The Invisible Light

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Contents

Editorial Notes

I hope you like this issue of The Invisible Light.
The paper by Michael Wood is of great interest and resulted from my suggestion that he wrote something for me. If you have a story to tell then please send it to me.
Ian Isherwood has stood down as Chair of the RHHCT. We owe Ian a great debt for all of his work for us over the years.
I am sad to have to record the death of Neil Ridyard. Neil was a tremendous help to me in my researches into the history of early CT.
Do visit us at UKRC in Manchester! We have a stand at the technical exhibition.

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The RHHCT web site

The RHHCT web site is to be found at: www.rhhct.org.uk

The British Society for the History of Medicine:

The 2005 BSHM Congress is from 1st – 4th September 2005 and is in Exeter. Do put the date in your diary and come along and present a paper! We always have a good time – and it is important that papers are presented with a radiological theme to ensure that radiology history is represented. The secretary is: Dr. Ann Ferguson, New Barn, 39a Grange Road, Broadstairs, Kent CT10 3ER annferguson@doctors.org.uk

Recent Books & Articles

Register of Ephemera Collections in the United Kingdom.
Published by the Centre for Ephemera Studies, Department of Typography & Graphic Communications, The University of Reading. Whiteknights, Reading RG6 6AU
ISBN 0 7049 1126
This is the first register of publicly available ephemera collections in the United Kingdom. There is a short introduction by Michael Twyman, the Director of the Centre for Ephemera Studies.

Douglas W. MacEwan, Adrian M. K. Thomas, and Brian C. Lentle
Scenes from the Past: Presentation Silver: Loving Cup of the Canadian Association of Radiologists
RadioGraphics 2004 24: 311-312
An account of the presentation of a silver cup to the Canadian Association of Radiologists by the Faculty of Radiologists in the UK.

Uwe Busch
Wilhelm Conrad Röntgen's contribution to physics.
Toshiba Visions No. 5 Vol. 4 (2004) pp48-53
What Röntgen did in physics when he was not discovering X-rays - quite a lot actually!

Medals:

Reproduced are some interesting radiological medals.

Chernobyl by Oxsana Teryokhina and Natalya Domovitskikh, 1995,
cast bronze 120mm. (Ukraine manufacture), BAMS 111, M.28, edition 40. A raging inferno on one side with a reference to the Goya print El sueno de la razon produce monstruos (The sleep of reason produces monsters) on the other side; a sleeping figure with bats flying around him.

Belot, J.
Large 80mm. bronze Art Deco medal commemorating the work of J Belot at the St Louis Hospital.
He wrote the first paper on Radiotherapy in France.
Portrait by French medalist Jean Vernon (Radiotherapy, Radiography); reverse. (Paris) Hospital St. Louis 1910, Electroradiologie 1938, text translates first protective apparatus 1902, First Radiotherapy treatment 1904, Atlas of Radiographic Anatomy and Pathology large bronze medal 80mm nice patina and condition.

Electricity
Dammann P M - CPDE (Electricity) MCMVII (1907), From the outstretched hands of Electricity personified as a young woman rays of light beam down on to Paris; the other side shows a face, eyes closed with hair on end as if filled with static, and rays of light behind. AE 64mm gVF

Mackenzie Davidson, James
Mackenzie Davidson bronze medal, 56mm. Marked Vaughton Birm. 'Rontgen Society incorporated with The British Institute of Radiology. Electro. Therap. Secn. Roy. Soc. Med. In Memoriam 1856-1919 Professor Milton Friedman M.D. 1974'. In Fattorini & Sons Birmingham box.

Societe de Radiologie Medicale de France
(Radiology) Rispal, G N Societe de Radiologie Medicale de France/Fondee en 1909. X-ray machinery both sides (ed. Artus Bertrand) AE 59mm. VF

RADIOLOGICAL REMINISCENCES

Dr Michael Wood MA., MD., DMR

Emeritus Consultant Radiologist, Lewisham Hospital

INTRODUCTION

I was born in the pleasant old Lancashire town of Preston (now a city) in 1915 a short time before the dreadful slaughter of the Battle of the Somme; my father was a qualified engineer and volunteered for army service and it so happened that he was called up immediately after I was born. My mother aged 23 with no immediate relations in the vicinity was all alone and under these circumstances what does a girl do? Go home to mother! Mother was some hundreds of miles away in the West of Ireland in a small town about half way between Limerick and Killarney, situated in the most delightful country was Home. This was a small estate with imposing entrance, lovely house and gardens and bordered by a fast flowing river. She was met with all the love and affection possible by all and staff but of course had the continuous worry of my father in danger in France. He was stationed in Cologne and when the war ended the army were very slow in returning the troops from abroad thus delaying their demobilisation but when this did come, it meant the return to Preston. Life now seemed so dull, no men working in the garden, no shooting and no fishing and no damns to be built in the river; no joy of bringing in the hay to the barn and being welcomed at all the places around. No horses nor dogs, that place and that life there was a boy's absolute dream.

I attended school in Preston until the age of 10 years and then I went to Stonyhurst which was 15 miles from Preston and like all English public schools of the day, life there was tough. I found physics and mathematics easy but languages and academics difficult. I am afraid that I was not very bright but managed the necessary exams. In my latter time there, there were always discussions about going to Oxford or Cambridge with view to entering the diplomatic service or foreign office, banking or law. Without much encouragement, I said little but made up my own mind that I should do medicine.

My father retired to my mother's old home in Ireland and enjoyed many years of happy life there. In view of this, I went to Trinity College Dublin in 1932 which had a very high reputation for their medical school. I found that the teaching there was extremely good and this together with my now doing what I wanted and with my great ambition to do well, I changed from being at the lower end of class results to the top end and passed all exams without difficulty and in the final exams I obtained the only medal occasionally given in them. I also obtained my BA while there, which is necessary as in most universities before the medical degree is presented. M.A. followed later.

House jobs followed but bitten by ambition, some time in general practice was necessary to make a little money to pay for medical course for the MRCP. By living very frugally, I made enough to pay the fees at Edinburgh University and keep myself and left for Edinburgh only to find that on the 3rd September 1939 that war was declared on that Sunday morning. The university immediately cancelled all courses and exams and in fact almost every thing and I was there with no job. With good luck, a very good one turned up which I grabbed. I was contacted by the local BMA secretary asking which service I wished to Volunteer for and stating that if I volunteered now my choice would be assured – see later how this worked out. In view of my father's description of life in the trenches in France in WW 1, I chose to enter the Royal Navy for better or worse but as it turned out, this was a very lucky choice. My call came in 1940 with orders as a Surgeon Lieutenant to report to Chatham Barracks for instructions prior to joining one of the HM

ships. At that time I was pretty tough, and after a few days, I was approached by the powers that be to be told that I was being seconded to the marines as they were short of a medical officer. I said that in view of the BMA assurances, I must protest, I was told that I could forget that and go to the armoury and collect a revolver and 30 rounds of ammunition, again I said that I must protest as if captured with fire arm or even with a amputation knife with blade of more than four inches, I should be shot straight away. I was assured that I would not be captured, if the German invasion started, where I would be going there would be no retreat under any circumstances and further no quarter would be given on either side – no prisoners and so I had nothing to worry about! Several weeks later I went to sea in a destroyer and experienced the atrocious Atlantic weather of the winters of 1939/1940 and again in 1940/1941 when the shipping losses were so high. We were very severely damaged in the spring of 1941 and I still can clearly remember the captain shouting "prepare to abandon ship." With good luck, we managed to limp home. Later we were attacked by aircraft, again with luck; a large bomb just missed falling among the depth charges in the stern. Our miserable anti aircraft guns went into action, a shell in one gun failed to go off. The routine for this was during the action, the unfortunate gunner opens the breech of the gun and carries the dud shell to the side of the ship and if it does no off on the way, he throws it over board. If the air attack has passed off, he waits for 30 minutes warning any body coming near to keep clear should they approach. After the attack, I went on deck to ensure that no one had been hurt-, no warning from the gunner and as I passed the gun, the dud shell went off, this blew me over and alas I was now stone deaf but lucky to be still alive. This state of deafness lasted about one week and gradually some hearing returned on the side away from the gun. I realised then that my hope now of eventually becoming a consultant physician was ruined, this caused great disappointment and I had to consider another branch of medicine which did not require much conversation. There was a rumour at that time the an ENT consultant was removing the ossicles from the ear in such cases as mine, I had no wish to part with mine, so said little about it. Not having had any instructions about Hurt Certificates issued at time of accident or injury to be retained for pension or compensation at end of hostilities, I never received one. After the war, I felt that there was no point now in applying for pension with out the certificate; it had however been mentioned in my discharge papers and about forty years later I was persuaded to now apply for pension. To my surprise, I was offered not a large lump sum but never the less greatly welcomed sum. My audiogram was a sad sight but strangely, in spite of this I could usually disguise the hearing defect for some years then it became much worse.

After much consideration as to which branch of medicine I should now turn to, I chose radiology. During my six years in the Navy, I was fortunate and greatly honoured to have to have been appointed to three Naval Hospitals, one after the other in the latter part of the war and finally appointed to the new huge hospital in Sydney Australia where we expected huge number of British and American casualties in the invasion of Japan and remained there until the war was over. We were very fortunate that the radiologist appointed to the Sydney Hospital was excellent and I spent all my free time with him and learnt much from him and this confirmed my decision of taking up radiology.

Oh, the Naval Hospitals were all so well run, we were all given full freedom for treatment and there was always a specialist available for opinion in any difficult case. All were full timers. Our patients were all spoilt but for what so many of them had been through, they well deserved all that we could do for them.

After demobilisation, the government arranged for post graduate courses for doctors for their desired speciality. I went to the London Hospital to train in diagnostic radiology and in radio therapy, this was a year's course and I took the DMR successfully for both at the end of the course. I found that the teaching at the London Hospital was excellent and every body there was so pleasant. I spent a year at Bart's as assistant radiologist and then was made a consultant after that at the start of the health service in the year of 1948; six years later, I was made deputy director of diagnostic radiology at The Royal Marsden Hospital with some years at Lewisham Hospital.

I found that the teaching at the London Hospital was excellent and every body there was so pleasant and they spent endless time on "going over and over "informative and interesting films with us. The teaching was highly concentrated there and the physics teaching for both diagnostic and radio therapy radiology was carried out at Guy's Hospital medical school and there we had the great pleasure of listening to Professor Stead, his lectures were the most interesting that I have ever heard and for an hour, one's mind was completely captivated by his words. To add to his interesting lecture he told us about his previous work with the famous J.J.Thompson in their experiments to determine the weight of the hydrogen atom many, many years ago. This work required the use of what is now known as a cathode tube which they made – the first one! What an achievement.

At The London Hospital, the X-ray equipment so soon after the war ending was all pre war type; I still remember that when a radiographer attempted to obtain a lateral view of large male patients lumber region with the low KV and current and slow intensifying screens, slow films, the time factor was would be long. On pressing the exposure button, she placed her hand on the m/a control while watching the m/a meter on the wall, this was liable to fluctuations should other loads be taken from the mains during this time such as lift going up and she would have to control the current to the right amount. During barium examinations, carried out in total darkness, sparks seemed to fly from various areas like fire works and I remember that high voltage cables were usually not insulated but were isolated by perforated guards. It all added mystique to the patients wonder of X-rays, little was known by them in those days. To change the current from under couch X-ray tube to that in the erect position, an exposed overhead switch was employed by pulling on a rope, hoping that it was dry! A manually activated tilting table was used for barium work, but not motorised yet.

After completing my year at the London Hospital, and passing all the DMR examinations, in both Diagnostic Radiology and Radio Therapy, I was appointed to St. Bart's Hospital as Assistant Radiologist which was very pleasant, like the London Hospital nearly all the X-ray equipment was of pre war vintage except one general use set, this had a tomographic attachment but for exposing, the radiographer had to walk along pushing the upright column to activate the swing of the tomograph, not yet motorised.

It was with amazement on my first day at Bart's that I saw a porter carrying a watering can as he approached an X-ray tube and started filling it with water- high voltage and water do not normally mix without some fire works. This was the first that I knew of water cooled X-ray tubes! There was much of Dean's equipment present, all built like a battle ship to last for years. There was no tilting table for barium work, the patient stood in the screening unit for chest viewing, barium swallow and view of lower stomach and duodenum; for view of fundus of stomach, the patient was placed on an X- table with X-ray tube below the table and screen above, there was no tilting unfortunately. I understand that with the shortage of radiologists during the war, those remaining at

Bart's undertook large barium sessions of about twelve barium meals per session. On this machine, to my utter surprise, I saw a picture that I had never seen previously nor I shall ever see again was of a bullet in a cardiac cavity bouncing about like a ping pong ball on a fountain. Unfortunately in those days we had no visual recording to show this; the patient told us that he had been wounded in chest during action in the war but little else. I presume that he was referred to a cardiac unit but in those days there was no open heart surgery and I do not know what happened to him eventually, probably left well alone.

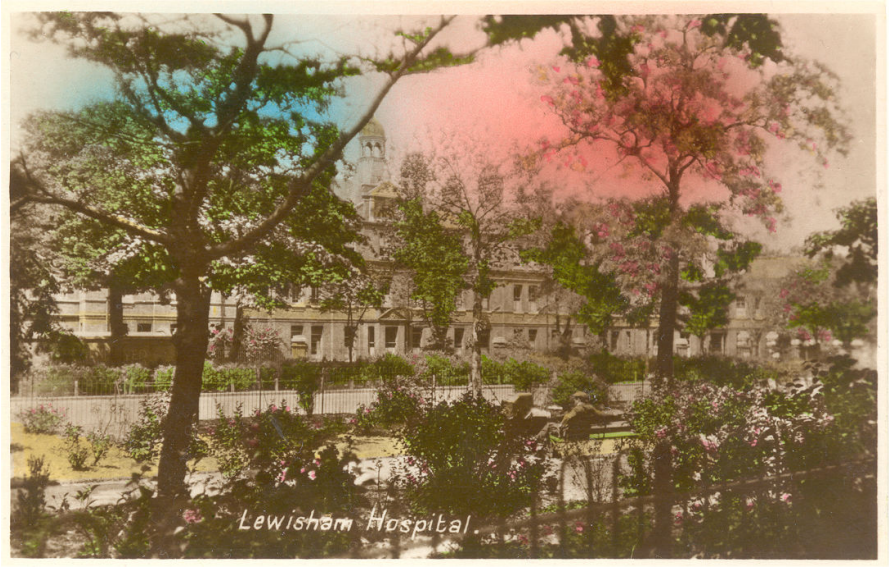
While I was at Bart's, they started to clear out some old equipment and among this were numerous old photographic glass plates, those used before the present type of film. Viewing these pictures, I was surprised at the high quality of the pictures in spite of the long exposure needed for them. There were pictures taken with some barium or bismuth showing the presence of large hair balls in the stomach, not uncommon in Edwardian time. I heard that these plates ended up glazing a green house!

X-raying of whole set of teeth required numerous changes of angulation of the X-ray tube which was time consuming; I considered the possible use of template type of rail on which the tube could rotate presenting the correct angulation at each tooth. About this time the present system of rotating the patient with out angulation was used. I did not like this as surely a hot spot would be produced in the soft tissues at centre of the rotation. Also at this time at start of health service, I left Bart's to start at Lewisham Hospital where alas I was far too busy to think any more about the teeth jig. Years later at the Marsden where I had access to radio active materials, the above ideas were considered placing the source of radiation in the open mouth but we had little demand for dental X-rays at that hospital and nothing further was done about it. This system could produce useful views of hard palate, sinuses and also A/P views of C.1 & C.2 without over shadow.

At the commencement of The National Health Service in 1948, I was appointed consultant radiologist to the Lewisham group, this was a large group made up of four hospitals, Lewisham Hospital being the main unit, this was a large hospital – larger now, very busy and with a high standard.
It was previously run by the LCC who maintained this standard as with the other LCC hospitals. The radiological work there was heavy and I worked single handed there for a couple of years when without any request from me, the authorities appointed a second radiologist, they said that they feared that I was over worked which might lead to collapse! They did not know me. I have been blessed with boundless energy all my life.

LEWISHAM HOSPITAL
In 1948, the X-ray equipment at Lewisham Hospital was all pre war type, old and of poor quality and in dire need of replacement. On out patient orthopaedic days the main general set's tube – non rotating anode would be cut-out by the thermal safety switch and then there would be a long delay while it cooled down. When I demanded new equipment stating the type and manufacture, I was told by the LCC "radiological" experts that they alone decided what and type of equipment, if any would be provided. After a year or two, these "experts" faded away but in the mean time, I managed to obtain one Phillips DX 4 screening unit and also one DX4 general unit. These were entirely newly designed units and what a change from the old units. The output was much greater giving 100 KV voltage and 500 m/a (not together). The screening unit now had raising and lowering of its patients step and of course motorised tilting table beyond the horizontal. All X-ray tubes were rotating anode type; PVC insulation now covered most of the cables which were now no longer protected by perforated metal guards. These sets

which had just become available were a wonderful improvement of anything seen previously and were a joy to work. Eventually all the equipment was replaced and the department extended. I managed to obtain a typist for my reporting; previously it had all to be hand written! But all reports went out on time.



FIRE IN X-RAY DEPARTMENT

Some time in the nineteen fifties on a bank holiday, I was telephoned by the hospital to come in as quick as possible, I said "what on earth is the haste, this is the only rest in bed that I have had for months" The answer came back pretty quickly. The x-ray department is on fire and half of the London Brigade are here and they are considering evacuating the hospital. I thought then I should go in to see what is really happening. Sure enough, the screening room was filled with thick black smoke which was issuing from the cabinet housing the main transformer, rectifying valves and high voltage change over switches in the tank of transformer oil. I think that the firemen must have put out the flames with carbon dioxide. Practically all the wiring was insulated with PVC but I thought I saw one small area of cotton wound insulation which may have been ignited by a flash over from switch or condenser. No other damage done and at least the fire caused the x-ray room to be painted. This was one of two occasions that I was called in to Lewisham Hospital in all my years there; the other occasion was to see a member of the lay committee who had sustained a motor accident.

After about two or three years at Lewisham Hospital, when appointments for X-rays from GPs were not accepted, then the demand from the GPs increased and much correspondence resulted in the BMJ. I wrote a long letter there stating that at Lewisham Hospital, we had started the service for the GPs and found that there were no un-reasonable requests and no foolish demands; also this service speeded up the work in the OPD departments as the consultant could see the necessary films and report on the patient's first visit.

In my attempt to bring up and maintain a high standard of radiography, I found that the naming of patients films frequently showed variation of back ground blackening due to either holding the naming switch too long or too short a time or possibly wrong temperature of developer or over or under exposure of film – treatment – Automatic processes for light switch and temperature control

FIXED TIME OF LIGHT IN MARKER

Two simple timing circuits in the unit, one giving exposure time of light for standard film, the other for the fine grain slower film activated by two way switch, up for standard film and down for slow film. I published this more than 50 plus years ago in the then new

Radiological Journal; it was immediately copied by the manufacturers of this type of equipment.

TEMPERATURE CONTROLED TIMER

In the developing dark room at my time at Lewisham as in most hospitals, there was difficulty in maintaining a constant temperature of 65 degrees of the developer during the summer months especially if heat wave occurred. The staff placing the exposed film into the developer and set the dark room timer for the five minutes regardless of the temperature with over development of the film. When the raised temperature is eventually noticed, ice is placed in the water bath surrounding the developing tanks which cause the temperature in them to fall below the 65 degree with poor developing. So the answer was – build a simple timer circuit with fixed capacity condenser, relay and resistances. These resistances would be connected to a mercury thermometer so that each one of these would be shorted out in series for each degree rise of the temperature thus reducing the time factor. In the event of fall of temperature more resistances are brought in, in series as required by the temperature thus lengthening the time factor. The thermometer must be in a vertical position and leads are inserted directly into the mercury, one degree or half degree levels in the thermometer centring on 65 degrees, these leads would be each connected to that one degree, or half by a resistance above it to cause raised temperature or below if falling thus shortening or lengthening the time factor. By having variable resistances between the leads in the mercury, it is possible to produce a timing unit to exactly follow the chemical manufacture's Time/Temperature chart automatically without any thought by dark room staff. The cost of use of one thermometer in which all leads are inserted at one or half degree levels is can be high. Purchase of single thermometers at each level is very much cheaper. The whole idea is so simple and unique that I decided to patent it. The cost of this is almost prohibitive especially when funds are low and most of the equipment is built out of junk apart from the cost of the thermometers.

I connected several of the radiological firms but no one showed any interest, then one large firm outside the radiological field could not get over to see them about it soon enough. They were very keen to get into production as soon as possible. I understood from my patent agent that all alternative possible circuits 0were covered, then when it came to the final stage, the firm informed me that they were now going to go ahead using metal bellows! What could I do with little capital, I had no wish to risk raising any money in case I was landed with a financial mill stone round my neck. That is now a long time ago and all forgotten.

JIG ATTATCHMENT FOR HOLDING FILM CASETTE FOR X-RAYING LATERAL HIP VIEWS

It was with surprise that I noticed that when lateral views of hips were being taken a nurse or radiographer would be requested to hold the cassette with out protective gloves or apron and the cassette was usually sited at the level of the lower abdomen of the holder. This at the level of testes or ovaries and with little coning. I thought that it should be possible to make a suitable jig to hold the cassette in place for the exposure and make this available for use on theatre operating table, X-ray table or trolley. In one hospital, I had a superintendent radiographer who was a very keen model maker, especially steam locomotives which he did beautifully; he had well equipped work room. I told him what I wanted and asked him to design it and make it. It turned out so well and when one of the reps saw it, he gave the order for some. Although it was my idea I gave the whole lot over to the superintendent radiographer who was soon to retire. It would have kept him employed for much of his retirement.

SHORTAGE OF X-RAY FILMS

In the mid nineteen fifties, in the drive for maximum exports too many films were exported leaving some hospitals very short, or even without films. For barium work, I approached a camera manufacture in Beckenham (Rays or Wrays) with regard to obtaining a suitable camera for filming the X-ray screen to record stomach views. This had to be done in total darkness and raising the m/a to the tube slightly and prolonging the exposure time slightly. To compensate for this, very few films were taken, these were 35 mm films and had to be partly enlarged and were far better than expected and they filled the gap until supply of X-ray films again became available. A good camera was lent to me by this firm and when its work was done, I purchased it at cost price. On a trip to Malta, I left the car for about two minutes, alas the camera was stolen never to be seen again, I did not expect this to happen in Malta,

X-PELVIMETRY

Again, I think that in the nineteen fifties, a very elaborate technique for pelvic measurement was produced by a radiologist in New Zealand for which he was awarded an honours degree by an obstetric college in this country. It consisted of one A/P view, two A/P views, each with lateral shift, and one or two pelvic outlet views. I was horrified. In the later stage of pregnancy when most of these examinations are required, a large foetus is exposed to at least full body scans in the three A/P views alone which I consider unjustified. At that time I did not have the facilities to work out the actual dose of radiation given which must be large. It is possible if this is not appreciated, and if the views are not fully up to standard, this examination may be repeated! In my department I refused absolutely to carry it out. One A/P view gives sufficient information.

I.V.P. IN PREGNANCY

Again, one is very reluctant to carry out this examination; some fullness of the renal calyces is normal with patient in this state; I felt that in most such cases, the five minute film show give all the information required unless there some gross lesion present.

It was very pleasant working at Lewisham and lunch was available for consultants in the large nurses home, we had a large table there and the catering was carried out by the home sister and very well done, all for the price of one shilling. The maid would come along to us and ask "fish or meat" to which I always replied "we shall start with the fish and then try the meat". That went well for a long time until Bureaucracy raised its ugly head and a catering officer was appointed. He had to be paid so no more Fish or Meat. Previously at Christmas time, the hospital invited all the consultants and wives to a wonderful dinner, a long established practice – no longer now.

In 1954 I was appointed deputy director of diagnostic radiology for five sessions a week, two of which were for experimental purposes for the annual salary of £1237 at the Royal Marsden Hospital. The South East Regional Board were very good in that they let me stay on at Lewisham for four sessions as I was now going part time and making a new appointment for my now absent five sessions. That sounded too good to be true and so it was, I found that on my experimental sessions on several occasions when working on some proposed project I should be called away to carry out barium swallow on a patient who had just arrived from the middle east and who was very distressed suffering from late stages of post cricoid carcinoma. There were only two radiologists at the Marsden and it was seldom that we were there together so that most of my time there; I was there on my own.

The radiological work there was mostly confined to malignancy with a high proportion of tumours of oesophagus, mainly upper end, and tumours of larynx, tongue, epiglottis,

arytenoids, hard and soft palate, naso pharynx, sinuses and of course carcinoma of bronchi. Of these, the most distressing examination was that of advanced lesion of post cricoid region which necessitated the patient attempting to swallow liquid barium immediately he or she was requested. No doubt that the patient made every effort to do this and some times would say a garbled "What now" when one had already made the exposure of X-ray film. Frequently there were delay in the attempted swallowing and there was difficulty in securing the exposure at the exact time. Some times, a trickle of barium would extend into the larynx causing severe coughing and blustering of barium causing considerable distress to the patient that he may refuse to attempt further swallows and lack of the patient's understanding English in many cases renders the examination even more difficult. Under these circumstances the necessity of including an automatic exposure unit in the X-ray set is absolutely essential.

AUTOMATIC EXPOSURE UNIT FOR BARIUM SWALLOW EXAMINATION

I have given considerable thought to the method of acquiring this unit; it consists of a small lead castle containing a radio active substance placed on one side of screening set which is provided with a small port on its medial side: this is closed until required. Directly opposite this and placed at same level, is X-ray receptor unit which is connected to the exposure mechanism and in its active state it with holds any exposure of the X-ray tube. For the barium swallow examination, the X-ray screen is set at the level of upper oesophagus, the patient is requested to take a mouth full of barium, the operator then pressed the exposure button, this starts the anode of the X-ray tube rotating and also this opens the port releasing the beam which activates the receptor on the opposite side of the patients neck with holding the X-ray exposure; the patient is asked to swallow the barium which as it passes between the radio active substance in the lead castle and the receptor now blocks the beam which has been with holding the exposure now makes the exposure of X-ray film and is only made when the barium is in the ideal position. The X-ray tube will not expose until the barium is in this right position.

I approached Professor Maynard at The Marsden Hospital about the possible production of this unit, he was enthralled with the idea and set physicists and instrument makers to work; having given the idea of the unit to the professor, I left all choice of radio-active substance and building to him. The initial unit was quickly constructed and worked perfectly. Siemens were called in to attach the small units such as lead castle on one side of the elaborate Siemens screening unit in use there and receptor on opposite side, they under took all the internal wiring connections. Professor Maynard chose radio active thulium for the unit; it has a long half life and from what I remember all those years ago, it has a narrow radio active out put band corresponding to about to that produced by X-ray tube using 85 KV.

In practice, this unit worked perfectly and completely changed the whole art of barium swallow examination and greatly reduced the discomfort of those patients with advanced post cricoid lesions and reduced the number of exposures and films previously necessary to obtain satisfactory results.

An interesting point to note is that having taken one A/P swallow film and followed by second A/P view, some times the lower border of the bolus of barium in the second film would be just one cm below that in the first view; it is difficult to state what the time difference there is between the levels of these lower borders, probably 1/100 of a second. Some times the lower levels are at exactly at identical levels, a condition impossible to achieve by manual effort.

Some time in the nineteen fifties, I was asked to read a paper on this subject at an international conference in London; this was later published in one of the British journals including copies of my swallow films. Some time later, the editor of one of the large American Radiological Journals wrote to me asking for permission to publish copies of my films used in the paper. I said "Certainly" but suggested that he obtained permission from the British publisher to ensure copy rights. Professor Smithers, head of radio therapy department at the Marsden Hospital asked me to write a short account of this unit to be included in his classic book 'Tumours Of The Oesophagus', showing the swallow films taken with this unit.

It is possible that by using radio active substances in this unit that the powers that be may not permit its use out side radio therapy units; in that case, a miniature modified dental type of X-ray unit could be easily produced to act as the trigger unit.

X-RAY AMPLIFICATION

From early in my radiological career, I was interested in thinking up some idea of amplification of the X-ray image together with reduction of the necessary strength of the X-ray source producing this image. After much thought, I wondered how the astronomers obtained satisfactory films of even faint stars and heard that they used some thing called a tube. I immediately thought of a cathode ray one or a modified type of TV tube in reverse with a fluorescent face acting as an electron emitting cathode when activated and the anode acting as the picture forming anode screen. X-rays falling on this cathode would emit electrons and their passage to the anode would be greatly hastened by high voltage between cathode and anode giving bright picture on anode screen. With the anode screen being so much smaller than the receptor cathode, there would be a higher concentration at this site with brighter picture; this would then be most suitable for TV camera. Of course I had no facilities to produce such a unit but discussed it with various manufacturers; none were the least bit interested except one Rep who said practically nothing. 18 months later, his firm had produced a working model and when I told him that this was what I had explained to him, his answer was of course 'We have been working on this project for a long time'. They did how ever leave their first model at the Marsden Hospital for me to try out, criticise and possibly suggest some additions or alterations. When the final model was placed on the market, The Marsden Hospital purchased one; this was the start of many hospitals to be equipped with one eventually. This had two very important assets in that it was no longer necessary to carry out barium screening work in complete darkness and by working in normal lighting; the operator used his light vision as opposed to his dark vision previously employed. The other factor is the great reduction in radiation required; the unit is now in world wide use.

TWENTY FIVE MILLION VOLT X-RAYS

During my early days working at the Marsden Hospital, I was interested in obtaining satisfactory x-ray films using radio active substances in place of X-rays generated by high voltages and X-ray tubes. This with view to marked reduction of weight as X-ray units are very heavy mainly due to the quantity of copper and iron required in the transformer necessary to produce these high voltages. Many places in the Third World are without electric supply and thus no X-ray facilities, this also applies to casualty clearing stations for troops in time of active service and where there are sparse areas served by the so called 'Flying Doctors' who can not carry X-ray units. Then in 1956, the Suez crisis arose and the use of radio-active units would have been so useful if available.

There was a considerable variety of such substances available at the Marsden and I gradually worked through them, some were unsuitable in that their half life period was too short, for some their output beam too high as expressed in corresponding KV. I presented a paper at a clinical meeting at the Marsden giving all details and results and I have forgotten most of these; it is nearly 50 years ago, the original paper has long been lost, probably lent and as in most cases never returned. An interesting factor was noted was that the density of bone became less as the beam produced by the radio active substances corresponded to higher and higher KV, I thought that it might just be possible that with extremely high voltage that some thing near a ribless or nearly boneless X-ray picture could be produced! Wishful thinking! The highest corresponding KV substance that I could find was caesium which showed such a beam as produced by 500,000 Volts. A Van de Graff unit can produce even higher Voltage but the unit used at the Marsden was old and it could not be turned on and off for the short exposures required. Quite by chance at the Marsden we happened to find a shutter unit in which the actual shutters were lead and about 9 inches thick and activated by a huge solenoid and worked well but causing a very loud bang on use. No one knew where this very large piece of mystery came from nor what it was ever used for or how long that it had been there. The modern Van de Graff unit like the older unit has a transmission target but the new model has in addition a coil round the stream of electrons going to the target so this beam would be diverted normally off the target, so that the timer then can make the exposure for as little or as long as required by stopping the current in the coil and allowing the electrons direct passage to the target. (In a transmission target, the beam of electrons strike the thin target on one side and the X-rays are emitted from the other side of the target)

I found that by raising the Voltage in The Van de Graff that I did not achieve any further lessening of bone density as seen in the films so what next? Some thing that to the best of my knowledge had not been tried previously – The use of the cyclotron to produce X-rays with corresponding voltage of 25 million volts! This huge unit was situated deep in the sub-basement of the hospital; to use this unit required the presence of at least two physicists and a bottle of liquid nitrogen (do not ask me what that was for) Disappointedly the results did not come up to the great expectations that was hoped for and not as good as those produced by the Van de Graff unit but we found to our surprise happenings occurring which we had not anticipated. Working first with a phantom and usual film and screens at this voltage, following exposure there was no sign of any blackening or discoloration of the silver salts in the X-ray film; I tried replacing the fluorescent screens with a paper thin sheet of lead which did produce blackening of the film, presumably due to scatter radiation from the lead sheet. Now placing the patient beyond the lead shutter unit and cassette with lead sheet and film behind him an exposure was made; this produced a picture most probably by scattered secondary electrons from the lead sheet but greatly fogged which should be due to scatter radiation from the patient. To over come this, the cassette with film was moved two feet backwards from the patient and this prevented the scattered fogging. These patients were receiving X-ray treatment and the dose of experimental radiation for each exposure was known; physicists deducted the very few Rs exposures that we made from their total dose.

An interesting point was noted during these experiments in that in spite of the X-rays produced at such high levels, soft tissues that were exposed to air did show up which could be very helpful in dealing with lesions in or about the naso pharynx, soft palate, pharynx etc.

In undertaking experimental work, such as this, with luck success may happen but it is inevitable that at times the expectations hoped for do not
materialise but we may even learn from this – never venture, never win

About this time, I found that traffic on my route from Croydon to the Marsden was becoming steadily more congested and it was taking me longer and longer to get there often over one hour to cover 15 miles with considerable stress. The return journey was like wise and one was inclined to rush if a private case or cases had been booked for that evening. I found that I was spending a ridiculous number of stressful hours car driving each week and in view of this, so when a vacancy occurred in the large Croydon group for a Radiologist, where I could reach any of the hospitals in the group in a very short time I applied and I was lucky to be appointed there leaving my sessions both at the Marsden and Lewisham groups. I found that working in the Croydon group to be very pleasant and no longer the mad hectic rush morning and evening, nor did I have to leave so early in the morning. I stayed there until raised BP forced me out in my last months before retiring date when I had the honour of being given status of Emeritus Consultant.

PRIVATE RADIOLOGICAL PRACTICE

In 1954 I decided to venture into Private Radiological Practice but where best to start, the majority of people with a similar problem rented a room in Harley Street with X-ray set and staff for a couple of sessions per week but I had other ideas. I met Mr. Dean, maker of the famous X-ray equipment and sought advice from him, he was very wise and advised me to go to Croydon which I did, found the field wide open and bought a very fine house with large garden in Sanderstead overlooking the golf course and containing a billiard room which would be ideal as an X-ray room. It had a loo adjacent with washing facilities and also next to it was the butlers pantry which with all its plumbing which would make a good dark room. Fortunately, sale of property at that particularly time was slack so that prices were very low and just right for purchase. I was also fortunate in obtaining an almost brand new excellent complete X-ray set and it also happened that a prolonged dock strike was in progress leading to numerous frustrated exports including a large order of dark room equipment which was being sold off cheaply. Three phase electrics were installed and three weeks later the whole X-ray was installed and working well and there was no competition. To my surprise, there were already a number of patients awaiting the start of the practice and which I ran successfully for almost twenty years, thanks partly to help and care from my wonderful wife. I undertook all the radiography myself but with aid of nurse for barium enemas and for IVPs and a part time typist. I endeavoured to maintain as high standard of work as possible. We also went to town on the decoration of the X-ray room itself and all the furnishings and with some very fine antiques. Every comfort was provided for the patients with as short delay for appointments as possible. Up to 1956, consultants all had to attend their hospital session on Saturday morning but when the Suez crisis came about, this ceased temporally to save petrol on traveling, I still have my petrol coupons from those days, but like so many civil service "temporary stoppages" they still remain 50 years later! As a result of this, I was able to keep Saturday free for barium meals starting 8 a.m. and possibly IVPs late morning with barium enemas after lunch and any thing that turns up after that. The typist came Sunday p.m. During the week evenings, cases were done with out delay. The rest of my time or what there was left of it was spent on writing papers or trying to complete my numerous ideas into a working state but had to find the time to have a quick look at auction view days at any suitable antique piece or my main choice – long case clocks which intrigued me. I was also interested in property; the day was just not long enough. There was just not time available for all the ideas that I would like to

have developed but there had been no financial return on any of my ideas or developments apart from some small sum on a simple piece of equipment to be mentioned later. I found private practice most interesting and to meet so many delightful patients and one met many of them later on the social round.

One day in Croydon, a lady GP phoned to ask me if I could possibly X-ray an American lady almost immediately who had just come off the Queen Mary liner after a very rough journey causing a severe fall with injury mostly to her pelvis; the main trouble was that she had tumour of breast with some secondaries. She was due to travel to Ireland on the following day and they wanted to exclude fractures or pathological fractures and they wanted to deliver the films to the pilot of an American aircraft that late afternoon so as to be on the desk of the consultant in New York next morning. After viewing these he would immediately contact the radio therapist in Dublin to continue the treatment at once which was commenced just previously in New York. Shortly before this patient left my department, I asked her if she could excuse me for five minutes while I said good bye to my elder daughter who was leaving for her job out side Boston. This good lady said that her son was with one of the major air lines, gave me his card for my daughter to contact him later, but she did not tell us that her son was a director of the air line. My daughter did this and she and another girl were invited for a few days trip to see New York. They were given such a time there as only the Americans can do, they were shown the city from the air, taken round the United Nations building, dinners and shows and they had very little sleep and were completely exhausted. They were almost pleased to get home, sleeping all the way to Boston. I think that this trip may well have been a big thank you for what we had done for the mother.

In 1972, both my daughters were married, both my wife and I thought that a change of this rather extraordinary life style might be good for us both. My B.P. had started to rise as could have been suspected; I kept my eyes and ears open and heard that a lovely property was coming on the market in delightful Woldingham, saw it, liked it, and bought it with view of converting it into flats. We moved into part of this property with its huge stables and coach house, I had idea of selling the practice but no one was interested; I could not even give it away, no one wanted the entire equipment as a gift apart from some Indian charity if I would pay the necessary freight charges; it is surprising how so few people have real drive and enterprise, so I had the sad day of seeing my pride and joy leaving the house after almost 20 years of hard work on the end of a crane to being dumped onto a truck. The house was sold but if only we had kept it – how often that I have said that. The price of property in Croydon just went up and up partly as being so close to centre of London; 15 minutes by train.

DOMICILARY VISITS

The NHS paid a fee of four pounds for X-ray visits plus two pounds for use of ones own equipment, this was limited to 200 visits in the year and limited to part time consultants. You could do as many cases as you wished but only received payment for the 200 per year. While working at Lewisham, I eventually went part time and the first thing that I did was to purchase a good so called portable X-ray unit, no second hand ones available and had to pay £300 for a Phillips DX1 which was very good. I undertook about 1200 cases for NHS, mostly in the Lewisham area but in the Croydon area they were mostly PP which was more desirable. Fortunately in those days I was pretty strong, although the unit split up into several parts, it was hard work carrying every thing upstairs. I went into several magnificent houses and there were many around Croydon. It was surprising what one saw, there was also the other extreme; and I saw the odd old house with very aged patient in which contents had not changed since about 1860; no electricity or gas, only

oil lamps or candles I had to ask the neighbours to let me take an electric cable from their house to the X-ray set. This was quite likely to blow all the fuses there with complaints from the children when the "Telly" as they called it went off. I had to be prepared to mend all these. I took the x-ray set to an old peoples home were the electrics looked in a very poor state and of course I blew the fuse which fortunately was on just one circuit. I apologised to the nurse and I said I will fix it. She said that it may not be advisable but to leave it to the electrician and I will call him in the morning, you see that when he comes to mend a fuse, he wears rubber gloves up to his elbows! This repair would be done in the kitchen and to my horror there the cables were taken off bare buss bars. No wonder that long rubber gloves would be used.

I was occasionally asked to X-ray horses at their home to show a spavin in the lower leg; to keep them still, some one had to flex and raised an other leg for the exposure. I was lucky; the horses were all well mannered.

VETINARY RADIOLOGY

While I was working the X-ray practice in Croydon, my daughters had four horses, four dogs and one Persian cat, the cat managed to get out one night and got into a fight with injury to upper end of one paw. A large swelling developed at this site which was an abscess; I X-rayed this swelling and found that the eye tooth of the attacking cat was inside the abscess; we took the cat to the Vet for opening the abscess and she was quite impressed with the films About the same time, one of our immediate neighbours who had two large Great Dane dogs, one of these had developed a large swelling in mid region of one front paw, asked his GP to ask me if I could X-ray it for him to take the films to his vet. I did X-ray the dog for him and we produced some very clear pictures of a large osteogenic sarcoma.

Then the Pro at the golf club adjacent to us whose dog picked up all the lost golf balls – very profitable, went off to South Africa competing in a competition there and asked the assistant Pro to look after his dog very carefully while he was away. Unfortunately, one golf ball did get impacted in the dog's oesophagus and I was asked to X-ray the dog to show the exact site of the ball. This ball was not opaque so I passed a soft rubber catheter down the oesophagus and injected barium which outlined the ball, localising it clearly. The vet decided to operate but with fatal results, the Pro was none too pleased about this on his return.

The news must have got about in the vet world that I had obtained good X-ray films for some of the vets and some requests were coming in and I really did not have the time to manage it all and they may want post operative films of say plated fractures and their times did not really fit in with mine. It so happened that a new X-ray set was being installed at Mayday Hospital and the old one being sold for scrap. I told the vet who sent most cases and suggested that he make a really silly offer for the scrap and then have the set properly installed in his cellar. I helped him all I could, instructing him of the dangers in working with X-rays and that both he and his staff would require lead rubber aprons and gloves to be worn at all times when using the X-ray set. He should also provide safety films for all to ware at all times and to be returned to the radiological safety department each week. Every thing went off safely as far as I know.

NON MEDICAL USE OF X-RAYS

As mentioned previously, I was interested in purchase of good quality antiques being careful previously to avoid any suggestion that showed signs of wood worm. Now that I had the powerful X-ray unit at home, I was able to give any affected area in the

antiques a full dose of X-rays, ensuring that the little Bs deep in the woodwork or resting in the old worm holes would be well and truly fried and not emerge as flies next spring and infect other areas. This could be extended to other parasites.

At present various town councils are moaning that they are finding difficulty in dealing with being over run by rats especially in sewers and are aware of the dangers and diseases that they can carry such as bubonic plague through their fleas; and Weil's disease is also an unpleasant disease that can be picked up from the water that has been infected by rats. Lethal X-rays could be produced by suitable radio active substances housed in water tight lead containers with water tight window openings controlled by remote control and beams directed laterally and downwards. They should cause sterility early in both male and female rats while waiting for their fatal results. I do not know what arrangements there are for firms who undertake this work but I believe some ship yards use this service for X-raying welded areas on ships to confirm that they are satisfactory.

While working at Lewisham Hospital, I found an old dental unit there which had been thrown out as scrap many moons ago, as unserviceable due to a burnt out transformer and un-repairable, I sought permission to take this useless article to take it to pieces and for first time see the innards of a dental unit. I took out the transformer and found that the secondary windings are made up of two coils to produce 32.5 KV each and when connected in series then the voltage would be ranged up to the necessary 65. KV with slight variation given by the tapings from the auto-transformer. One of the secondary coils of the transformer had burnt out so I removed this and re-assembled the transformer which could now produce just 32.5 KV. which was no use in producing X-rays.

In the early TV days, I played about assembling small TV sets using 6 inch screens from old radar sets but as we were approaching the Coronation year, I was required to have a larger screen. A 15 inch screen was available but what a price for those days, about £15 – no ex government ones! and it required about 18KV of EHT, I thought about voltage doubling and then the dental X-ray transformer sprang to mind. The voltage output in this unit at present was far too high so I had to make an auto- transformer with suitable windings to reduce it to the correct level (I made a suitable jig for windings out of old bits and pieces and used a distance meter from a bicycle purchased from a street trader for 6 old pence for counting the windings. I used to have a quick lunch at Bart's and then nip round to the street markets at the back of old Gamages when it was standing) The result was a great success and all was set for Coronation Day when so many children arrived to view the TV, there were not many sets about at that time; pleased to say that it went on for ages and the dental transformer never gave any trouble. If the EHT in the TV tube exceeds more than 19 to 20 KV, there may be X-ray emission from the front of the tube which must be avoided at all costs.

Shoe fitting X-rays units were common in so many shoe shops pre war especially for children; these sets had a fluorescent screen which could be viewed in day light to see the relation of the foot to the shoe, goodness knows what strength of radiation was used to acquire this. Repeated views were taken and possibly the child may have gone from shop to shop. This practice has now ceased, probably banned completely.

As a medical student in 1932, there was a silly story going the rounds "What is gonophone"? Answer – An instrument with which you hear the gonococcus clapp. Ha Ha. Very puerile but suddenly it came to mind about 30 years later in view of the odd practices in the markets in towns in the far East, namely their treatment of bladder stones,

mostly in public. I thought that by attaching a crystal to the tip of a metal catheter with a simple circuit should if the catheter inserted into the bladder with stone present produce a grating sound. I mentioned this one day to a small firm in Croydon, they were delighted, patented in my name and went into production. We found that the crystal worked just as well if attached to the heel of the catheter as to its tip. Quite a lot were sold but in this country they were mostly used for detecting a biliary calculus in the common bile duct. There was possibly also some commercial use for them also. I only mention this as if positive, its result might or should lead to X-ray examination. I did receive a little cash for this, the only cash benefit that I did receive for all my ideas.

MAINTAINANANCE OF X-RAY SETS
Both of my X-ray sets –one major and one portable were delivered to me in excellent condition, the minor unit never gave any trouble in over twenty years; the major one produced two faults in that time.

One Saturday afternoon just as I commenced a barium enema examination, with horror I heard that familiar "click" indicating the failure of a rectifying valve so turned off the X-ray set. Fortunately the patient was a young sensible male; I told him what had happened and asked him as only a very small of barium had been given, could he hold this to which he replied "of course". I opened the cabinet holding the tank which contained transformer oil, transformer, change over switches and of course the four rectifying valves. As all the mains were off I shorted the positive circuits with a large screw driver with insulated handle more than once. Wiring in modern sets is now insulated with PVC so that the whole circuit acts like a condenser and could give one a mighty shock if touched. I always follow the old tip "Keep you left hand in your trouser pocket" Should one be unfortunate and touch high voltage contact in this position, the current will not cross the body at heart level to other hand and also prevents the other hand from touching any earth contact making a possible fatal accident. I put my arm into the oil in the tank, the patient was enthralled to watch this especially when I produced the large faulty rectifying valve. I always carried a spare valve so avoid having the set out of action waiting for a new Valve as in hostel. I screwed in the new valve, fixed its cathode heater voltage, shut the cabinet, washed my hand and arm and re-accommodated, switched on the set and completed the examination with very good pictures.

At a later date, I had a heavy Friday evening session, the last case was just a simple chest and to my horror on making the exposure, the set just cut out – the tube had blown! I brought the portable X-ray set in from the car where it was normally kept and finished the case with this unit. With the tube having expired, I was worried about the cases booked for the next day, Saturday. Fortunately like the rectifying valve, I always kept a spare tube to avoid long delays, the worry was whether the tube had become gassy with not being used. I took the faulty tube out of its clamps and replaced it with the new one; I then made all the connections making sure not to touch any of the high voltage connectors covered in jelly in case sweat from my fingers should leave a tract in which the high voltage might travel along with disastrous results. It was now getting late and the time had come for the big test when the current was switched on. The anode rotated, the cathode glowed and I set the KV at its lowest with minimum current and timer set for short exposure. I went behind the lead screen in front of the control unit, pressed the exposure button, all went well and the ma/s meter read as set. Cheers, although I was all alone and after midnight. The set was left running for a short time, hoping to absorb any free gases. I gradually brought up the kV and current to normal working levels with out trouble. The set worked well next day with barium meals and

enemas and was still working well when thrown out several years later. We had no other troubles with this set.

MERIT AWARD

This always passed me by. At the Marsden Hospital, the six professors there were whole timers, the rest of us were part timers and the Marsden left any thing about merit awards to the other hospitals that we attended. I heard along the grape vine that my other hospital's "Three wise men" thought that with my private practice, I was not in need of any extra payment and the award was granted to one said to be in need. These awards were never intended to act as charity grants but I believe that some were abused.

NON RADIOLOGICAL PROJECTS

Although outside the radiological sphere, you may be interested in just two projects that I completed some years ago:-

Foetal heart amplifier, recorder, tachometer and demonstrator of foetal sound complex. As mentioned earlier, my ears were damaged by gun fire in the Navy causing considerable deafness and in 1949 when we were expecting our second child, our first came shortly after I had left for Australia in 1945. Unfortunately I was unable to hear the baby's heart so an amplifier was required and funds were very low at that time. This was completed out of ex-service junk after many hours work and much burning of mid night oil. The construction was aided by my home made oscilloscope but it lacked many useful features and as the work on it had gone so well. the hospital bought a good oscilloscope for my use. A copy of the circuit is enclosed but that of the whole of the cathode ray tube circuit to produce the picture of the sound complex is omitted as it is now taken over by the oscilloscope which is capable of photographing this complex. If only the oscilloscope had been available earlier, it would have saved me a great deal of time. The hospital electricity mains in those days was in a poor state, showing a fall in voltage if suddenly loaded as with up going lift. To over come this necessitated the building a complicated voltage stabiliser – not shown in circuit. Unfortunately transistors and IC units (Integrated circuits) were not available at that time. As I had to use thermiotic valves – 30 of them which required a line voltage of 300 volts The transistors are vary small, require no cathode heating and work on low voltage 6 to 12 voltage and if the CRT. is omitted can be made pocket size and no dangers and can be run on a battery.

Our obstetrician at Lewisham, Alistair Gunn who I knew him well as a Surgeon Commander having been with him early in the early days of the war, we later travelled out to South Africa on an American transport. We each had a single cabin on the boat deck which we each shared with five others! We had the American ships doctor sitting at our table, he told us that he was considered a radiologist, he said smiling, after six weeks training. Gunn provided the foetal hearts for me to work on after our one was born. This machine worked well, it was built purely as an experimental unit with numerous variations of circuitry. Mr. Gunn arranged for me to be invited to demonstrate this machine fully working to about two or three hundred obstetricians at the Royal Society of Medicine which I did in 1953 and fortunately it worked well. The foetal heart could be heard on ear phones or loud all over the hall from loud speaker. The meeting was recorded in the proceedings of the society. I published the circuit and electrical details in the excellent journal Electronic Engineering and received correspondence from many parts of the world.

My daughter was living in Miami several years later and in the last months of her pregnancy when she developed a rise of blood pressure; she had to attend the local

hospital there and among the test given was foetal heart recording. She said to the technician, you may be surprised to hear that my father invented this machine. The girl looked at her and smiled and said " at a time like this one does get strange ideas"! All went well.

Our first recordings were obtained on a wire recorder borrowed from a local GP, later tape was used. The BBC TV telephoned me one day asking permission to play the foetal sounds over the air at the same time showing the complex on the screen. Of course I agreed but asked how did they obtain the sound tract; apparently this came from the British sound department some where who retained a copy for their achieves for all time. The other non radiological idea that I had developed was when I had an interest in a firm with heavy transport and where graphic paper and ink recording was used for travel details but not entirely satisfactory. I managed to record all this information with better results on a very slow running tape. The results were good and when I showed them to an entrepreneur friend, he took it up at once and patented it. When it was about to be placed on the market. The EU stated that all such recordings were to continue to done on graphic paper as previously and away went my idea and his cost. Such is life. I can not understand why such an order has been announced.

In the latter part of my time with the S.W. Regional Board, I was occasionally invited to sit on selection committees for appointing consultant radiologist and I found this duty very interesting. If there was an already established radiologist at this hospital, I was always very keen to know which of the prospective candidates he would choice and why. I considered harmony in the department as a very important factor and was not easily over ruled on this factor. Originally, these appointments used to be held in the Board's office in Paddington but later at the appointees hospital. If this was situated well out of London, it would require a whole day away from my hospital and that meant an enjoyable trip and lunch out with my wife.

COMMENT
Having spent a 35 year career exclusively in radiology preceded by three years in general medicine and six war years in The Royal Navy fortunately with considerable hospital experience there, I have seen many changes in the radiological world. I have one grandson training in radiology and we discuss these changes which have mostly taken place in recent times but are snow balling. Radiological books, both British and foreign are now so much more informative but the cost is very high. These changes will certainly continue.

Fairly early in my radiological career, one female relative of mine married an ENT surgeon with fashionable practice in New York and they then came back to meet the family. He was charming and when he heard that I was working in London, he wanted to know all the new ideas which were developing over here. I told him about some of my ideas which were taking shape and some still in the embryonic state. He was amazed and said what are you doing here on a mere pittance; what the big American firms badly need are people to produce ideas of new inventions for them. I can arrange satisfactory contacts for you and greatly assist you, and your income would rise considerably with a good future ahead. I had recently bought our first house, the vendor had worked for one of the British tobacco firms designing the machinery for making and packing cigarettes and he was taken up by an American firm and joined the brain drain to Washington never to return. I gave this careful thought but finally decided to remain in our own beloved country. I wonder some times what would have happened had I accepted one of their possible jobs.

Finally a little word about Mr. Dean. The last time that I saw him, he told me that his father was a glass blower and he used to blow the early X-ray tubes with their curious probosci for the early X-ray builders. He considered that as he completed the most difficult part of the construction he would start his own business in Wimbledon; I do not know what he did about high vacuum but this business did grow and grow. He showed me a catalogue for 1907 with picture of his X-ray set for sale. He also said that funds were low at that time and sets seemed to be purchased on the "never never" and there were times when some one had to go get some money in to pay for the gas next week other wise – No money –No gas – No work. Very many years later, I had a private patient for X-ray at home and asked me if I knew Mr. Dean, I said of course. The patient told me that he had been Mr. Dean's accountant and each time he went over to see him with numerous documents to be signed, he always had to bring a new pen as what Mr. Dean had was in a shocking state! Dean left no son to carry on the business and thus it was taken over unfortunately by a large firm for a large sum "From little acorns grow, into large oaks I know." I shall always be grateful to him for he did for me with his good advice.

I enjoyed my career in Radiology and would have liked to continue in experimental work after enforced retirement but alas my BP had now risen and I had to abandon all ideas of continued work.

Radioactive Water?

Adrian Thomas

I am very interested in the history of spas particularly in relation to the curious story of the radioactive spas.
These radioactive spas were very popular in the early 20C with the therapeutic use of radioactive mud or water for a variety of ailments. They were more popular in continental Europe than in the UK.
I have recently bought a postcard dated 19th May 1921 advertising Buxton. The photograph is of St Ann's Well and says that there is a constant flow of radioactive water. There are three ladies in nursing style uniforms around the well.
Presumably the water picks up radioactive material as it passes through rocks.
Whilst the radioactive nature of the water might be worth emphasizing in 1921, at present this would not be a property of the water that they would wish to emphasize. On the Buxton website they say:
The water which emerges from the source at St Ann's Spring in Buxton has been shown over a long period of time to be consistently pure. By definition - a natural mineral water may not be treated and must emerge at source. It must be naturally and consistently pure and must

be drinkable in its natural state.
Presumably if the source was radioactive in the 1920s then it is still radioactive. I therefore wrote to Buxton and received the following interesting reply:

"Dear Dr Thomas
Further to your enquiry regarding the radioactivity of Buxton Natural Mineral Water, I am writing to give you some useful background information. This is a somewhat complex issue, but I have done my best to clarify it as follows:
The presence of minute amounts of radioactive substances in natural groundwaters is ubiquitous and in nearly all cases, concentrations present no threat to health.
In groundwaters the most commonly occurring radioactive substances are from the uranium (238U and 239U), radium (226Ra and 228Ra) and radon (222Rn) series.
Because of the varying radiotoxicity of the individual radionuclides, maximum exposure levels vary for each species, and because the determination of individual radionuclide activities is complex, only if gross activities exceed these levels are the activities of individual radionuclides investigated. It is therefore possible that high recorded activities may be due to the presence of radionuclides with a low radiotoxicity.
Buxton Mineral Water has been sampled in accordance with the Natural Mineral Waters Regulations (2003) to determine its gross activity levels, and in addition the activities of individual radionuclides have been checked. There are presently no Standards for radioactivity levels in Natural Mineral Waters; however, there are standards that apply to Spring Waters & Other bottled waters and these have been applied to our own results and we have also taken into account the World Health Organisation (WHO) limits. These standards show that the "total indicative dose" should be less than 0.10 mSv/year. Buxton Mineral Water is well below this standard at 0.022 mSv/year, and as part of our commitment to ensuring the quality of our product we continue to monitor these levels regularly. The "total indicative dose" is based on consuming 2Lts per day (as per the WHO guidelines).
Furthermore, it is known that radioactivity is lost during the pumping, filling and distribution of water, and hence the level in the final product is barely distinguishable from the "background" level generated by all other types of radioactivity, including cosmic radiation, terrestrial sources, such as naturally occurring radon gas, and food ingestion.
To put this into context, if all water drunk by a consumer was Buxton water, the average yearly intake by an adult would represent less than 1% of the total alpha / beta ingested.
I hope this explanation clarifies the position.
Karen Short
Consumer Services, Nestle UK Ltd www.nestle.co.uk 16 January 2004"

New Scientist reports :
"People drinking a litre or more a day could breach radiation dosage guidelines"

Bottled hot water DRINKING too much mineral water could make you glow, but not with health. There is so much natural radioactivity in some Hungarian brands of bottled water that regular drinkers could exceed the World Health Organization's safety limit.
Radioactivity gets into water with minerals from rocks. A study by scientists from the University of Veszprém in Hungary found high levels of radium-226 in three out of 18 commercial mineral waters. People drinking a litre or more a day could breach the limit of 100 microsieverts a year recommended for drinking water, by the WHO, they say (Radiation Protection Dosimetry, vol 108, p175). Lead author Tibor Kovács says children aged between 12 and 17 are most at risk because they drink large amounts of flavoured mineral water and their growing bones are vulnerable to damage from radium. As a

precaution, he recommends that people avoid drinking the most radioactive water in place of tap water.

Previous studies have suggested that mineral waters from France, Germany, Austria and Portugal also contain high levels of natural radioactivity, sometimes in breach of WHO limits. In the UK, a survey of 161 named brands of bottled water from across Europe is due to be published by the government's Food Standards Agency in April.

SciCult

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SciCult is a specialist science-related contemporary art gallery. Established primarily as a network for arts practioners who either use or are inspired by science and technology. Their objectives are:
i) Create a platform for established and emerging contemporary artists to showcase their science-related work.
ii) Encourage creative experimentation across disciplines.
iii) Promote debate around contemporary issues in science & culture.
iv) Mediate contact between public & private institutions, collectors, and artists working in science & culture.
v) Commentate on current trends and activities in science, culture & contemporary art.

SciCult Education: all SciCult artists, staff and partners are represented as 'communicators of ideas'. SciCult organises conferences, events and quest lectures. Part of our 'Cultural design programme' involves the design of science & culture educational programmes aimed at audiences from primary school to degree level.

SciCult/SciArt Dating: a service which operates as a database of scientists and artists who are searching for collaborative partners - the aim is that SciCult will initiate residencies, the results of which will be reported and showcased online.

Marilene Oliver was born in 1977 and lives and works in London. She gained a BA in Fine Art Printmaking and Photomedia at Central St Martin's College of Art & Design, before completing an MA in Fine Art Printmaking at the Royal College of Art.

Her work addresses new digital media in relation to the human body, particularly medical imaging and communications technologies. The main aim of this work is to provoke an enquiry into human interaction that is increasingly being mediated by digital media and to find new ways to sustain intimacy in a disembodied environment.

At the Royal College of Art MA Degree Show in 2001, she presented a sculpture titled 'I Know You Inside Out'. The sculpture was a reconstruction of a 39-year old convicted murderer named Joseph Paul Jernigan (more commonly known in the medical world as NLM's Visible Human) who, prior to his execution, was persuaded to donate his body to medical science. Once dead, his body was frozen and sliced into 1871 cryosections, photographed and uploaded onto the Internet in November 1994.

Oliver undertook the project of downloading the images and 'putting him back together again' by screenprinting 20mm interval slices of his body onto sheets of acrylic and then stacking them on top of each other. The technique developed, results in a body that at certain angles appears to be solid and whole but then vanishes at eye level - it becomes an intangible body. The vanishing point that exists between the virtual and the physical forms the poetic crux of the work both visually and conceptually.

From exhibiting 'I Know You Inside Out' and talking to artists, medics and the general public about their response, Oliver has realised a huge potential in a poetic subversion of medical imaging. Translating flat or screen based medical imagery into a sculptural object allows the viewer to identify spatially with the imaged body as well as repairing its fragmentation/dislocation. She strongly believes that it is essential that as new digital imagery is being created that the implications of digital storage of bodies is addressed ethically, socially and historically within both Fine Art and scientific contexts.

Since leaving the Royal College of Art, Oliver has been researching medical imaging extensively and has embarked on a number of projects. A female 'Know You Inside Out' has been created and she is currently working on a family portrait derived from MRI scans. Her aim is to produce a series of sculptures that will develop the technical aspects of 'I Know You Inside Out', and also further address romantic notions of portraiture, digital preservation and resurrection. She has formed a collaborative partnership with scientists at Nottingham University's MRI research department at Queens Medical Centre, producing work that has proved mutually inspiring and enlightening.

Her work has been exhibited both nationally and internationally. Select group exhibitions include; 'Summer 2002' at Beaux Arts, 'Print and Sculpture Interim' at the Royal College of Art and 'ART2002' at Beaux Arts in London in 2002, 'Never Look Here' at the Foyles Gallery in London and 'The Show: Part 1' at the Royal College of Art in 2001, 'Secret 2000' at the Royal College of Art, 'Divine Expiration' at the Takumi Studio in Gifu City, Japan in 2000, 'Now Vision' at the Victoria and Albert museum, London and 'Screensavers' at Lauderdale House in London in 1999 and '22 Printmakers' at the Standpoint Gallery in London in 1998.

Oliver won the Printmaking Today Prize and Alf Dunn Prize in 2001, was artist-in-residence at the Takumi Studio in Gifu, Japan in 2000 and won the Now Vision, Cannon Photography Prize in 1999.

National Cataloguing Unit for the Archives of Contemporary Scientists

Thirty years of achievement, 1973-2003

30th Anniversary Appeal

The Library, University of Bath, Claverton Down, Bath BA2 7AY, United Kingdom
Telephone: +44 (0)1225 383522 (internal 3522). Fax: +44 (0)1225 386229. Email: ncuacs@bath.ac.uk
http://www.bath.ac.uk/ncuacs

In their first thirty years they have catalogued 230 archives of British scientists for 49 repositories throughout the United Kingdom, principally university archives and libraries, and national scientific institutions and learned societies such as the Royal Society, National History Museum and Science Museum London. In this way they have made an

indispensable contribution to the history of science and the history of Britain in the twentieth century.
Those wishing to make a donation in support of this important work should send their cheques (made payable to the 'University of Bath') to the Director, NCUACS.

The National Cataloguing Unit for the Archives of Contemporary Scientists (NCUACS), a small unit funded by various charitable and other grants and located at the University of Bath, was established in April 1987 to locate, sort, index and catalogue the manuscript papers of distinguished contemporary British scientists and engineers.
The NCUACS is the successor to the Contemporary Scientific Archives Centre at Oxford which operated along similar lines for fourteen years. It is headed by the Director, Mr Peter Harper. The Unit is supervised by an Advisory Committee under the Chairmanship of the Vice-Chancellor of the University of Bath which reports back to the University Senate and the Council of the Royal Society.
The NCUACS is **not** an archive. It does not retain the collections it processes. That is why it can run on a small staff. It offers a multi-disciplinary service, nationwide, flexible and fast. Documents entrusted to its care by scientists, their families or colleagues are sorted, catalogued and indexed, and then placed in an appropriate national or university repository or archive in accordance with the wishes of the donors. They are thus made accessible, subject to any agreed restrictions of confidentiality or library rules of access.
If you would like to know more about the NCUACS, or receive its Progress Reports, please write to the Director, National Cataloguing Unit for the Archives of Contemporary Scientists, The Library, University of Bath, Claverton Down, Bath BA2 7AY.

Read, John (1908-1993), radiobiology. NCUACS catalogue no. 131/4/04, 79pp., Deposited in the Archives and Manuscripts section, Wellcome Library for the History and Understanding of Medicine, London.
The papers were received from the British Institute of Radiology in 2000.
John Read was born in Hendon, Middlesex on 31 March 1908. He left school at 16 to work as a clerk in the Derbyshire County Council Education Department. Studying in the evenings, he took the University of London external B.Sc. in Physics and Applied Mathematics in 1929 and then won a scholarship to Nottingham University College where he took a B.Sc. in Special Physics in 1931.

Read then won a teaching fellowship at the California Institute of Technology (Caltech), and worked for his Ph.D. on the attenuation coefficients of scattered radiation from a range of elements. He returned to the UK in 1934, joining the Radium Beam Research Unit as Assistant Physicist working with L.H. Gray at Mount Vernon Hospital in London. Gray and Read were awarded a grant from the British Empire Cancer Campaign to build a neutron generator for study of the biological action of neutrons. In the words of John Haggith's obituary of Read in *Scope* vol 3 (1994), 'The next five years were remarkable. It took them two years of toil and brilliant improvisation to build the neutron generator and then just three years to put neutron and alpha dosimetry on a sound footing and obtain the RBEs [Relative Biological Effectiveness] for neutrons, alpha particles, X- and gamma-rays'.

In 1939 Read moved to the British Institute of Radiology. In 1941 he was seconded to British Thomson-Houston Co. in Rugby for war work, after which in 1943 he took up the post of Hospital Physicist at the London Hospital. In the same year he played a leading role in the establishment of the Hospital Physicists Association. In 1946 he was made Head of the British Empire Cancer Campaign's Biophysics Research Group at the Mount

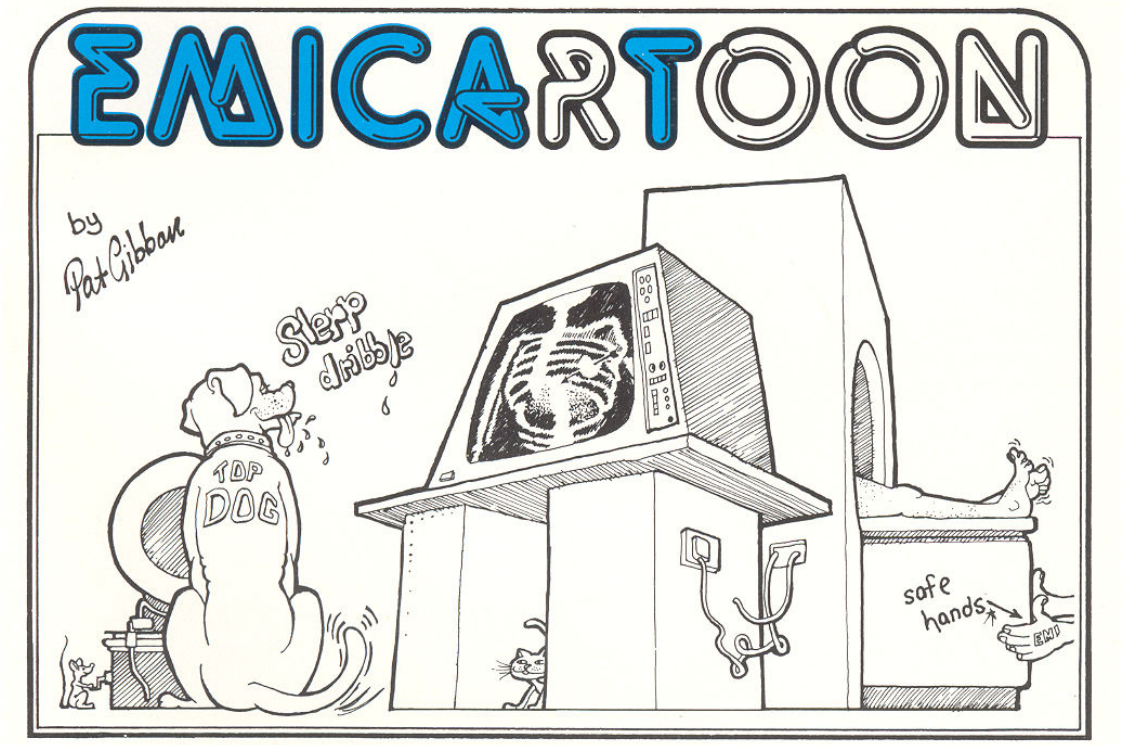
Vernon Hospital and the Radium Institute, from 1948 serving as Combined Head of the Research Group and Physics Department.
In 1950 the British Empire Cancer Campaign established a laboratory for research into radiation biology in Christchurch, New Zealand (moving to Dunedin in 1952). Read was appointed Director of the Radiation Biology Group. He remained in New Zealand for the rest of his life, making occasional return visits to Britain. As head of the Radiation Biology Group, with limited resources, Read pursued research into how ionising radiations destroy tumours and how this action could be influenced by other factors. He retired in 1974. Read was awarded the Royal Society of Edinburgh's Anderson-Berry Gold Medal in 1953 and gave the Douglas Lea Memorial Lecture in 1957. He died in Dunedin on 10 October 1993.

The papers cover the period 1931 to 1994. The bulk of the material dates from the 1950s to the 1970s and research material is by far the largest component.
Biographical material is very slight. It includes two obituaries, incomplete lists of publications, and a little material relating to Read's early career in New Zealand. There are also a few undergraduate notes from University College Nottingham, 1930-1931.

Research material covers Read's entire career from his postgraduate study at Caltech, through work with L.H. Gray at the Mount Vernon Hospital in London and research while Hospital Physicist at the London Hospital, to his move to New Zealand in 1950 and ongoing work to retirement in 1974. Following Read's own arrangement, the material is divided into a number of components. In addition to postgraduate notes from the early 1930s, there is a run of notebooks for the period 1936-1974. The notebook entries are detailed, with dates and often times of experiments, descriptions of techniques and results. The largest component is Read's chronological sequence of folders identified by year and (generally) also by topic. The contents of the folders may include manuscript data, drafts of publications, correspondence on work in progress, supply of chemicals, figures, calculations and graphs. Other components are Read's alphabetical sequence of folders, chiefly extensive notes on the literature; a general series of folders arranged by research topic - mostly undated research notes and data; documentation of research on E. Coli carried out with C. Cowell, 1965-1967; and a little miscellaneous material.
Publications material includes documentation relating to Read's book *Radiation Biology of Vicia Faba in relation to the General Problem* (Oxford, 1959), a number of miscellaneous drafts and a set of his offprints, 1934-1976. Lectures material is not extensive, comprising drafts and notes for lectures delivered from the 1960s. It includes 'The physics of radiotherapy and radiation biology in the early 1930s', Read's John Strong Memorial Lecture of 1961 and a sequence of numbered lectures, probably relating to a course of seminars in radiobiology delivered in 1962. Societies and organisations material is also slight. Nine, mostly New Zealand, organisations are represented, including the British Empire Cancer Campaign Society, chiefly relating to Read's terms of employment; the New Zealand Department of Health Dominion X-ray and Radium Laboratory, with papers and correspondence on radiological equipment, supply of radioactive substances, monitoring of radioactivity, etc; and the New Zealand Medical Physicists Association, of which Read was chairman in the early 1970s.

There is an alphabetical sequence of correspondence with individuals and companies, covering a wide range of topics, including laboratory equipment and chemicals, progress of research, visits, the launch of new journals, as well as social and personal news. There are a few extended sequences, though correspondence of particular note includes that with L.H. Gray, G.E. Roth and H.C. Sutton. The correspondence postdates Read's relocation to New Zealand and continues up to retirement in 1974.
There is also an index of correspondents.

The EMI Scanner



Hello Adrian,
Please find attached my initial response to your appeal in 'Synergy News', April 2004, page 25.
Mrs Alison Broggini

'Hello Adrian,

my name is Alison Broggini, Senior 1 Radiographer in Breast Screening (for my sins).
Your article re: the EMI Scanner interested me as I did work on the first one at Queen Square in the seventies. I met Godfrey Hounsfield a couple of times, once when he came to see how we were getting on with his scanner, and once soon after at a country weekend where I saw him join in the Country Dancing.
I too remember the sense of excitement when the images of the brain were being shown to various members of the medical staff when the patients in their care were being scanned.

Before the scanner was installed there was an air of scepticism among the radiographic staff as to how useful it was going to be and vague stories of placing the head in a water box were mentioned. The scanner had to be installed in the basement of our small hospital due to its size and weight, as our X-ray department was on the third floor in those days and the building was I think Victorian with rickety wooden floors! When I did get to work on the scanner the water box turned out to be the most important feature of the

process as air bubbles had to be eliminated frequently in order to ensure homogeneity and reduce artefact.

The patient had to place their head inside a latex rubber bag (lying supine) and then the water box was filled so that the rubber fitted snugly around the skull before the scan could proceed. This was a lengthy process especially as the latex often developed small holes and had to be replaced frequently. I seem to remember that only about five patients were scanned in a day, and that was a good day. We very soon had to increase the length of our working day and shifts were organised. The images were stored on magnetic tape and that too took a long time and could only be done after the scanning was complete.

Thirty years later I still remember the night we had to creep back after hours to scan a severed head in order that the scan slices could be compared with the actual brain slices after dissection. It was a fairly hopeless task as the water pressure behind the latex kept pushing the head back out of the scanner.
The mission was accomplished another night using a whole body instead.

My six years at Queen Square were the most exciting and interesting of my radiographic career and I hope these few memories are of some interest to you.

Sincerely

Alison Broggini'

CAT scan!