# The Invisible Light

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## Editorial Notes

I hope you like this issue of The Invisible Light.
I came across a good quotation recently:
*"As a historian of xxxx it is my unshakeable conviction that a tradition can be understood only genetically, with reference to its origins and evolution. Those ignorant of history are prisoners of the latest cliché, for they have nothing against which to test it. That is what a knowledge of the past can give us ……. The past is always instructive, but not necessarily normative. What we do today is ruled not by the past but be the adaptation of tradition to the needs of the present. History can only help us to decide what the essentials of that tradition are, and the parameters of its adaptation."*
All good stuff – the quotation was from Robert Taft SJ and xxxx refers to the 'Christian liturgical tradition' but the sentiments apply to history generally.

I have included some material given to my by the son of the late Derek Guttery. When going through these papers I have been more and more aware of the depth of knowledge that Derek had and the great loss to the world of radiology history that happened by his death.

Do please consider presenting a paper in Dundee at The British Society for the History of Medicine in 2007. There is to be a session on radiation medicine.

Adrian


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19th November 2006

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## 2007 ukradiological congress: Advance Programme

This 2007 UK congress will be held in Manchester on 11th - 13th June 2007 www.ukrc.org.uk
The Congress President is Prof Rodney Reznek.

History Special Focus Group ('kindly organised by the British Society for the History of Radiology'). The history session is in stream 7 and is on the afternoon of the 12th June 2007.

The BSHR has organised a full session. Do come and attend. We will also be having a stand in the technical exhibition. If you are able to help on the stand please contact either myself of Mrs Jean Barrett.

The programme is:

'The current state of radiology history'
Dr Adrian Thomas, Princess Royal University Hospital, Orpington

'Archiving clinical radiology in Manchester in the 20th century'
Mrs Geraldine Hunwick, The John Rylands University Library, Manchester

'The German Röntgen Museum'
Dr Uwe Busch, Deutsches Röntgen Museum, Remscheid, Germany

'Dr Samuel Stuart Pennington and the Battle of the River Plate'
Dr Alfredo Buzzi, University of Buenos Aires, Buenos Aires, Argentina

'Patient and staff radiation doses from early radiography (1899-1902)'
Dr John Kotre, Newcastle General Hospital, Newcastle-upon-Tyne

## Books and Articles on the History of Radiology

### Voices from Chernobyl: The Oral History of a Nuclear Disaster (Paperback)
by Svetlana Alexievich, Keith Gessen (Translator)
Hardback: 240 pages
Publisher: Dalkey Archive Press (2005)
ISBN: 1-56478-401-0
Price: $22.95

"On April 26, 1986, the worst nuclear reactor accident in history occurred in Chernobyl. Until now, all of the books published in English focused on the facts, names and data. This hard-hitting collection presents first-hand accounts of what happened to the people of Belarus and the fear, anger and uncertainty that they lived through. In order to give voice to their experience, Alexievich, a journalist by trade, interviewed hundreds of people who have been affected by the meltdown. These accounts document a crucial one of the 20th century biggest disasters. In this book the people of Chernobyl talk about their lives before, during, and after the worst nuclear reactor accident in history which occurred on April 26, 1986 in Chernobyl."
The book is worth reading. For more information about the Chernobyl disaster and how you can help please visit www.chernobyl.info .

### Megaton Mornings
By Charles Hall
Paperback: 224 pages
Publisher: Owl Press (1 Sep 1993)
ISBN: 189805201
Price: £4.99

"Whilst serving in the Royal Air Force, I spent a year on Christmas Island in the pacific, (1200 miles south of Hawaii), and during an eleven week period in 1962, I witnessed twenty-five nuclear weapons tests. These were carried out by the U.S.A. government. Only three hundred or so British Army, Navy and Air Force were involved. Twenty years down the line, after meeting up with Jock, a fellow veteran, - one of the main characters in the book - I had an incredible urge to write about our experiences. Letters I sent home at the time were re-read and details confirmed by Jock. Twelve years later the book was ready for publication. Several publishing houses expressed an interest but they would have preferred a fictionalised account. However, I had to tell it how it really was. The small publisher Owl Press specialised in military stories and during 1993 local radio, press and television showed interest. I had a number of letters from veterans most notably for the books accuracy. One such comment was, 'Reading the book in bed made me feel as though I was back on the island.' Comments like that made the twelve years worth while."

## Deadly Sunshine: The History and Fatal Legacy of Radium
By David Harvie
Paperback: 288 pages
Publisher: Tempus Publishing Ltd (29 April 2005)
ISBN: 0752433954
Price: £12.99

"Radium, discovered by Marie Curie, has an extraordinary history. First touted as a miracle cure, its dangers emerged by the 1920s and its legacy is still with us."
This is a useful book for anyone interested in the history of Radium.

## Vintage Papers from The Lancet
By Ruth Richardson
Paperback: 488 pages
Publisher: Elsevier / The Lancet (2 Nov 2005)
ISBN: 0080446833
Price: £32.99
"Its pages stand witness to the history of its own times, from the cholera epidemics of the early 19th century to SARS. Perhaps above all, "The Lancet" is a chronicle of the unfolding of knowledge in its most important human application. This volume is a taster from this rich brew. It is a choice selection of historic clinical and scientific articles appearing in "The Lancet's" pages over its publishing lifetime. It looks at the whole of modern medicine refracted through the pages of one of the finest medical journals in the world."
This is a useful book. There are many papers relating to the development of medical imaging. The main problem is that for most of the papers all we are given is the first page. This significantly reduces the value of this book. The full papers should either have been reprinted or alternatively they could be in an accompanying CD or web-link.

## A Personal History of Nuclear Medicine
by Henry N. Wagner, Nancy Knight
Hardcover: 308 pages
Publisher: Springer-Verlag London Ltd (Jun 2006)
Language English ISBN: 1852339721
Price: £90.00

"This book outlines the history of the development of nuclear medicine and describes the hurdles that nuclear medicine has had to face, in view of the perception of risk of radiation. Up to the present day, the diagnosis and treatment of cancer has been primarily surgical. When a mass or an enlarged lymph node is detected, immediate attempts are made to remove it or obtain a histological diagnosis by biopsy. Today, characterization of molecular processes in cancerous lesions by PET can help to determine whether therapy should be aggressive or postponed. The most important reason for the rapid acceptance of PET imaging

is its value in the care of patients with suspected or known cancer, for establishing the diagnosis, planning and monitoring therapy, and in detecting early recurrence. Written for nuclear medicine professionals, non-nuclear medicine physicians and the public, this book chronicles the development of nuclear medicine together with its basic philosophy in the past, present and future."
This book is warmly recommended. Of particular interest for a book about history is that it comes with accompanying CD containing reflections by the author, a BBC audio recording and account of the advent of Nuclear Medicine in China.

## Interesting Web Sites

### medicalphysicsweb

"medicalphysicsweb: your community website": Since its recent launch, medicalphysicsweb has attracted a rapidly growing base of readers and advertisers. This new community website from IOP Publishing has a remit to promote fundamental research, technology transfer and business development across the medical physics community.
medicalphysicsweb delivers daily news, analysis and comment comprising the best in science and technology journalism from our team of editors. This core offering is reinforced by weekly opinion articles from academia and industry alongside highlights from our medical and biological group of journals.
Access to all content is free of charge.
Visit http://herald.iop.org/medicalphysicsweb/m114/rsw//link/348 to register as a site member.
If you would like any further information about medicalphysicsweb, the e-mail is:
info@medicalphysicsweb.org
http://medicalphysicsweb.org

### $E = mc^2$ Explained

How would 10 top physicists—two Nobel Prize winners among them—describe Einstein's equation to curious non-physicists?

"Einstein was one brilliant dude! Here's some audio shorts on his profound revelation that Energy IS Matter and Matter IS Energy - hmmmmm, I wonder if science and spirituality are pointing at the same No-thing/Every-thing, just using different words...be sure to click on the link below to hear top physicists explain the importance of E=MC2 to laypeople... Love, B"

http://www.pbs.org/wgbh/nova/einstein/experts.html

### Train to be a radiologic technologist

You may enjoy this radiology video on YouTube, all about why a person would want to train to be a radiologic technologist.  It is American.
http://www.youtube.com/watch?v=N1RAzz44Ljk

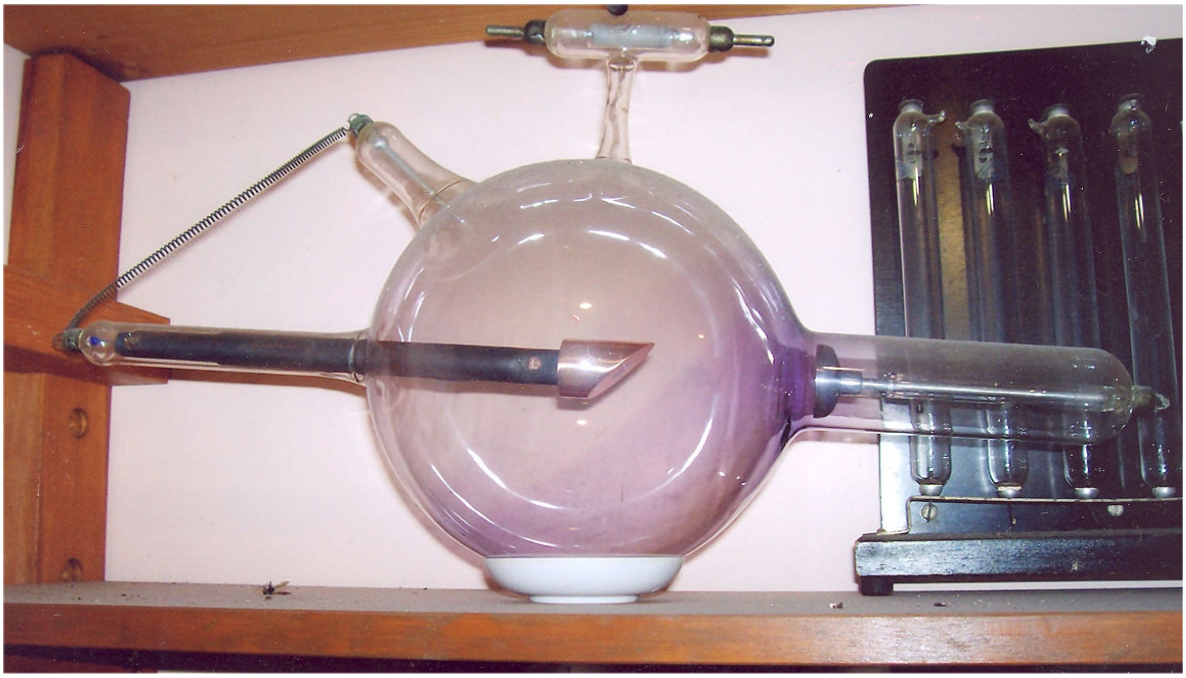
### How to dismantle an atomic bomb.

Helpful hints on how to how to dismantle an atomic bomb  ;-)

http://wired.com/wired/archive/14.10/start.html?pg=12

## **A reply to questions about a gas tube.**

By Adrian Thomas



The design of X-ray tubes is always an interesting subject.
The tube in question (and illustrated above) is an ion X-ray tube also known as a gas tube or a cold cathode tube. The design is typical of many of the time, before our modern Coolidge-type tubes with a heated spiral cathode and a high vacuum. These tubes are variants of and derived from the earlier cathode ray tubes (such as the Crookes and Hittorf tubes).
The ion X-ray tube illustrated has three electrodes and a softening device in a side-arm. The three electrodes are the cathode, the anticathode and the anode.

The wall (bulb) of the tube is made of glass, which contained silicates of potassium, sodium and calcium and occasionally lead, manganese, aluminium and boron.

The early X-ray tubes have either two or three electrodes.

The cathode.
The cathode of the earliest tubes was a simple electrode and this was replaced by a flat plate. In order to produce some electron focussing, the flat plate was replaced by a dish concave towards the target. This focussing cathode was probably first introduced by Sir Herbert Jackson.

The target.
The target was placed opposite the cathode and was called the anticathode. The surface of the target was sloping at an angle of 45º to the tube axis. The surface of the anticathode was covered with platinum and acted as a target. The x-rays were emitted in all directions with the central ray being at right angles to the long axis of the tube. Modern line focus was not introduced until 1922. The target was made of platinum because of its high melting point. Wilhelm Röntgen preferred a concave mirror of aluminium as the cathode and a piece of platinum foil as the anode turned 45º to the mirror axis (this was a 2 electrode tube).

The anticathode in the three electrode tubes (as illustrated) was connected to another electrode called the anode (and also called the auxiliary anode). The joined anode and anticathode were both connected to the positive pole of the voltage source. The cathode and auxiliary anode were made of aluminium. The exact reason why a third electrode was needed is a little difficult to determine. That the cathode and auxiliary anode were both made of aluminium was thought to have a stabilising effect on the functioning of the tube. It was also felt that when the tube was used with an alternating current that it offered some protection against the reverse current. It was believed that any undesirable discharge that took place in the tube would take place between the cathode and auxiliary anode and the desirable discharge is between the cathode and anticathode. Tubes were produced with both two and three electrodes and most German tubes were fitted with the auxiliary anode.

The illustrated tube has the original anticathode. The essential problem with the X-ray tube is in increasing the permissible load. This was particularly important for tubes used in radiotherapy. The illustrated tube has the platinum plate set in a bevelled copper cylindrical solid block. This copper block is then fixed to and supported by a slotted steel tube, which passes down the glass neck of the X-ray tube. This iron tube has a thin wall and this reduces the flow of heat into the glass neck and the large surface area of the iron tube will facilitate the radiation of heat. The principle was very effective and was first produced by the firm of Emil Gundelach in 1899 (the Patent Röhre) and remained on the market for in excess of 15 years.

Regeneration / Regulation.

The working of the ion x-ray tubes depended on the presence of a small quantity of gas within the bulb. If the vacuum was too intense (hard tube) the current would not pass through the tube and would pass around the tube and no x-rays would be produced. If there was too much gas in the tube (soft tube) then the gas would fluoresce and no x-rays were produced. The degree of hardness had to be just right and the experienced radiographer could judge exactly what was necessary.
During use the tube gradually became harder and so a mechanism to introduce more gas was needed. The tube illustrated has what looks like a Gundelach regulation device. This was described by the firm of Emil Gundelach in their catalogue of February 1910 and was still being offered in their catalogue of 1926! The device consisted of a puncture-proof glass cylinder with two electrodes connected to cylinders of a porous semiconductor material acting as condenser sheets. During regeneration these were connected to the cathode and anticathode and with repeated charging and discharging a small amount of air is driven off the porous material. The form of regulation in the tube depicted is condenser regeneration.

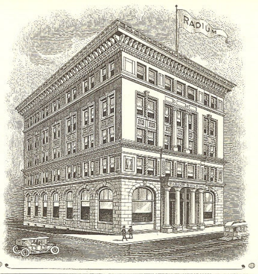
I would presume that the tube belonging to kit Bunker was made by the firm of Emil Gundelach between 1910 and 1926. It would be interesting to know if there were any identifying marks on the bulb.

The best reference book on the old gas tubes is:

Development of the ion X-ray tube by Paul Rønne & Arnold Nielsen. CA Reitzel Publishers, Copenhagen 1986

## Radium Chemical Company

The enclosed contract for the supply of Radium may interest. $100 is charged for 9.9 milligrams of Radium in 1916. This was a considerable amount of money at the time.

**Contract**  **No.** 272



# Radium Chemical Company

*MEMORANDUM OF AGREEMENT* made this ______ day of September, Nineteen Hundred and Sixteen, by and between the RADIUM CHEMICAL COMPANY, a corporation organized under the laws of the State of Delaware, having its principal offices in the City of Pittsburgh, State of Pennsylvania, the party of the first part, and Dr. Southgate Leigh, of 109 College Place, Norfolk, Virginia., the party of the second part.

*THIS AGREEMENT WITNESSETH:*

*FIRST:* The party of the first part agrees to sell and deliver to the party of the second part Nine and Nine Tenths (9.9) milligrams of Radium Element in the form of Radium Barium Sulfate Salt, of a purity of from 50% to 60% at the price or rate of One Hundred Dollars ($100.00) per milligram of Radium Element contained; to be delivered as follows:

September 6th, 1916.

or, in all, Nine and Nine Tenths (9.9) milligrams of Radium Element.

*SECOND:* The party of the first part agrees to deliver the Radium Salt in One Type "B" Tube container , the cost of such container to be borne by the party of the first part.

*THIRD:* The Radium Salt is to be delivered by the party of the first part to the party of the second part through the Virginia National Bank ~~bank~~ of Norfolk, Virginia. and the party of the second part agrees to pay for the Radium Salt immediately upon its receipt by the aforesaid bank and in accordance with the measurements of the Radium Research Laboratories of the Standard Chemical Company of Pittsburgh, Pennsylvania.

*FOURTH:* The party of the first part will furnish to the party of the second part with each delivery of Radium Salt a certificate of guarantee of the Standard Chemical Company of Pittsburgh, Pennsylvania, certifying to the quantity and quality of the Radium Salt furnished.

*FIFTH:* The party of the second part hereby agrees to purchase from the party of the first part Nine and Nine Tenths (9.9) milligrams of Radium Element in the form of Radium Barium Sulfate Salt, of a purity of from 50% to 60% at the rate or price of One Hundred Dollars ($100.00) per milligram of Radium Element contained, to be delivered as follows:

September 6th, 1916.

or, in all Nine and Nine Tenths (9.9) milligrams of Radium Element.

*SIXTH:* It is hereby agreed, so far as the delivery of the aforesaid quantity of Radium Salt is concerned, that this contract is subject to fires, accidents, strikes and other causes beyond the control of the party of the first part.

*IN WITNESS WHEREOF,* the parties concerned have hereunto caused this contract to be executed on the day and year above written.

ATTEST:

RADIUM CHEMICAL COMPANY,

By ______________________

President.

## Chernobyl 20 years on - key findings

From the Press Office
Centre for Radiation, Chemical and Environmental Hazards
Health Protection Agency
Chilton, Didcot
Oxfordshire, OX11 0RQ
Tel: (01235) 822744/5
Fax: (01235) 822746
Email: pressoffice@hpa-rp.org.uk
Website: http://www.hpa.org.uk/

Press Release: Chernobyl 20 years on - key findings

The 26th April this year marked the 20th anniversary of the Chernobyl nuclear accident.

Delegates at the Health Protection Agency's annual conference will tomorrow hear a number of presentations from staff from the Agency's Radiation Protection Division at Chilton on the Chernobyl accident, its effects on the UK and how radiation exposure is assessed following a major accident.

The first news of the accident at the Chernobyl nuclear power station came via the detection of radioactivity over a thousand kilometres away in Sweden. Ms Jane Simmonds described how the National Radiological Protection Board (NRPB, now the Agency's Radiation Protection Division) started estimating the scale of the accident and giving advice to everyone from concerned embassy staff in eastern Europe to concerned members of the public all over the world. Dose assessments were based on measurements made by NRPB and Dr Bernie Wilkins described how these measurements were made. He also explained the responsibility of NRPB for collating measurements in foodstuffs, milk, air and grass made by various laboratories across the UK, a responsibility now transferred to HPA.

Presenting the Chernobyl epidemiology work at the Conference, Dr Colin Muirhead explained how it had been hoped that epidemiological studies of exposed population would have provided new important information on radiation risks. Dr Muirhead said, "In practice, this has proved to be difficult for the most part, owing to limitations in the framework for conducting epidemiology in the former Soviet Union and because of the generally low radiation doses received in countries further away".

In contrast, Dr David Lloyd reported more positive results regarding cytogenetic dosimetry. He told Conference delegates how "with the ending of the Cold War, it became possible for the UK to collaborate with several cytogenetics laboratories in Russia, Belarus and the Ukraine to undertake chromosomal examinations on Chernobyl-irradiated subjects. Through studies carried out to measure the frequencies of chromosome aberrations in blood lymphocytes, the data obtained could be used retrospectively to assess group and/or individuals' absorbed radiation dose".

Sir William Stewart Chairman of the Agency said, "The Chernobyl accident had a dramatic impact in 1986. Fallout was detectable in the UK and scientists measured the environmental deposition to help estimate the possible health impact. Fortunately the impact on health in the UK was judged to be very small indeed, but in the Ukraine and Belarus there has been a clear excess of thyroid cancer in young people, linked to exposure to radioactive iodine 20 years ago when they were children."

## Chernobyl Medals

Soviet Russian medal awarded to those who helped with the clean-up operation following the Chernobyl disaster.


Russian Federation / Belarus Memorial Medal: in the memory of tragedy at Chernobyl Nuclear Power Plant 1986-2006
Issued to celebrate 20 years anniversary of Chernobyl tragedy, conferred to those who took part in elimination of consequences after 1986
Mint Condition Medal, made of brass, 32 mm in diameter, attached to 5-sided pin back suspension

Russian Federation medal: 20 years of tragedy at Chernobyl nuclear power plant 1986-2006, with blank certificate
Mint Condition Medal, made of brass, 32 mm in diameter, attached to 5-sided pin back suspension



**МЕДАЛЬ**
**«Двадцать лет трагедии на ЧАЭС»**

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______________________________

**вручена медаль**
**«Двадцать лет трагедии на ЧАЭС»**

**«___»____________200__года**

## Notes on Radiology at the Hereford Hospitals in response to a question.

By the late Derek Guttery

These are from the papers of the late Derek Guttery in my possession.

First, a few somewhat prolix generalities:

The X-ray unit donated to Hereford Infirmary in 1896 would have consisted of a high-voltage induction coil, Crookes' gas discharge or primitive form of X-ray tube (depending upon how early in 1896 the donation was made), and a simple tube holder (usually adapted from a laboratory retort stand). In addition, the installation would almost certainly have included a barium-platinocyanide fluorescent screen (usually, about 10" x 8") mounted in a wood frame. Exposures in early 1896 would have been made on standard photographic glass plates placed in camera plate-holders (normally incorporating aluminium or fibre dark-slides). Plate sizes then readily available for photography – and size-wise also very suitable for many X-ray examinations – were 4¼ x 3¾, 6½ x 8½, 10 x 8 and 12 x 10 in. Larger sizes were uncommon until later. Plate manufacturers introduced thicker emulsions specifically compounded for X-ray use from about May, 1896 onwards but glass as the supporting medium continued in general use until about 1918 when satisfactory X-ray film became available. Processing of the plates would have been undertaken by a local photographer or photographic chemist as it is extremely unlikely that the Infirmary would have had darkroom facilities. The complete X-ray equipment would have cost the donor from £30 to £120.

The important point to remember is that dedicated X-ray "sets" did not arrive on the scene until after late 1897 and that what the supplier delivered prior to then – either assembled by him or by the user – was a collection of separate components that had been employed in academic, private and commercial laboratories since about 1880. In fact, it was the ready availability of all the necessary bits and pieces – apart from the fluorescent screen – combined with a practical knowledge of photography that enabled several enthusiastic amateur experimentalists to make X-ray images within a very short time following the first announcement of Röntgen's discovery in the London press on 6 and 7 January 1896. Most of them already possessed a darkroom together with a source of high-voltage (induction coil or Wimshurst machine) and one or more Crookes' gas-discharge tubes and were thus enabled to replicate the press descriptions of the discovery almost immediately. The first English translation of Röntgen's 10-page paper *EINE NEUE ART VON STRAHLEN setting* out the facts of his discovery appeared in the journal *NATURE* on 23 January and by a different translator in the *ELECTRICIAN* the following day but by then at least two of the first experimentalists had already publicly demonstrated successful generation of X-rays and sent accounts of their work to photographic journals – thus the "new photography".

The 1896 equipment at Hereford would have been energised from either a set of primary batteries (usually evil-smelling Grove cells) or, more probably, from a set of secondary accumulators. The input voltage would have been in the range 6 to 20 V. Accumulators were charged from a dynamo where no mains electricity was available. There would have been no form of radiation shielding for the patient or the operator. The process of taking a radiograph would have been very "hit and miss" with failure more common than success. The relatively low power of 1896 equipment – combined with the very low sensitivity of single-emulsion photographic plates to X-radiation – would have limited most practicable examinations to the location of foreign bodies in soft tissue and fracture in the bones of extremities.

As example, a very similar installation of an induction coil equipment donated to my local [Bedford General] Hospital in 1901 by the town's Medical Society [at a cost between £60 and £70] was used for 134 X-ray examinations during the first year of operation apportioned as follows [*Annual Reports, 1899-1904*]:

| | |
|---|---|
| Fractures, dislocations & injuries | 98 cases |
| Foreign bodies: nails, needles, etc. | 26 cases |
| Chest | 6 cases |
| Stones in kidney, bladder | 3 cases |
| Treatment of lupus by ?many/?heavy exposures | 1 case |

Much of the exploratory work would have been undertaken – especially when looking for foreign bodies – with a fluorescent screen and a permanent photographic record was often not considered necessary. Plate exposures for a human hand ranged from 1-minute to 10-minutes and for denser parts of the body could extend to 45-60 minutes making such examinations quite impracticable. Plates were expensive and by virtue of their fragility – especially in the larger sizes – not easily referable elsewhere. For the occasional referral, positive contact prints could be made from the original glass negative or reduced-size prints with a camera.

A number of handbooks on X-ray equipment and the practical aspects of radiography were published during 1896. Two of the best and most commonly available texts were H. Snowdon Ward's *Practical Radiography* published in April and Arthur Thornton's *The X Rays*, published in May. Numerous "do it yourself" articles also appeared in the photographic journals. Technical assistance might also be available from local photographers or the science master of the local Grammar School or technical college. For example, Arthur Thornton, author of *The X rays* (written while he was senior science master at Bradford Grammar school) personally installed the first X-ray unit at the Lloyds Hospital in Bridlington as he was the only person in the area with the necessary technical knowledge. There are other instances of similar technical skills being available locally.

I am surprised that mains electricity was not installed at Hereford Infirmary until as late as 1905 as I am fairly sure that the town had a 220 V direct-current supply for lighting from at least 1901. The supply was still direct current in 1913. Outside London, direct current predominated over alternating current by a factor of more than 2:1 until the 'twenties and persisted in several towns until the late 'forties. The predominance of direct current mains supplies in Britain is one of the reasons why induction-coil X-ray units continued in fairly general use for nearly two decades following introduction by the American C. H. Snook of the closed circuit A.C. transformer in 1907.

Incidentally, it is quite possible that the 1896 equipment at Hereford was purchased from the long-established photographic and scientific instrument dealer, Philip Harris of Edmund Street, Birmingham as his company was one of the principal suppliers outside London. Apart from the company's relative proximity to Hereford, it may also be significant that the Birmingham Harris family is thought to have been descended from "Flying Wagons" Philip Harris, the late 18th century Hereford carrier. Philip Harris is still very much in business today as a plc supplier of medical, chemical and scientific laboratory equipment.

When Hereford equipped its new "Electric and X-ray Department" in 1907 the equipment would still have been based on a high voltage induction coil as the first British-made (Newton & Co.) closed-circuit high-voltage transformers were not available until that year and took some time to be accepted in Britain even by the larger London hospitals. The equipment was probably mains operated and the D.C. mains voltage would have been reduced to the approximately 20-volts required for the coil with a wall-mounted control panel incorporating a voltage-dropping series resistance, voltmeter, ammeter and switches for the mains supply and for initiating and terminating the exposure.

The X-ray tube would still have been the "gas" type derived from Crookes' original gas discharge tubes but by 1907 was quite a sophisticated instrument and relatively reliable. In practice, the department probably possessed 4, 5, 6 or even more tubes of different degrees of "hardness" to meet the penetration requirements of the different parts of the body. The tubes would have been stored in a neat row on a wall-mounted rack and carefully selected by the operator to suit individual applications. Exposure times would have been considerably shortened since 1896 but would still be measured with a clock or stop-watch or by counting the swings of a 9¾in. ½-second string pendulum. The tube holder would have provided both for angulation and vertical and horizontal adjustment; there would also have been some form of wooden examination table. Radiation protection for the operator and patient continued to be non-existent or, at best, rudimentary and radiographs would still be on glass plates. "Eastman's X-ray Paper", introduced in March 1907 as an early alternative to glass plates, does not seem to have achieved more than limited acceptance. Newton & Co.'s 1910-1911 catalogue gives some idea of the range of equipment available as improvements made between 1907 and 1910 are insignificant in the present context.

The total cost of equipping the new department would still have been below £250. Other equipment in the same department would almost certainly have included a Finsen light apparatus for the treatment of lupus.

The records of Bedford County Hospital illustrate a situation probably very similar to that at Hereford. In early 1912 the Medical Committee decided to replace the original 1901 equipment with a complete new installation and invited tenders from three leading suppliers with results as follows:

| | |
|---|---|
| Watson's | £182 8 6d |
| Schall | £178 0 0d |
| Siemens [Bros.] | £214 8 6d |

Schall's quotation was accepted after existing users of the three makes of equipment had been canvassed. Installation of the new equipment was completed on 25 November, 1912 and local medical practitioners were advised –

The old X-ray apparatus which was presented to the hospital by the members of the Bedford Medical Society having proved itself inadequate has been replaced by a thoroughly modern installation supplied by Messrs Schall & Son with all the appliances necessary for every variety of radiography and electric therapeutics. The apparatus has been housed in a new annex readily accessibly from the wards and provided with a dressing room. — Minute Book of the Medical Committee, 1910-1919

The Schall equipment continued in use until 1930 while the original 1901 equipment was offered to "one of the educational establishments of the town" [Bedford School] for £20.

To get a "feel" for the period, Mr. Renton could do no better than read the enclosed copies of two very relevant papers by the eminent X-ray pioneer, radiologist and sometime surgeon, C. Thurstan Holland. His article "X-rays in 1896" (first published in the *Liverpool Medico-Chirurgical Journal* in 1937) and Silvanus Thompson Memorial Lecture "X-rays and Diagnosis" (delivered in 1923) give a valuable personal account of the use of X-rays in medicine from almost immediately following their discovery. The two papers contain some duplication but should be read as separate accounts. The copies are included for text only as clear reproduction of half-tones is beyond the capability of my machine.

Three relevant photographic prints and a single electrostatic copy page enclosed with this letter show:

Schematic arrangement of an induction coil, pear-shaped 2-electrode Crookes' tube and photographic plate arranged for the X-ray examination of a human hand. The tube pre-dates the 3-electrode "focus" tube introduced in mid-March 1896 and the X-ray emission would have originated at the domed end of the glass envelope. (Derived from an advertisement by E. Ducretet and L. Le Jeune of Paris which also appeared in the [London] *Electrical Review* , 27 March 1896)

Artist's impression of a lady in bombazine dress having her hand radiographed. The primitive 2-electrode Crookes' type tube suspended over the lady's hand is connected to an induction coil. The associated batteries shown on the floor are mounted in two carrying frames. The male figure is Gaston Séguy who is reputed to have taken the first X-ray pictures in France at Francois Pierre Le Roux's laboratory at the Ecole Supérieure de Pharmacie, Paris. (Enlarged from a picture reproduced in *Scientific American* Supplement, 41:16910, 11 April, 1896)

Depiction of the X-ray fluoroscopic examination of a young lady's heavily be-ringed hand "staged" sometime during early to mid-1896. The induction coil is sitting on the end of the table and the X-ray tube is mounted in a basic laboratory retort stand with two sash-window counterweights for additional stability. The primary batteries or accumulators are beneath the table. The hand-held fluorescent screen is mounted in a card-backed wood frame and lacking any form of dark viewing hood or radiation protection. In practice, the examination would have been undertaken in a darkened room and the only light would have been the apple-green fluorescence emitted by the screen and the soda-glass envelope of the X-ray tube. The radiograph shown beneath is of the same lady's be-ringed hand. For some reason she decided to don a stitched kid glove before it was taken. (Picture of unknown provenance)

Philip Harris press advertisement (April 1896) for "X RAYS, Induction Coils, Batteries, and Accumulators [and] Tubes all Patterns . . . "

And now to specifics:

The MULTOSTAT was the trade name of a multi-function electro-medical instrument providing galvanic, faradic, sinusoidal and other electrical treatments from a single source. It was manufactured by Elektrizitätsgesellschaft Sanitas of Berlin and sold in Britain through its London branch, Sanitas Electrical Company. Sanitas was also deeply involved in the manufacture and supply of X-ray equipment. Perhaps Hereford's 1907 X-ray installation came from the same source.

The London branch of Sanitas opened in 1902-04 under the control of two Germans, Willi H. Schwedler and Arthur Strich. The first office and showroom was in Soho Square but in 1907 the company moved to more suitable premises at 61 Cavendish Street. Its workshops and test rooms were at 9 & 10 Bentinck Mews. The MULTOSTAT was probably introduced to London in about 1907. At the declaration of the 1914-18 war, the London branch was confiscated by the Custodian of Enemy Property in accordance with the Enemy Trading Act and in fact never re-opened. Consequently, the history of the MULTOSTAT in Britain is relatively short and it is extremely unlikely that any British versions of the instrument have survived.

The MULTOSTAT was one of a family of similar instruments offered by various manufacturers and marketed under names such as PANTOSTAT and POLYSTAT. The design concept – irrespective of manufacturer – was, firstly, to allow "earth-free" electrical treatment to be made from a D.C. mains supply without the possibility of the patient receiving the unpleasant and sometimes fatal electrical shocks that could occur with treatment energised direct from the mains and, secondly, to provide for several different types of treatment from the same instrument. Subsequently, some manufacturers offered similar "universal" machines for A.C. mains and battery operation.

The key features of D.C. mains-operated versions of "earth-free" instruments were an electric motor and generator insulated from each other and typically wound side-by-side on the same shaft and within the same housing. Some manufacturers mounted the two components separately. The A.C. current from the generator was transformed to a lower A.C. voltage for sinusoidal applications and for heating a cautery or the filament of a surgical lamp and a separate insulated winding on the motor gave a reduced D.C. output for galvanization, ionization and the testing of nerve and muscle. In some models, the motor (usually about 1/8 horse-power) could be employed to drive a flexible shaft for mechanical massage and for powering drills, trephines and circular saws for surgery. Generically, the instruments fully justified the commonly applied appellation "Universal".

The first "Earth-free" instrument was the PANTOSTAT designed and manufactured by Reiniger, Gebbert and Schall (R.G.S.) of Erlangen and introduced to London by Karl Schall (then at 55 Wigmore Street) in 1903. British-made versions of the PANTOSTAT continued to be offered by Karl Schall's successor company, Schall & Son, for at least another forty years and were, without doubt, the make most widely used in British hospitals and private practices.

The MULTOSTAT and PANTOSTAT appeared during a period when German manufacturers tended to give medical instruments descriptive trade names compounded from Latin and Greek elements. One very descriptive but otherwise unrelated example was the name TRIDORUS GIGANTUS given to a powerful 3-phase X-ray generator introduced during the early 'thirties by Siemens-Reiniger Werke. The two languages were often combined in a single name and sometimes derived from questionable etymology. However, the universality of classical languages made them memorable and acceptable in a world-wide medical instrument export market more or less dominated by German companies.

Two of the enclosed (with this reply by Derek Guttery) photographic prints show:

Four versions of an advertisement for the Sanitas Electrical MULTOSTAT "Earth-free Universal Apparatus" published in the January, May and July 1909 and July 1911 issues of the *Journal of the Röntgen Society*. The advertisements illustrate a change in design introduced sometime between January and May 1909. [Advertisements reproduced same-size].

Illustration and description of the PANTOSTAT "Universal Apparatus" taken from page 145 of the 16th (December 1914) edition of Schall & Son's catalogue *Electro-Medical Instruments and their Management.* [Reproduced slightly reduced].

I hope I've provided your enquirer with answers to some of his questions. If he has any further queries, please do not hesitate to let me know.

Additional notes:

The first British account of Röntgen's discovery appeared in the *DAILY CHRONICLE* on Monday, 6 January, 1896 ["Remarkable Scientific Discovery"] and was followed by a similar but slightly more detailed account in *THE STANDARD* morning newspaper the following day ("A Photographic Discovery"). Both accounts contained sufficient detail {"Light emitted from one of Crookes' vacuum tubes"] to enable a number of readers to attempt to confirm Röntgen's discovery which, initially, was viewed with some scepticism. The first successful experimenter was A.A.Campbell Swinton who produced a very faint X-ray image of a coin during the evening of 7 January and followed with two clear images of various metallic and fibrous objects the following day and of a human hand on 13 January. The radiographs were exhibited by him at a meeting of the Camera Club at 21 Bedford Street, Covent Garden on 16 January and a few days later at the Royal Institution. Swinton's letter confirming "the truth of Professor Röntgen's discovery" appeared in the *STANDARD* newspaper on 10 January. The original glass plate negatives of Swinton's radiographs of 8 and 13 January are now located in the B.I.R. archives.

The second person to take a radiograph in Britain was J.W.Gifford, a wealthy Chard lace manufacture and amateur scientist, who – following several earlier attempts to produce X-rays following his reading of the press notices – produced a radiograph of his ten year old son's hand on Saturday 18 January. His wife, Emma, recalled the circumstances thirty-six years later in a letter to the *TIMES* – "I well remember the excitement when my husband came out of the darkroom with the dripping negative in his hand and said 'You can see the bones !'

Elektrizitäts-Gesellschaft Sanitas of Berlin probably originated before 1900 and by 1910 had branches in London, Brussels, Paris, Oporto, Vienna, Prague, St. Petersburg, Moscow, Odessa, Kiev and Warsaw. In 1933 it introduced the world's first commercial X-ray tomographic equipment based on a design by Gustav Grodssmann. By then, the company was employing approximately 1000 workers and devoting approximately 50% of its production to cosmetic products such as hair dryers, massage equipment and ultra-violet and infra-red lamps. In November 1945, allied bombs completely destroyed the Sanitas factory in the northern part of Berlin and the engineering staff was moved to Asch in the Sudetan district of Czechoslovakia where production was restarted on a small scale with about 68 staff. The company returned to Berlin after the war but finally closed in 1960 following bankruptcy.

## Radiographs — 1896-1897: a collection of original lantern slides made in 1896-97

By the late Derek Guttery

As virtually no original radiographs from the pre-1900 period have survived (apart from two small collections at the British Institute of Radiology and a few individual plates in teaching hospitals and at the Science Museum) it could be claimed that positive lantern slides copy reduced from the original negatives remain the best surviving evidence of the level of technical picture quality achieved by the early experimenters. The only other remaining pictorial evidence is in the form of contact or reduced positive prints on silver-chloride paper (often gold toned to a pleasing sepia colour) and screened half-tone positive reproductions in books and journals. Neither reveal as much information as a transparency; however, their frequent reproduction in print form led to the public's perception of an "X-ray" as a positive image whereas the radiographer always saw a negative image apart from when he was using a fluorescent screen.

The only recording media available to the early X-ray experimenters were standard photographic plates with an emulsions coated on one side of the glass. The sensitivity to X-rays was low because of poor absorption in the thin emulsion resulting in low density, poor contrast and extended exposure times. Experimenters tried various methods to increase the film sensitivity ranging from sensitisation of the plates before exposure and chemical intensification after development to impregnation of the emulsion with fluorescent salts. A commercial example of the latter idea was the Cathodal Plate introduced in May 1896 by the English manufacture B.J.Edwards & Company incorporating a fluorescent salt recommended by Sir Oliver Lodge. Another commonly used method was to expose the plate in intimate contact with a barium platino-cyanide - or, after March, 1896 - calcium tungstate fluorescent screen — a technique which has persisted until today. Plate manufactures soon introduced thicker emulsions specifically for X-ray use but were still limited to applying the coating on one side only because of the interposed thickness of glass. Duplex coating was not feasible until thin "film" bases became available many years later.

Development was carried out in a standard horizontal dish in the same way as a photographic plate. Hydroquinone - often in a highly diluted concentration - was a popular developer and typical development times were in the range 10-30 minutes. It was not unusual for safelamps to be illuminated by oil or gas as many darkrooms lacked electricity. Small hospitals and doctors in private practice without darkroom facilities were obliged to send their plates to a local photographer or chemist for processing.

Glass plates were heavy and extremely fragile and in the larger sizes of 12 x 10", 15 x 12" and 17 x 14" (2 lb.), quite unsuited to referral between different locations. For this reason, it was not uncommon to produce contact or reduced-size positive prints for independent viewing purposes and suitable reducing cameras were offered by most equipment and accessory suppliers. Obviously, the process of producing a radiograph from exposure to final image would often become a lengthy and tedious process.

Despite their high cost and fragility, glass plates continued in general use until Kodak's introduction in 1914 of a single-coated X-ray film of improved X-ray sensitivity on a cellulose nitrate base. However, this film also had disadvantages in that the base was highly inflammable, potentially explosive and difficult to process in a shallow dish because it curled excessively. Traditionalist therefore continued using plates. Meanwhile, any intended changeover to film required new types of film holders and cassettes to be devised and deep, vertical processing tanks and film suspension frames adopted. Finally, in 1918, Kodak's Dupli-Tized, double-coated film was made available allowing an enormous reduction in exposure times as a result of a greater absorption of X-rays in the thicker combined emulsion and the possibility to use fluorescent intensifying screens on both sides.

The hazards of cellulose nitrate as a film base was recognised but the adoption of "safe" and potentially more suitable cellulose acetate was not possible until its original disadvantages of brittleness, low strength, poor clarity and included impurities had been overcome. In 1924 Kodak finally introduced an X-ray film on an acetate base but because it was more expensive and initially had certain disadvantages such as wrinkling and growing mould in storage, nitrate-based films continued to be used. In 1929 a disastrous film fire occurred in the X-ray Department of the Cleveland Clinic in the USA in which 124 people perished and the outcry which followed finally forced cellulose nitrate to be outlawed and cellulose acetate adopted as the standard base material for all professional films used for X-ray, photographic and cinematographic purposes.

The 35 "magic lantern" slides on display are contemporaneous copy reductions from the original negatives and mainly depict subjects typical of the period — foreign bodies, fractures, physical abnormalities and curiosities of nature. Because of the extremely low power of the early equipment and the lack of sensitivity in the photographic plates, most of the human radiographs are limited to the extremities of hand and foot.

Photographic journals - of which there where many - were one of the main media for the discussion of X-rays during the first two years following their discovery and in fact, radiography was for a short while considered as a new form of photography and, as such, adopted by many enthusiasts as a new and interesting hobby. There was also intense interest from the public so that lantern slides of radiographs might equally well be shown by the parson in the village hall as by the physician to his medical colleagues and students. Slides of pre-1900 radiographs made by pioneer X-ray workers such as Campbell Swinton and Colonel Gifford remained in the catalogues of specialist dealers like Newton & Co. and Flatters & Garnett until the mid-1920's. Despite the considerable numbers produced, pre-1900 lantern slides of radiographs are now almost as rare as the original negatives from which they were copied.

Slide Nos.1 - 12 are copies of a series of radiographs taken during early 1896 by James MacKenzie Davidson (1857-1919). Davidson was in private practice as an Aberdeen ophthalmologist when X-rays were discovered. Using his own Crookes tube and an induction coil with 10" spark, he succeeded in the early part of February 1896 in making a radiograph of a broken needle in a patient's foot. The new discovery soon persuaded him to devote his future career to radiology and in 1897 he was elected to the staff of Charing Cross Hospital as "Consulting Surgeon to the X-ray Department". He remained at Charing Cross until his death twenty years later by which time he had became the leader of his profession and the first man to receive a knighthood for services to medical radiology. One of his especial personal interests was stereoscopic radiography.

MacKenzie Davidson's slides were published by the Aberdeen photographic company G.W.Wilson at one shilling each and first announced as being available in the April 1896 issue of THE PHOTOGRAM.

In some examples, slide No.1 "Hand of adult male" is labeled "Hand of gentleman" and in that form contrasts with the obviously gnarled "Hand of workman" depicted in slide No.2. The radiographs of three different hands depicted on slide Nos.5, 6 and 7 were obviously taken before the availability of Jackson's "focus" tube in March, 1896; this may equally apply to the radiograph of a foot on slide No.11.

Slide Nos.15-17 are of three radiographs of the human hand taken by Lieutenant-Colonel James William Gifford, F.R.P.S. (1856-1930) or, possibly, by his wife, Emma.. All were taken during early 1896. The severe undercutting and lack of definition apparent in slides 16 and 17 (taken in January) almost certainly results from the fact that they were taken with the tube suspended approximately 2" above the plate rather than because of an unfocussed cathode beam. Gifford soon realised the benefits to be obtained by increasing the distance to 6".

Colonel Gifford, of Chard, Somerset, was a wealthy lace manufacturer, astronomer, skilled photographer, amateur scientist, one-time voluntary assistant to William Crookes and, when it was founded in 1897, one of the first members of the Röntgen Society. The photograph at the foot of page 6 below was taken in February, 1896 and published in the April issue of the WINDSOR MAGAZINE. It shows Gifford in his home laboratory surrounded by a plethora of the apparatus needed to generate X-rays — Crookes tube, two induction coils, a collection of Leyden jars and a hand operated vacuum pump. Some of Gifford's other scientific interests are indicated by a "state of the art" spectroscope and a collection of chemicals pictured in the background.

Gifford was very well equipped with all the necessary apparatus to make X-rays when he read an account of Rontgen's discovery in the EVENING STANDARD for 7 and 8 January as he had recently purchased a hand driven dynamo and a powerful spark coil for research into "spectrum photography". He also possessed a set of Crookes tubes which he had acquired about fifteen years early including one with a saucer shaped "focused" cathode and platinum foil anti-cathode.

His first attempt to produce X-rays was a failure leading him to suppose that the newspaper account was either a hoax or a misconception and on this basis addressed a letter to the Royal Photographic Society for its 14 January meeting detailing his experiments and their failure. More definite information in later press reports caused him to make a fresh attempt and on Saturday, 18 January, 1896 he succeeded in "electrographing" his young son's hand through cardboard. The exposure time was 10-15 minutes

Mrs. Gifford recalled the event in a letter to the TIMES nearly forty years later (27 February, 1932):

"...My husband took his [radiograph] at the request of my son, a boy of 10, on Saturday afternoon. I well remember the excitement when my husband came out of the dark room with the dripping negative in his hand and said 'You can see the bones!' " This was amongst the very first radiographs taken in this country.
In an article in the April 1896 issue of KNOWLEDGE, Gifford explains in considerable detail the preparatory work prior to the actual exposure:

"The subject to be operated on is taken into the darkroom. A sheet of celluloid or mica is laid over the film of a sensitive plate; the hand, if that is the part to be electrographed, is laid on the celluloid, and the whole enclosed in a black cloth bag, tied tightly round the wrist so that no light may get at the plate. The plate may then be taken into broad daylight - not bright sunshine - and laid with the patient's hand upon it, on a table over which the bulb [Crookes tube] is hung. ... In some experiments no celluloid was used, and in more than one case the warm moisture of the hand partially melted the gelatine. In others a paper bag made of grocer's paper was slipped over the plate to prevent contact. The paper meant is the greased paper used for wrapping up butter; ... but in some cases the grease melted, and the last of that plate was worse than the first..."  and so on, in a similar vein.

Gifford gave one of the earliest public demonstrations  of X-rays in London (at the Royal Photographic Society, 12 Hanover Square) on 21 January 1896 and also published many articles on the subject in NATURE, KNOWLEDGE and various photographic journals but soon withdrew from the scene to concentrate on other matters.

Slide Nos.22-23 — foot in woolen sock and foot in nailed shoe

Slide No.24 — foot with seven - or possibly eight - toes

Slide No.25 — halfpenny in child's gullet

Slide Nos.26-27 — slide No.26 is of the hand of a young child with a  supernumerary thumb taken by Snowden Ward at Southport during the afternoon of 24 March, 1896.  The 15-min. exposure was interrupted because the child moved.  It was taken at the request of the surgical staff of the Infirmary to determine the feasibility of an operation to correct the abnormality.  Slide No.27 is probably of the same subject in adult life.

Slide No.30 — composite whole-body radiograph

Slide No.31 — mummy's hand with amputated thumb taken by A.W.Isenthal, equipment supplier and joint author with Snowden Ward of the second and third editions of Practical Radiography  (1898 and 1901)

Slide No.32 —  chicken's foot.       The original radiograph was taken on  3 February, 1896 by Alfred W.Porter (1865-1939), at that time Fellow and Assistant Professor of Physics at University College, London.  He was later to become Sir Alfred Porter, F.R.S.   For the purpose of the exposure, the chicken's foot was placed on a photographic plate at the bottom of a cardboard box and packed with corrugated paper up to the lid which explains the horizontal  shadow markings in the background. The apparatus used was a battery-powered induction coil in conjunction with what Porter claimed to be a type of 'focus' Crookes tube which he had first shown in a lecture at University College on 29 January and which employing a saucer-shaped cathode to focus the cathode rays on a platinum target. Porter praised the result as being of "unsurpassed sharpness"

The development of the eponymous 'focus' tube is generally credited to Herbert Jackson (later Sir Herbert Jackson, F.R.S.) whilst he was lecturer in chemistry at King's College London based on a modified Crookes tube he had devised in July 1894 for research on the fluorescence of glass in vacua. However, A.W.Porter, Professor Hicks of Sheffield and no doubt many others also realised the need to produce a point source of X-rays almost immediately following their first fumbling attempts to take radiographs.  A commercial version of the "Jackson focus tube"  was announced as being available from Newton & Co. of No.3 Fleet Street in the 7 March, 1896 issue of the British Medical Journal.  Röntgen describes a similar type of tube in his "second communication" submitted 10 March 1896 and Sir William Crookes had used a concave cathode and platinum anode as early as 1879 during his research into the heating effect of cathode rays.  An 1880 Crookes tube with saucer shaped cathode was also used by J.W.Gifford (slides Nos.15-17) during his experiments with X-rays in the early part of January 1896.

Porter took an active part in demonstrating, lecturing and writing about X rays during the first two years following Röntgen's discovery and was President of the Röntgen Society, 1913 14.

Slide No.33 — German frog;   Slide No.34 —adder;   Slide No.35 — sheep's leg.

J.W.Gifford experimenting in his private laboratory at Chard, Somerset
February, 1896.

## SILVANUS P. THOMPSON, W. C. RÖNTGEN AND THE RÖNTGEN SOCIETY

By the late Derek Guttery

Shortly after the formation of the Röntgen Society in 1897, the Council of the Society decided at its opening General Meeting on 3 June to elect Professor Röntgen as its first Honorary Member without firstly asking for his agreement. In August, 1897, the President of the Society (Professor Silvanus P.Thompson) and the Honorary Secretary (David Walsh) addressed a formal letter to Röntgen informing him of his "unanimous election as the first Honorary Member" and asking him "to permit us to enroll your name on our register in that capacity." The formal invitation was enclosed with a longer and more personal letter from Silvanus Thompson in which he invited Röntgen to attend the Society's forthcoming Inaugural Meeting (1st Conversazione) in London on November 5 1897. He also asked about the possibility of exhibiting some of Röntgen's apparatus at the meeting as "for example, the tube with which you first found the rays"

LETTER FROM THE RÖNTGEN SOCIETY AWARDING ITS FIRST HONORARY MEMBERSHIP TO PROFESSOR W.C.RÖNTGEN (COPIED FROM A TRANSCRIPT IN THE RÖNTGEN SOCIETY'S COUNCIL MINUTE BOOK):

To Professor Röntgen, of Würzburg

Dear Sir, —

A Society has recently been founded in London for the study and the practical applications of the rays, the discovery of which at the close of the year 1895 was due to your special insight and genius in research.

On behalf of that Society, we, the undersigned, the President and the Honorary Secretary of the Röntgen Society of London, have the honour to inform you of your unanimous election as the first Honorary Member of our Society at its opening General Meeting, held on June 3rd, 1897; and we beg you kindly to permit us to enroll your name on our register in that capacity.

We have the honour to remain, dear Sir,

Yours faithfully

{Silvanus P.Thompson, President
{
{David Walsh. M.D., Honorary Secretary.

5 Pump Court
August 1897
Temple
London. EC.

LETTER FROM SILVANUS P. THOMPSON TO PROFESSOR RÖNTGEN ENCLOSING A FORMAL INVITATION TO ACCEPT THE FIRST HONORARY MEMBERSHIP OF THE RÖNTGEN SOCIETY AND INVITING HIM TO ATTEND ITS INAUGURAL MEETING IN LONDON:

Silvanus P. Thompson, D.Sc., F.R.S.
Technical College Finsbury
Consulting Electrical Engineer
(City and Guilds of London Institute)
Leonard St., City Road
London, E.

October 27 1897
Professor Röntgen in Würzburg:

My dear Sir and Colleague.

Absence from England in Canada has prevented me until today from sending to you the enclosed letter.

You may have learned that some of us in this country have formed a little Society for the special object of studying those rays, the discovery of which will ever be associated with your name.

The gentlemen who originated this movement in London were mostly medical men; but as they desired that the Society should embrace not only the medical and surgical applications of your discovery, but also the physical aspects of it, they desired to empasize their view by selecting an English physicist as President. The choice of a physicist fell upon myself' and hence, in that capacity I write. For the very first act of the newly constituted Society at its preliminary meeting was to pass a unanimous vote, electing you as its first Honorary Member. The letter I have the honour to enclose is the official intimation of that act; and I beg that you will honour the Society by kindly consenting to this nomination. Your acceptance will give universal satisfaction to all our members.

I have further to inform you that our first general meeting will be held in London on the 5th of November next, when there will be an exhibition of appliances and of skiagrams &c. &c., and when also I shall deliver an inaugural address. I would that it were possible to hope that you, whose name our Society bears, might be able to be present on that occasion, I should be delighted to offer you the hospitality of my house, and to introduce you to the circle of scientific men in London. Pray think of this invitation; for you will meet a most cordial welcome on every hand.

Further, in the event of your finding yourself able to come, Mrs. Thompson would be most delighted if you could prolong your stay, for several days, at our home.

In the event of your finding yourself unable to visit London in person, might I, on behalf of the Council of the Röntgen Society of London, venture to express the hope that you will be able to send for exhibition at the meeting of November 5th., some of your now-historic apparatus . If you could send us, for example, the tube with which you first found the rays, or the piece of paper covered with barium-platinocyanide with which you first saw the shadows cast by the rays, such a relic would be regarded with the highest interest; and we would guarantee its safe custody and its return to you after the meeting.

With the highest esteem,
Believe me,
dear Sir & Colleague
Yours most truly
Silvanus P. Thompson.

During the opening part of his Presidential Address to the Inaugural Meeting of the Röntgen Society on 5 November, 1897, Professor Thompson announced "Here let me pause to say that at the preliminary meeting of our Society, . . . it was determined, unanimously and cordially, to elect Prof. Roentgen as our first honorary member. I am happy to be able to announce that Prof. Roentgen has accepted that position. In a letter which I have received from him he tells of the regret with which he is prevented by his official duties from being with us at this gathering to-night. He bids me convey to the Society which has named him as honorary member his cordial thanks for the honour we have desired to pay him, and to couple with this message of thanks his best wishes for the prosperity and success of our Society. We had at one time hoped that Prof. Roentgen might have been able to send us for exhibition either the vacuum tube of the fluorescent screen with which he made his discovery. Unfortunately for our hopes, he informs us that most of his early apparatus, having been made with his own hands, was very simply and crudely constructed, and that much of it has been worn out or used up in the course of his researches, so that he is not able to send us any of those objects. To us, had this been possible, they would have been objects of priceless interest. – Archives of the Roentgen Ray, II, 23-24 (November 1897)

## Public Perception (1896): To Meet the Röntgen Rays – A country house pastime

[Published in *THE ROCKET*, October 15, 1896, p.239]

Compiled by the late Derek Guttery

“Want to see the kink in your little finger?" asked the radiographer. "Well, take care you don't touch any of these wires, or our pleasant party may end in an inquest. I am going to turn out the lights."

"What wires?" I gasped.

The table beside which I sat, and on which an elaborate apparatus lay, was littered with a mass of wires, connecting mysterious cylinders and boxes. It was more than a bit alarming. I had never been to such a queer entertainment as this, to meet the "Röntgen Rays" before. "You hear that?" asked the operator. "That" was a hissing frizzling sound. It seemed to emanate from a particularly wicked-looking green light that burned with vivid fervour inside a small glass bulb.

"That is the electric current," he added.

Through a species of stereoscope was directed to gaze, my hand having previously been guided to a proper and safe situation by my mentor in a splayed-out attitude at the other end of the tunnel. What an unprepossessing sight met my eyes. There was my hand in skeleton, every knuckle and bone, both small and great, displayed to view. The bones looked black. My rings circled the fleshless stumps with an effect little short of ghastly. Of course I saw distinctly the bend in the little finger bone of that crooked member.

"Now we will take a photograph," remarked my host, who is an eminent man of science. "Let's see what your foot looks like to the rays. No, there isn't the slightest need for you to remove either boot or stocking. The rays don't object to them, I assure you. They penetrate flesh, you see; so leather and hosiery are mere nothings to them."

I was placed in a chair, and my right foot was put to rest on a slab of aluminium. The photographic plate was underneath, and the rays were directed at it. The room now was flooded with the electric light. For seven long minutes I sat and cooked. When I say "cooked," I don't mean that I felt hot, but that the apparatus, with its crackling, frizzling splutters, made me feel exactly as if my foot were a mutton chop.

While the plate was being developed in the dark room, the operator and I sat and talked.

"Yes," said he, "the rays are veritably private detectives of the most relentless type. Useful? They are indeed. They are able to discover the whereabouts of bullets that defy surgical investigation, buttons, or bones swallowed inadvertently, broken bones, and even adulterations in wine. That is one of their latest achievements; but every day develops their powers, or rather the investigations of scientists bring these to light."

"Of course it is all very wonderful; but then electricity is the wonder of our age. All the big hospitals are working with the shadowgram; private operators, too, are kept intensely busy. The fashion is not only to have parties, like this one, at which the attraction is the new photography, but to intoduce [sic] the process as a novelty at bazaars. The Duke of Newcastle is an expert shadowgrapher. At a bazaar the other day the Duke and Duchess of Connaught submitted their hands to his tender mercies. The Prince of Wales has also been operated upon, and was delighted with the result. It is you ladies who are so dissatisfied with your bone portraits. I asked why, but a queer little smirk was the only answer I received. I was soon to comprehend it.

"What, *that* my foot?" I exclaimed presently in indignation.

"That horrid bundle of twisted bones - beetle crushers of the beetlest crushing description? Never!"

I threw the photo from me. My host was in paroxysms of mirth.

"I told your so," laughed he. "As a matter of fact the radiograph is not flattering — it is too absurdly true."

"But this is a deformity," I urged ruefully.

"It merely shows for what you have to thank shoe-leather. I assure you that these bones of yours are by no means so distorted as those of many feet I have taken. You would like your hand bones very little more, and if I were to take your skeleton entire I doubt if it would please you."..............................

## Notes:

The original story in *THE ROCKET* is not illustrated. Derek Guttery suggested the following illustrations. I do not have his illustrations however the notes for his suggestions are worth reproducing:

Illustration 1: The French physicist Gaston Séguy (among the first people in France to take a radiograph) is shown examining the hand of a female subject in Le Roux's laboratory at the École Supérieure de Pharmacie in Paris. He is using a primitive Crookes tube energized by a battery-operated induction coil. The scene dates from January-February, 1896 and was reproduced in the 11 April, 1896 issue of the *Scientific American* Supplement.

Illustration 2: A woodcut illustration of a hand being radiographed with Crookes tube. The illustration first appeared in Germany in January, 1896 but derivatives and variants of the same illustration appeared in other countries later.

Illustration 3: A curious advertisement from the July, 1896 issue of *The Strand Magazine* in which "Dr." Van Buskirk obviously hopes to promote sales of his mouthwash *SOZODONT* by associating himself with the public craze for the new "Röntgen rays". Two skeletal hands are seen in the background together with a mercury vacuum pump and an imaginary X-ray tube which seems to have confused itself with a floodlamp.

Illustration 4: "Notes of the Week" from the 7 March, 1896 issue of *The Ladies Gazette* containing a short note about Röntgen's discovery illustrated by a skeletal lady beneath an elegant tea-gown.

Illustration 5: X-ray examination of the hand in early 1896. The top view shows the hand being examined on a wood-framed fluorescent screen and the bottom view after recording on a photographic plate. Photographs showing a screen without viewing hood in use are extremely uncommon as hoods were generally adopted within a few weeks of the discovery. The induction coil looks like a respected model manufactured by Newton & Co. of No.3 Fleet-street. The tube is a standard Crookes. The photograph was taken in Glasgow but has not otherwise been identified.

## Additional notes by Derek Guttery to accompany the text:

*The Rocket* article is a rare, interesting and accurate account of the public's perception of X-rays within a few months of the announcement of their discovery.

*The Rocket*, price one penny, was a weekly journal with the subtitle "The Most Enjoyable Paper of the Day". It had a short life as it only ran from Thursday, 13 August, 1896 to 16 April, 1898. (London: Vol.1, No.1 to Vol.3, No.21). The copyright set at the British Library, Colindale includes a Registration issue dated 9 July. The scurrilous Editorial pages of each issue are entirely devoted to detailed facts, figures and outspoken comments relating to the income and expenditure of Queen Victoria's household and the aristocracy of the day as, for example, the cost of maintaining and refurbishing the then *four* Royal yachts. *The Rocket* contains no further references to X-rays but is worthy of closer examination as a surprisingly outspoken social document of the period.

The "species of stereoscope" referred to is obviously an example of a *Cryptoscope* - a barium platinocyanide screen mounted at the base end of a light-tight truncated cardboard cone enabling the operator to view a *positive* fluorescent image of the object being examined through the open end. The device was introduced by Professor Salvioni of Perugia in February 1896 and immediately copied by every X-ray user and is only described in the article as a [photographic] 'stereoscope' because that is what it must have looked like to the writer and when described as such would have been recognisable to most readers of the time.

"The Duke of Newcastle, who is an enthusiast in photography, has taken up the Röntgen rays and is demonstrating them." *The Photographic Review*, July 1896, p.243a.

"At the reception in aid of Guy's Hospital at the Imperial Institute on Wednesday, June 10 [1896], a demonstration of the X-rays was given by Mr. Le Conteur and Messrs Houghton & Son, with the apparatus supplied by the latter. A very successful negative was taken of the hand of H.R.H. the Prince of Wales, who took great interest in the apparatus, this being the first time he had seen a demonstration of the Röntgen rays. Messrs Houghton & Son had five complete apparatus at work, and Mr. Joyce, of Oxford, Mr. Gray, and Mr. Martin were all present with the apparatus". *British Journal of Photography*, June 19, 1896, p.396b. The same reception is reported in *The Photographic News*, Friday, June 19, 1896. XL, 25, p.385. A.A.Campbell Swinton's account in his *Autobiographical and other Writings* (1930) - retold by M.Jupe in "Early days of Radiology in Britain" (*Clinical Radiology*, 12, 148b ) - that Edward, Prince of Wales, exclaimed "How disgusting!" when shown a radiograph of Swinton's hand in 1896 is probably apocryphal.

## The Omniscope

By Katie Maggs
Assistant Curator of Medicine, Science Museum, South Kensington, London SW7 2DD

The Pohl 'Omniskop' is one of the most fascinating pieces of x-ray equipment cared for by the Science Museum, London (inventory number A600315). It is a utilitarian, sleekly engineered machine from the 1930s, which made it an ideal if unusual candidate to feature as a loan to the V&A's *Modernism* exhibition which ran from 6th April to 23rd July 2006. The machine's design embraces the modernism spirit; "ostensibly a piece of functional medical equipment…it could just as well have been a piece of Bauhaus theatre" (Deyan Sudjic, The Observer, Sunday April 2, 2006). Even more intriguing, this machine is believed to be the only example of its type in Britain. Since the Omniscope's display within the *Modernism* exhibition, the fascinating history of this object has come to light regarding its revolutionary design but also how this particular machine came to the UK.

The Science Museum was contacted by Peter and Henry Rockwell, who had visited the *Modernism* exhibition and had realised that the Omniscope on display was in fact the same machine that had belonged to their father, Dr Ernst Rachwalsky. They very kindly offered to meet with the medical curators at the Science Museum and to provide further information about the history of the machine. Realising this would be a fascinating opportunity to learn from first-hand recollections about the machine, a meeting was arranged with the Rockwells on July 18th to visit the Omniscope in person and to then conduct an oral history session. We were also thrilled to have the opportunity to invite Marion Frank to the meeting, formerly Senior Radiography Lecturer at Middlesex Hospital and who was a close friend of Dr Rachwalsky's, and also Dr Uwe Busch, Director of the Rontgen Museum, who has conducted research into the history of the Omniscope.

Fig 1: Science Museum curators meet with the Rockwells, Marion Frank and Dr Uwe Busch in front of the Pohl 'Omniskop' on display at the *Modernism* exhibition.

The Rockwells' father, Dr. Ernst Rachwalsky (b.1889 d.1962), owned the Omniscope between 1936 and 1962. Born in Germany, he practised as a physician and radiologist in a fashionable Berlin clinic (Augsberger Strasse) between 1926 and 1936. He had become interested in radiology due to his specialisation in gastroenterology.

As more complex techniques for working with x-rays were developed from the late 1800s, the correct positioning of the patient became increasingly important within the examination. This was particularly the case for examining internal organs by x-ray. The American, Walter Cannon, was one of the earliest researchers to mix salts of heavy metals (including bismuth salts and later barium sulphate) into foodstuffs in order to improve the contrast of X-ray images of the digestive tract. The technique was applied to humans from 1904 until 'Barium swallows' became routine (1). The means to reposition the patient became imperative so that the internal movements of the barium meal could be observed by doctors such as Rachwalsky.

Ernst Pohl (b.1876 d.1962), a talented engineer, resolved the issue of repositioning the patient by developing his revolutionary Omniscope machine c.1914. Pohl was working for the University of Kiel's medical department, where he developed a variety of medical equipment in conjunction with medical practitioners. Whereas earlier x-ray equipment had to be carefully realigned with each new position of the patient, Pohl engineered the Omniscope so that the distances between the patient, x-ray tube and screen remained fixed, even when the patient's couch was tilted from horizontal to vertical, rotated 180 degrees or moved up and down in the vertical plane. An important feature of the apparatus was the ease and rapidity with which the position of the patient could be altered. The earliest Omniscope models used a sophisticated system of counterweights requiring only the lightest touch to move the equipment to different angles. Later models, such as Dr Rachwalsky's, used an electric motor to move the patient into the appropriate position before the screen.

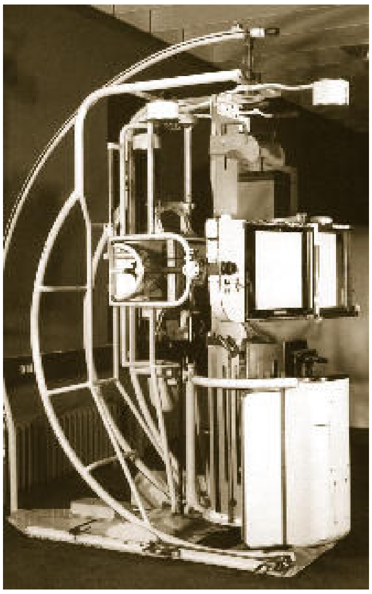

Fig 2: An Omniscope machine made by Ernst Pohl. The image is taken courtesy of the Röntgen Museum.

Dr Rachwalsky's Omniscope was not the first example that Pohl had built. However, it appears that Rachwalsky was one of the few practitioners fortunate enough to have been able to purchase one from Pohl. Pohl only manufactured his machines on a very small scale, and his low-key operation meant that he took an intensely personalised approach to taking commissions. Practitioners would invite Pohl to their practice, and Pohl would conduct an interview to assess the practice to see whether he would be able to establish an effective partnership with the practitioner in question. Thus the Omniscopes in existence today (two of which are held at the Rontgen Museum) demonstrate highly individual characteristics in contrast to mass produced x-ray equipment. Henry Rockwell recounts that his father was particularly proud of the fact that he had personally helped Pohl to build the machine to his own specifications.
Despite his family and practice being established in Berlin, the threat of increasing hostility towards the Jewish community in Germany during the early 1930s, eventually compelled Dr. Rachwalsky to emigrate to the UK. He gained his work permit in 1931, and eventually moved to London at the beginning of 1936. At that time foreign doctors were required by their work permits to re-qualify in order to be licensed on the Medical Register. Rachwalsky did so by

the autumn of 1937, at which time he gradually moved his family from Berlin to London. He initially set up his practice in Devonshire Street, but soon after became established at 9 Upper Wimpole Street. Interestingly, Dr Rachwalsky shipped the Omniscope over to his UK practice whilst he was re-qualifying. At this time, it was still relatively unusual for a physician with a small practice to possess an x-ray machine, especially one as specialised as the Omniscope.

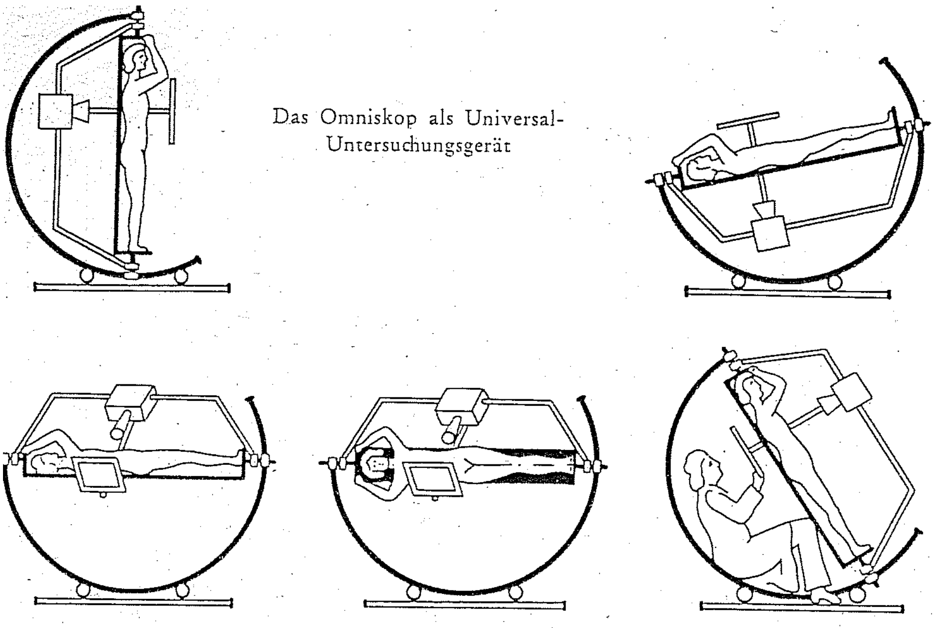


Fig 3: Positioning the patient using the Omniscope. Image taken from H. Kohnle: *Personliche Erinnerungen an Dr. med. h. c. Ernst Pohl.*

The Omniscope proved a very reliable machine and Dr. Rachwalsky continued to use it until his retirement, and did not acquire a second x-ray machine until the 1950s. On seeing the machine at the *Modernism* exhibition, Peter and Henry Rockwell shared a number of fascinating anecdotes with us about the equipment and their father's practice. They recalled riding in the machine as children, and that the Omniscope was surprisingly comfortable to be moved about in but that the machine's motor was particularly noisy when operated. The Rockwells recalled with some amusement that their father continued to resist his friends' advice and was reluctant to wear a protective lead apron due to its unwieldy nature.

Dr Rachwalsky retired in 1962. Rather than scrap the machine, Dr Rachwalsky, with the help of his daughter Dr. Emma L. Stein (also a radiologist), contacted the Wellcome Medical Museum offering to donate the machine. Since the late 1970s, the Omniscope and the Wellcome Collection have been looked after by the Science Museum.

The Science Museum would like to offer our great thanks for all the help and information that Peter and Henry Rockwell, Marion Frank and Dr Busch were able to offer during the visit to the Omniscope. The Science Museum is hoping to research further details about the x-ray machine and Pohl's life and share the story on a forthcoming web project. We would be very interested in hearing from anyone who could offer any further information about the Omniscope, Pohl, or with regards to Dr Rachwalsky's practice and the patients he examined with the equipment. Meanwhile after the huge success of the *Modernism* exhibition at the V&A, the Omniscope has gone on tour with the exhibition to the MARTa Herford museum, Germany, which runs from 16th September to 7th January 2007, and then on to the Corcoran Gallery of Art, Washington DC, from 17th March to the 29th July 2007.

Reference:

1 Porter, Roy. The Greatest Benefit to Mankind. Fontana Press. London. 1997.

## Conference: Securing the Ultimate Victory

A conference exploring the history of military medicine and health care

The conference will take place based in Keogh Barracks, Ash Vale, Hampshire over the period 11-13 April 2007.

It includes twenty papers given by international academics and medical historians on subjects ranging from the early modern period, Napoleonic period, 19th century, the first and second world wars and covers all aspects of medicine and health care including veterinary medicine and dental care.

CONFERENCE FEES
Full conference: £160.00 to include refreshments, buffet lunches, evening reception and delegate's pack.
Single Day: £60.00 to include refreshments and buffet lunch.
Formal Black Tie dinner on the evening of 12th April: £35.00

Included in the conference fee is an evening reception on the first day. On the evening of the second day there will be an optional formal black tie dinner during which the RAMC band will play and an eminent historian will speak after the dinner.

Delegates should book a place using the booking form attached. Closing date for booking places is 31st January 2007.

ACCOMMODATION
Accommodation is not included in the conference fee and delegates should secure their own accommodation. A list of local hotels is included and it is from these hotels that transport will operate on a daily basis.

For further details and booking form contact:
Army Medical Services Museum
Keogh Barracks, Ash Vale, Aldershot, Hants, GU12 5RQ
01252 868820

## Conference: The British Society for the History of Medicine

22nd Congress: The University of Dundee, 5th-8th September 2007

The venue for the 22nd Congress of the British Society for the History of Medicine will be West Park Centre in Dundee. The meeting is organised by the Scottish Society of the History of Medicine and will incorporate a joint session with Dundee University Medical School, on Thursday 6th September, to celebrate "Dundee 40", 40 years since the establishment of Dundee as a separate Medical School in 1967.

West Park Centre is a purpose built conference centre standing in a peaceful, leafy site, about one mile west of Dundee City Centre. Residential accommodation will be at the Centre, where there is on site parking for more than 100 vehicles.

Dundee is easily accessible by road, rail and air. The A90 dual carriageway from Perth to Dundee connects by motorway to Edinburgh and Glasgow. There is a regular train service to London Kings Cross via Edinburgh and a daily air service from London City Airport. The conference dinner will be on Friday 7th September and the meeting will end after lunch on Saturday 8th September to facilitate travel home for congress participants.

The City of Dundee has a rich historical heritage based on the sea and industry and we are planning for congress participants to visit Captain Scott's ship RRS Discovery and the Verdant Works, a working Jute mill and Museum.

Since its beginnings in 1967, Dundee University Medical School has established itself as a major force in Education and Research and the joint session will allow an overview of the developments that have taken place. Other topics planned for the congress include:
Exploration Medicine
Industrial/Occupational Medicine
Military Medicine
Radiation Medicine
'Varia' (Open session)
We hope to show participants what Scotland can offer in history, natural beauty and hospitality, to rekindle happy memories of previous BSHM meetings held in Scotland in Edinburgh in 1986 and St Andrews in 1995.

Proposals for papers (oral presentations or posters)

If you are interested in presenting at this meeting, please complete the application form and attach an abstract of no more than 250 words, outlining the main points and conclusions of your presentation, with a few key references. Oral presentations should be not more than 20 minutes in length. Please also attach a brief personal biography which will appear in the book of accepted abstracts. As a record of the conference, photographs will be taken of those who present papers.
Forms should be returned by 1 December 2006
by post to Professor JAW Wildsmith, Department of Anaesthesia, Ninewells Hospital, Dundee DD1 9SY, or by email to j.a.w.wildsmith@dundee.ac.uk

Registration
Those who would like to attend, whether or not they are submitting an abstract, should make contact by email: dr.david.wright@virgin.net post: Dr David Wright, 20 Lennox Row, Edinburgh EH5 3JW, or telephone: 0131 552 3439 to receive a registration form.

Proposals are invited for papers (oral presentations or posters) for the 22nd Congress of the British Society for the History of Medicine. Topics for the meeting include the history of Occupational Medicine, Exploration Medicine, Radiation Medicine, and Military Medicine. While we are looking to put together a programme of papers on these topics, we would welcome papers on other subjects.

If you are interested in presenting at this meeting, please can you complete the forms below, attaching an abstract of no more than 250 words, outlining the main points and conclusions of your presentation, with a few key references. Oral presentations should be not more than 20 minutes in length. Please also attach a brief personal biography which will appear in the book of accepted abstracts. As a record of the conference, photographs will be taken of those who present papers.
Forms should be returned by 1 December 2006 by post to Professor JAW Wildsmith
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or by email to j.a.w.wildsmith@dundee.ac.uk

The 22nd Congress of the British Society for the History of Medicine

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Bookings for the Congress will open on 1 September 2006

For further information please contact

Dr David Wright, 20 Lennox Row, Edinburgh EH5 3JW

Email dr.david.wright@virgin.net Telephone no 0131 552 3439

BSHM DUNDEE 5-8TH SEPTEMBER 2007

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Please send to Professor JAW Wildsmith, Department of Anaesthesia, Ninewells Hospital, Dundee DD1 9SY     or email to j.a.w.wildsmith@dundee.ac.uk

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