The Invisible Light

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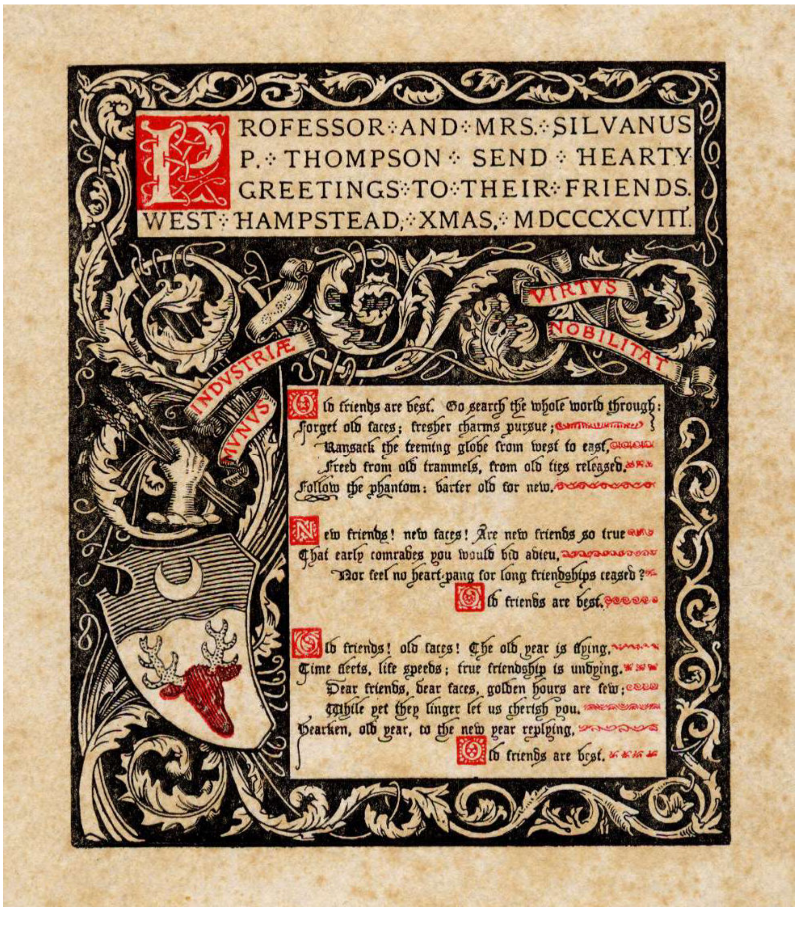

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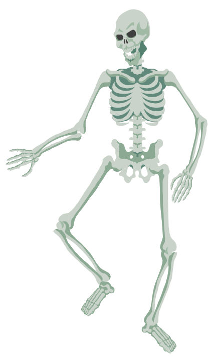
Officers of the RHHCT

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, particularly related to radiotherapy and physics. There is also a hero’s section. If you have a radiological hero then consider writing a short piece for inclusion with a photograph.



Editorial Notes

The RHHCT had a stand at UKRC2001 in Wembley I was very pleased by the response to the exhibition on the 1940s X-ray department and since then I have been producing a series of commentaries on the historical posters for Synergy. If you can help with the RHHCT stand at UKRC 2002 then please contact me.

I had a pleasant visit to the Science museum in London recently. My son enjoyed being spun around upside down in a gyroscope and I enjoyed the 'Health Matters' exhibition. In the exhibition there is a 1940s vintage AE Dean X-ray apparatus. There was a detailed model of a 1933 King Edwards Fund hospital in miniature with a fully equipped (pre-shockproof) X-ray department made by Kodak. Next to the model there is another, this time of the 1998 Chelsea and Westminster Hospital with the X-ray Department replaced by a modern Imaging Department. In the same exhibition we find a 1962 vintage Mobaltron Cobalt Unit and the 1977 Nottingham MRI scanner with material relating to Sir Peter Mansfield FRS. The science Museum web-site is www.sciencemuseum.org.uk.

We had a visit from Uwe Busch from the German Röntgen Museum. With Marion Frank a visit to EMI at Hayes was arranged and the photograph is of Uwe Busch, Sir Godfrey Hounsfield and Miss Marion Frank.

And as they say "seasons greetings to all of our readers". The illustration on the cover is of a Christmas card sent by Silvanus Thompson in 1898 (not 1908 as I said in my card – my Cs and Ms were mixed!).

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Book Note

Science in the 18th Century: The King George III Collection
Alan Q Morton
Science Museum (1993) ISBN 0 901805 63 7 £4.95
Alan Morton is a Senior Curator (Modern Physics) at the Science Museum in London. This book is based on the wonderful king George III collection of scientific apparatus held in the Science Museum. There is much of interest to those looking at early electrical apparatus and the book accompanies the exhibition that is well worth visiting. The collection comprises about 1000 items. Many of the items were commissioned by King George III from the instrument maker George Adams. Items by George Adams illustrated are his electrical machine made around 1762, his air pump and condenser of 1761 and some Magdeburg hemispheres of 1761. In the exhibition although not in the catalogue is beautiful air pump made by Francis Hauksbee in about 1705.

The National Radiological Protection Board.

The NRPB Radiological Protection Bulletin No 231, September 2001 is now available on the NRPB website and the Bulletin is being published quarterly.
The web site is:
http://www.nrpb.org.uk/publications/bulletin/bulletin_index.htm

Become a Friend of the Thackray Museum

Thackray Medical Museum Company Limited,
Beckett Street, Leeds LS9 7LN UK. www.thackraymuseum.org

The Thackray Museum in Leeds is the only major museum in the north of England to deal exclusively with the history of medicine, and boasts a fine array of interactive displays, an atmospheric reconstruction of a Victorian street and a wide range of surgical artefacts related to all things medical. The Museum also houses the most comprehensive collection of apothecary's porcelain in the country, generously donated to the Museum by the inimitable Dr Wilkinson, an eminent Manchester physician with an eye for the unusual.

The Museum first opened its doors to the public in 1997, but it was not until 16th October this year that it celebrated the launch of its Friends organisation. The Lord Mayor of Leeds, Councillor David Ellis Hudson was in attendance at the launch event, as were a number of the Museum's Trustees. The Mayor, Trustees and new found Friends enjoyed a light buffet supper, accompanied by the strains of a string quartet, before moving on to the highlight of the evening - a lecture on *The Diseases of the Great Composers*, by Dr Steve Green. The Thackray Museum is now delighted to announce that it has upwards of 100 Friends, of all ages and from many different backgrounds, from health care professionals to keen amateur historians.

It is hoped that as the Friends organisation grows and flourishes it will serve, not only to enhance its members' experience of the Museum's collections, but also to provide the Museum with an enthusiastic source of support. After all… that's what friends are for.

Judy Lindsay
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"We remember…"
Recollections from the Chesney Twins

The Time, The Place, The People

The time was March 1942, the place was the General Hospital, Birmingham, and the people were yet to be discovered as the inhabitants of a strange country to which we had never before been. Beginning to train as radiographers, we were setting out on a voyage of adventure.

In those wartime days, the training for the qualification of Membership of the Society of Radiographers (the MSR Diploma) was less formally organised than it later became. This was long before the time when the College of Radiographers was created. Students (who were required to pay fees for their training) could enter courses in hospitals where there was a radiologist in charge who wanted to train and could organise the lectures and tuition that the Society of Radiographers required.

The minimum period of training was two years. It included much clinical experience, the students working in x-ray departments (departments of diagnostic imaging did not exist then) and in radiotherapy departments under the supervision of qualified radiographers, much as the student nurses of those days worked on the wards. One of the differences between the two groups was that the nurses were paid a tiny salary. The would-be radiographers were not!

The General Hospital was the only one in Birmingham at that time which could offer training. No NHS in those days! G.H.B. (as those who worked there affectionately knew it) was an old voluntary hospital, housed in a distinctive building, which was a good example of top-rate Victorian architecture when it was built. The building is still there in the centre of the city, but the General Hospital no linger exists. The hospital which now lives and works there is what used to be called the Birmingham Children's Hospital but now has added to its title (for some strange reason unknown to us) the name of the late Princess of Wales.

Prior to World War II, the students accepted for training as radiographers were required to be already trained nurses with the qualification State Registered Nurse (SRN); but by 1942 the x-ray department was accepting students (such as we were) who had no experience of hospital work at all. Our only knowledge of the medical field came from the fact our father was a doctor.

The diagnostic x-ray department at the General Hospital was squashed into three ground floor rooms in a far corner of the outpatients' waiting hall and was surrounded by clinical consultants' suites. Figure 1 is a sketch plan of the x-ray department at ground floor level. Brown tiled, with a green dado on the walls; this waiting hall was certainly a 'period piece' of the Victorian age. The door used by outpatients to enter the X-ray department from the waiting hall took them into a large room. Half of this in fact was a diagnostic room. The X-ray section was separated from the other half of the room by a tall panel, which consisted of two panels of wood with a suitable thickness of lead placed between them. This panel screened from view those who were the subjects of the radiographer's attention on the X-ray table and provided radiation protection for the patients in the other half of the room.

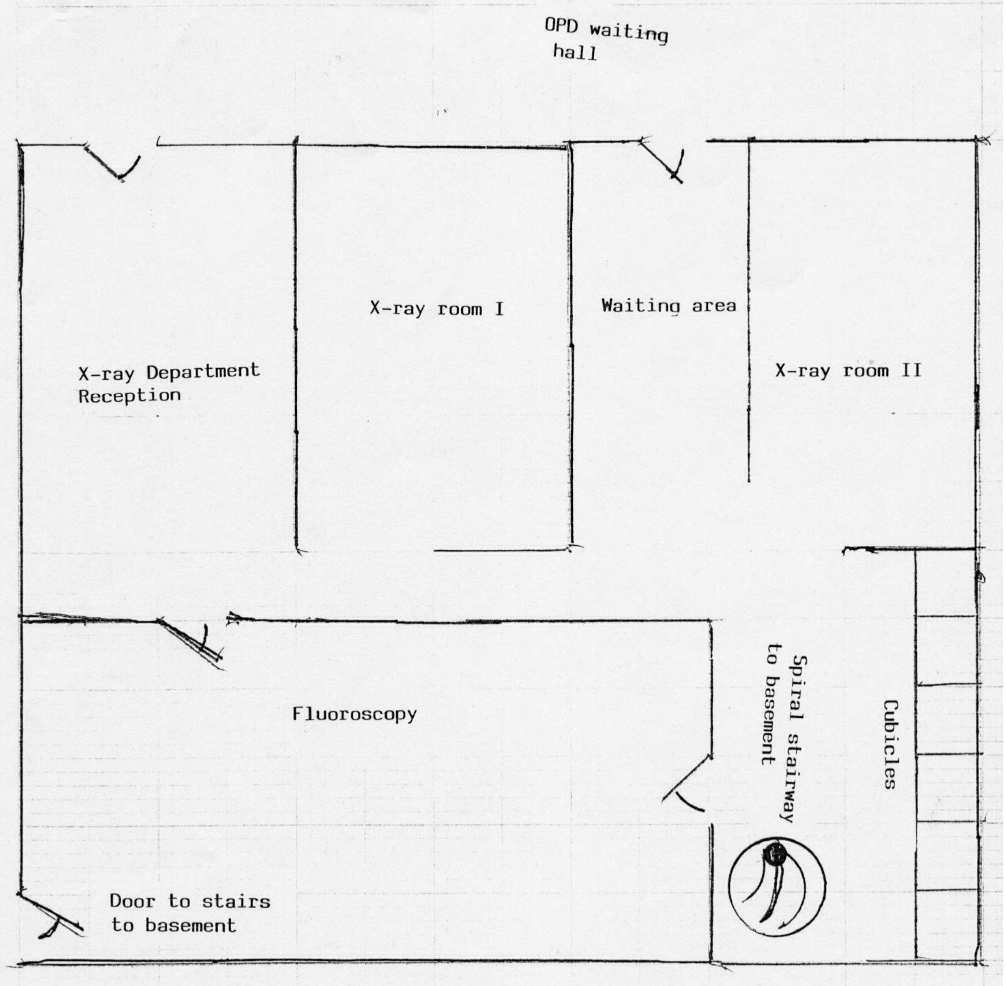


Fig. 1. X-ray department at the General Hospital Birmingham circa 1942.
Sketch plan (not to scale) of the ground floor rooms in the Out Patients' Department

This other part of the room was a reception area and held a table at which sat a 'receptionist' to whom the patients presented their request forms, which stated the examination to be made. Later there was someone who could be termed 'a proper receptionist'. We did not discover any improper ones and we use the term 'proper' here to denote someone whose job it was to receive patients. In our earliest days the people manning the diagnostic X-ray room had to deal also with arriving patients. Student radiographers were very useful for this!

Some of the patients could be X-rayed straight away and they sat down to await their turns. Others required appointments and we had to learn the correct procedure's for these. Patients in those days were docile and accepting of almost anything, or so it seems to us as we look, back. For instance, patients who presented with a request for cholecystography (old-fashioned physicians requested Graham's Test for this examination) required bowel preparation to free the abdomen of gas and faecal shadows. So we immediately gave them a small dose of senna, which they drank on the spot and we arranged their appointments for the preliminary examination to take place 48 hours later. We do not recall that we told the patients the nature of what we were giving them and results to be expected and the patients did not ask.

Adjacent to this first room and entered from the waiting hall through a separate door, was another diagnostic X-ray room, with a narrow waiting area for patients to be examined. Again there was suitable lead-lined panelling between the two sections. Leading off this room was a small area with a few cubicles in which patients could undress (no separate arrangements for men and women). There were no patients' lavatories within the department and those who required such accommodation had to trail across (we could only hope that 'trail' wouldn't be an appropriate description) to the lavatories in the outpatients' waiting hall.

In the area of the dressing cubicles there was a spiral staircase which took us down to the basement. For the hazards of this spiral staircase, read on! We explain it later in these recollections.

Let us now return to the first room with its X-ray equipment and reception area, such as it was. Leading from it was a door through which we entered a room, which held equipment for fluoroscopy only. Leading out of that room was another door which opened to show you that you were at the top of a narrow and steep wooden staircase: these stairs took you to the basement. There, at below ground floor level were the offices and also the darkroom where the films were processed. For drying, the films were taken to another basement room where they were hung up on lines, like so much washing and held by bulldog clips. Fans – which were ordinary air-cooling fans, as used in homes and offices – were in action to provide a breeze to dry the wet films.

Because the darkroom was in the basement, cassettes must be carried there, down the steep wooden staircase, from the diagnostic rooms and of course – when re-loaded in the darkroom – must make the return journey up the stairs to the X-ray rooms. This was well enough (it had to be) when the fluoroscopic room was not in use, but when the radiologists were screening patients there was no access to the wooden staircase. There was no alternative to going up and down that spiral staircase…

At that time we were reading a story by Dorothy Sayers in which the murdered victim was found at the foot of a spiral staircase. Staggering up and down with arms-full of heavy cassettes, we feared that one-day we might be found dead in a similar place.

Through the following years-new equipment and extensions markedly improved the old X-ray department, which later was to be relocated in much more spacious quarters. It was not, after all, so very long (whatever it may have seemed to be) before we realised that with luck we could outlive that spiral staircase.

We were due to begin our training early in March 1942. For the four months immediately preceding (November 1941 – February 1942), Noreen had been working in paid employment as a darkroom technician in the diagnostic X-ray department. It was known that she was due to train as a radiographer and on occasion she was introduced to some of the procedures to be observed in the diagnostic rooms. So, by the time of March 1942, Noreen was well acquainted with the place and the people. Muriel was not. Presenting herself to the superintendent radiographer on the due date, she felt a complete ignoramus and stood in awe of both the place and the people.

The superintendent of the time was a trained nurse as well as a radiographer. She held the rank of Sister and wore the appropriate uniform: dark blue dress, starched white apron, stiff white cuffs, and on her head a neat starched cap which appeared to be held in place by a band which completed itself with a stiffly starched bow under her chin. A long time afterwards, Muriel was amazed to discover that this band and its stiff now served no function more useful than that of maintaining tradition. Before putting on her cap, the sister placed the band and its stiff bow over her head, from cranium to beneath the chin and secured it with hairpins or Kerbigrips (whatever happened to Kerbigrips?). She then simply put the cap on top of it, the cap being similarly secured.

But none of this was known on that day in March when Muriel stood before this figure of authority. Straight faced and silent, the Superintendent looked her up and down for what seemed long minutes before speaking. "My god, aren't you like your sister!" Something of Muriel's awe slid away!

"Aren't you like your sister" were words, which opened a period of some confusion for the people at that time in that place, as they tried with cheerfulness and goodwill to distinguish between Chesney I (Noreen) and Chesney II (Muriel). Indeed when some years later Chesney I had left to further her career elsewhere, some people retained the dregs of uncertainty as to which Chesney was which, and which identity belonged to the Chesney to whom they wanted to talk: "Are you the one I want?" The two Chesneys resisted the temptation to stir up the confusion by changing places every month.

<u>The equipment.</u>

At Birmingham General Hospital during the early 1940's the equipment in use – in what was then called simply the X-ray department – must have carried a pre-war date. (Such is now our presumption: we do not know it for a fact.) As the young students that we were at the time, any X-ray generator and its accoutrements was a strange beast to us. We were prone to the belief that all X-ray equipment was the same as that now standing before our respectful eyes and would remain so for evermore; but of course it did not.

Not least impressive during some forty years of our professional careers, have been developments in the equipment which we used every day and with which we needs must become familiar; very very familiar, since not only had we to employ it for the production of sparkling radiographs, but also we had to explain all this new gadgetry to others.

Thank heaven, we came too late to experience mechanical rectification of the high-tension circuit. However, the Society of Radiographers' diplomate syllabus of the time required us to understand how these reactors worked, our lecturer in the subject handed out blue prints (does anyone have such a copying system now? We can only hope that our present readers understand the reference) and the then current edition of W. E. Schall included more diagrams and explanation. We readily became familiar with mechanical rectifiers and were glad to be spared their inherent and reputed noise. We could have no knowledge of what patients might think of their auditory assailments!

Thermionic valves, saturation current and all that jazz were more difficult to master. The high voltage generators of that day were very large. The oil filled tank which housed the high tension transformer must include transformers for the valves and the valves themselves and might include also a change-over high tension switch if there was more than one X-ray tube available in the room. Sometimes – to preserve floor space – the high-tension transformer and its et-ceteras were positioned outside the X-ray room in another enclosure. We recall some radiotherapy equipment (form Siemens?) which we used for what was then termed deep X-ray treatment and which employed capacitors to smooth the voltage applied to the X-ray tube. These arrangements were necessarily housed in a closed high-tension room, which was entered from the treatment room and was held in some awe by the likes of us junior fry. An incursion of the high-tension room – and 'switching off' at the end of the day included this mandate – might be made only when a barrier across the doorway was raised: this action triggered a safe release of the residual charge on the capacitors. We knew of no one – in a hurry to get off home – who had thought to hasten progress and had ducked under the bar.

In diagnostic practice, we did not welcome the advent of overload protection of the X-ray tube; were we considered as fools not to be trusted with our expensive toys? Automatic preselection of milliamperes was received in much the same way. Until then, tube current was selected through adjustment of a variable ammeter, which read the filament currents of the X-ray tube. Embedded in our professional consciousness were the words: **SMALL CHANGES IN FILAMENT CURRENT RESULT IN LARGE CHANGES IN TUBE CURRENT.** Depending on the kilovoltage employed, a filament ammeter incorrectly set at 4.5 amperes, when it should have been 4.2 amperes, might double the emission f the X-ray tube. In denying us the frisson associated with the filament ammeter, we believed that equipment manufacturers were depriving radiographers of some of the thrills of radiographic practice…… and where now was the switch which altered the operation of the X- ray tube from one focal spot to another? We did not care for this nannying; half suspecting that it indicated an opinion among our superiors that we were a bunch of incompetents.

The preceding paragraph mentioned tube kilovoltage; of this, too, the equipment of the Chesneys' early radiographic days gave no direct indication. Before you even began exposure selection, there was an incoming mains voltage meter which should be studied, and adjusted when its reading was too low or too high. After all that, you might consider the tap0ped autotransformer, on which a rotary switch offered you an encouragingly large number of positions. The snag was that these positions were simply numbered – say 1 to 100: you had to discover the kilovoltage from another chart. Of course there was a tendency for radiographers in discussion of exposure factors with each other to refer to the kilovoltage in terms of a 'stud' number on the kilovoltage selector. When we did this we were sure of the scorn of our splendid lecturer in the intricacies of diagnostic X-ray equipment, R.W. ('Bill') Armstrong of the General Electric Corporation. He insisted that "You must say what you mean", and ever demanded from his students a statement of ye actual kilovoltage. When we were not in the classroom, impaled on our lecturer's question, we trundled through sundry X-ray rooms only half-aware of the kilovoltages employed. Possible such ignorance was unwittingly sustained when a senior – commenting on our chosen exposure factors – might say "I should go up two studs, it I were you". In time we became familiar with the real significance of this: we should increase the kilovoltage by 5kVp (peak kilovoltage was a significant point then!).

Much later, a warm welcome was given to image intensifiers for fluoroscopy. Farewell to red goggles; or perhaps it might be au revoir, if the wonderful new system were to break down! Farewell, also, to breathing sown the back of the radiologist's neck as – peering over a shoulder – you tried to follow the progress of the examination and to gather whatever crumbs of learning might fall your way. To abandon these attempts was to lapse to a reprehensible inattentiveness; or even perhaps to succumb to the sleep-inducing properties of that darkened room. We sometimes suspected of a fellow student, who apparently pursued an active social life, that she simply dozed off on a stool at the back of the 'screening room' (the only title by which we then knew that place).

Even in this year of grace 2001 we suppose that exposed X-ray film requires chemical processing; but not as we learned to do it some sixty years ago in the X-ray department of Birmingham General Hospital. A darkroom was necessary. From this room all white light must be excluded whilst the film was handled and thus the design of its entrance was significant: it must give personnel ready access, yet also prevent disasters arising from attempted entrance at an inappropriate time, from some adjacent lighted area. Double doors or a labyrinth style of short, black-walled passages were mandatory. The sop-called 'safe'' lighting allowed for the handling of most X-ray film was olive green or orange in colour; so we were not – our mental state excluded – really in the dark.

In their early student days of course, the Chesney's <u>were</u> 'in the dark', not having then much understanding of the processes, which they applied. Every cassette, which came to the darkroom, carried a ticket on which the radiographer had written the name of the patient whose examination it was. Sometimes the Chesney doubts might be increased when a hurried radiographer – who had made several projections – brought two or three cassettes with only a single ticket to their name.

Once satisfied of its identity, the darkroom operator must open each cassette and remove the film, then turning this so that the aspect, which had faced the X-ray tube, was uppermost. To our amazement, we were instructed to write the name of the patient along the lower edge of the film (never across a possibly significant area of the expected image) simply with a pencil: it seemed that this relic – to us – of our school days was a medium which would survive immersion in chemicals and water.

The next manoeuvre was insertion of each film (carefully manipulated by its edges only) in a carrier or frame which was usually made of stainless steel and was known as a hanger: the hangers enabled a number of sheets of film to be suspended in processing tanks and left to get on with it. When an examination had entailed the use of more than one radiographic projection the darkroom operator was faced with several cassettes at once, from which the series of films should all go into the developing solution at the same time, if the operator were to be sure of even semi-accurate control of the developing period. It was necessary to complete the unloading-marker-hanger sequence for each film as expeditiously as possible, in the – er – light of the possibility that by the time when the last film was in its hanger the first might have exceeded the period during which exposure to the darkroom's safelight actually was 'safe'. Darkroom operators of the day did not dawdle.

The processing equipment with which this memoir is concerned comprised a number of deep tanks (hard rubber in construction) which stood in a low sink. The first of these (of perhaps 10-gallon capacity) contained the developing solution and had a lid (OK, we can put on the white lights now!); the second tank was much smaller and provided rinsing water; the next tank – or even two tanks – contained the fixing solution; and the last – again a larger one – was fed with running water for final washing of the processed film.

The darkroom operator through regular checks supervised the temperature of the developer with a thermometer. In practice, 'regular' in theory proved irregular. This was not due to neglect but simply to the sheer difficulty of halting the operation of a busy darkroom whilst the check was made and – if necessary – the developer was re-heated to the correct working temperature of 65° F (18° C). The instrument for maintaining the temperature of the solution was a poker-style immersion heater: this had to be lifted from its storage bracket on an adjacent wall and immersed in the tank of developer for as long as we deemed necessary. Overlong immersion naturally resulted in overheating of the developer solution.

The next scenario illustrates likely circumstances of such overheating. On-call radiographer is summoned from bed in the day's wee small hours; there follows a rush to the darkroom, where the immersion heater is grabbed from the wall and plunged in the appropriate tank; radiographer remembers to switch on the immersion heater; radiographer receives patient and concentrates upon the conduct of the examination; meanwhile the immersion heater – unlike many household kettles – does not recognise a switch-off point and continues quietly with its work; radiographer, returning cassette-laden to the darkroom, discovers that the developer is way past the point of mere tepidity. During the ensuing period of ceased activity while the developer cools itself to working temperature, the X-ray department suffers recurrent invasion from other clinical staff: "Aren't those X-rays ready yet?" To these urgent – and sometimes irate – questions, there is only one reply, which should be delivered as loftily as possible: “I cannot expedite a chemical process”. By then, of course, you are likely to be suffering from a seared forearm, incurred when you heedlessly restored the hot ‘poker’ to its wall bracket.

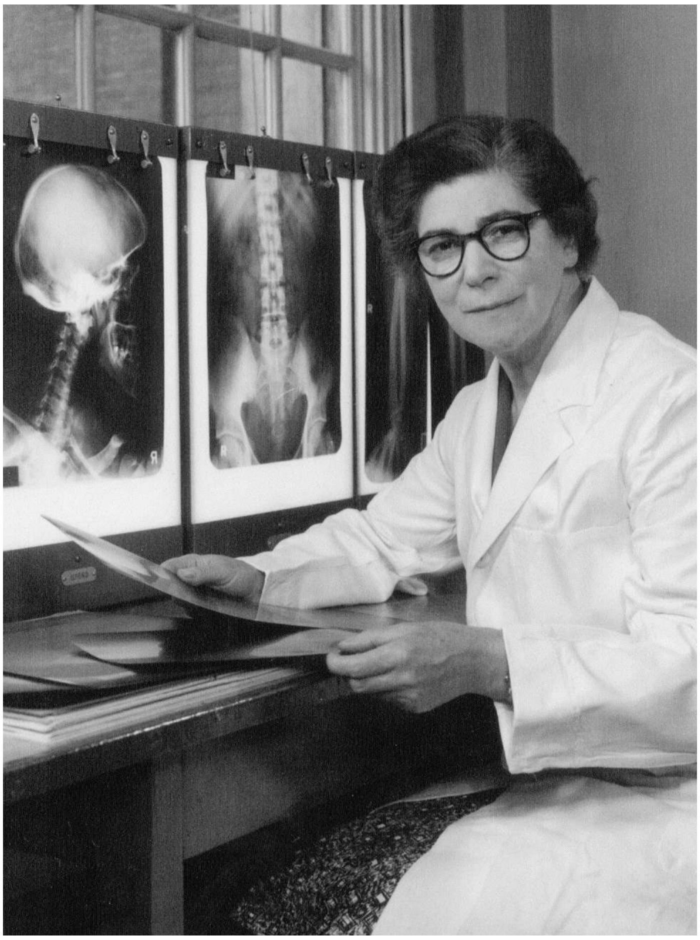
Leaving aside mishaps with immersion heaters, normal radiographic processing was a much lengthier procedure than we came afterwards to know. Complete development of the image necessitated immersion of the film for a period of 3½ minutes at the stipulated solution temperature (65ºF or 18ºC). The best darkroom technicians were said to be people who were able to tell the time and had absolutely no interest in the result of the procedure. Radiographers, who inevitably were interested in the results but might have some doubts of the exposure selection, possessed – or might be said to develop – a tendency to develop films by inspection. This deplorable modus operandi would see the radiographer in question hoist the film hanger briefly form the developing solution – after perhaps 2½ minutes insertion – and attempt to assess whether the radiographic densities were acceptable. If over-exposure was suspected and the film was considered to be already ‘dark’ enough, the radiographer would immediately move it to the next stage of processing. Conversely, an under-exposed film might be left in the developer for twice the correct period, in a forlorn hope that its densities might eventually become adequate. Intermittent success in the first circumstances gave rise to a rule of thumb not to be found in any radiographic manual: ***WHEN IN DOUBT, OVER-EXPOSE!***

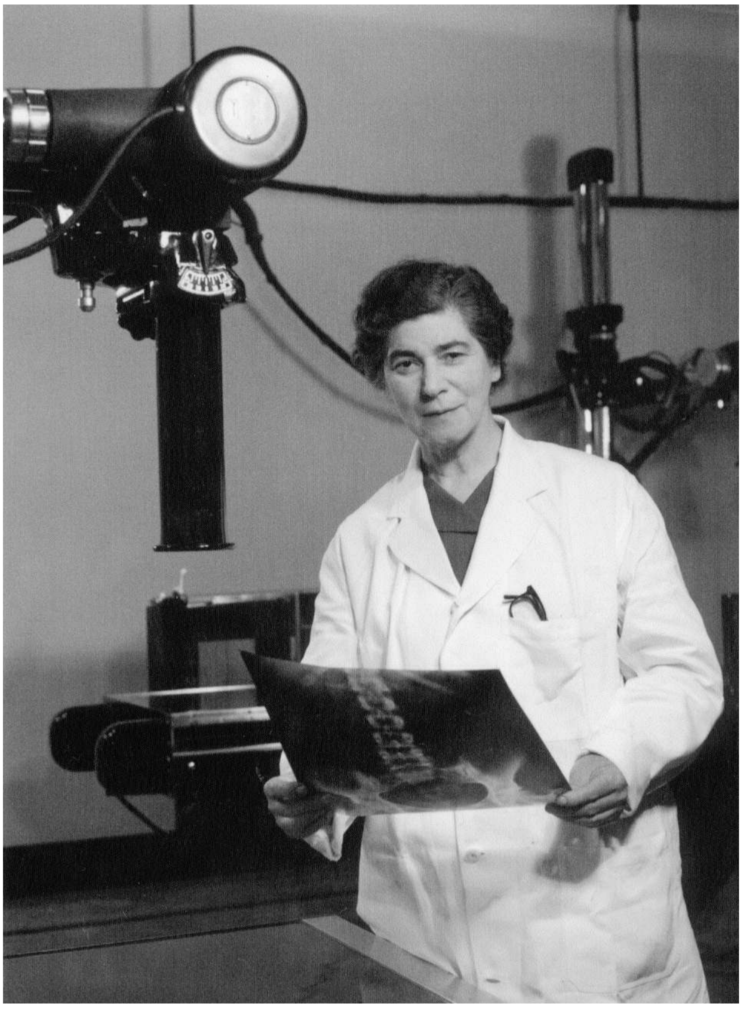
Finis

A conclusion is necessary now, if readers are not to be over-exposed to ‘the Cheyenne’s’ rambling tour through radiological memory. It will seem that we worked in very difficult conditions, but dominating all others is our recollection of the team spirit, the glue that held together that old X-ray department. We all helped <u>each other</u> to get the work done properly, whatever the obstacles to smooth progress that stood in our way.

Images of K C Clark

Miss 'Katie' Clark (1898-1968) the pioneer Radiographer and editor of **Positioning in Radiography** (1939) the standard textbook for Radiographers. She passed the first examination ever set by the Society of Radiographers in 1921. She founded a school of radiography at the Royal Northern Hospital in London (1927) and led the way for the establishment of similar schools elsewhere.
She was Principal of the Department of Radiography at Ilford Ltd. (a photographic company) and under her leadership the department acquired a world-wide reputation.





K. C. Clark, E. R. Hutchinson & Marion Frank in 1962

Bust of K. C. Clark,

Röntgen and the Nobel Prize
Adrian Thomas
Notes for a presentation at UKRC 2001.

Alfred Bernhard Nobel was born on October 21st 1833 in Stockholm in Sweden. After a variety of jobs including four years in the United States, he returned to Stockholm and started making nitro-glycerine (a dangerous liquid explosive). In 1864 the factory exploded killing five people which included Emil, Alfred Nobel's younger brother. The Swedish government forbade the rebuilding of the factory. Alfred Nobel continued to work on nitro-glycerine and developed a process to dry the nitro-glycerine and allow it to be handled safely. Nobel then developed dynamite and a suitable detonator cap. Nobel continued to develop explosives (such gelignite) and detonators and amassed an immense fortune. He was a holder of over 350 patents. In his personal live he was retiring and never married. Nobel wrote poetry, drama and completed a novel. He lived in both Paris and Italy. Nobel loved Paris and found there a sophistication unrelated to social class. He finally settled in San Remo in Italy and died there of a heart attack on December 10th 1896. Up to the time of his death he was working on his inventions.

Aphorisms of Alfred Nobel:

- "Contentment is the only real wealth"
- "Worry is the stomachs worst poison"
- "Lying is the greatest of all sins"
- "Justice is to be found only in imagination"
- "A heart can no more be forced to love than a stomach be forced to digest food by persuasion"

1888: Ludvid (brother of Alfred) died. The newspapers declared: "Le marchand de la mort est mort" thinking that Alfred was dead!

The will of Alfred Nobel:
"The capital….shall constitute a fund, the interest on which shall annually be distributed in the form of prizes to those who, during the preceding year, shall have conferred the greatest benefit to mankind"
there was to be no consideration as to nationality.
Nobel was a private person. In a letter to his brother Ludvig is 1887 he wrote: Alfred Nobel-pitiable half-creature, should have been stifled by a humane doctor when he made his entry yelling into life. Greatest merits: Keeps his nails clean and is never a burden to anyone. Greatest fault: Lacks family, cheerful spirits, and a strong stomach. Greatest and only petition: Not to be buried alive. Greatest sin: does not worship Mammon. Important events in his life: None."
The Nobel Foundation was established under the terms of the will of Alfred Nobel drawn up on the 27th November 1895. The interest was initially to be divided into 5 parts:
Literature, Chemistry, Physics, Physiology or Medicine, peace.
Since 1901 the Nobel Prizes have been presented to the Laureates on the anniversary of the death of Alfred Nobel. The Nobel prizes for Literature, Chemistry, Physics, Physiology or Medicine are awarded in Stockholm, Sweden and the Peace Prize in Oslo, Norway. Between 1901 and 1920 the prize money for each Laureate was

150,800 Swedish Crowns. By 1999 the prize had risen to 7,900,000 Swedish crowns (£530,000).
Wilhelm Röntgen: Interview by H.J.W. Dam entitled "A wizard of to-day" (Pearson's Magazine 1896)

"I was working with a Crooke's tube covered by a shield of black cardboard. A piece of barium platino-cyanide paper lay on the bench there. I had been passing a current through the tube, and I noticed a peculiar black line across the paper."
"The effect was one which could only be produced in ordinary parlance by the passage of light."
"I did not think, I investigated."
"There is too much to do and I am busy, very busy."

Über eine neue Art von Strahlen: first communication of Röntgen. A description of x-rays:
"If the hand be held between the discharge-tube and the screen, the darker shadow of the bones is seen within the slightly dark shadow-image of the hand itself. "

For the award of the first Nobel Prize in physics candidates were proposed by members of the Academy of Sciences and by Swedish professors of physics. A number of authorities on physics throughout the world were also consulted. 29 nominations were received; 12 recommended Röntgen, 1 recommended Phillip Lenard and 5 recommended a joint award between Röntgen and Lenard. There were 9 other recommendations, however each candidate received only 1 or 2 votes. Röntgen himself had recommended Lord Kelvin (1824-1907) however the work of Kelvin had been performed too early to be allowed by the rules of the prize. In the UK, Silvanus P Thompson (the first President of the British Institute of Radiology had recommended that Lenard be awarded the prize. It is interesting to learn the Silvanus Thompson had presented a detailed proposal for Lenard to receive the prize whereas those recommending Röntgen had assumed that Röntgen's worth was self-evident.

The Nobel committee for physics recommended that Röntgen and Lenard were awarded the prize jointly and two of their members, Svante Arrenius and Knut Ångström produce a report outlining their reasons. Although Röntgen s discovery was enough to warrant receiving the Nobel Prize in his own right it was felt that

Lenard's work on the cathode rays had paved the way for the discovery of X-rays. The discoveries of Röntgen and Lenard were closely related. In 1896 the Academy of Sciences in Vienna gave the Baumgarten Prize to Röntgen and Lenard jointly and in 1898 the Paris Academy awarded the La Caze Prize to both Röntgen and Lenard. The work of Lenard looked at cathode rays outside the discharge tube and also looked at the properties of the cathode rays. Lenard must have produced X-rays but was unable to distinguish them from cathode rays. This was left for Röntgen to demonstrate. The committee found it difficult to decide which of the scientists should receive the Nobel Prize. It was felt that Lenard's work led to the discovery of x-rays by Röntgen and it would therefore follow that the Prize should be awarded jointly.

The meetings of the Academy of Sciences at which the Nobel Committee's recommendation were discussed were not minuted. It was decided to award the Nobel Prize to Röntgen alone, ignoring the recommendation of the committee. Lenard took considerable exception to Röntgen receiving the first Nobel Prize for physics. Lenard felt that it was he that had observed the new form of radiation and maintained his hostility for the rest of his life. This hostility was maintained even after Lenard had received the Nobel Prize for Physics in 1905 for his work on cathode rays. Lenard studied the magnetic deflection and electrostatic properties of

cathode rays.
Lenard also contributed to atomic theory and to the phenomena of magnetism and luminescence and to the understanding of spectral lines.
In 1944 when Lenard was 82 he wrote a bitter paper with the following parable: "Röntgen was the assistant at the delivery and thereby was the first to be able to hold up the child for inspection; Lenard on the other hand, was the mother who possessed the knowledge of all that had gone before."
Following the rise of Hitler, Lenard became an ardent Nazi party supporter.
Lenard was violently anti-Semitic and publicly attacked "Jewish Science" and in particular the work of Albert Einstein.
As a reward Hitler named him "Chief Aryan of German Physics".

Röntgen Nobel Commemorative Coin
North Korea 2001 1 Won Nobel Prize-Roentgen

Thomas Edward Clark.

The following e-mails from Robert Clark are interesting. If you know anything about Thomas Clark then please let me know.

Dear Dr. Thomas,
I am making some enquiries in connection with research into family history concerning my grandfather, Thomas Edward Clark. I sent an Email to the Royal College of Radiologists on 20th. July last and in their reply, received today, they suggest that I might contact you for advice or suggestions to help me on my way. My grandfather lived and worked in Bristol and London between 1900 and 1948. I believe he was a member of the Roentgen Society and I have tried to find some

information on the "net" about this Society. It appears that societies bearing this name can be found in America and Germany but not in the U.K.
Thomas Clark worked in the field of x-rays and carried out a lot of pioneering work prior to the 14/18 war. On 6th. Oct 1914 he patented a "fluorescent screen bullet localiser & indicator" and details of his invention were printed in the "Archives of Radiology and Electrotherapy" in July 1915. This equipment was also used by the 3rd. London General Hospital, Wandsworth and the General Hospital in Bristol. Both Hospitals were only too happy to express their approval and satisfaction with the equipment. My grandfather was in business as T.Clark & Son at 96, Mildmay Road, London N. and also from his home at 3, Kildare Terrace, Bayswater. It may be that at that time the Roentgen Society existed in this country and in later years was taken into another organisation. Naturally I would like to trace any records there may be of him. I believe that during the 14/18 war all patents were suspended and all inventions were taken over by H/.M.G. as part of the national war effort. The Patent Office records are unclear for the period prior to 1916. They do however have on file another patent of his in connection with a new design of gas fire (1930).
The R.C of R have also suggested that I have a look at the Radiology History web site. This I shall be doing.
I would much appreciate any lines of enquiry you feel might be worth pursuing. Please accept my apologies for disturbing you on this matter but I know many members of Thomas Clark`s family would be more than interested to learn more about him. In his time he met Marconi who was pioneering radio in Bristol. On one special occasion he met the Queen at an exhibition in Bristol where he was demonstrating some of his inventions. He had set up a chair isolated from the ground by wax blocks
and arranged that static electricity generated by his equipment could be passed into someone sitting in the chair resulting in the persons hair standing up on end. The Queen asked her lady in waiting to try it but alas, much to my grandfathers' consternation, nothing happened and he had to admit defeat. The Queen thanked him and as she left she commented "you obviously do not know the modern woman, Mr Clark". It appears that the lady in waiting was wearing something quite new at the time - a hair net!
With kind regards, Robert F. Clark.

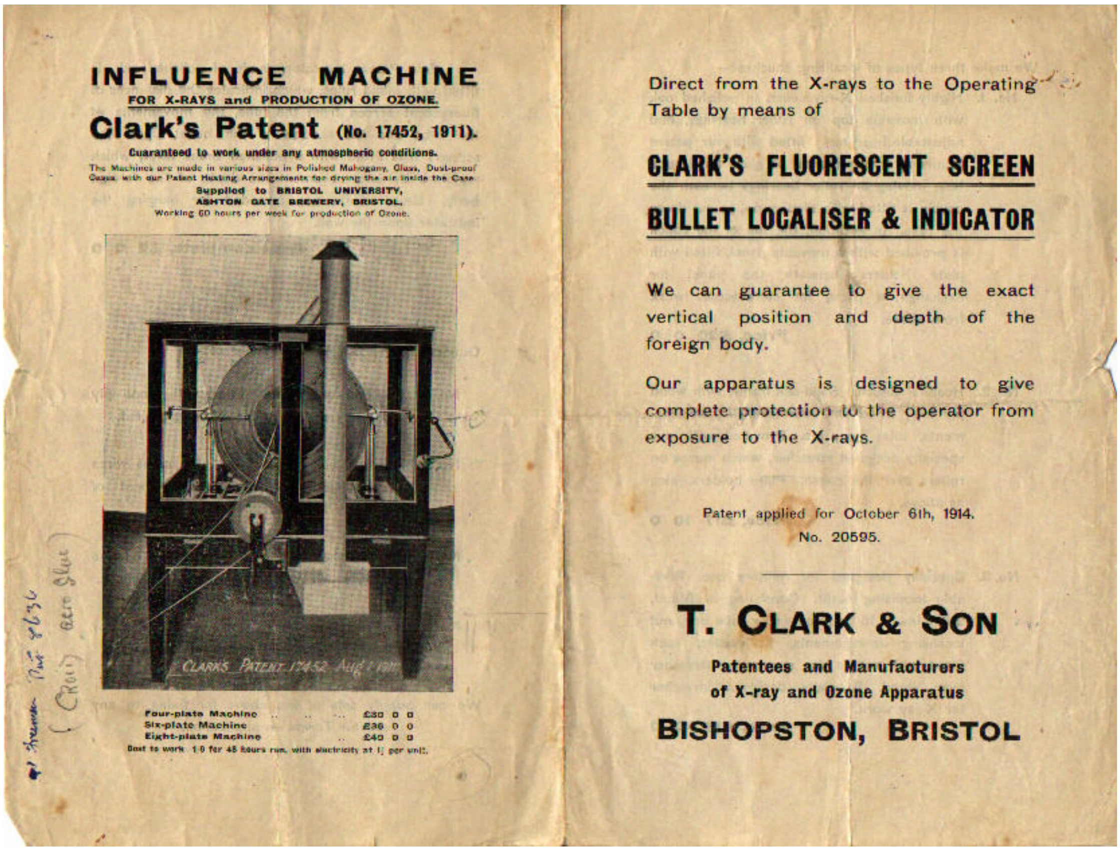
Dear Dr. Thomas,
Further to my Email to you yesterday I attach for your interest a copy of a leaflet issued by my grandfather which is self-explanatory.
With regard to the "bullet localiser..." I recall a story he told me many years ago. The army asked him to examine a patient with a wound in the lower part of his back to see if he could locate a foreign body and if so to pin point its location for them. They had used conventional x-ray plates and found nothing. The patient was positioned on the couch so that the whole lower half of the back could be examined at the same time. Nothing was found. The army MO said" Thank you Mr. Clark. You have confirmed what we already suspect. The man is a malingerer." At this the patient turned to my grandfather and, with his hand behind his back and pointing with his thumb up toward his shoulders said " It's up there guv. It hurts up there." The MO was loath to waste any more time but my grandfather insisted on making a further examination - this time of the whole upper half of the trunk. He immediately located the foreign body

which it would appear had been deflected up the spine, away from the entry wound, to his shoulders. The army MO was quite astonished. The equipment had passed with flying colours.

It is a tale I always remember though told to me over 60 years ago. With apologies for taking up your time.

With kind regards,

Robert F. Clark



Dear Dr. Thomas,

Thank you for responding so quickly and for your willingness to help me.

My grandfather was born in 1866 - I do not know the actual date. At the age of 10 he moved from Bath to Bristol where he grew up, married and had his large family at 36, Falmouth Road, Bishopston, Bristol. During the latter part of his life he moved to London. He died in Bristol on the 29th. April 1948 and was cremated at Arnos Vale Crem., Bristol. At the time of his death a short article appeared in the Bristol Echo and it may be that if this paper was in existence in the 18980s there may be reports of him and his experiments, I am told he did travel around various venues in Bristol demonstrating his equipment. I am hoping that the July 1915 issue of "Archives of Radiology and electrotherapy" prove fruitful.

Since I was last in contact I have received from one of the family copies of T.Clark & Sons leaflets advertising various products he was supplying to hospitals, doctors, nursing homes and Dr. Barnardo Homes. These products included artificial sunlight lamps, tungsten arc lamps, ultraviolet ray apparatus, high frequency transformers, thermal heat baths and static machines. It seems that later on in life with the need to earn a living he moved away from the pioneering work in X-Rays into something more lucrative. As with many keen inventive minds he lacked the skills needed to run a business profitably and died a relatively poor man.

Thank you again for your interest. I look forward to hearing further from either yourself or Kate Sanders in due course.
With kind regards,
Robert F.Clark

RONTGEN AND THE DISCOVERY OF X-RAYS*
By
Dr Sebastian Gilbert Scott

(* For the personal anecdotes concerning Röntgen, I am indebted, as every writer on the subject must be, to "Wilhelm Conrad Röntgen and the Early History of the X-rays". By Otto Glasser. Bale, Sons and Danielsson.)

This paper was given to be by the late Michael Gilbert Scott (the son of Sebastian Gilbert Scott). It was from a proposed book related to the history of radiology and was written in 1942. The book was never completed.

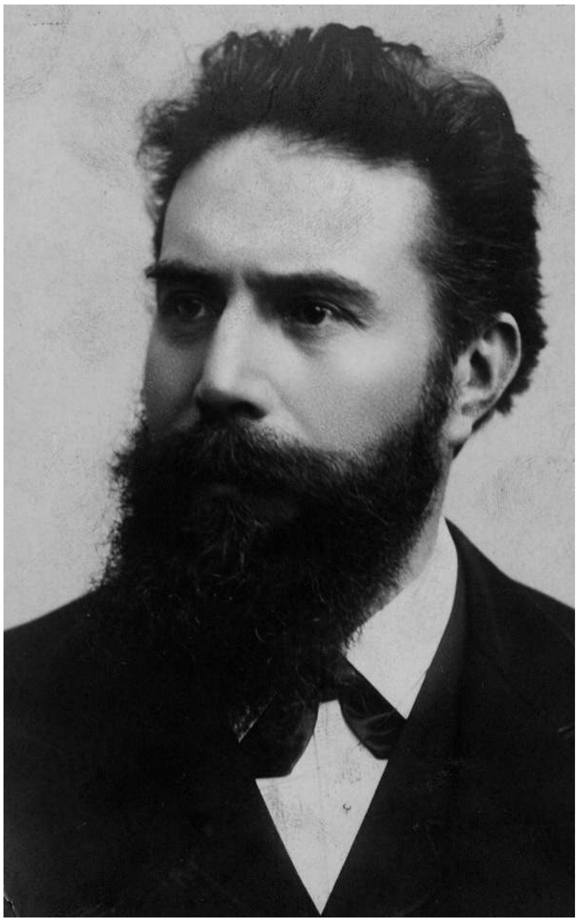
Sebastian Gilbert Scott qualified in medicine in 1904 and following his house appointments started X-ray and electro-therapeutic work at King's College Hospital. He was appointed as Radiologist to the London Hospital in 1909 and held the post until his resignation and appointment as Consulting Radiologist in 1930.

Dr S.G. Scott was a pioneer radiologist particularly interested in gastro-intestinal radiology, pituitary radiology, ankylosing spondylitis and whole body radiation. He helped to develop the barium meal (opaque meal) in Britain. He was an expert on congenital variations and medico-legal aspects of radiology. He was a keen teacher and a supporter of the Cambridge X-ray diploma, the D.M.R.E.

He used wide field low dose radiotherapy for rheumatic diseases (the X-ray bath) particularly ankylosing spondylitis and believed that small doses of radiation stimulated immunity. In the period before the Second World War when many modern medicines and treatments had not been devised he believed that radiotherapy was probably of even more value for benign than malignant disease. He was on the staff of the British Red Cross Clinic for the treatment of Rheumatism (Peto Place) and was the Director of the Nuffield Wide Field x-ray Research.

He came from the family of architects; his grandfather was Sir George Gilbert Scott, his father George Gilbert Scott and his brother Sir Giles Gilbert Scott. He had many hobbies and was a keen cricket player, playing for his local team in Little Marlow.

Professor W C Röntgen



As the twelfth century was a time of general cultural expansion throughout Europe, so the nineteenth century must ever be remarkable for the great advances made in every field of science. Biology, physics, and geology, to name but a few of the scientific aspects, were enriched by new discoveries and observations. These, in their turns, suggested further possibilities of research, some of which were to prove of epoch-making significance. And among the names of those whose genius contributed to the realm of physics, none is more illustrious than that of Wilhelm Conrad Röntgen, the discoverer of “a new kind of rays”, which were destined to revolutionise our knowledge of medicine. The only child of a substantial mercantile family, he was born at Lennep, in the Province of the Rhine, Germany, on March 27th, 1845, some ninety-five years ago. This place of residence was soon exchanged for the Dutch town of Apeldoorn, where Wilhelm Conrad began his schooling. But the early years of mental formation are seldom indicative of future development, and the young boy Röntgen was no exception to this rule. His work gave little promise of mature eminence, though he soon revealed a certain talent in the constructing of mechanical devices. Most of his leisure was spent in the open air rather than in the study, and this love of nature remained a characteristic of Röntgen’s even during the busiest periods of his life.

At the age of seventeen he was registered as a pupil at the Utrecht Technical School, after which it was part of his plan to enter the University. But this prospect received a setback as the result of a boyish prank, for which Röntgen was expelled from the School. A caricature of one of the masters was drawn upon a firescreen, and Röntgen, when asked to divulge the name of the pupil who had been responsible, would not speak. His sensitive mind, no less than his future outlook, suffered from the expulsion. Röntgen was forced to seek a new avenue of entrance to the University.

Yet another blow awaited him, however, for, although he was prepared by means of private examinations, through no fault of his own his chance of entry was cut short by the intervention of some interfering authority. These disappointments were probably responsible for the somewhat negative attitude he always maintained in regard to examinations, which, he rightly declared, were necessary evils but unreliable tests of a student's capacity for a given subject. There was equal truth in his statement that experience alone could provide the touchstone of ultimate judgement.

When at last, early in 1865, as a young man of twenty, he was permitted to enter the University, it was without the regular facilities for learning. He was therefore eager to avail himself of the opportunity which soon occurred for entering the Polytechnic School at Zurich, where the preliminary regulations were less stringent. The move was made in November of the same year, when it may be said that Röntgen fairly commenced his knowledge of the science that determined his future.

The Professor of Physics at the Zurich establishment was August Kundt, who eventually made Röntgen his assistant. Their laboratory was a small ill-lit lower room, barely furnished and fitted; but in such quarters Röntgen laid the foundations of an experimental integrity that achieved such astonishing results. His mode of living was quiet, while, in keeping with the modest retirement that always distinguished him, he showed a dislike of organised pleasure and gaiety. The company of a few friends, or a long walk over the mountains (when, significantly enough, he played the part of an enthusiastic photographer), were his foremost unchanging recreations.

At the end of the day's studies, Röntgen and his friends would gather about the tables of a certain cafe in the town, that was kept by a German refugee named Ludwig. In time Röntgen became closely acquainted with one of his daughters, Anna Bertha, some six years older than the student, and who, as a young woman, showed signs of a delicate constitution that gradually became more pronounced as years went on. They were married on January 19th, 1872, somewhat to the disappointment of Röntgen's materially ambitious father, who afforded them little of the financial help that was needed before his son had established a position. The union was happy, although childless, and after five years they adopted a young niece of Mrs Röntgen's.

Meanwhile the scientific appeal, and the experimental side in particular, was gaining upon Röntgen, who studied the mechanical theory of heat previous to obtaining his diploma as mechanical engineer. His next step was the drawing-up of a thesis on various gases, after which he was successful in obtaining his Ph.D. degree. Röntgen had no definite plans for the future, but these were eventually decided for him by the appointment of his master, August Kundt, to the Physical Institute of Würzburg University, where Röntgen also continued working in the hope of gaining an academic title.

In the spring of every year, the R¬ntgens visited the Italian Lakes, while autumn found them at Pontresina in the Engadin Mountains. The scientist's love of nature continued to be supplemented by the use of a camera, which he employed during his mountaineering excursion to the Bermina and other lofty summits. It is worthy of note that, despite his experimental instinct, he was unsympathetic towards modern travel conveniences, and preferred a horse carriage even when the railroad was available.

Another favourite spot was Weilheim, in the Alps of Bavaria, where Röntgen enjoyed the retirement that is the domestic counterpart of routine in the laboratory. Shooting, climbing, and bowls were his chief sports, while at home he indulged in a modest understanding of music.

The Würzburg authorities continued to overlook Röntgen in the awarding of titles, and when in 1872 Kundt was appointed to Strassburg, the younger man, now twenty-seven years old, accompanied him there. It was a period of general rejoicing for Germany, following the recently concluded war with France, and the founding of a German University at Strassburg was an event of national importance; while for Röntgen, who had made an extensive study of scientific literature, it was a definite turning point. At Strassburg he received the dignity of "Privatdozen", and published a number of papers which represented a high standard of experimentation in a wide range of physics.

His work covered investigations on the discharges of electricity under certain conditions; on the conductivity of heat in crystals; on the determination of the ratio of specific heats for air and various gases; on the problem of elasticity, and on capillarity; while he also took part in demonstrating the existence of the plane of polarization, and the fact that it was subject to quantitative measurement.

In April, 1875, Röntgen was appointed to the Chair of Physics and Mathematics at the Hohenheim Agricultural Academy, in Wurtenburg. But there his studies were hampered by limited resources, and before many months had passed he returned to Strassburg. The next two years witnessed the publication of most of his papers belonging to his residence in that city, and it was therefore with a growing reputation that he accepted, at the age of thirty-five, the Professorship of Physics at Giessen University, in Hessen.

Once again he experienced the difficulties of meagre equipment, and found it necessary to re-organise the laboratory before continuing his work. The death of both Röntgen's parents occurred during his stay at Giessen; but the consciously growing significance of his researches, together with the opportunities afforded him for renewing his companionship with nature, contributed to make the time as happy as it was fruitful.

He continued the study of crystalline phenomena, which always retained his interest; a fact, incidentally, that reminds us of another great scientist, this time the Frenchman, Louis Pasteur, who achieved his earliest success by investigating the rotatory power and chemical composition of crystals. Röntgen, moreover, demonstrated the absorbence of heat radiation by water vapour, dealt with the viscosity of certain fluids, and various theories of compression; while the emergence of an electrical effect, which became known as the "Röntgen Current", resulted from his important work on moving dielectrics.

These publications, displaying Röntgen's characteristics of a critical observance and untiring patience, allied to a perfect honesty of conclusion (for he maintained that the basis of judgement in every secret extracted from nature was experiment, no matter what hypothesis was supported or cast aside in the process), secured him the recognition that academic formalism had once denied. But Röntgen disregarded the various offers that were made for his services until the end of 1888, when at the age of forty-three he became Professor of Physics and Director of the Physical Institute of the University of Würzburg. He was, of course, already acquainted with that city, where he had worked under his old teacher, August Kundt, seventeen years prior to his return there as Professor.

It is well to glance at the figure of Röntgen the man as he stood, in his middle forties, on the threshold of his great discovery. Each movement of his tall, loose-limbed body bespoke an unusual energy, while his features radiated the same vigour of intellectual grasp. The eyes were keen, the hair dark and worn rather long, as was his beard, while the quick yet deep-sounding accents made his voice a somewhat poor medium in the lecture room. A conscious pride and uncertainty of temper created a diffident impression at the first meeting, which was not overcome by the scientist's habitual reticence.

The greater part of his laboratory work was carried on without assistance and this, in spite of a certain defect of vision, resulted from an early illness. Furthermore, the apparatus he used was elementary, even crude, in form, much of it being self-constructed. At no period of his life did Röntgen's attitude conflict with the essence of his statement, in which he declared that "intellect provides the highest and purest pleasure of humanity". By the measure of his achievement and the simplicity of his bearing, Röntgen was the true savant.

His earlier papers embodying the studies made at Würzburg dealt with such subjects as the different physical properties of liquids and solids; the electro-dynamic effects of moving dielectrics; the thickness of coherent oil layers on a fluid surface and the compressibility of liquids and alcohols.

In common with other scientific workers all over the world, Röntgen's enquiries gradually became directed upon the properties of the cathode rays, with which, he felt, many unknown phenomena were associated. The formation of these rays in a vacuum has thus been somewhat technically described by Tomassin: "The electric flux, starting from the anode, flows through the rarefied air of the tube, along the lines of force, and forms its own conducting path of polarized radiant matter". And to epitomise the foregoing chapter, it had been demonstrated by Crookes that the cathode stream was responsible for a brilliant fluorescence of the glass walls of the exhausted tube, while certain substances placed therein would fluoresce under influence of the rays.

Moreover, it was shown that these rays (which must not be confused with the X-rays, of which the cathode radiation was the immediate precursor and necessary adjunct), traveled in straight lines; while their deflection by a magnet proved that they consisted of material particles (since called electrons), each one being charged with negative electricity and travelling at colossal speed. The study of the fluorescence caused by the cathode stream, and the search for unknown rays that might emanate from the vacuum, was responsible for the 'Crookes' or 'Hittorf' vacuum tube, as it was called in Germany, becoming a feature of scientific investigation in many countries. This glass vacuum tube was not unlike the present day electric light bulb. Such then was the position of research when Röntgen took up the investigation.

Strange to relate, the particular rays (the X-rays) that were soon to be associated with the name of Röntgen, had previously been produced unknowingly by many a worker in more than one laboratory in various parts of the world. But the work of detaching, or isolating them, had nowhere been successful, and Röntgen was the first to grasp the significance of the phenomena that earlier seekers in the same field had persistently overlooked.

Every discovery marks the sum total of former systematic investigations, and on this account some construe it in the terms of an 'accidental' finding. More properly it is the outcome of acute observation and deduction, which are the essence of scientific genius.

On the evening of Friday, November 8th, 1895, Röntgen was working alone in his small unpretentious laboratory at the Physical Institute. His apparatus consisted of a Ruhmkorff coil, that is a transformer necessary to create the high-tension current, and a Hittorf vacuum tube, through which this high-tension current was passed. It had been found previously that the action of invisible ultra-violet light upon crystals of barium platino-cyanide caused a most brilliant fluorescence, and it so happened that a card coated with that compound was lying on a table some distance from the actual spot where Röntgen was examining the phenomena that accompanied the passing of a high tension electric current through a vacuum.

The room was darkened, while the tube itself was fitted with a black, light-tight cardboard cover. Röntgen proceeded to pass a high tension current through the tube, and was surprised to observe that, in spite of its light-tight covering, a sudden illumination played over the screen of crystals, which, it must be remembered, stood on a table some little distance away. This phenomena only occurred when the tube was activated, and this apparently simple fact led him on to eight weeks of almost unbroken labour. Sometimes he ate and slept in the laboratory to avoid distraction, while the nervous strain to which he was subject made him even more gruff and irritable to those around him.

Such, in brief, was the unromantic manner in which X-rays were discovered. Several incorrect versions of the discovery, certainly more attractive, were circulated in the papers at the time. By continuing his researches, Röntgen found that he had detected a new type of radiation, differing from the cathode particles which caused the glass walls of the vacuum to fluoresce. The new rays, in fact, arose wherever the cathode electrons were brought to rest by impinging on the glass of the tube, which acted as a transformer of energy. It was also found that they passed through various objects and liquids that otherwise repelled light, such as a thick book, a double pack of cards, blocks of wood, rubber and aluminium, whilst lead and platinum retained their opaqueness. The power of the rays in effecting transparency was seen to be closely dependent upon the 'compactness' or 'atomic weight' of the object concerned.

A further result was foreshadowed when Röntgen placed his hand between the activated tube and the screen of platino-cyanide crystals. For the image appearing on the screen clearly revealed the bones, while the softer tissues gave a shadow of much less density. He next substituted a photographic plate for the screen, and again interposed his hand between it and the vacuum tube. After development, an outline of the hand, including a silhouette of the bones, was visible on the plate.

Röntgen gave the new radiation the name of ”X-rays” (‘X’ denoting an unknown quantity in Algebra), thus acknowledging that the essential nature of the rays was wholly unknown to him. They are invisible to the eye, only the fluorescence they excite in certain substances being observable. While in addition to the latter property, as already mentioned, it had been determined that they possessed the power of passing through various materials that were opaque to ordinary light, and of effecting the emulsion of a photographic plate.

Röntgen proceeded with the utmost caution, and made his discovery known only after a rigid and carefully controlled investigation. A report of the matter was made to the President of the Physical Medical Society of Würzburg on December 28th, in a document that was remarkable both for brevity - it took but 15 minutes to read - and a straightforward assembling of facts. Röntgen insisted that no mistake was possible, as for the greater part his observations rested upon the ocular proof of photography.

Early in the New Year (1896), forty-six years ago, this report was given to the public, whose reception was startling and instantaneous. Translations carried the discovery to all parts of the world; experiments and photographs were made in countless laboratories where the necessary apparatus was already in daily use, while scientists proclaimed and lay people discussed the results. Equally rapid was the improvement of the necessary apparatus. The power of electric generators and the induction coils were bettered, while the employment of static machines as a source of high tension current was soon suggested.

In the words of Bertin-Sans, who wrote of this period: “What excited the imagination was not so much the new theory of the electric discharge, as the discovery of a new procedure, as precise as it was unhoped-for, which enabled us to obtain a photograph of the skeleton and to perform an autopsy of the living body”.

The month of January found Röntgen demonstrating his discovery before Kaiser Wilhelm II in Berlin; and, on the 23rd, he spoke at a meeting of the Würzburg Physical Medical Society. To an enthusiastic audience, who saw the material side of his observations borne out by photographs, he explained the likelihood of securing pictures of the more complicated parts of the body by means of the new rays, and his own readiness to help in experiments that might prove of medical value. No one, from Röntgen to the least important of his listeners, could ever have realised how vast those medical uses would eventually become. It was at this meeting that the title of “Röntgen Rays” was suggested for the discovery.

His sudden emergence as a world-famous figure made Röntgen even more modest and reticent, except for his proud recognition that the radiation was of untold value to science and medicine. He continued working without pause or interruption, while German and foreign scientific societies vied with each other in bestowing their honours. The University of Würzburg awarded him the honorary degree of Doctor of Medicine; he was made a corresponding member of the Academies of Science in Berlin and Munich; other awards being the Royal Bavarian Order of the Crown, and the honorary citizenship of his birthplace, Lennep. This flow of honours did not disturb him.

Röntgen made a second communication, entitled "On a New Kind of Rays", on March 9th, 1896, while a subsequent report, "Further Observations on the Properties of the X-rays", followed a year later. But he was still far from abandoning his work on crystals, and dealt with their conductive power and reactions under the rays. In April 1900, now fifty-five years old, he accepted the post of Professor of Physics at the University of Munich, while the year following saw him receive the Nobel Prize for physics. It was customary for Röntgen to avoid, whenever possible, the need of making a public appearance, but on this occasion he journeyed to Stockholm for the awardment.

Many offers were made for his services, which he declined, and continued working in the Bavarian capital. His investigations throughout were marked by unyielding care and systematic control, with a stricter regard for the recording of facts than for the nature of the apparatus with which he obtained them, which, to say the least of it, was often crudely unprofessional. Röntgen was alive to the dangers that invariably attend the popular expositions of science, and deplored the reception of superficial and erroneous conclusion by the ordinary public. Such a state, he held, was worse than absolute ignorance.

A personal anecdote illustrating the consistency of his attitude toward social invidiousness is told by Margaret Boveri, a daughter of the professor who was Röntgen's friend. At a function, where the University heads were present, the couples were paired-off for dinner in such a fashion as to leave the wives of the professors without escort. Röntgen took in the situation, and abandoned the lady of title whom it was intended he should accompany in favour of his own wife.*
(* "Wilhelm Conrad Röntgen". By Glasser.)

On May 2nd, 1905, the German Röntgen Society came into existence, a later honour being the bestowal of the title of Excellency upon the scientist. The years of the Great War entailed a twofold sorrow for Röntgen, who displayed a natural patriotism that was sensibly void of the extreme bitterness that characterised many of the non-militant leaders of intellect on both sides. He was unprepared for the downfall of his country, while an equal shadow was cast by the growing illness of his wife.

There was, however, some consolation in the knowledge that the X-rays were being applied medically to the benefit of the general combatants, a fact that the German Government recognised by awarding the Iron Cross to Röntgen. His wife died on October 31st, 1919, and Röntgen, the lonely representative of an era that had passed away, looked out with saddened eyes upon a future that promised nothing either for himself or his country.

In 1920 he resigned his Professorship, but still retained an active interest in the laboratory. He also continued in office as the Conservatoire of the Physical Metronomical Institute of the Munich Academy of Science, living for the most part at

Weilheim with occasional journeys to Switzerland. Nature had lost nothing of her old charm for the scientist, who could yet stand, with the marks of age upon him, recapturing memories from the sound of falling waters. His eyesight and hearing were defective, and after a short period of fitful energy he discontinued a number of new researches.

The early days of 1923, however, found him once more at the laboratory, but it was a last effort. All about him were the signs of a great country and a people in eclipse. The Ruhr was occupied by the victorious troops of a foreign power; Strassburg, the home of so many of his early and happier sentiments, was lost to the Fatherland; while a maddened youth plunged itself into orgies of pleasure and post-war decadence.

The burdens of the time oppressed him and, with the development of an intestinal complaint, Röntgen died at Munich on February 10th, 1923, aged seventy-eight. On the 13th, accompanied by the tributes of representative science, his body was cremated, and some months later the ashes were placed beside those of his wife and parents in the cemetery at Giessen. Speaking by the value of his work to the human race, a better fate should have been his than to die in the midst of tragedy.

The Science Museum, London.

The Science Museum has recently announced that from 1st December 2001 admission to the Museum will be free to all. The web site of the Science Museum is www.sciencmuseum.org.uk. From this Science Museum website you can register for the Science Museum 'What's On' email newsletter with the email-address: newsletter@scimu.ecircle-solutions.com. There is also a group Education Mailing List, with the email-address: education@scimu.ecircle-solutions.com giving regular updates of educational updates at the Science Museum. The National Museum of Science and Industry has a web Address of www.nmsi.ac.uk .

Interesting Web site

Mr Michael Bennett-Levy (grandson of Leonard Levy). He runs a company called Early Technology and is (as you might have guessed) interested in this, especially in early television. He has a website www.earlytech.com which features a number of images of early X-ray tubes including some Victorian examples.

Book Review:
The History of Radiology in Scotland 1896-2000.
John F Calder
ISBN 1 903765 05 6 £25.00
Reviewed by Prof. Ian Isherwood.

Dr Calder has documented a detailed chronology of Scottish radiology departments and Scottish radiologists from 1896 to the present day. Such a historiography and catalogue will, without doubt, be of immense value to radiology historians in the future and should be commended for that alone. It represents an immense research effort by an active clinical radiologist into the background to his discipline. – and what better time than when 100 years of development can still be recalled albeit by a second generation of practitioners.

Alan Bullock wrote that "History is an attempt to explain the sequence and connection of events ….. Not why they *had* to follow but why *in fact* they followed". Peter Acroyd makes the additional point that "Everything in every age, is of a piece" implying that other and more varied manifestations than the technology itself might be viewed together. Scotland with its early radiological interests, is geographically spread and its own Home and Health Department presents a unique opportunity to explore some of these issues. Factual information on the Glasgow campaign against tuberculosis in 1957 and the origins of the breast screening programme in 1987 are provided but the wider social implications of these and similar Scottish developments remain unexplored. It might have been valuable to examine parallel progress in anatomical teaching, medicine, technology and the pharmaceutical industry or even the commercialisation of science in the 20th century. Why, for example, did the commercial production of Magnetic Resonance Imaging in Aberdeen fail in the 1980s? Why indeed does the major technological development of Positron Emission Tomography (PET) scanning in Aberdeen go unmentioned?

John Macintyre, whose portrait adorns the book wrapper, was a truly major figure in the international acceptance of the clinical value of X-rays in 1896. His influence on hospital development, his vision of the future for electricity in medicine, his recognition of the role of X-rays for the physician as well as the surgeon and his appreciation that fluoroscopy was the key to the understanding of pathophysiology could perhaps have been developed further. Lord Kelvin, incidentally, sent an earlier and more cautious letter to Röntgen than the one printed here. Kelvin, it is said, regarded X-rays initially as a hoax but Macintyre thankfully showed him otherwise!

It would be churlish to draw attention to too many typographical errors in such an otherwise excellent an welcome book. Abbreviations (CT, MRI, ERCP, DMRE etc) do need explanation for the uninitiated and the non-medical reader. The Wellcome foundation, like the 2LL llama, should have 2lls – perhaps the spellcheck failed there! – Thurstan is spelt with an "a" not an "e" and the X-ray martyr's memorial was surely unveiled in 1936 and not 1836! John Calder's monumental effort deserved better from his proof reader.

THE NEW ROENTGEN PHOTOGRAPHY.
"LOOK PLEASANT, PLEASE."

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