospital stood on Holloway Road for 136 years before it sadly closed its doors in 1992. With its beautiful architecture and a flow of leading, forward thinking staff and supporters, the Royal Northern has provided over a century of medical and social history.

In a wonderfully compiled book by Dr Albert Rinsler the history of the Royal Northern is told, from its birth in York Road in 1856, to its move in 1888 to Grove House Estate in Holloway, as well as its many amalgamations with hospitals around the city.

Dr Rinsler's interest in art and photography are apparent in insightful chapters that explore the relationship and influences the Royal Northern, once the Great Northern, has had on certain masterpieces of the Victorian era. Throughout, the book is laced with similar winning details that characterise the hospital and the areas and people surrounding it. Accompanied by an impressive array of photographs, maps, and illustrations, the reader is never left without a full picture of the history and the people who guided it.

Dr Albert Rinsler qualified from Kings College hospital in 1947, becoming a General Practitioner several years on and practiced in North London. The following year he became honorary clinical photographer to the Royal Northern Hospital and the Whittington Hospital for nine years and has produced exhibitions connected with the history of both hospitals. In 2005 he co-produced a short documentary film, *Two Pioneers of Surgery*, which he had originally filmed in 1943 when he was a pre-clinical medical student.

An Illustrated History of the Royal Northern Hospital, can be purchased in the Press and Communications office at the Whittington Hospital for £5 or by sending a cheque payable for £6 which inc post and packing to Whittington Hospital Charitable Funds

The Whittington Hospital Charitable Fund
Fundraising Office
Magdala Avenue
London N19 5NF
T: 020 7288 5641

Interesting Web sites

National Inventors Hall of Fame

Godfrey Newbold Hounsfield (Born August 28, 1919 - April 12, 2004): Apparatus for Examining a Body by Means of Penetrating Radiation. Patent #: 3,965,357

Lu Lariccia of the National Inventors Hall of Fame (221 S. Broadway St. Akron, OH llariccia@invent.org) wrote "I am happy to inform you that Godfrey Hounsfield is one of the inventors who will be inducted into the National Inventors Hall of Fame this Friday, May 4, 2007." You can see the profile at http://www.invent.org/hall_of_fame/342.html

Antique X-Ray Tubes and Accessories: Dr. HAKIM'S COLLECTION

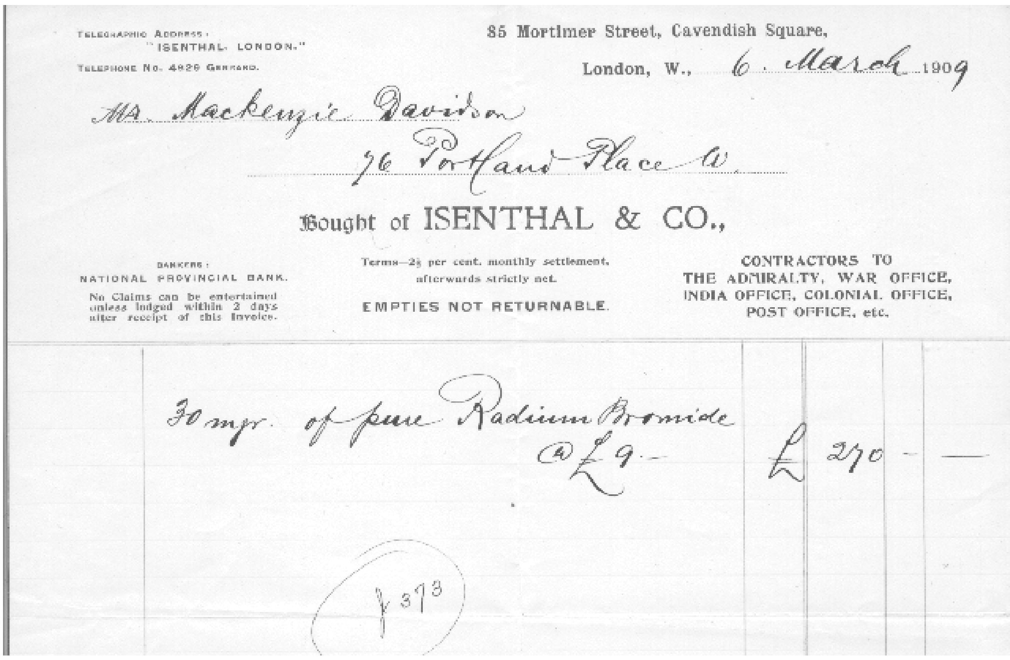
http://home.comcast.net/~znhakim Updated May 2007
The web site was made by Zhao N. Hakim, MD, actively involved in Radiology since 1957. He has succeeded during his long career in building a personal collection of antique X-Ray tubes and accessories, some of which he is happy to show, with some comments, in the web site.

The items shown fall into the following categories: "Cold Cathode" Ion Tubes, "Hot Cathode" Air Cooled Tubes (Coolidge), Oil-Immersed Fixed Anode Tubes and Tubes with dedicated functions, Air-Cooled Kenotrons, Oil-Immersed Kenotrons, Historical Artifacts.

Inquiries, comments and corrections are most welcome to znhakim@cyberia.net.lb
The website may also be directly accessed at the address www.earlytubes.com

Mackenzie Davidson Radium Bill (Isenthal)(1909)

Malcolm Davidson writes that he has pulled up a cost of living calculator and that 270 quid is now about 10 grand!!



TELEGRAPHIC ADDRESS: "ISENTHAL, LONDON."
TELEPHONE No. 4829 GERRARD.

85 Mortimer Street, Cavendish Square,
London, W., 6 March 1909

Mr Mackenzie Davidson
76 Portland Place W

Bought of ISENTHAL & CO.,

BANKERS: NATIONAL PROVINCIAL BANK.
No Claims can be entertained unless lodged within 2 days after receipt of this Invoice.

Terms—2½ per cent. monthly settlement, afterwards strictly net.
EMPTIES NOT RETURNABLE.

CONTRACTORS TO THE ADMIRALTY, WAR OFFICE, INDIA OFFICE, COLONIAL OFFICE, POST OFFICE, etc.

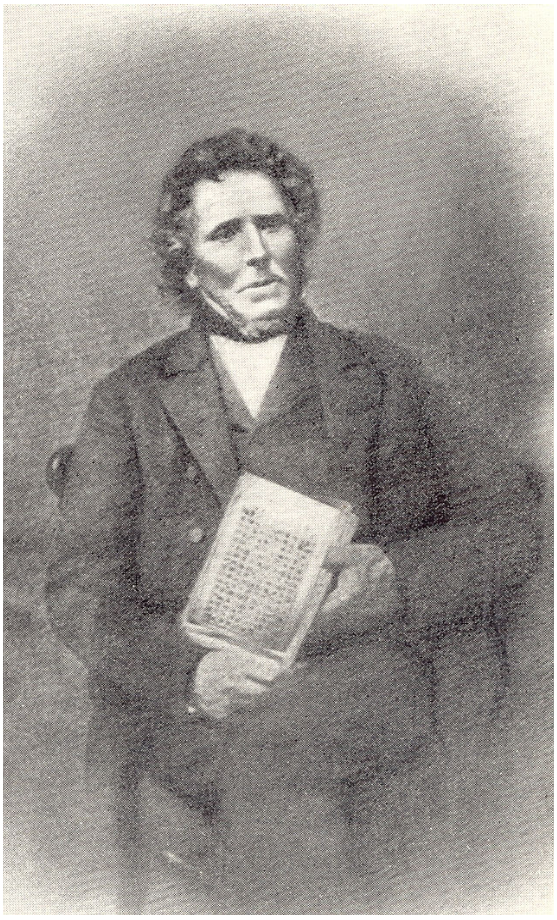
30 mgr. of pure Radium Bromide @ £9 – £ 270 – —

f 373

James Bowman Lindsay
By Adrian Thomas

Whilst attending the British Society for the History of Medicine at the West Park Centre in Dundee, Dr Jean Guy suggested that I visit the nearby Western Cemetery to see a remarkable gravestone. I was not disappointed by the visit. The graveyard is in a lovely location overlooking the beautiful Tay.

James Bowman Lindsay was born at Carmyllie on the 8th September 1799 and died at Dundee on the 29th June 1862 at the age of 63 years. He is buried in the Western Cemetery in Dundee and the splendid monument (shown on the next page) was erected by public subscription in 1901. At the summit of the obelisk is the figure of a winged hand grasping and electric cable from which electric sparks are arising (shown on the front cover).



The inscription on the monument reads:

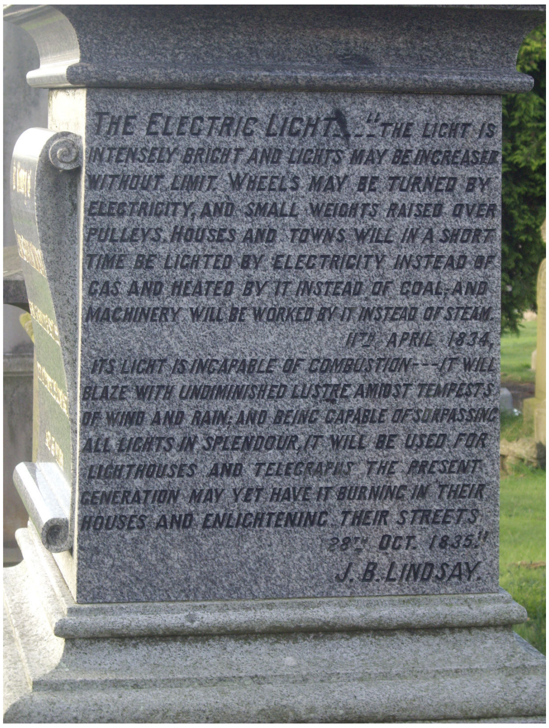
"A pioneer in electrical science, foretold the application of electricity as an illuminant, a motive power to replace steam, and a substitute for coal in heating. He devised an electric telegraphy, 1832, suggested welding by electricity, proposed a continuous electric light, 1835, proposed a submarine transatlantic telegraph, 1843, and accomplishes wireless telegraphy through water, 1853. As a philologist his attainments were extraordinary; in 1828 he began the compilation of a dictionary in fifty languages, uncompleted when he died. An accomplished scientist a profound student and an earnest Christian."

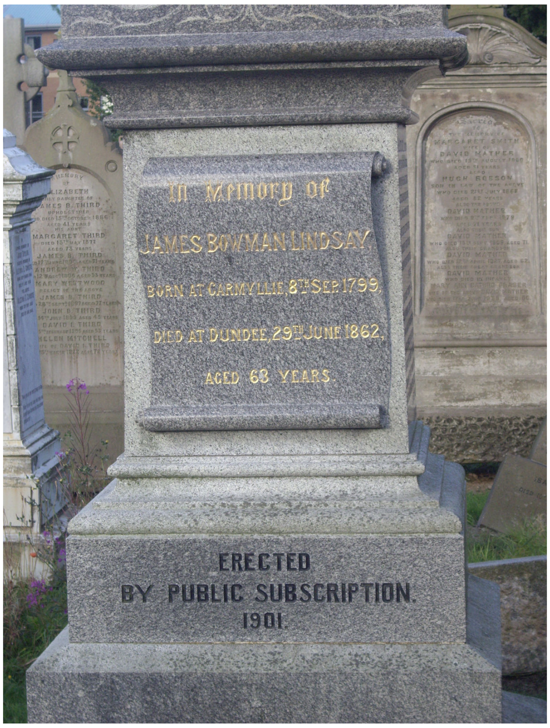
I had never heard of James Bowman Lindsay before I visited Dundee. His work on wireless telegraphy was important and Marconi wrote that Lindsay was the first man who thoroughly believed in to possibility and utility of long distance wireless telegraphy. Lindsay used water as a medium for telegraphy and Marconi rather more effectively used than air. Fahie called Lindsay "the father of electric Lighting."

The Electric Light:

"The light is intensely bright and lights may be increased without limit. Wheels may be turned by electricity, and small weights raised over pulleys. Housed and towns will in a short time be lighted by electricity instead of gas and heated by it instead of coal, and machinery will be worked by it instead of steam."
11th April 1834

"Its light is incapable of combustion --- it will blaze with undiminished lustre amidst tempests of wind and rain; and being capable of surpassing all lights in splendour it will be used for lighthouses and telegraphs. The present generation may yet have it burning in their houses and enlightening their streets."
28th October 1835





The grave of James Bowman Lindsay at the Western Cemetery in Dundee

Reference: James Bowman Lindsay and other Pioneers of Invention, A H Millar (1925) Dundee

The History of CT – A Personal View
Professor Ian Isherwood CBE
Emeritus Professor of Diagnostic Radiology, University of Manchester

Churchill liked to say that he spoke and wrote about history the way the Canadian Pacific Railway was built. 'First I lay the track from coast to coast and after that I put in the stations'. So, on one coast, so to speak, on the 8th of February 1896, only 2 months after Rontgen's discovery, Wm Randolph Hearst, the newspaper magnate, sent a telegram to Thomas Edison

'Will you as an especial favour undertake to make a cathodograph of the human brain. Kindly telegraph answer at our expense.'

Edison tried but of course failed. His great invention in 1877 had been the phonograph. An inversion of this name produced, in 1898, the Gramophone Company who bought a painting of Nipper, a bemused dog, listening to the horn of an Edison phonograph, entitled 'His Master's Voice' – a trademark which still persists. Marconiphone and Columbia, both rival companies, went on to merge with the Gramophone Company to form a new firm – Electrical and Musical Industries (EMI). It is ironic that this new firm, albeit some 70 years later, managed to produce, on the opposite Churchillian coast, the very images so craved by Randolph Hearst and now, 100 years later <u>we</u> can present, with spiral multislice techniques in 3 dimensional format.

I entered radiological training in Manchester in 1955, as the first Macdonald's opened, when percutaneous carotid and vertebral angiography, and tumbling pneumencephalograms were the norm. One of the reasons for my additional training in Scandinavia was to learn about the new Seldinger method of intravascular catheterisation. It was a revelation to see Amundsen in Oslo actually using a femoral catheter to demonstrate the cerebral circulation! It was an even greater revelation, however to witness in Stockholm, in both the Seraphimer and the Karolinska Hostpitals, the daily interaction between senior radiologists and engineers in both hospital and factory and the influence this interaction had in placing radiology in the centre of the hospital and at the forefront of clinical care.

The key developments of the 1950's in addition to the Seldinger technique were, of course, the Image Intensifier and Television enabling the exploitation of the relationship between the detector and the observer. Yet even when combined with conventional tomography for example in the 360 degree rotating Mimer unit, it was still only possible to produce 2 dimensional representations of a 3 dimensional patient – with wet film processing!

From the 1960's there had been a microprocessor revolution with the number of functions per device increasing by a factor of 10, year on year, from 100 in 1960 to a million in 1990. Godfrey Hounsfield before developing CT, had made notable advances in computer memory design. The first digital computer developed here in Manchester in the 1950's occupied 2 large rooms to achieve a fraction of the capacity of a current iPod! In 1967 Hounsfield moved to the Central Research Laboratories of EMI and into the field of automatic pattern recognition where he realised that much information was being lost to inefficient data retrieval. He wondered if it might be possible 'to determine what was in a box by taking readings at all angles through it'. The contemporaneous development of computer technology, the microprocessor revolution and the notion of the skull as a box provided the ideal circumstances.

My personal road to Damascus occurred on a visit to my friend and contemporary, James Ambrose, at the Atkinson Morley's Hospital in December 1971. The purpose of the visit, with superintendent radiographer Hilary Jarvis, was to visit some new myelographic equipment. Instead Ambrose invited me to see, in an entirely separate part of the department, the prototype of a new device he and Godfrey Hounsfield were developing, it seemed to me, along the Scandinavian principles of a strong collaboration between medicine and industry and what's more it was British, supported and actively encouraged by the Department of Health!

A cross section of a brain had been demonstrated with an 80x80 matrix. The 80x80 matrix, incidentally, resulted from the original 10 inch square plastic box used by Hounsfield to develop the rotate translate system eventually used in the CT 1000. He had needed to rotate a screw through one turn to advance the beam by one-eighth of an inch. Eighty traverses were needed to cover the 10inch box and the process was repeated with each rotation. Hence 80x80. This process with a gamma source using a rotate-translate system required 9 days to acquire the data and 2.5 hours to reconstruct the image on a large main frame computer. Replacing the gamma source with finely collimated X-rays reduced the scanning time to 9 hours. The scanning procedure was limited to the head because of the water bag, which was required as a reference material. It surrounded the skull like a bathing cap but a real patient with a frontal cystic tumour had, by then, been demonstrated on the prototype machine.

I arrived home full of excitement – my wife remembers it still – about this extraordinary X-ray technique which could demonstrate the brain without recourse to air or any other contrast agent. The following day I wrote to the Department of Health praising its potential and offering to hep in assisting its clinical role. On February 19 1972 I received an encouraging letter from the Department. Two months later on the 20th of April Hounsfield and Ambrose gave their seminal paper to the BIR. Later that year the Department of Health acquired 3 units from EMI and one was offered to Manchester. The other two were placed in Queen Square and Glasgow. Within 6 months, in Manchester with full support of the hospital administration, we had a purpose built extension to the Neuroradiology Department at a cost of £10,000 and the first commercial Emiscanner in the world – the CT 1000 – up and running! Try that in 2007! The scanning procedure was still limited to the head because of the water bath and the patient had to be secured firmly into it by restraining bands under the buttocks. The water bath was inclined to leak. If it did, it had to be removed by unscrewing 360 screws by hand. Slices 13 mm in thickness were acquired 2 at a time using the 80x80 matrix and the rotate translate principle. Reproducibility was not easy and required close attention to positioning.

Research grants for staff and materials were obtained from the D of H, the University, the RHA and EMI and the first clinical scan on this Manchester system was carried out in July 1973. Two further units were then bought directly by the Mayo Clinic and the Massachusetts General Hospital for trials in the United States. EMI at that time, of course, was concerned principally with the manufacture of vinyl records and electronic equipment. The Beatles who recorded under the EMI label provided the most significant financial input into the company at that time – EMI had no previous experience of medical technology and the learning curve for both industry and medicine proved to be quite steep.

The purpose built extension to the Neuroradiology Department in Manchester was designed along the lines of the Atkinson Morley's development since this was the only role model. The control room was small and dominated by the digital printer. Results, in the early stages, necessitated evaluation of all the numerical data on the computer print out. The audible noise was deafening and frequently exceeded Health and Safety limits. Digital to analog conversion resulted in a grey scale image on the television monitor which, after appropriate radiological interaction, was then captured using a Polaroid camera. The raw data was stored either on floppy discs or, later, magnetic tape. The Polaroid images on hard copy presented an initial problem of display at the daily meetings of the clinical and radiological teams concerned with clinical management but was eventually solved by means of a television camera and a monitor.

One of our first examinations was of a deeply unconscious elderly female with a head injury sustained by falling down her cellar steps. The scan carried out immediately after admission revealed bilateral high density haematomas with a central pineal gland. Prior to CT it would have taken multiple burr holes to discover the extent of bleeding. As it was the patient was taken straight to theatre where the haematomas were evacuated and she made an excellent recovery. This single examination had a profound effect on neurosurgical colleagues and changed attitudes thereafter to the clinical management of head injuries. Indeed it was not long before any lack of CT facilities in the management of head injuries became a medico-legal issue. Demonstration of cystic and solid tumours together with differentiation of haemorrhage and infarct became routine.

There were, nevertheless, many new concepts for both radiologist and referring clinician to grasp – for example visualising detailed anatomy in cross section, a process familiar then to perhaps the neuropathologist but not to the radiologist and from which direction should the images be viewed and labelled – from above or below? Initially all images were viewed from above with the right marker on the viewer's right but this gave rise to real difficulties when body images came eventually to be viewed from below and the neck became a no-man's land! The fact that the grey scale image represented only the numerical data selected on interrogation by the radiologist was not always understood. As CT requests increased, however, so pneumoencephalographic and angiographic requests fell but the departmental work load in terms of the in patient-out ratio rose in proportion to 2:1.

News spread rapidly to both doctor and potential patient – not always accurately. One request was had was addressed to the 'Cat Skinning Department' and even Snoopy explained that there might be more than one way to scan a Cat! Requests for brain scans rained down, however, from all the clinical departments of the hospital. A prominent appointments board was established with colour coding for individual clinicians and out patient appointments to try and achieve and to demonstrate an equitable distribution. This appointments display was a focal point of interest during a visit, one of many from around the world, by Torgny Greitz of the Karolinska Hospital in Stockholm who had similar problems. The neurosurgeons were persuaded to examine as many requests as possible on the basis of no treatment, no scan – but even this failed to stem the avalanche and as a result a great deal of time was spent on explanations why waiting times were increasing to 4 and then to 6 months. By 1974 we had carried out 1653 scans and by 1976 almost 3000 at approximately 15 patients per day. Intravenous contrast – 50ml of Conray 420 – which of course doubled the scan time – had proved helpful in many pathological situations and was carried out in 60-70% of cases without complication.

It soon became apparent that despite original optimism there was in fact no clear correlation between tissue type and CT attenuation values due mainly to the large voxel size. We succeeded in demonstrating, however, that a chemical signature expressing atomic composition of tissue could be obtained by measuring the subtraction of information obtained from two different effective X-ray energies. The methodology for this process was published in the Journal of CAT. Such a dual energy technique made use of the fact that the photoelectric interaction of lower energy X-rays with tissue is highly dependent on Atomic Number whilst electron density, or mass per unit volume, is dependent on the Compton Effect at higher energies. The high density of blood clot, could be shown, for example, to be due to the large haemoglobin molecule and nothing at all to do with the iron content. It also accounted for the diminution in density of a haematoma over time and the importance of the original haematocrit in assessing an isodense subdural haematoma – factors which remained unappreciated for some years, even in the published literature. The dual energy method, with the added value of the water bath, proved of particular value in improving the accuracy of bone mineral measurement in trabecular bone using a home made device for introducing the forearm into the head scanner. CT was unique amongst the non invasive methods in permitting a separate assessment of trabecular and cortical bone in cross section – seen to best advantage in a colour display. In fact, the paper 'Bone Mineral Estimation by Computer Assisted Transverse Axial Tomography' – I. Isherwood et al in the Lancet Oct 2 1976, was probably the first demonstration of the potential for direct trabecular bone measurement.

In 1975 the first international conference on CT was held in Bermuda where by invitation we were privileged to present several papers on dual energy scanning, the clinical advantages of CT in head injuries, in tumours and in stroke and describe the development of a colour display unit. It was at this meeting that Godfrey Hounsfield announced a general purpose scanner which did not require a water bath and therefore enabled access to otherwise inaccessible parts of the body providing not only enhanced diagnostic possibilities but also more effective application of treatment programmes. His announcement was greeted with a standing ovation and a queue of Americans waving cheque books.

In 1975 I was appointed to the first Chair of Diagnostic Radiology in Manchester and with the aid of further research grants from the D of H, CRC, MRC, the local RHA, the University and EMI was able to install, in the new academic department in the Medical School, the first CT 5000 general purpose scanner in Europe. Because of the regional funding contribution and the location of the scanner it was important to try to serve the interests of all the clinicians in the North West whilst still retaining our research commitments. This we managed to do with closely defined protocols though not at times without lengthy and sometimes difficult negotiations! The CT 5000 coincided with the advent of Metrizamide, a new and relatively safe water soluble contrast agent suitable in dilute form for spinal examinations using CT.

Regular technical and clinical evaluation meetings were held with the D of H at Russell Square from July 1973 to June 1977 and later ad hoc meetings with EMI from 1977 to discuss instrument modifications and marketing. Complete sets of all these minutes and correspondence together with other papers have been placed in the University of Manchester John Rylands Library Special Collections. In 1976, by invitation, I lectured in China to try and promote British industry by which time unfortunately EMI was losing its grip on the annual percentage of the world market – from 100% in 1974 to 56% in 1976. The public perception was of an all seeing device which had to be available everywhere whatever the cost – public collections and private subscriptions were established and monies rapidly accumulated for the capital outlay. In Henecky's steak bar the appeal for one Emiscanner was unfortunately marred by the misprint which read 'For everyone who *dies* in the bar 20p will be donated to the fund'. What the public and indeed the Department of Health failed to understand was that the associated costs of medical, radiographic and nursing staff, not to mention portering and clerical staff, estimated then to be £100,000, simply could not be met by the local Health Service. This led inevitably to a very public debate on the role and value of high technology in medicine and an identification that prescribed drugs were a far greater drain on financial resources than CT. 20 years later in 1992 the number of CT units per million head of population in the UK was estimated at 3.6, that in the US was 30. The figure for Japan is now 107!

The earliest competition came from the US with the Acta scanner from Pfizer, then the Delta scanner by Ohio-Nuclear. At the RSNA in 1975 there were 10 companies offering Ct scanners but only 3, EMI, Pfizer and Ohio-Nuclear were delivering. By the 1976 RSNA only the same 3 were actually delivering. Ohio-Nuclear marketed its machine through Siemens. The most important competition came in 1977 from IGE, a world leader in X-ray equipment. EMI were already involved in expensive patent suits with IGE and others. By then 62% of the world total of 1130 scanners were made by EMI. Two thirds of this market was in the US and it was clear that there lay the most lucrative opportunities. EMI had a choice, it could continue with its British factory, license an American company or, to gain credence in the US market place find a new manufacturing location in the US. They chose the last option – alas one which led to their ultimate demise in the medical field. A combination of the cost containment policies of the US Federal Government, a failure to achieve full scale production in the new Illinois factory, patent issues, difficulties in recruitment of software and service engineers for an expanding market and the death of a key US engineer were too much. Beatle mania had gone and EMI were forced to reorganise by dropping their medical commitment and merging with Thorn Electrical Industries.

What made CT possible? – without doubt computer speed and the microprocessor. Many would say that CT had as great an impact on clinical medicine and surgery as Rontgen's earlier discovery of X-rays. It certainly had a profound effect on Radiology, liberating with the first step the brain of both patient and doctor from the constraints of traditional imagery. It introduced the concepts of digital data acquisition, sophisticated interactive display systems and powerful image processing to in vivo biological studies, at the same time providing a stimulus and scientific environment for other major developments to follow, including MRI.

I had many opportunities over the years to travel the world with Godfrey Hounsfield and never ceased to be amazed at his ability to retain Greenwich Mean Time in all locations. He was given numerous awards including the Nobel Prize and a Knighthood but had no formal university education. Indeed on the presentation of an Honorary Doctorate in Manchester his list of awards and Honorary Degrees was longer than his conventional CV including the publications! His words of advice to young relatives and Nobel Laureates alike was always 'Not to worry about passing exams so long as you have understood the subject'. He was a man without interest in power, position or possessions yet a man whose work contributed massively to the advance of human welfare across the globe.

AJP Taylor once said 'History is about what happens next' so let me finish this personal journey with a prayer I have entitled 'The Radiologist's Prayer':-

Our Hounsfield who art with EMI
Hallowed be thy scanner
Thy computer came and thy water bath
At EMI but not at others
Give us this day our digital data
And forgive us our errors
As we forgive those who err against us
Lead us not into misinterpretation
But deliver us from the pneumoencephalogram
For thine are the Departments, the X-rays and the microchip
For GE, Siemens and Philips for ever.
Amen.

The Hooded Anode: Facts and question marks
by Zahi N. Hakim, MD

In fixed focus tubes the copper hooded anode with a deeply imbedded tungsten target is extremely common (fig.1) and is often fitted with a beryllium window filter (Fig.2). The idea behind the hooded anode is to cut off extra-focal radiation from the anode while increasing the anode mass for a better thermal loadability.

Fig. 1

Fig. 2

Traditionally, it is common belief that W.D.Coolidge (of G.E.) is the inventor, in 1915. But did W.D.Coolidge in fact "invent" the hooded anode?

I didn't dig into the patent files and descriptions, but I would point out a few intriguing facts:

In his reputed and highly reliable book "The Trail of the Invisible Light" (*Charles.C.Thomas,1965*) and about the hooded anode, E.R.N.Grigg avoids the word *"invented"* and simply says (p.79) "In 1915 Coolidge *introduced* the hooded anode x-ray tube" and further (p.129) gives the brief definition: "Coolidge's hooded target was a metal shield placed around the focal spot".

This crisp definition of the hooded anode, incidentally, applies to 2 early cold-cathode x-ray tubes in my personal collection (*www.earlytubes.com*):

The first is the "Chabaud Tube" (Fig.3) introduced by the French scientist Victor Chabaud in the early years of the 20th Century, probably in, or prior to, 1905, where the platinum target is set deep inside a conical platinum hood (Fig.4).

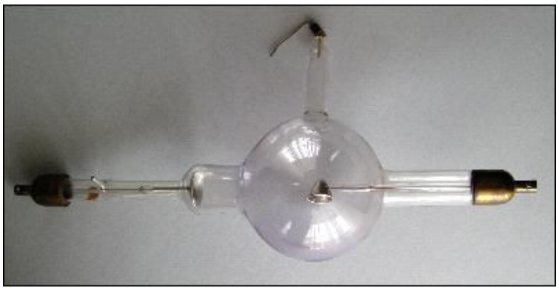


Fig.3

Fig.4

The second is a large-bulb cold-cathode tube, of unknown make, recently acquired in Köln (Germany), and where the tungsten target sits deep inside a thick cylindrical metallic hood (Fig.5 and Fig.6), corresponding to a diagram (Fig.7), with a short mention, in a German book printed in 1912 (*p.11, Atlas Typischer Röntgenbilder, by Rudolf Grashey, J.F.Lehmann's Verlag").*

Fig.5

Fig.6

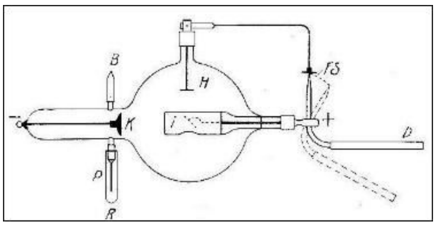


Fig.7

Finally, admitting W.D.Coolidge did in fact "*introduce* the hooded anode x-ray tube in 1915", why no hooded anodes are seen, neither in early Coolidge bulbar type tubes, nor in Coolidge tubes of the Twenties or the Thirties, not even in tubes made by G.E. ? In fact hooded anodes in their present form are first seen in the Forties, and mainly after WWII (i.e. some 30 years after 1915). Was this solely due to technical manufacturing difficulties in placing the tungsten target deep inside the copper anode?

The great merits of W.D.Coolidge in the field of radiology and his scientific integrity are definitely beyond any doubt. But, may be, the history of the hooded anode needs some investigation.

Zahi N. Hakim, MD
Radiologist

A Radiographer in Wartime
By Muriel Chesney

Does my age make me a genuine antique? No answer is required but I thought that the hint in the question might put a stamp of authenticity on recollections of early days in my training as a radiographer. I trained as a radiographer at the General Hospital Birmingham in the early 1940's and qualified in 1944.

A Victorian edifice
D.C. or A.C.?

The General Hospital Birmingham was built in the Victorian era. It was known as 'the new General Hospital' because it replaced the first General Hospital which was in a Georgian mansion on another site. The new hospital was considered to be completely up-to-date and 'modern' as a hospital.

I was surprised to find in 1942 that some of its wards had a D.C. supply from the mains sockets. Others had advanced to A.C. supply. We needed to know which wards gave A.C. and which ones gave D.C. only. How was it possible to operate a small portable X-ray set from a D.C. supply? Answer: easily if you tale a rotary converter (D.C. to A.C.) with you. We differed from that opinion. Easy it was not.

The rotary converter was a massive piece of equipment. Its working parts were enclosed in a heavy iron cylinder which was firmly bolted to a four-wheel trolley. This trolley had the solidity of a farmer's horse-drawn cart constructed of stout timber. At its front was a metal handle of suitable strength to serve as a means of hauling the trolley. We were mostly the haulers. A well-trained donkey would have been a help but I did not know of any asses – well, not four-legged ones – who were employed by the General Hospital.

The converter was noisy in operation and shrieked a wail which rose and fell. This must have been bad enough in peacetime when you took it into a ward of sleeping patients. In 1942 and later it sounded like the siren which warned us of an air-raid. Oddly enough, it did not result in any panic that we can remember. Perhaps in those day people in hospital felt safe and thought themselves to be secure from any catastrophe that might be occurring outside.

Work in a mini-hospital

Just up the road from the General was a large branch of Lewises' department store. To aid the war effort, Lewises' turned its basement away from the retail business and allowed it to be set up as a hospital. There were a ward, an operating theatre and an X-ray department.

One day after an air raid I found myself going with others to work in the mini-hospital's X-ray department. As a junior student, I was to function as a darkroom technician and process the films. No automatic processing in those days!

Some of the patients being examined that day would undergo fluoroscopy in the search for impacted foreign bodies – for example bits of shrapnel. Nothing very elaborate would be done that day, I knew. In my mind then was a nightmare fantasy about impacted foreign bodies and it is of this that I now wish to tell you.

The radiographers of the day were required to master a technique for the exact localisation of an impacted foreign body. Certain radiographs had to be taken with precision, certain measurements must be made with the same faultless accuracy, certain calculations must be made. The radiographer was expected to be able to point to a marker on the skin-surface and say to the surgeon 'There's your point of entry, sir. It is directly above the F.B. and if you go down x no. of millimetres, you will be able to remove it.' In my alarming fantasy, the qualified radiographers had been killed in an air raid and it was my lot to carry out this procedure. Of course I get it wrong and must confront the most fearsome surgeon whom I know.

A comic ending

Lewises' laid on lunch in their restaurant for the hospital staff. In those days of rationing this free lunch was sumptuous indeed: pork chops with apple sauce and all the trimmings. I went up in the lift with the X-ray staff and the theatre staff which included the surgeon. Half-way up, the lift stuck and for a few minutes we were stranded. Those old lifts had doors which were open metal grids. I saw that the shoppers in the store, ignorant of our basement activities, were looking at us in wonderment. How did a surgeon in clinical dress come to be in the lift with hospital staff around him? I wonder if they ever found the answer.

A radiographer in the new Elizabethan age.
A memoir from Noreen Chesney

On February 5th 1952, Elizabeth II inherited the British throne. A month later, on March 17th, a similarly significant event occurred in the city of Coventry. Well, it was highly significant for me: I accepted a job there, and this was my first day! H.M. Elizabeth II has outlasted me in her post: I remained with Coventry and Warwickshire Hospital no longer than for the next thirty-three years.

Like the city itself, Coventry and Warwickshire Hospital was severely damaged by bombs during World War 2. At the time of my advent – and for many subsequent years – several wards occupied a former manor house in another district: paediatrics, obstetrics, some eye surgery, et al, were supported by certain requisite services. One of these props was an X-ray department: its single radiodiagnostic room, plus not much else, scarcely merited the title.

Back on the C.W.H. site, I understood that a new X-ray department had not survived the bombing. Rescued equipment had been re-installed temporarily in another part of the hospital (Temporary = you'll be there for 30 years). This other part of the hospital was in fact a separate small building on one edge of the area. Its circular structure and tall sloping roof brought thoughts of a dovecote to mind: it was known as Dept. 25 for a reason which I never discovered. Once I asked and elderly patients if he knew what had been the use of Dept. 25 before the war: he told me of his tonsillectomy there as a child; some one else recalled its functioning as a kitchen. For these purposes, as for the guise in which I knew it, Dept. 25 has to be described as inconvenient. (There are stronger terms for it!)

If the siting of Dept. 25 entailed an awkwardness for its personnel ('Going across for lunch? You'll need an umbrella.'), for in-patients mere awkwardness must have expanded often enough to become suffering. By wheel chair or by stretcher, this was not a smooth trip; and even if you were then feeling reasonably bright, bad weather would offer an additional challenge to your power of endurance, I did not hear anyone who had just experienced a myelogram announce his fitness for the cross-country journey which lay between him and his bed on the ward: but I heard no complaint either. Their situation seemed to be universally accepted by Coventry's citizens as 'one of those things'.

Nevertheless, I was in sympathy with a patient who attended Dept. 25 during the week when Coventry's new modern cathedral was to be dedicated (1962). It was her opinion that the city should have had a new hospital ahead of that cathedral. 'You can pray to god anywhere,' she observed expressively, 'but you cannot have an operation in the gutter.'

Remarkably, it was in Dept. 25 that I was introduced to angiography, long before Coventry and Warwickshire Hospital acquired an AOT rapid film changer, nor indeed any hospital of my acquaintance then. This cassette changer was a unique production, devised, constructed and donated under the aegis of Captain Smith Clarke. Who, did you say…? Everyone at Coventry and Warwickshire Hospital knew who Captain Smith Clarke was: except me. He was an engineer by training, I supposed, but – at the time when I first made his acquaintance – he was a power in the land, or at least in one of Coventry's famous motor industries. Jaguar in Brown's Lane? Alvis on the Holyhead Road?

Like other equipment for rapid serial radiography of which I was to have later experience, the Smith Clarke changer collected a film (in this case a loaded cassette) from a stack in a protected station, and moved it to where it could be – and normally was – in receipt of a radiation exposure. The changer then must withdraw the exposed film, move it to a further protected station, and replace it with another film in readiness for the next exposure. The Smith Clarke changer was capable of all of that.

Today I cannot claim to be – and perhaps was not then – fully familiar with the springs, levers, and whatever, of the Smith Clarke changer. Externally it was a featureless, big, black, wooden box (suitable for blankets?), but longer, taller, narrower, and uglier than any respectable blanket box would likely be. It remained permanently in situ, parallel to the X-ray table and near enough for the over-table tube stand of the time to be turned across it.

Lifting the hinged lid of this box gave you access to the stacked cassettes (and also to 'the works' for anyone who needed to associate with them). The half-dozen cassettes (I am uncertain now of the precise number) were made ingeniously of cardboard: probably this was for the purpose of reducing their weight, but also must have been effective in limiting noise in the changer's operation.

The Smith Clarke changer moved films at a rate of one in 1.5 seconds: or it may have been one film in one second. Either way, it now seems incredible to me that our procedure was angiocardiography. A thoracic surgeon – Mr (later Prof.) Leigh Collis – journeyed from Birmingham's marble halls to officiate. I presume that the radiographs which we produced must have been helpful in some respect, or clinical requests for the examination would have ceased long before the march of medical science inevitably ensured that they did.

When (in the 1970's) we left Dept. 25 for a new, purpose built, radiological department (in the main hospital: rousing cheers!), the Smith Clarke cassette changer did not accompany us. Thought by then to be an interesting curio, it was moved across two driveways to a position of honour in the entrance hall of the Warwickshire Post-graduate Medical Centre. Whether it is still there, and whether anyone ever again examined or understood the Smith Clarke cassette changer, I do not know.

Of course I have other memories of Dept. 25, but my lasting thoughts are of its valiant spirit. That undersized, awkward, and overworked, building illustrated the truth that bricks and stones matter little beside the qualities of those with whom you share the work. I use the word share with consideration: Dept. 25 was the home ground of a strong team, who had a happy esprit de corps. When we left Dept. 25, we gave it a farewell party (we were rather good party organisers as well as good radiographers!). That night, some of us recognised that we might not immediately give to our new glossy radiological environment a comparable loyalty.

We've All Been On One Of Them
by Henry Crooks

When he visited the newly-formed Atomic Energy Research Establishment (AERE) at Harwell in 1947, the then Foreign Secretary, Ernest Bevin, was shown the Medical Department; seeing the x-ray table, he remarked, 'We've all been on one of them.' His words were not far from the truth, for it would seem that most members of the public have had an x-ray in one form or another, and in turn, suggest that the x-ray department is perhaps the most heavily involved of the hospital ancillary units.

During the course of their work, members of x-ray departments have met the high and low of society and can recall many interesting experiences: for instance, my AERE, Harwell radiographer colleague, Miss Jean Bowes-Lyon – a distant relative of the Queen Mother – told me that, when a radiographer at Great Ormond Street Children's Hospital, she x-rayed the very young Princess Alexandra and her brother, and had great difficulty in performing her task, for the royal children made the x-ray department into a mini playground, jumping on and off the x-ray table and swinging on anything available.

Other radiographers will have interesting episodes and coincidences, such as at RAMC, Shaftesbury Military Hospital in 1944, when a stocky sergeant attended for knee x-ray; his name was Alan Feeney, and I remembered, when a boy, seeing the Notts. County Football Club inside right of this name receive the ball, dribble past four defenders and score a brilliant goal; I mentioned this to the sergeant and he said, 'It was me. We beat Port Vale 2-1!' There were other memories from Shaftesbury, especially x-raying prisoners-of-war. We were taught basic instruction in French, Italian and German, which came in useful when I x-rayed the pelvis of an important German officer. He was wheeled into the department by two nurses, who helped him onto the x-ray table, watched by two well-armed red-cap officers, with hip dirks at the ready. The patient behaved perfectly, obeyed all instructions, and a perfect radiograph resulted. Also at Shaftesbury, during lumbar spine radiography, I discovered that my patient was a sometime leading violin member of both the London Symphony and BBC Symphony Orchestras and I, being a violinist of some accomplishment, one night after duty, wheeled him from his ward for him to give me some tuition – some years later by remarkable coincidence I sat next to him on a London bus and recalled our wartime experience in the x-ray department.

At the now-demolished Harrow Road Hospital, after a portable ward x-ray of a lady's hip, she said she was going to leave me all her money (but failed to take my name and address!).

While at AERE, Harwell, I performed diagnostic and routine radiography on many of the leading scientists of the day, including Klaus Fuchs and Bruno Pontecorvo, and this is worth recording in some detail, as there are historic connotations, and to follow-up a recent mention in the *Daily Telegraph* concerning these two atom spies.

Neil Tweedie and Peter Day: 'Personal Archives', *DT* May 22nd and David Barnard: 'Safe pair of hands', *DT* May 28th, have gallantly raked through MI5 files – top-secret and classified papers, concerning the spies Klaus Fuchs & Bruno Pontecorvo; the following will have escaped their notice.

As Radiographer/Experimental Officer in the Medical Division of the AERE, Harwell, January 1947 to September 1979, I was responsible for staff routine and diagnostic x-ray examinations and research into associated work, and I can recall exchanges with both Klaus Fuchs and Bruno Pontecorvo.

Rigorous radiation protection measures were high priority from the first days of AERE, Harwell, and thus director Professor (later Sir John) Cockcroft ordained that the necessary routine and diagnostic x-ray examinations should be conducted using the least possible radiation, and that research be conducted to meet these requirements. Thus at the end of 1947 techniques (some against set rules) succeeded in reducing x-ray exposure to one quarter that received in general practice, with no loss in radiographic film quality (1). When Fuchs attended for his routine chest radiography in late 1949, the x-ray reducing techniques had advanced further. Fuchs would have known of the work we were doing and enquired of the measures we had taken, and of course I divulged everything and showed him drawings of work in progress. He showed interest and asked questions concerning certain aspects.

About this time, a Theoretical Physics party was about to be held, to include a competition in identifying a young heads on adult bodies of division members, and a Theoretical Physics friend asked me to copy a photograph of infant Fuchs (we had photographic facilities). Unfortunately I slightly damaged the original photograph and, thinking that Fuchs would have known all about this, apologised for the slight damage I had caused to his photograph. He made no comment and it occurred to me that I had gaffed – knowledge of the competition did not come my way, or even if it took place.

When Fuchs was arrested, his colleagues and friends were appalled and another Theoretical Physics friend, speaking out of his respect for his chief, told me, 'I am not good enough to clean his shoes.'

Tweedie and Day suggest an affair between Fuchs and the wife of the deputy AERE director, Dr Skinner. I did not know of this, but had gathered that Fuchs had a young lady, who would be seen with him in his dark blue 2½-litre MG saloon, which later was put on sale for £170 – my pocket did not extend to this, but in any case was settled with my sporty Morris 8 drophead two-seater tourer, with the ominous number DKT <u>666</u>.

Jovial Bruno Pontecorvo (he could ride a bicycle seated on the handlebars) also attended for routine chest examination, but did not ask questions concerning our x-ray reducing techniques. He and his family were well liked, and when they disappeared, his friends and colleagues were shocked. their friendship can be judged when one evening the AERE first and second chess teams were on the way to Oxford to play in a chess match, but the second team was a man short, so one of the members suggested we call at Bruno's Abingdon AERE estate home and ask him to make up the second team numbers. He was at dinner but, after a quick bite, he joined the party. Science and chess are supposed to go together, but not on this occasion, because Bruno lost his game on board five (of six). However Bruno was out of practice, and probably met an opponent rather better than position five, which was often the case.

While hardly MI5 or secret material, this glimpse of life in the early days of the Atomic Energy Research Establishment, Harwell may be of interest, particularly the Fuchs episode of the infant photograph, which might have some significance.

I am certain that other radiologists and radiographers have had similar experiences which are worth recording, concerning some patients for x-ray examination, both on and off 'one of them'.

Note: (1) In his introduction to Protection in Diagnostic Radiology (Rutgers University Press, New Brunswick, New Jersey 1959), editor B.P. Sonnenblick writes: 'Ardran and his associates have made a series of admirable investigations in radiological protection. Ardran (Consultant Radiologist) and Crooks cite herein the radiographic factors and methods which in their experience at the Atomic Energy Research Establishment in England result in a notable reduction per exposure for many types of diagnostic films as compared with other published estimates. This study is often quoted, as well it deserves to be. Their results lead Ardran and Crooks to advocate the use of fast film (and screens), increase in added filtration of the primary beam (also limitation of extra local radiation, smallest beam area used and increased temperature of developer, allowing shorter exposures), and frequent use of higher kilovoltage in diagnostic examination.'

From one Profession to another and back again.
Thomas Charles Tipler

In 1955 I reluctantly left the Radiography profession, purely for financial reasons, and joined the Police Force. I served in the Durham Constabulary from 1955 to 1985. After completing the necessary probationary period and beat duties I was transferred to the force Fingerprint Branch in 1958 to 1960. From 1960 to 1967 I served on the Serious Incident Squads as an enquiry officer and scientific aids officer. These squads dealt with all types of 'major incidents' including scenes of murder and fatal accidents and were responsible for the photographing of scenes and collection and submission of samples to the Forensic Science Laboratory.

In 1967 I was seconded to the Home Office Forensic Science Laboratory, Gosforth, Newcastle-on-Tyne as a Police Liaison Officer. In 1977 this laboratory amalgamated with the Harrogate laboratory and became the Wetherby laboratory in Yorkshire where I took up the post of Senior Police Liason Officer. In 1980 I returned to the Durham Constabulary and eventually became Officer in Charge of the Scientific Aids Training School. I retired from this post and the Durham Constabulary in 1985.

Prior to becoming a 'Liaison Officer' I always associated Forensic Radiography as being confined purely with the medical/legal profession as a means to body identification, disclosure of non-accidental injuries and other medical applications, all of which are well documented. I soon realized that there was far more to it than what I had hitherto thought as a medical diagnostic radiographer. In order to demonstrate this I have recalled some of the instances where the use of radiography has assisted in the field of forensic investigations.

<u>Case 1</u>
A 5p coin and a metal strip, which formed part of the internal mechanism of a cigarette machine used by the general public, were submitted to the laboratory with the history of the coin having been found attached to the metal strip. It was suspected that the coin was counterfeit and that the metal strip was a magnetic anti-thief device to prevent faulty discs being used in the machine.

The coin appeared macroscopically to be perfectly genuine but on closer microscopic examination a circumferential join could be seen close to the edge on the obverse side. The coin weighed nearly 1.0g less than a genuine 5p. Further examination revealed that the metal strip was not magnetic and that the suspect coin could pick up metal paper clips. The question arose as to how a 5p coin could become a permanent magnet? The suspect coin was X-rayed alongside a genuine 5p coin (as a control). The radiograph revealed that the suspect coin had an outer casing, including a join at the edge, containing a disc, which subsequently proved to be a permanent magnet.

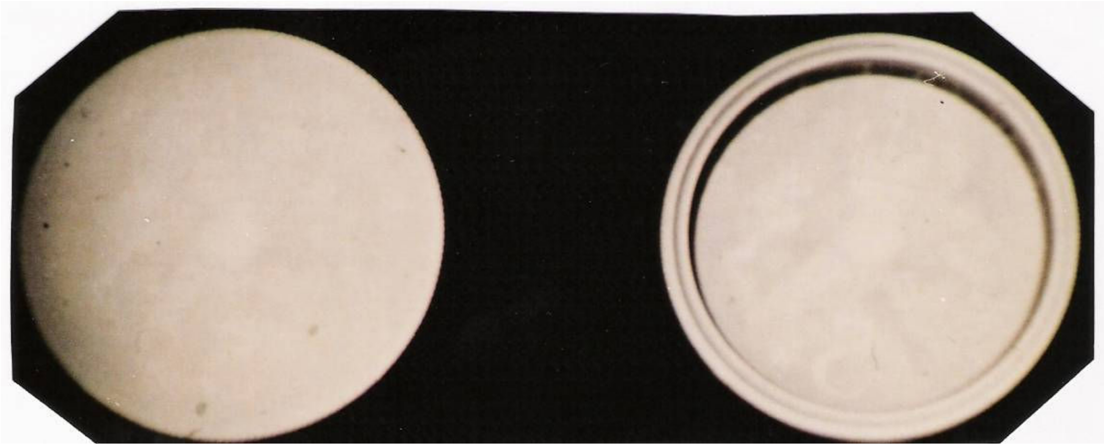
The next stage of the examination proved to be of a high scientific nature. How does one open the coin to really examine the inside? The problem was solved when the coin was accidentally dropped on a workbench and simply fell apart. The casing of the coin was formed in two parts. It had been formed from two genuine 5p pieces, which had been recessed from opposite sides by a lathe. The edge of the obverse half had been chamfered to obtain a tight physical fit with the reverse half. The metal disc insert was a permanent magnet, which had been cemented into the casing.

Having solved the mystery of how such a coin was constructed, the question of why go to so much trouble to trouble to produce an object of so small value was raised? It was later revealed that such coins were made for the conjuring profession and that often as many as four or five genuine coins are machined before a genuine one is obtained. The magnetic coins cost about £2 each in the 1970s.

As the owner of the coin was never traced and in the absence of evidence to the contrary, it can only be suggested that the coin was accidentally introduced into legal circulation by mistake by a forgetful owner.

Photograph 1. Reverse side of a genuine coin (left) and the suspect coin (right).

Photograph 2. Obverse side of a genuine coin (left) and suspect coin (right).

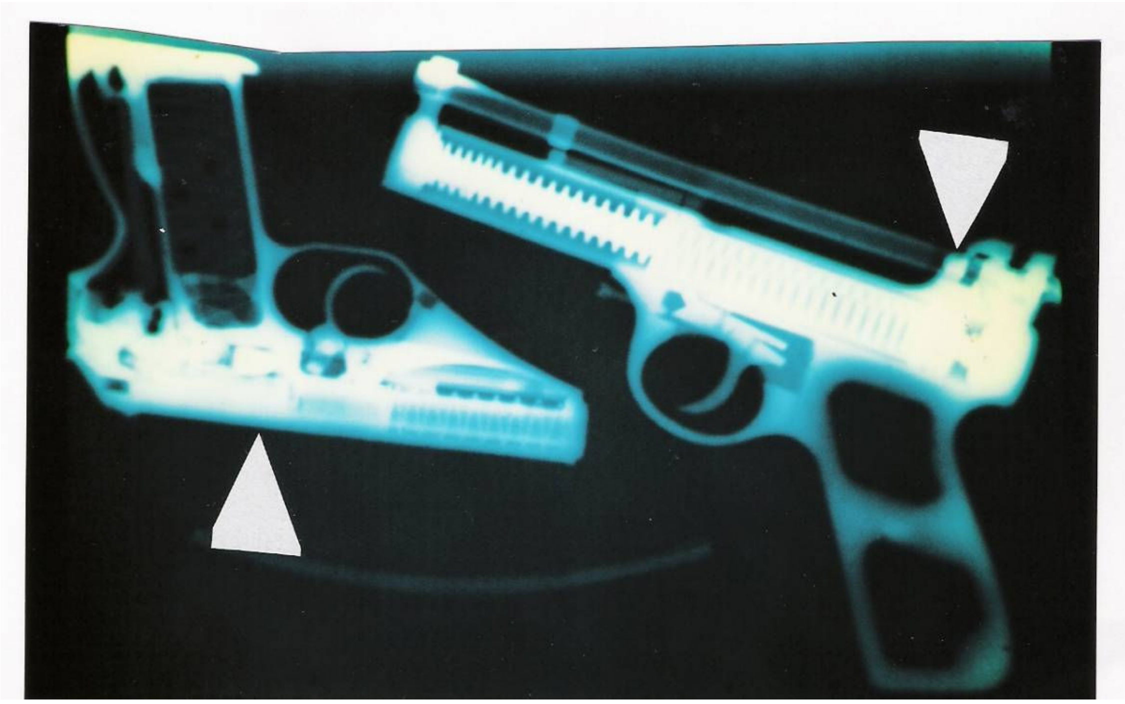


Radiograph of a genuine coin (left) and the suspect coin (right).

Photograph 3. The suspect coin opened up to show the affixed magnet.

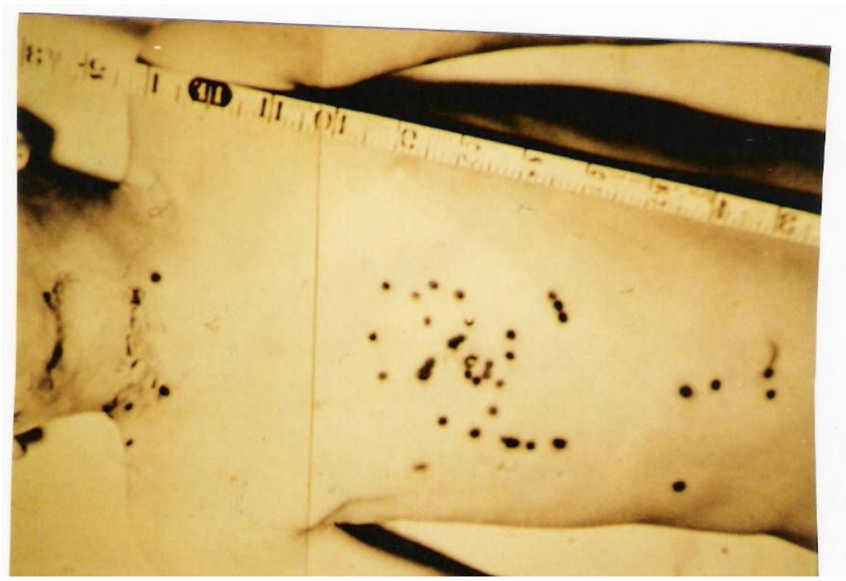
Case 2
Recovered firearms are often in a rusted state and some have received attempts at mechanical manipulation by the criminal fraternity. Such weapons have been sent to the laboratory for examination. For safety reasons weapons in such corroded or suspect condition were submitted to the laboratory prior to any further investigative handling.

Radiograph of a Revolver demonstrates a bullet in the top chamber.

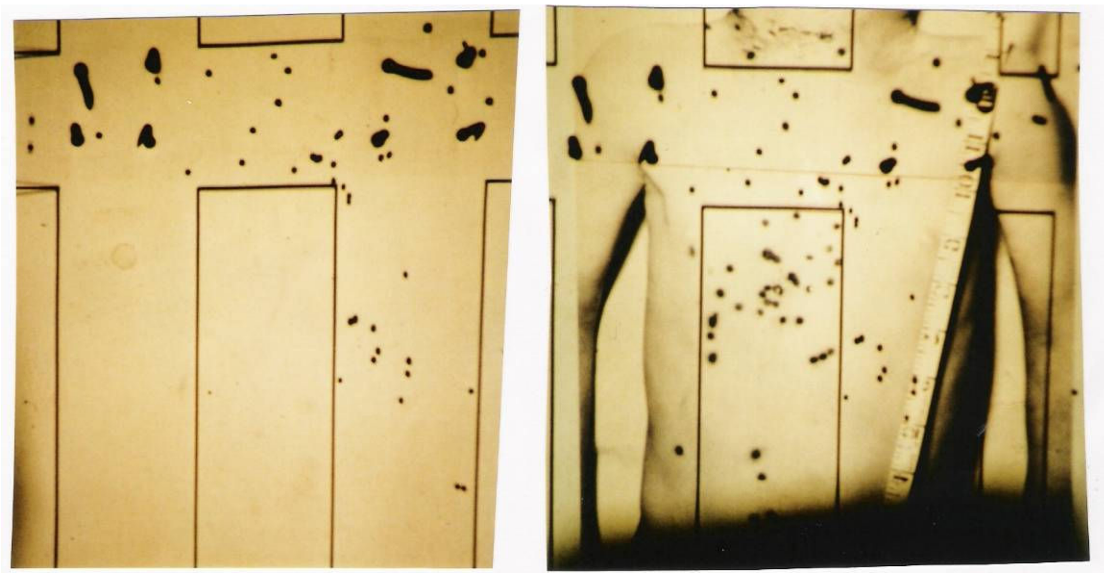


Radiographs of a loaded handgun and an air pistol
containing a pellet in the firing barrel.

Case 3
A fatal shotgun shooting accident whereby the proximity of the deceased, a young boy, in relation to the gate was in question.



Photograph showing gunshot pellet wound distribution on the body.

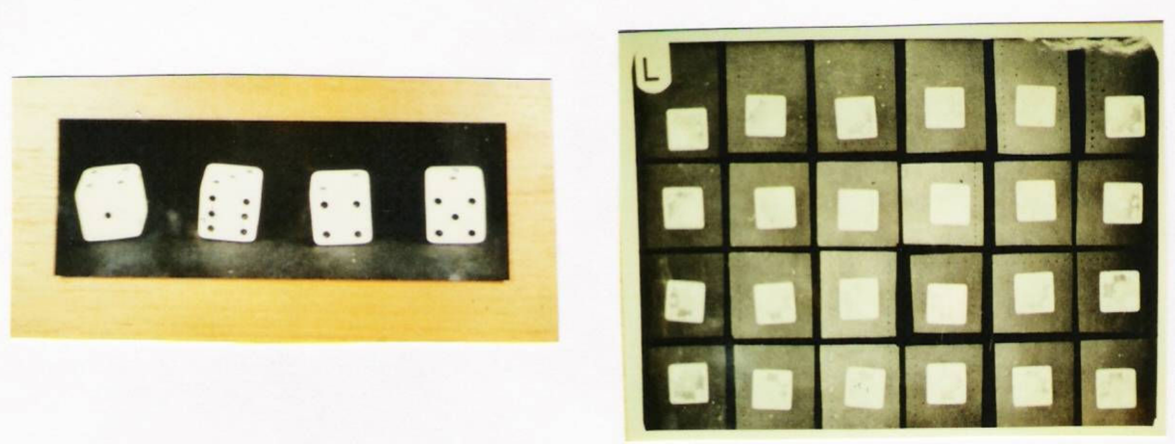


The gate was X-rayed. The position, pitch of the pellets, and gate outline were recorded. This information was transferred, onto clear film (left). This film was superimposed onto the photograph of the body.   The composite picture (right) demonstrates that the boy was in close proximity and shielded by the gate when the accident happened.

<u>Case 4</u>
An attendant in a gaming club noticed that what he considered to be an abnormal amount of winning dice throws, with a set of four dice, were taking place at one of the gambling tables. The winning throws were happening regardless of which gambler threw the dice. He decided to withdraw the dice and replace them with a new set. Superficially the two sets of dice appeared to be identical in appearance.

The set of four withdrawn dice, together with a 'new' set of four dice, was submitted to the laboratory for examination. All the dice were similar in appearance but the withdrawn dice felt very slightly heavier than the 'new' dice. On X-raying the suspect dice they were founded to be 'loaded' with what is called 'liquid solder' which could be purchased in tube form from any hardware store. Closer examination revealed that some of the spots on the dice had very skilfully been drilled out, at various angles, in order to introduce the solder into the body of the dice. The spot had then been refilled with a black substance, similar in appearance to the remaining spots.

It was obvious that a person or persons unknown, after being given the gambling club's legitimate dice to throw, substituted them with the 'loaded' dice. The culprit that introduced them was never traced. In fact some of the people throwing the dice may well have been unaware that the dice were loaded. Practice throws in the laboratory revealed an approximately 65% success rate which according to the gambling club would have received a pay out.



Photograph of set of four suspect dice (left) and radiograph of the same dice rotated through various faces, highlighting the solder (right).

<u>Case 5</u>
In the early hours of a summer morning, a man was walking along the northern side of mud flats at the side of a tidal river. The river happened to form the geographical division between two Police Forces; one being the northern side, which we call 'A', and the other on the south, which we call 'B'. The 'B' force was responsible for policing the actual river. Road and railway bridges spanned the river.

The man saw a closed suitcase lying between the high and low water lines at the river edge. There were no footmarks or any other marks near the suitcase and it appeared to have been washed up by the tide. He opened the suitcase and found it contained the body of a young baby girl, clad only in a vest. The police attended the scene and it was decided that those of force 'B' would deal with the incident; it being debatable as to in whose police area the incident may have originated. Officers from force 'B' were also responsible for policing the river.

After routine photographs, measurements and samples were taken from the scene, the body was taken to a mortuary where a pathologist, who had visited the scene, carried out a post mortem and informed the police that: -

- (i) The body was that of an apparently well-nourished female baby, approximately 6 months old.
- (ii) There were no marks of violence or obvious evidence of neglect.
- (iii) The baby had been dead before entering the water, as there was no indication of water inhalation in the lungs.

The routine body samples were taken and together with the suitcase and vest they were submitted to the forensic science laboratory for further examination. Fingerprints and footprints were also taken from the body. Subsequent examination of all the samples did not reveal anything that would lead to identification of the child. The pathologist concluded the baby had died from 'Natural Causes' and gave an educated guess that death had occurred perhaps weeks before the body was discovered. He also mentioned that the body had what he described as a 'mummified appearance of the skin' but perhaps the body having been immersed in water may have accounted for this appearance. However, as he was making an educated guess, he went on to say that the 'mummified appearance of the skin' lent him to believe that there had been some means of preservation after death. He also stated that perhaps this could be due to the body having been kept in an ideally ventilated environment at a temperature that would retard normal deterioration.

Enquiries and media appeals in both police areas proved negative. Photographs of the baby were not released because of the 'mummified appearance'. After a few days the trail, to coin a police phrase, was 'going cold'; nevertheless, routine enquiries continued. After about a week it came to light that an unmarried couple, living together in 'B' force area, had a female child of the material age. They had one of their very frequent rows and the woman and the baby had not been seen in the area since a few days prior to the discovery of the dead baby in the suitcase. The father was interviewed at length as to the whereabouts of his partner and child. He stated that he had no idea where they were and that they had gone off on previous occasions, after a row, but had eventually returned after a few days. He was interviewed by a Detective Superintendent of 'B' force and stated that the last row had been due to the fact that the child had been unwell and needed hospital treatment and had had her head X-rayed. He put forward that the explanation for his partner having left with the child might have been because they were going through a stressful period due to the child's illness. There were no relatives or friends to contact.

The Detective Superintendent contacted me and asked if there was anything that could be done to assist in establishing whether the dead child was, or was not, that belonging to the person he had in for interview. The reason he made this request was because he knew that I had been a radiographer prior to becoming a police liaison officer at the laboratory. I contacted the pathologist and we both returned to the mortuary where the dead baby's skull was X-rayed. The radiographs of the skull of the child that was missing with her mother were found and compared with those of the deceased. It was obvious that the radiographs were not of the same child as the bone structure and the frontal sinuses were totally different. A quick telephone call to the Detective Superintendent resulted in the release of what could be called a reasonable 'suspect'. I do not know whether the woman and child of this liaison ever returned or were even traced but as there were no other apparent offences committed I presume that there was no further police interest in them. The whole point in mentioning this part in the enquiry is to prove the value of the use of radiography to confirm or deny a person's identity. As can be seen, in this case it was constructive in releasing an innocent man.

After about another week into the enquiry, a woman from the 'A' force area came forward with the information to the effect that an unmarried woman, of retarded mental ability, had a young baby girl and lived as a single parent. This parent had left her rented flat at the material time and she and the baby had not been seen in the area since. The single parent was traced and told the story that she had gone to feed the baby and found her dead in her cot. She panicked and decided to hide the dead baby inside a disused fire-grate in the flat. She thought that people would think she killed the baby. The fire-grate, which was concealed by a loose-fitting piece of hardboard, had a flue system open to a chimney, which allowed good air circulation. As far as could be established the body had been concealed for 3 to 4 weeks. The pathologist was informed of the facts and concluded that this state of affairs could account for the body's 'mummified appearance'. The woman was simply in a very distressed condition and after a short while decided to leave the area. She put the dead baby in a suitcase and on passing along the Road Bridge over the river she had thrown it into the river.

Due to the retarded mental condition of the mother plus the fact that the pathologist was of the opinion that the child had died of 'Natural Causes', it was considered by the police and H.M. Coroner that 'No Further Action' need be taken.

<u>Case 6</u>
As I have outlined in the aforementioned cases, there are many ways in which radiography has assisted in the 'forensic' medium and I have no doubt that other people will know of other incidents. Having had the privilege of working with many forensic scientists who are experts in their respective fields, I feel it is only right that I recall one incident where both they and I were 'brought down to earth' by a very young student.

An oil painting said to be very valuable, measuring approximately 12 x 10 inches, was brought into the laboratory as a 'private case'. This meant that it was not the subject of any suspected criminal activity, therefore it was of no special interest to me. Scientists were quite entitled to undertake private work, as the police did not use the laboratory exclusively, as most people think. The scientist who had brought the painting in told me that he had been asked to establish whether the painting had been done on a copper, aluminium, tin or zinc base as knowing this would either enhance or decrease its value. However, the picture was in a gold-coloured frame and the back was sealed with a form of strong cloth-type material coated in a black paint-type substance. The instructions accompanying the painting strongly suggested that the picture was not to be removed from the frame. The picture had already been through various art galleries and museums, where, because of the stipulated restrictions, the experts had not been able to solve the problem.

The scientist involved knew that I had attended an 'Industrial Radiography Course' at a local College. He wondered whether, if he produced a sample of each of the metals in question, of a similar thickness to what he estimated may have been used, would I be able to establish, with the use of radiography, which metal was involved? He suggested that the picture be X-rayed together with the samples of the metals in question situated alongside the painting and the results could then be compared and perhaps the problem would be solved. I told him that I did not know if such an experiment would work but we had nothing to lose by giving it a try. He said he would send out to a local foundry to obtain the necessary samples. In the meantime a student working in the laboratory, during his vacation from a local university, saw the painting which was in my office and asked me why it was in the laboratory. I told him the story, the restrictions involved, and what we intended to do in an effort to solve the problem. I then left my office and returned after a few minutes. The student informed me that there was no need to send out for any metal samples as he had established that given the stated number of metals possibly involved, the paintings were undoubtedly on a tin base. I asked him how he could possibly be so sure of his facts to which he replied, 'because this magnet sticks to it.' (Do I hear the saying – by your pupils you'll be taught?) I never did X-ray the picture so I will never know if the experiment would have been successful.

I hope that my recall of some of the cases whereby 'forensic radiography' was applied may have whetted one's appetite: if so, I would recommend as further reading 'The use of X-ray Techniques in Forensic Investigations' by Daniel Graham. FSR. (Churchill Livingstone Press 1973).

Acknowledgements

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