The Invisible Light

The Journal

of

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Contents

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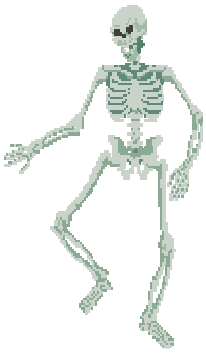

The RHHCT web site is to be found at: www.rhhct.org.uk

I am always interested in material for the web site, particularly related to radiotherapy and physics. There is also a hero's section. If you have a radiological hero then consider writing a short piece for inclusion with a photograph.

Editorial notes

I hope that you enjoy this RHHCT Journal. There are several interesting papers included.

We have Austin Carty on the great Thurstan Holland. Thurstan Holland was a pioneer radiologist in Liverpool and the President of the First International Congress of Radiology.

Fathi Habashi from Quebec has an interesting paper on medicine and the mining industry.

I include a paper by the late Derek Guttery on early practitioners in radiology. It was good to read in the last journal the paper by Richard Price on the history of radiographer reporting and the paper by Derek Guttery gives some primary material related to reporting of X-rays by non-medically qualified practitioners.

It is interesting to see the coins celebrating Marie Curie and Wilhelm Röntgen. There

are some more and I will include them in the next issue if I can obtain good images.

The picture on the front cover is by Frederick Reynolds and is from the article "The Greatest Woman in the world" by Mrs. William Brown Meloney and appeared in The Delineator in April 1921. This was the paper that brought Marie Curie to the attention of the public in America.

I had an interesting visit to the Millennium Dome in Greenwich. In the Self-Portrait Zone there was an interesting panel of what the UK people feel are their best qualities. I was more than a little amused to see a comment from one Philip J Notthage, retired, of Nottingham who selected X-rays: "Still the best invention for 100 years and British too."

The RHHCT has a stand (number 1024) at UKRC in Wembley (21-23 May 2001). Please come and visit us.

Please send me information about historical books and articles. Please contact me if you want to write an article for the RHHCT journal.

Adrian Thomas

Dr Adrian Thomas BSc FRCP FRCR

Department of Clinical Radiology

Bromley Hospital

17 Cromwell Avenue, Bromley, Kent BR2 9AJ UK

Tel: +44 (0)20 8289 7070

Fax: +44 (0)20 8289 7003

E-mail:adrian.thomas@btinternet.com

International Society for the History of Medicine (ISHM).

Do consider the ISHM. The cost is only modest at £20 for the current year. There is an interesting journal Vesalius included with the subscription. The next International conference is in September 2002 in Istanbul. The next British National conference is in Birmingham from 6-9th September 2001. Do please contact me if you want information about the ISHM and the British Society for the History of Medicine.

Book Notes

The Human Body: Image and Emotion.

Philippe Comar. Thames and Hudson (1999) ISBN 0-500-30093-3 £6.95

This is a translation of the French book that came out in 1993. It is an account of the various images that have been made of the body – by both artists and scientists. It starts with anatomical paintings contrasted with MRI images. There is a fascinating mixture of art, anthropology, medical imaging and popular culture. On page 87 there is an image of fluoroscopy from 1914 and this is followed by an account of cross sectional imaging. "This new generation of imaging tools personalizes anatomy by making medical portraits that are individual and evolving – no longer the picture of the body in general, but that of one body in all its vital particularity." "We may say that nothing is more enigmatic to our eyes than what lies beneath the surface of our own body, for we cannot grasp its complexity except by reducing it to a play of simple surfaces, immediately intelligible." There is an interesting discussion of the relation of medical imaging to the traditional study anatomy. All those interested in imaging the body…. radiology, photography, sculpture, painting….will find this book of interest.

Calculus Made Easy: Being a very-simplest introduction to those beautiful methods of reckoning which are generally called by the terrifying names of the Differential Calculus and the Integral Calculus. Newly Revised, Updated, Expanded, and Annotated for its 1998 edition.

Silvanus P Thompson F.R.S. and Martin Gardner.

St. Martyns Press, New York © 1998 ISBN 0-312-18548-0 $21.95 (hardback)

Macmillan Press Ltd. 1999 ISBN 0-333-77243-1 (paperback)

The first edition of this book was published in 1910. It was written by Silvanus Thompson the first President of the Röntgen Society that became the British Institute of Radiology. The book went through many editions and has been one of the most popular books on mathematics ever written. The book has never been out of print. In the prologue to the First Edition Silvanus Thompson wrote: "Considering how many fools can calculate, it is surprising that is should be thought either a difficult or a tedious task for any other fool to learn how to master the same tricks." The whole book is about the expert making things difficult! The original book now seems rather old-fashioned and has been brought up to date by Martin Gardner. I first came across Martin Gardner in his Mathematical Puzzles and Diversions in Scientific American and his books particularly his "Ambidextrous Universe " (the mathematics of being left-handed) and "The Annotated Alice" (the annotated Alice in Wonderland). The book also includes an interesting Appendix on puzzles related to calculus.

Cent ans après: la Radioactivité Le rayonnement d'une découverte

(René Bimbot, André Bonnin, Robert Deloche et Claire Lapeyre)

© EDP Sciences 1999 ISBN: 2-86883-430-2

This is a beautifully illustrated French book on the history of radioactivity coming

from a nuclear physics direction. There are many lovely pictures on all aspects of radioactivity. The book is particularly recommended in that it is so wide in its cover of the topic.

(My copy was from René Bimbot, institut de physique nucléaire 91406 ORSAY Cedex, FRANCE).

Recent Historical Articles

Reflections: Medical Physics: Some Recollections in Diagnostic X-ray Imaging and Therapeutic Radiology

Joel E. Gray, PhD and Colin G. Orton, PhD (*Radiology.* 2000;217:619-625.) © RSNA, 2000

An interesting paper on the history of medical physics with a North American perspective. There is an account of the development of quality control and radiation protection. New developments such as computed tomography, magnetic resonance imaging, three dimensional treatment planning systems, stereotactic radiosurgery and intensity modulated radiation therapy are considered. Al interested in the history of medical physics should read this article.

Reflections: History of Head and Neck Radiology: Past, Present, and Future.

Alfred L. Weber, MD (*Radiology.* 2001; 218:15-24.)

Alfred Weber (e-mail: alweber1@aol.com) is from the Department of Radiology, Massachusetts Eye and Ear Infirmary. This is an excellent and clear article on the history of ENT radiology from the earliest days to modern radiology.

SPECIAL EXHIBIT: Birth of Battlefield Radiology: Greco-Turkish War of 1897.

Ioanna A. Ramoutsaki, PhD, Euaggelos N. Giannacos, MD and Gerasimos N. Livadas From the Faculty of Medicine, University of Crete, Platia Kyprou 7, 71306 Iraklion-Crete, Greece (I.A.R., E.N.G.) and A & L

Medical Supplies, Crete (G.N.L.). (*Radiographics.* 2001;21:263-266.)

Radiance – The brilliant career of Marie Curie. (Giants: The movers and shakers of modern science)

Wilson da Silva. Newton Graphic Science. Jan-Feb 2001 p104-107 (An Australian Geographic publication)

This is an account of the life and work of Marie Curie. The account is the common story that has been told many times and the tone is summed up by the final quotation from Albert Einstein: "Marie Curie is, of all celebrated beings, the one whom fame has not corrupted." The reality is that Marie Curie is a more complex and interesting person than that told in the popular story.

SPECIAL EXHIBIT Scenes from the Past CT in the Archaeologic Study of Ancient Greek Ceramics (*Radiographics.* 2001;21:315-321.)

Roel J. Jansen, RT, Hans F. W. Koens, MSc, Cornelis W. Neeft, MA, PhD and Jaap Stoker, MD, PhD from the Department of Radiology, Academic Medical Center (R.J.J., J.S.) and the Department of Mediterranean Archaeology, Allard Pierson Museum (H.F.W.K., C.W.N.), University of Amsterdam, Meibergdreef 9, 1105 AZ Amsterdam, The Netherlands.

This is less an account of the history of radiology but is more using radiology in historical research. The article shows examples of CT scans of ancient Greek vases and ceramics. I particularly liked the scan of the Miracle jar dated 325-300 BCE and made in Etruria.

Stamps of Development: Postage Stamps Highlight History of Uranium.

Fathi Habashi, Professor of Extractive Metallurgy, Department of Mining, Metallurgical, and Materials Engineering Laval University, Quebec City Canada G1K 7P4
This most interesting article on the history of uranium is illustrated with postage stamps and is in the IAEA Bulletin (42/4/2000) and is to be found at:
http://www.iaea.org/worldatom/Periodicals/Bulletin/Bull424/

Marie Curie

There is a Marie Curie web site to be found at www.aip.org/history/curie called "Marie Curie and the Science of Radioactivity". This is an exhibit at the American Institute of Physics' history centre.

Madame Curie DVD

Starring: Greer Garson & Walter Pidgeon and Henry Travers .

The classic MGM film "Marie Curie. Directed by Mervyn Leroy and produced by Sidney Franklin.

The film has a very idealistic view of science in general and radioactivity in particular, in this film made before Hiroshima and Chernobyl.

A classic and brilliant film.

Marie Curie in Coins

French Gold coin: This coin is rare with only 5,000 proofs minted. It commemorates the 50th Anniversary of the death of Marie Curie (1867-1934).
The content is 17 gm. of 920 fine gold and it was valued at $400 in the 2001 Standard Catalogue of World Coins.

France, Marie and Pierre Curie (100F) 1997

French Marie Curie Silver Coin: 100 Franks 1984

Poland. This is a 1998 Proof Silver 20 Z Madam Curie Coin. On the coin are the symbols for radium (Ra) and polonium (Po) and with a picture of Marie and Pierre Curie at work.

Wilhelm Röntgen 1995 Centenary Coin.

Proof German 10 mark silver coin dated 1995-D commemorating the 100th anniversary of the discovery of x-rays and the 150th anniversary of the birth of their discoverer, Wilhelm Konrad Röntgen.

Early Radiological Reporting Services

Derek Guttery

THE NON-MEDICAL PRACTITIONERS NAMED BELOW WERE OFFERING AN X-RAY EXAMINATION SERVICE FROM 1896. SOME WERE IN BUSINESS FOR ONLY A SHORT TIME, WHEREAS OTHERS SUCH AS E.L.GLEW AND W.A.COLDWELL CONTINUED OPERATING UNTIL THE MID AND LATE 1920s. TYPICAL X-RAY EXAMINATIONS WOULD HAVE BEEN LIMITED TO DEMONSTRATING FRACTURES AND DISLOCATIONS IN HANDS, FEET, ARMS AND LEGS AND DETECTING FOREIGN BODES SUCH AS NEEDLES AND BULLETS AND SWALLOWED OBJECTS SUCH AS COINS:

***A.A.Campbell Swinton* informs us that he is going to arrange a special laboratory for the purpose of the medical applications of the Röntgen photography. The laboratory will be at his address, 66 Victoria Street, London, S.W., and is expected to be opened early next week. — *The Photogram*, III, 105b (April 1896)**

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. . . The announcement [of the discovery of X-rays] was in *The Standard* on January 7, and my brother, Mr. Alan Swinton, afterwards F.R.S., and now dead – to whom you often gave hospitality in your columns on scientific subjects – having fortunately a Crookes' tube, experimented on the 7th., and got results which I myself saw, I think, that day. He wrote, confirming Röntgen's discovery, to *The Standard* on January 9, his letter appearing on the 10th, and on the 13th he produced a photograph showing the bones of his own hand, which was exhibited at a lecture he gave at the Camera Club on January 16th.

I am quoting from the cuttings in his scrap-book, which include one from *The Times* of the 17th, and the photograph of his hand lies before me.

In a very short time his office was besieged by doctors, and he set up a special laboratory.

On my brother's death, 15 months ago, his first radiographs were deposited by his executors at the British Institute of Radiology. — letter to *The Times* from George S.C.Swinton, Monday, February 15, 1932, p.8c.

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. . . Soon after the discovery of the Röntgen rays, there sprang up a demand for Röntgen-ray photographs – or radiographs as they cam to be called later – for surgical purposes, and I set up what was, I believe, the earliest laboratory in this country to which medical men were able to send their patients to be photographed by these rays. . .

. . . Many distinguished people visited my laboratory in those days to see photographs taken by the Röntgen rays, and on one occasion Lord Salisbury, at that time Prime Minister, visited us, when we did a photograph of the bones of his hand, which photograph was a particularly good one. – A.A.Campbell Swinton: *Autobiographical and other Writings,* 43 (1930).

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***Professional Radiography* is undertaken by W.E.Gray, F.R.P.S., 92 Queen's Road, Bayswater; by G Ridsdale Cleare, 97 Lower Clapton Road, N.E.; by Friese Greene, and by Appleton & Co., Manningham Lane, Bradford. Messrs. Leo Atkinson & Co., 193 Greenwich Road, S.E., also inform us that they have fitted up a laboratory for the production of radiograms for**
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medical man and others. — *The Photogram*, III, 131a (May 1896)

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THE NEW PHOTOGRAPHY. A Practical Remonstration by Mr.H.H.Powles [at the Camera Club, Wednesday, March 25, 1896] . . . SURGICAL POSSIBILITIES. It will be gathered from what has gone before that surgeons are only too glad of this new method of seeing the bones, to help them come to a decision in cases difficult of diagnosis. It will certainly prove invaluable in cases of necrosis and other diseases affecting the bone structure. Laboratories for the investigation of such cases by the Röntgen method are now being established, and one of them is under the supervision of Mr.Powles at Faraday House. Here already several obscure cases have been investigated with satisfactory results. — *The Journal of the Camera Club*, X, 73-74 (April 1896)

The experiments were made at Mr.Friese Green's "New Photography" laboratory, 39, King's Road, Chelsea . . . — *THE PHOTOGRAPHIC NEWS*, XL, 210 (April 3, 1896)

William Friese Green (1855-1921) was a British pioneer of cinematographer who saw X-rays as a means of making money. In 1896 he applied for a provisional patent (9,919) for "Producing X-rays and Light". One of his ventures involved Matinée X-ray Exhibitions at the Old Oxford Music Hall in London during which he would invite members of the audience to have their hands and arms radiographed and see the results displayed on photographic plates.

In 1896, he established a laboratory for radiography at 39, King's Road, Chelsea in 1896 where the X-ray examinations were undertaken by a young man called Forrest Barnes. An account of the sort of work he undertook is given in Ray Allister's *FRIESE-GREENE: Close-up of an Inventor* (1948):

A carriage arrived at 39, King's Road, and the coachman delivered a note. Sir Pierce Gould, the well-known surgeon . . . would be obliged if Mr Friese-Greene would come at once to Sir Pierce's house, bringing his X-ray apparatus. . .

Sir Pierce's nurse-receptionist lay on the couch, obviously in pain. The surgeon explained that last night she got a needle into her foot. She knew where it had entered. This morning it was not in the same place and the foot was so swollen it was impossible to find the needle by feeling for it. The X-ray found it. It had "walked" almost to the ankle during the night.

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Messrs R.J.Appleton & Co., photographers of Bradford, are prepared to treat medical cases with the Röntgen rays. This firm has been successful in photographing portions of the backbone, the arm and other parts of the body. — *The Practical Photographer*, VII, 152. (May, 1896)

The Roentgen Rays and Surgical Operations. — Dr.Moorhead, of Tong [a village near Bradford, West Yorkshire], has had a somewhat peculiar experience in connection with the X rays. A lady patient of his having got a portion of a needle into her foot, he took her to Messrs. Appleton of Bradford, where the X-rays were applied, and the needle localised The following morning, with the aid of a life-size tracing of the negative, the doctor attempted to cut out the needle, but, to his surprise, it was not where it should have been. On the photograph the needle was in a horizontal position, but it was found in a vertical position, and was extracted from the dorsal surface of the foot instead of the planter surface. The needle extracted was 1.1/8in. in length, and had struck the bone with such force as to bend the point. Surgeons resorting to the X rays will, therefore, have to devise some means of operating immediately a negative has been obtained. *English Mechanic and World of Science,* LXVI, 504a (January 14, 1898)

The Roentgen Rays and Surgical Operations. [40761.] — My attention has been called to an account of the experiences of Dr.Moorhead, of Tonge [sic], on the X-rays, and which was published in these columns about a fortnight ago. A lady having a needle in her foot was radiographed by a firm in Bradford, and the needle shown to be in a *horizontal* position. The following morning, aided by a tracing from the X rays negative, an attempt was made to remove the needle, but to the doctor's surprise the needle was now in a *vertical* position, it was 1.1/8in. long with a bent point, and it had to be removed from the dorsal surface instead of the plantar surface, and the conclusion arrived at from this experience was that "surgeons using the X rays will therefore have to devise some means of operating immediately after the negative has been obtained."

Now, the inference of all this is that the needle had moved during the few hours only before the operation. Well, I do not intend to discuss this point; but I desire to point out that if the plate was under the plantar surface, and the Crookes tube over the dorsal surface, the needle could only be shown as a line or as a dot; in the latter case it would have to be perfectly vertical to the plane of the plate, and directly under the central rays of the tube, which is a ten thousand to one chance; if the needle was a little inclined out of the perpendicular, or the tube a little to one side, the image by projection would have been shown as a line, and may have led to the misconception that the needle was in a horizontal position. Of course, radiography is not to blame for this. What should have been done was to have taken a second radiograph at right angles to the first, and the two would have more correctly located its position. In my own practice it sometimes happens that a second radiograph reveals conditions that make it advisable to take a third, and abandon the first. — W.I. Chadwick. *English Mechanic and World of Science,* LXVI, 577c-578a (February 4, 1898)

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***Radiographic Studios* appear to be opening everywhere. One of the latest is at the London Stereoscopic Co.'s premises in Regent-street. Jones & Scott, of Exeter, have fitted themselves very completely, under the advice of**
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J.W.Gifford, for all classes of surgical work. Unfortunately, some of those who have gone into the line are already working at ridiculous prices – an original surgical for half-a-crown, for instance – but our own experience of the uncertainty of the subject, and the skill necessary to ensure any regular success, makes us think that these people will not long keep to such prices, or anything approaching them. — *The Photogram*, III, 156b (June 1896)

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X Rays in the Court . . . Mrs Wills was walking up Bridge Street, Exeter, and when opposite Mr.Pike's premises a man, carrying sacks, came out suddenly and ran against her with such violence that she was knocked down. Her arm was badly injured and sprained, as was seen by the X-ray photographs produced, and it was doubtful whether she would ever thoroughly recover the use of the limb. — Mr.Andrew, surgeon, said he had attended Mrs.Wills, and was inclined to think the injury to the arm was permanent. He had the X-ray photographs taken by Scott and Son, thinking there might be other injuries besides the sprain, and these showed there was no fracture, but that the arm was twisted. That he attributed to the hand being doubled up under the arm in the fall. — Judgment (sic) for plaintiff for £15, and half a guinea was allowed for the photographs. — *THE PHOTOGRAPHIC REVIEW*, II, 18 (January 1897)

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***Radiography as a business* is being taken up all over the country. Not only are professional photographers going into it, but some amateurs also. V.E.Johnson, M.A., F.R.M.S., Alderley Edge, near Manchester, asks us to intimate that he is prepared to lecture and demonstrate, and to undertake surgical cases. — *The Photogram*, III, 202b (August 1896)**

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***Photographer and Radiographist* is the style and title of Jas. Dickinson, who has removed from Grainger-street to new premises in Neville-street and Pink-lane, Newcastle-on-Tyne. — *The Photogram*, III, 253 (October 1896)**

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Instruments for taking Roentgen's photographs are lent out with all the required accessories. The prices depend on the size and number of plates required, and the length of time for which they are wanted, and vary from £1 1s. to £5 5s. Damaged tubes and coils will be charged for. Skilled assistants can be sent to take these photographs. Terms on application. — Preface to 5th. edition (October. 1896) of K.Schall's *Electro-Medical Instruments and their Management* . . .

A radiographic laboratory which has turned out some excellent work and the proprietor of which is prepared to lecture and demonstrate upon the subject, has been recently opened by F.H.Glew, 156 Clapham-road, London

W. — *The Photogram,* IV, 154a (May 1897)

Glew advertised his radiographic services in London local newspapers —

> **F.H.Glew/ Surgical Radiographer/ the/ Radiographic Laboratory/ 156 Clapham Road/ London S.W. — Advertisement on front page of *The Brixton Free Press*, No.883, Friday, August 4, 1899.**

F.H.Glew was a chemist and electrical engineer and one of the earliest members of the Röntgen Society (1898). He had an experimental laboratory behind his chemist shop in Clapham Road. where he developed – sometimes in association with R.S.Wright of Newton & Co. – a number of pieces of X-ray equipment including a rectifier, a motorised mercury interrupter (patented), and a "vacuum regulating" X-ray tube (1896) now in the Science Museum, London. As a result of his later work with radium, he received severe radiation injury to his fingers. He died in September 1926. His name was added to the Hamburg Radiation Martyrs' Memorial in 1956. For Glew's spirited defence of the important work done by non-medical radiographers, see *Journal of the Röntgen Society*, XIV, 110–115 (October 1918) (Copy enclosed with my letter of 22 May, 1996).

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Allen & Hanbury, Chemists, London. Operated an X-ray service for General Practitioners from about 1896. The radiographer was W.A.Coldwell (q.v.) who left in about 1906 to establish his own radiographic service.

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Walter Augustus COLDWELL (1864-1929) Originally worked for the London chemists Allen & Hanbury. Following the discovery of X-rays, Coldwell ran Allen & Hanbury's X-ray examination service for general practitioners until 1906 when he left to establish his own radiographic service at 62 Welbeck Street, London W. In 1907-08 he moved to 6, Mandeville Place, Manchester Square, London W.

Coldwell was elected to membership of the Röntgen Society in March-April 1898. He suffered severe radiation injures to both hands with consequential amputation of several fingers and eventual death in 1929 from axillary mestastases. His name was added to the Hamburg Radiation Martyrs' Memorial in 1956.

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Frank Simpson PEPPERDENE (1862-1933) – or Dr Pepperdene as he preferred to be called – was, according to his own statement, involved with X-rays from 1897:

> **I commenced lecturing and demonstrating . . . in 1897. Since then I have been experimenting with the X-rays — interview with Pepperdene quoted in *The Daily Mail*, July 22, 1910.**

Pepperdene was proposed for Membership of the Röntgen Society on 5 April 1898 and elected on 10 May. At the time of his application for membership, he described
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himself as "Analytical Chemist" and claimed to hold the degrees of M.A. and PhD. There is no evidence that he was entitled to either qualification. He later became a member of Council of the Röntgen Society. Despite his friendship with A.W.Isenthal, there is no doubt that he was a charlatan or, at least, a clever opportunist.

At the end of 1898, Pepperdene approached the City Orthopaedic Hospital in Hatton Garden with an offer to set up an X-ray department at his expense subject to his being appointed to the staff. This arrangement seems to have continued until about 1901-02 when he moved his family to Bexhill-on-Sea. In the meantime, he had established a private radiographic practice in rented rooms at 68 Wimpole Street. From about 1900, his hands had been effected by X-ray dermatitis and by 1902 this was seen to be serious. The condition worsened until February 1910 when his left arm was amputated just below the elbow. A public appeal was made to raise funds as it was thought that Pepperdene might never be able to work again. Pepperdene emigrated to Canada with his family in early 1911 and appears to have continued his work with X-rays until his death in 1933.

Pepperdene was interviewed in July, 1910 "in his London operating room" by a reporter from the London *Daily News* and is quoted as saying:

> **I think I may claim to have been one of the earliest to experiment in radiography and radiotherapy, and I introduced the treatment into the City Orthopaedic Hospital. It is quite true that in those days, even in the hospital, I had to use my own instruments. They are those you see around you, and cost over £1,000. — interview with Pepperdene quoted in the *Bexhill Observer*, July 23, 1910.**

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> ***Isenthal, Potzler & Co.* have opened handsome premises at 85 Mortimer-street, W. (close to Regent-street), where they stock every possible kind of radiographic instrument, as well as a very large selection of other electrical-surgical apparatus. They are the sole British agent of the Voltholm Company of Munich, and are also importers of all novel and really special patters in Continental radiographic apparatus. They have a convenient radiographic laboratory under the charge of A.W.Isenthal, F.R.P.S., etc., who is well known as one of our best practical radiographers, a member of the Council of the Röntgen Society, and joint author of *Practical Radiography. — The Photogram,* V, 300a (September 1898)**

> ***Radiographic Outfits* of the most perfect kind are a special feature of the business of Isenthal, Potzler & Co., just opened at 85 Mortimer-street, Cavendish-square, London, W. An examination of some of the special lines will fully prove how great has been the progress in radiography since those early days of '96 when Röntgen's discovery was received with semi-incredulity. By Isenthal, Potzler & Co., two large floors are almost entirely devoted to radiographic apparatus, and to a model radiographic studio, in which radiography is undertaken for physicians and surgeons. The studio and dark-rooms may also be used by experienced operators. The fixed**
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installation includes a twenty-inch spark coil, with all the most perfect accessories in the way of electrically-driven and controllable interrupter, driven from separate batteries, volt-meters, ammeters, etc., and with complete outfits of intensifying screens, exposing and examining table for patients, etc., etc. . . . — *The Photogram*, V, 333b (October 1898)

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Radiographic Services listed in [Kellys] *Post Office London Directory* from 1900 until 1916 [later volumes not surveyed] show the following:

APPLETON & Co.

ATKINSON, Messrs Leo

CLEARE, G.Ridsdale

COLDWELL, W.A.

COXETER & Son

DAVIS, Harry & Walter

DICKINSON, James

FOWLES, H.W.

GLEW, F.H.

GRAY, W.E.

GREENE, William FRIESE-

ISENTHAL & Co.

ISENTHAL, POTZLER & Co.

JOHNSON, V.E.

JONES & SCOTT

LONDON STEREOSCOPIC COMPANY

SCHALL, K

SCOTT & Son

SWINTON, A.A.Campbell
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THATCHER, Cyril Frederic

GRAY, W.E.

Typical entries in the *Directory* are:

> **Coxeter & Son, improvements & complete apparatus for examination & difficult radiography; examinations made & radiographs taken at patients' residences or at 4 & 6 Grafton Street, Gower Street, London W.C. — [Directory entries from 1900 to 1903].**
>
> **Frederick H.Glew, 156 Clapham Road, S.W. TN 1787 HOP; silver medallist, Paris Exhibition 1900. — [Listed in Directory from 1900 to 1916].**
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> **Harry & Walter Davis, 52 Grafton Street, Gower Street, London W. — [Listed in 1904 Directory only.]**
>
> **Walter Augustus Coldwell, 62 Welbeck Street, London W. Late operator [radiographer] to Allen & Hanbury's Limited. TN 2430 MAYFAIR; TA "Skiagraphy London". [From 1914 onwards called "Laboratory of Radiographic Research"]. — [Listed in Directory from 1906 to 1916].**
>
> **Cyril Frederick Thatcher, 35 Harley Street, London W. — [Listed in 1915 and 1916 Directory only].**

[Verbatim transcripts of the relevant pages of [Kellys] *Post Office London Directory* from 1900 until 1916 are shown on attached green pages]

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THE PHOTOGRAM.

(Edited by H.Snowden Ward & Catherine Weed Ward) Published under this title from January 1894 to December 1905. 12 vols. (I - XII) London, 1894-1905.

Continued as:

***THE PHOTOGRAPHIC MONTHLY (THE PHOTOGRAM)* (Editors H.Snowden Ward, Catherine Weed Ward) Vols.XIII – XVIII, January 1906 – October, 1911.**

B.L. press mark for both titles: P.P. 1912. eb. (1.) [British Library set is lacking vol.15, No.180.]

NOTE: From March onwards, the 1896 volume contains a considerable number of references to "The New Light" or the "New Photography" and this interest in X-rays continued to a lesser degree during 1897 and 1898 but by the 1899 volume had diminished to three short entries (all at p.281 of the September issue.); four entries during 1900 and three during 1901.

The founder and chief editor of *THE PHOTOGRAM*, H.Snowden Ward (died New
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York, December 6, 1912), took a great interest in Röntgen's discovery and was one of the original members of the Röntgen Society and a very energetic member of Council. In late January, 1896 he published an illustrated 15-page special supplementary number of *THE PHOTOGRAM* under the title "The New Light and the New Photography" (price 3d.) containing "Full particulars popularly written, of Prof. Röntgen's Discovery" including "Early Work on Invisible Rays, and a Popular Exposition of the Subject" by E.J.Wall and H.Snowden Ward; "The 'X-rays'" translated [by C.M.Stanton] from Röntgen's "First Communication" and "The Work of A.A.Campbell Swinton, and J.W.Gifford". The supplement was obviously well received by the readers of Snowden Wards's journal as it reached a third edition – containing additional material and illustrations – by 5 February and thereafter went into a least one further edition. It was followed in ?July[#] 1896 by Snowden Ward's book *Practical Radiography* (price 1s., paper; 1s. 6d. cloth) which the author claimed to be "so far as we are aware, the first practical handbook of the applications of the X-rays published in any language". A second and virtually re-written edition of 158 pages produced in collaboration with A.W.Isenthal appeared in April 1898 and a third edition of 198-pages by the same co-authors in 1901. ["Practical radiography is again coming to the front with the commencement of the autumn season, and the little practical handbook, which we published under this title a year ago, is almost entirely out of print." — *The Photogram*, IV, 275, September 1897]

[#]reviewed in *The Photogram*, August 1896.

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PUBLIC DISINTEREST IN X-RAYS:

By the end of 1896, the educated public began to lose interest in X-rays which had received excessive attention in the press:

> **Tired as we are of the X-rays, they appear to be doomed, like the poor to be always with us — *The Photographic News*, XL, 482 (July 31 1896)**
>
> **The X rays. The *Middlesborough Gazette*, speaking of a lecture by Mr.Campbell Swanson [sic – Swinton], makes him say:**
>
> **That while six months ago everybody was excited with the subject, it has now become so stale that it was difficult to galvanise it into any sort of interest. The fact thus stated is another illustration of how soon we nowadays cease to wonder at anything. That all our ideas of photography should be reversed, and that interiors should be revealed and surfaces not, that the bones of the hand should be photographed and the skin and the flesh left out of the picture , was certainly a discovery that startled the world into the belief that anything was possible. But it has now taken its position among the commonplaces of existence, and people talk of the new photography as they do about the new woman. It is a pity that things capable of maintaining the feeling of healthful wonder should be permitted to lose their interest and settle down into the trivialities of everyday life. — quoted in *The Photographic Review*, I, 346b (November 1896)**
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The National Cataloguing Unit for the Archives of Contemporary Scientists.

The NCUACS is located in the University of Bath and as the name indicates is involved in the cataloguing of archives relating to contemporary scientists. The NCUACS will receive papers for cataloguing before they are deposited in a permanent location. They have a web site www.bath.ac.uk/Centres/NCUACS and may be contacted at ncuacs@bath.ac.uk. The papers relating to John Read the radiobiologist have recently been sent to Bath from the British Institute of Radiology and include his laboratory notebooks, research data, notes on lectures and correspondence.

Collections recently completed include:

1. **Sir Joseph John Thompson (1856-1940) NCUACS catalogue no: 91/4/00, 165pp., deposited in the Library, Trinity College Cambridge. These papers will not be available for research until 2003.**
2. **Harold Miller (1909-1995) NCUACS catalogue no: 92/5/00, 166pp., deposited in Sheffield University Library. The papers cover the period 1912-1995. Harold Miller was a major figure in medical physics and initially undertook research at the Cavendish Laboratory supervised by J Chadwick. He was appointed Physicist to the Sheffield National Centre for Radiotherapy in 1942. Medical Physics eventually became an independent Regional Department with Harold Miller as Chief Physicist. He received the title of Associate Professor in the University of Sheffield in 1972. He retired in 1975.**

CHARLES THURSTAN HOLLAND: PIONEER OF LIVERPOOL RADIOLOGY

AUSTIN CARTY. Consultant Radiologist Royal Liverpool Hospital.

I took up my duties as a consultant radiologist at the Royal Southern Hospital on 21 January 1974. The senior registrar, Nick Clitherow, told me it was the oldest hospital x-ray department in the country and as I looked around the equipment I was not prepared to challenge him. In 1977 I commenced private radiology practice at 43 Rodney Street in partnership with Iain Morle. We inherited a significant amount of archival material relating to the activities of the man who had started radiology in the Southern in 1896 and in Rodney Street in the very early 1900's, Charles Thurstan Holland.

The astonishing thing about the discovery of x-rays is the speed with which they were taken into clinical use. True, every physics laboratory across the world had primitive x-ray tubes but this hardly accounts for the epidemic. In Liverpool, progress can be attributed to the patronage of the doyen of orthopaedic surgery, Sir Robert Jones and the flair and dogged determination of Thurstan Holland.

In January 1896 Robert Jones was already a busy and successful surgeon whose practice revolved around his Sunday 'free' clinic in Nelson Street, the prototype of orthopaedic outpatient clinics the world over. He had been consulted about the case of a boy who had shot himself in the hand and in whom the pellet could not be found on probing. Jones had heard about x-rays in a roundabout way from the wife of a Viennese cotton broker, Augustus Wimpfheimer, then resident in Liverpool. Jones asked Oliver Lodge, head of the physics department at Liverpool University if he would help with the new x-rays. On 7 February 1896 the boy was brought to Lodge's laboratory. The pellet was identified embedded in the third carpo-metacarpal joint. Two weeks later, 22 February, the case was reported in The Lancet (pp 476-7). Holland had been in attendance on 7 February.

Charles Thurstan Holland was born in the West Country in 1863. He qualified in medicine at University College, London in 1888. He had been in general practice in Princes Avenue, Liverpool, then a very fashionable quarter, since qualification and was one of the senior assistants to Robert Jones at his Sunday clinic. When Jones saw how helpful x-rays had been in finding the pellet he asked Holland: 'If I pay for an apparatus, will you undertake it?' Holland leapt at the chance and by May 1896 was installed in primitive quarters in the basement of the Royal Southern Hospital.

During 1896 Holland did 261 clinical radiological examinations at the Southern and one of his last published papers (BJR) was an account of this work given to Liverpool Medical Institution (LMI) on the occasion of the centenary of its building in 1937. In the minutes of the LMI for the meeting of 8 October 1896 it is recorded:

'Dr Thurstan Holland gave an interesting demonstration of a series of radiographs. First shewing a series of normal hands at different ages calling attention to the ossifying centers. He then shewed a similar series of normal feet. After this came a series of fractures and dislocations and lastly a number shewing the presence of a foreign body. Among the best was that shewing a halfpenny in the trachea of a child'

Holland developed his x-ray practice at the Southern over the next eight years. He moved to the Royal Infirmary in 1904 and continued to be Head of Radiology there until 1923. He instituted formal training for radiologists in 1919 preparing candidates for the Cambridge DMRE. Contemporary accounts stress his tenacity, his vision, his gruffness, his kindness and above all his capacity for hard work. He was autocratic in his selection of doctors to train as radiologists and required in them above all a sound grounding in clinical thinking. He had obvious talents for leadership and was twice elected president of the Roentgen Ray Society (1904 and 1916) and of its successor society, the British Institute of Radiology in 1929. He was President of the first ever International Congress of Radiology in London in 1925.

An insight unique to the archive in my possession comes from the manuscript of Holland's Presidential address to the Liverpool Medico-Literary Society in 1895. The secrets of this neat and almost illegible document were released to me a few years ago by Holland's grand-daughter, Sylvia Roxburgh. She says she was his favorite and frequently took dinner as his guest in the Adelphi Hotel where he was resident in the 1930's. By coincidence she is a skilled typist and had no difficulty 'translating' the manuscript.

The address was given on 4 October 1895 at the very time Roentgen was conducting his experiments and there is a telling extract which was destined to be overturned within the year. The essay is entitled 'The Healing Art' and, frankly, is a fairly smug account of *fin de siecle* medical self-satisfaction:

'In the case of operative surgery we have, I take it, almost reached the acme of the art. It is difficult to see in what way it can make any further great advances. Every part of the human body, both inside and out, can be subjected to operation with a minimum of risk and a maximum of benefit. And although no doubt improvements will be made in the manner of operating, and in many technical details, it is difficult to see where new operations and great advances are coming from, from the merely operative point of view. That advances in the practice of surgery will come, and are coming every day, and which will be far reaching in their effects, is obvious; but they are not advances, so to speak, in the way of new, unthought of operations.'

Holland published over 100 papers in national and international literature. He did pioneering work on establishing the landmarks of skeletal maturation in children by preparing one of the first guides to bone age. His work on identifying the accessory bones of the foot is a lasting testimony to his meticulous clinical observation. Most of our knowledge of these structures and our ability to recognize them as normal, not the residue of previous injury, is based on Holland's work. He made one of the first reports on the hourglass stomach based on a large series of barium meals. He published extensively on the subject of urinary tract stones. Although much of the clinical use of x-rays in the late 1890's was concerned with identifying bullets in war wounded soldiers, notably in the battle of Omdurman (1898), Holland brought a much sterner discipline to this kind of work in the Great War. He perfected a technique for localizing bullets, devising a depth finder on the principle of the gunner's height finder. Such localisers were in use in my own practice for locating intra-ocular foreign bodies and the Barnes Wallis Dam Busters' bouncing bomb used the same principle. One of my earliest patients in 43 Rodney Street was a man of some 80 years referred for an IVP in 1978. The control film showed a lot of shrapnel in his back. I asked him about it and he told me he had been x-rayed in Rodney some 60 years before in 1918. The x-ray doctor told him;

'Don't let those surgeon Johnnies operate on you for shrapnel. It's all in a place where it wont do you any harm'

I showed him Holland's photograph and he confirmed that this was the man who had given him such sound advice.

The quality of clinical reasoning shown by Holland and other pioneers is an example to our generation. We have a richness of technology and modalities at our disposal. However, we are indiscriminate in its use and often illogical in its interpretation. All Holland's accounts of his radiology are firmly rooted in sound, if terse, clinical history. Radiological interpretation had to make clinical sense. There was restraint in the use of tests. If they were unlikely to illuminate the clinical problem they were not done. Radiology was the servant of clinical skills, not the substitute for them. Perhaps it is now the time to return to these roots.

Holland lived on in retirement to die in 1941, the year of the death of James Joyce and the year of my birth. Am I the reincarnation of one or the other or a bit of both?

Storage of Archival Material

These notes were posted in an Internet discussion group and may be of interest:

A member is wanting to record and store pictures of his late wife's artwork, including engraved glassware, tapestries etc. Many of these have been displayed. He would like to find a medium that he would be sure that this record of her work would last for 100 years. CD-ROMs are already becoming outdated. Is DVD a feasible option to produce such records? Would he be best with conventional photos or would inkjet prints with say a spray of fixer last long enough? Our friend also has old photos he would like to touch up but is unsure that re-producing them via inkjet paper would be lasting.

I highly recommend the preservation guides of the UK Public Record Office which are available online at: http://www.pro.gov.uk/preservation/guides/default.htm there are separate documents on photographs, parchments, new media and many others and I suspect these are as authoritative as you can get. This issue is also of interest to me as I am sure that many MM/PM records are being kept on disk as well as/perhaps instead of paper. I can put on my commercial photographer's hat ... and say that there is a body of literature on archival storage of photographs. Two good places to start are:
http://lcweb.loc.gov/preserv/care/photolea.html.
http://www.photographymuseum.com/archival.html
To purchase archival supplies, I would go to Light Impressions:
http://www.lightimpressionscom
I'm sure there are similar companies on your side of the pond.

The deterioration of photographs is pretty well understood. Most people don't realise that magnetic media also decay, and so it is not at all clear that tapes or disks that can be read today will be solid in 40 or 80 years. What is even more unlikely is that devices to read those tapes or disks will still exist -- except as relics in a museum. I'd look for a Friend who also has professional training in preservation, library science, etc. to get some solid advice about the particular materials you want to preserve.

Without going to the extent of consulting works on archival storage, the following conventional route should work. The details aren't intended to be exhaustive.

1. Make transparencies using low speed Fuji Provia film, or low speed Kodachrome. This is the major technical challenge, as the lighting of glassware requires considerable skill - and I speak as a veteran of numerous product shoots. I suggest making 4 sets of transparencies on different rolls of film, and if possible using either 12 or 10 on 120 rather than 35mm. But 35mm will do. You might also want to make a couple of black and white sets using Ilford FP4. For photographing tapestries 120 film is much better owing to the greater detail resolved, but obtaining even lighting is a problem (flash guns and small studio lights will not give even lighting over the area of a large tapestry, but good results can be obtained in a north-facing room using natural lighting in summer.

2. Have the transparencies processed by the manufacturer, or, in the case of Fuji, by a company like Colab.
3. If you use 120 or have 35mm processed by Colab, store the results in archival grade envelopes available from a professional photographers' suppliers. 35mm slide sets should ideally be removed from the holders and stored in archival envelopes using new cotton gloves to ensure there is no finger oil contamination. The inconvenience of this is the main reason non-mounted 120 is so superior.
4. Buy 4 sufficiently large stainless steel food containers from a good kitchen shop. Keep a set of slides in each. You might want to clean out the containers with strong dishwasher powder solution followed by plentiful water rinse and air-drying. Load and seal the containers on a dry day or use a nitrogen spray to displace most of the air. Assuming they have push on lids, seal them around the join with a thorough wrapping of plumber's PTFE tape and an overcoating of masking tape to hold the PTFE in position.

5. Label one container to be opened at 25-year intervals. Leave some money for this
purpose, and to make new copies of another set if the sample set shows signs of any fading.
6. Have prints made from black and white negatives on a non-resin paper using archival processing (Ilford Galerie for instance). Store using acid free paper.

You should be able to find advertisers who will do this kind of work in Amateur Photographer. With reasonable conservation you can expect life of much more than 100 years, but in any case reproducibility should be excellent.

Interesting Web Sites

Welcome to Kilokat's Antique Light Bulb Site

www.bulbcollector.com

This is a great site with much of interest to those interested in the vacuum tube. There is a wonderful version of the Vanity Fair Spy picture of Sir William Crookes with him holding a flashing tube. The following is taken directly from the site:

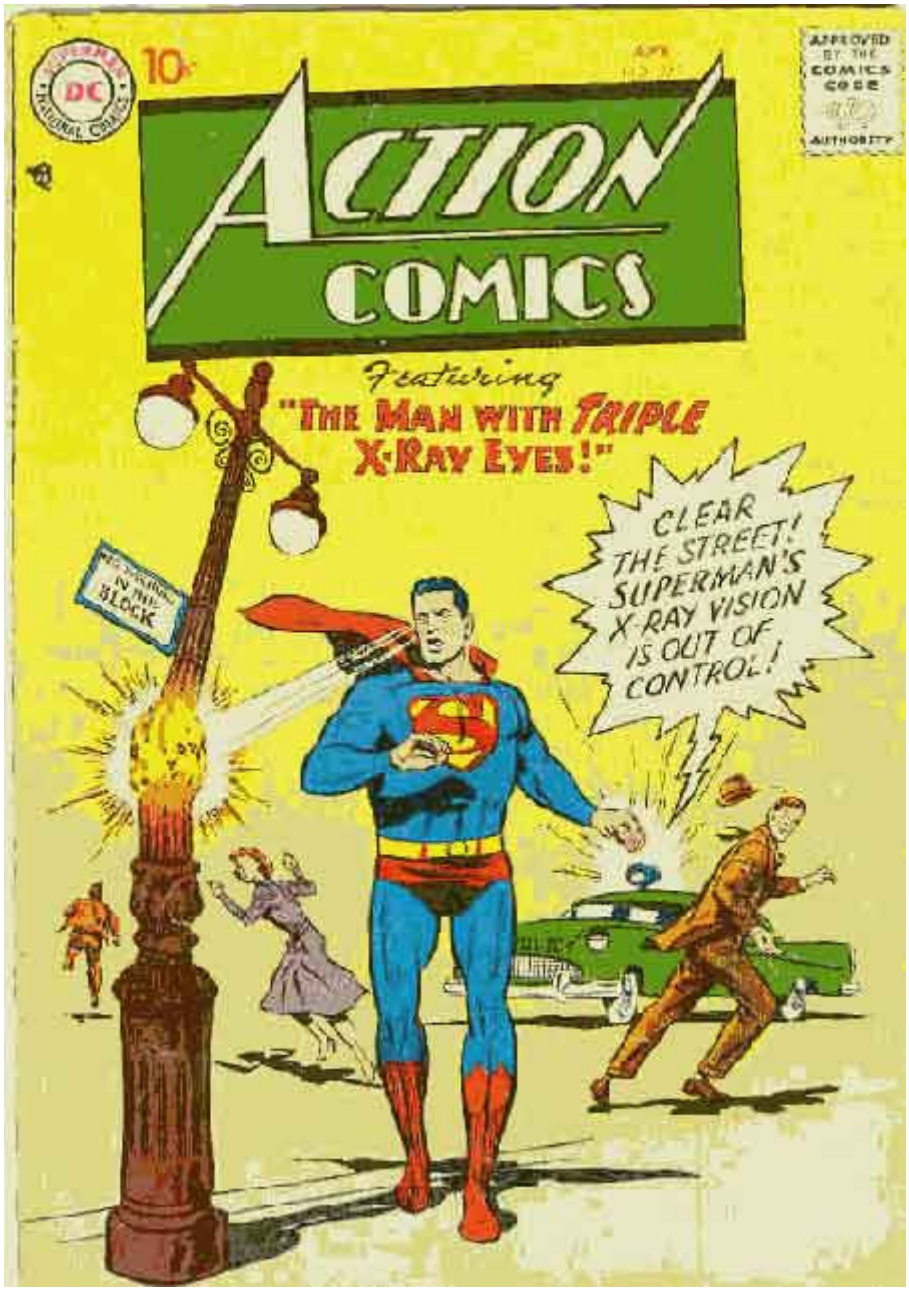
"This site was first created in November of 1997 with the hope of meeting other light bulb and vacuum tube collectors on the net. Over the years I've met some great people through this site and have added many interesting things to my collection and have helped other collectors add to their collections. This site continues on with it's original purpose of sharing items from my collection including antique light bulbs, early radio tubes and box art, Geissler and Crookes discharge tubes, x-ray tubes, Aerolux figural neon glow lights, vintage Christmas lights and more. Long time visitors will notice the new web address www.bulbcollector.com , now would be a great time to update your links and bookmarks. This site has been redesigned from the ground up to include more research information concerning antique light bulbs, radio tubes, and related items. Visitors can now browse & download old lighting catalogues, early historical books on light bulbs, and a vast assortment of other paper items from my collection. Many more pictures have been added including pictures from a recent trip to the Mount Vernon Museum of Incandescent Lighting. A new discussion board area has been created to allow collectors to network with others and post classified ads. Comments and additional information about the items pictured here are always welcome as are submitted articles concerning the collecting and history of antique light bulbs.

I'm always happy to help non-collectors who may have found an old light bulb in Granny's attic. Please keep in mind I get numerous requests weekly and I can't always reply instantly. Please read the FAQ before emailing me about an old light bulb you have. 90% of the requests I get are answered there. If your questions are not answered there then feel free to email and be sure to attach a picture or two of your item with your message. If you are unable to send a picture then please describe your item in detail with the help of this form."

"history repeats itself. historians repeat each other"

philip guedalla

X-rays in popular culture(1): Superman & X-ray vision.



ACTION COMICS #227, April 1957.

X-rays in popular culture (2): Advertisement for x-ray Exposure: "give me a dose of Kohler's Antidote for headache from an 1898 magazine . The healing action of X-rays.

MEDICINE AND THE MINING INDUSTRY

Fathi Habashi

Department of Mining, Metallurgical, and Materials Engineering

Laval University, Quebec City, Canada G1K 7P4

INTRODUCTION

It may look rather surprising that the first comprehensive books on mining and metallurgy were written in Latin, the language of the scholars at that time, by a medical doctor. It was Georgius Agricola (1494-1555) (Figure 1) the medical doctor in Chemnitz who was treating sick miners in the region and got interested in mining and metallurgy. He visited mines and smelters, asked questions, took notes, and then compiled this information in a number of books that became the basis of mining and metallurgical literature for about two centuries (Table 1: at end of article).

THE BAD-LUCK MINERAL

But, this was not only a matter of curiosity. It happened that the miners in the town of Joachimsthal suffered during the sixteenth century from a mysterious and untreatable sickness that was known to the physicians of that time as the "miner's sickness". The German miners who were exploiting the rich silver deposits there often came across a heavy lustrous black mineral which was for them bad luck because it did not contain silver. Also, because it was as black as pitch, they called it "Pechblende" since in German "Pech" stands for pitch or for bad luck. It

became known in English as "pitchblend". Soon, the miners' sickness was attributed to this black mineral.

Figure 1 - Georgius Agricola (1494-1555) the medical doctor in Saxony who wrote the basic books on mining and metallurgy.

Joachimsthal is located on the southern slopes of the Erzgebirge mountains at an altitude of 650 m, in an area exceptionally rich in ore deposits. The town was founded by Count Stephan Schlick in 1516 when few years earlier silver was discovered. The town was named after its patron Saint Joachim, Mary's father. The name was chosen to harmonize with the then existing settlings in Saxony on the other side of the mountains known as Annaberg (1491) and Marienberg both from Jesus family. Further settlings in the neighborhood, Freiberg (1168) and Schneeberg (1446) are also known by their silver discoveries.

Agricola stayed a month in Joachimsthal in 1550 to examine the ailing Count Hieronymus Schlick, brother of Stephan Schlick. He was not new to the town - - he had already practiced medicine from 1527 to 1531 and wrote his book « Bermannus » there. It is known also that he met there a native artist of the town, and engaged him to make the illustrations for his new book *De Re Metallica* which was published one year after his death. Figure 2 shows a doctor and a nurse attending to a sick miner in the town's hospital; from the window one can see mining activity. Figure 3 shows the town's apothecary from a woodcut dated 1568.

Figure 2 - A doctor and nurse attending to a sick miner in Joachimsthal's hospital. One can see the mining activity from the window. A woodcut dated 1518.

Figure 3 - An apothecary in Joachimsthal. A woodcut dated 1568.

The town recognized remarkable prosperity, silver production amounted to about 14 tonnes/per year, the population increased gradually, becoming the second largest town in Bohemia after Prague, with a population mostly German miners. The word « dollar » is derived from the silver « Thaler » in reference to Joachimsthal. However, during the religious war of 1546-1547 silver production decreased to 1.5 tonnes and the lack of pumps needed for deeper mining made it difficult to compete with silver from the new Spanish American colonies, which was arriving in increasing quantities on the European market. The town knew its depression and the population decreased drastically.

A DISCOVERY BY KLAPROTH

Joachimsthal was about to become a ghost town when Martin Klaproth (1743-1817) a pharmacist in Berlin who became later professor of chemistry at the Royal Mining Academy in Berlin discovered that the black mineral from Joachimsthal can be used to give glass a brilliant yellow color with green fluorescence when added to the molten batch. He was also convinced that this mineral must have

contained a new metal. This discovery coincided with the discovery in 1781 of a new planet in the solar system by his compatriot William Herschel who had emigrated to England in 1757 and called the planet Uranus. Hence Klaproth named the new metal « uranium » to honor his compatriot.

In 1815 the Austrian chemist, Adolf Patera at the Imperial Geological Institution in Vienna investigated the possibility of the commercial application of Klaproth's discovery. He devised a procedure for preparing « uranium yellow » known at that time as « Uranoxyd-natron » which is the yellow cake of sodium uranate. Consequently, a plant was built in 1854 next to the silver smelting operations to process this black uranium mineral for pigment manufacture which was kept a guarded secret and a monopoly of Bohemian glass manufacturers. Few years later, however, the silver operation became unprofitable and the government of the then existing Austrian Empire decided to close all the mines at the end of the nineteenth century. In 1873, the town suffered further from a great destructive fire.

THE DISCOVERY OF RADIOACTIVITY

Joachimsthal was about to become a ghost town again when new discoveries came to its rescue. One year after the discovery of X-rays by Wilhelm Konrad Roentgen in 1895 in Germany, came the discovery of radioactivity by Antoine Henri Becquerel in 1896 in France when he was trying to find a relation between phosphorescence of uranium salts and the possibility of emission of X-rays. Indeed, he found that pure uranyl potassium sulfate crystals did fog photographic plates although they were wrapped in black paper. This was followed by the search of Marie and Pierre Curie for the hypothetical element causing the intense radioactivity of the mineral containing uranium. The Austrian government permitted that 100 kg of the waste material from the Joachimsthal uranium-based pigment factory to be dispatched to Paris for the Curies. Marie Curie succeeded in the isolation of polonium in 1898 followed by radium in December of the same year.

As soon as the Curies announced that radium salts emit light in the dark (Figure 4), two distinguished physicists at McGill University in Montreal, Ernest Rutherford and Frederick Soddy immediately took up investigation of this new element. Within few years the area was thoroughly explored and important conclusions regarding the origin of radium and polonium, the radioactive decay, the structure of the atom, isotopes, etc., were formulated. The discovery in 1903 that radium emitted gamma rays was put into practice for treatment of cancer by the so-called « Curie Therapy », hence the production of radium became in great demand. A small plant was erected east of Paris to treat on a non-profit basis the Joachimsthal residue shipped from Bohemia, for its recovery.

Figure 4 - A glass dish containing 2.7 grams radium chloride crystals worth about $300 000 at that time glowing in the dark, prepared on October 15, 1922, at Olen in Belgium from uranium ore imported from the Belgian Congo. A confirmation of Madame Curie's announcement earlier that radium salts glow in the dark.

When the Curies together with Becquerel were awarded the Nobel prize in 1903, the attention was drawn to Joachimsthal. In the same year, the Austrian Government declared an embargo on the export of ore and residue and asked Carl Auer von Welsbach the famous Austrian chemist specialized in the recovery of rare earths to devise a method for radium recovery. At the same time the Austrian Academy of Sciences founded an Institute for Radium Research, the first such organization in Europe, with the physicist Stefan Mayer as its director. As a result of the boycott, exploration for radium was launched world wide. Ores were discovered, plants were erected, and small amounts of radium were produced at a very high cost — $100,000/gram.

In 1905, Stefan Meyer proved that the Joachimsthal mine waters indicated high content of radium. In 1906, the first radium spa in the world was opened there which attracted a large number of wealthy tourists. A year later, a radium separation unit was installed in the same building that was used for preparing uranium yellow pigment. It became the leading radium producer in the world.

During the heydays of Joachimesthal, radium was the magic word, for example, the radium beer in the pubs, the radium soap, etc. However, the death of the American Senator M. Byers changed all that. The senator, who

was suffering from certain disease, was recommended to him to drink radioactive water from a special kit available on the market composed of a small reservoir containing a radium salt in water. After one month drinking this water, however, he died. Autopsy showed that his bones were very high in radium. Immediately the Congress ordered the removal of all products containing radium from the market.

In September 1910 the International Radiology Congress was held in Brussels in Belgium under the sponsorship of the Belgian industrialist Ernest Solvay (1838-1922) in which leading scientists in the field of radioactivity (Figure 5) considered for the first time the question of preparing standard samples for comparison of measurements carried out at different laboratories.

Figure 5 - The first International Radiology Congress held at Hotel Metropole in Brussels in Belgium in September 1911 under the sponsorship of the industrialist Ernest Solvay in which leading scientists in the field of radioactivity at that time took part.

Sitting from left to right: Nernst, Brillouin, Solvay, Lorentz, Warburg, Perrin, Wien, Mme Curie, Poincaré.

Standing from left to right: Goldschmidt, Planck, Rubens, Sommerfeld, Lindemann, De Broglie, Knudsen, Hasenohrl, Hostelet, Herzen, Jeans, Rutherford, Kamerlingh Onnes, Einstein, Langevin. The historical photograph is hanging on the wall in a salon at the Hotel Metropole and is available

EPILOGUE

Mining and the medical profession may seem to be far apart, but in reality they are closely related. Georgius Agricola who studied medicine at the universities of Bologna, Venice, and Padua, and who was appointed physician at the Joachimsthal in Bohemia in 1527, then at Chemnitz in Saxony from 1533 on, then became mayor of Chemnitz wrote a series of books on mining and metallurgy that remained in use for over two hundred years. The mysterious "miners' sickness" at Joachimsthal in the sixteenth century could now be attributed to the presence of the new metal, uranium, in the silver ore. The discovery of X-rays led to the discovery of the phenomenon of radioactivity of pure uranium salts which in turn led to the discovery of the intense radioactive metals polonium and radium in uranium ores. Needles filled with a radium preparation were used for treating cancerous tumors till the availability of the cheaper radioactive isotope of cobalt after World War II.

There are many other examples illustrating the close relationship between mining and medicine. The poisonous nature of arsenic minerals were known to the seventeenth century Chinese and the French physician Etienne-François Geoffroy (1672-1731) wrote about this subject and how these minerals damage the hands and feet of miners. The medical doctor Giovanni Antonio Scopoli (1723-1788) studied the health of miners working in the Idria mercury mine in Slovenia, at that time part of the Austrian Empire. In 1761 he wrote the book *De Hydroargyro Idriensi Tentamina* on the symptoms of mercury poisoning among miners. In modern times, physicians are becoming more and more involved in monitoring, diagnosing, and treating miners working in such industries as asbestos, cadmium, beryllium, lead, etc.

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Table 1 – Mining, geological, and metallurgical books by the medical doctor Georgius Agricola

Year published	Title	Contents
1530	Bermannus	Conversation with a miner and mineralurgist
1533	De Mensuris et Ponderibus	Greek and Roman weights and measures with some correlation to those used in Saxony
1546	De Natura Fossilium	A treatise on minerals
1546	De Veteribus et Novis Metallis	Historical and geographical references to the occurrence of metals and mines, and history of mines in Central Europe
1546	Retum Metallicarum interpretatio	A collection of about 500 Latin terms in mineralogy and metallurgy with their German equivalent
1546	De Orlu et Causis Subterraneorum	Views on geological phenomena
1546	De Natura eorum quae Effluunt ex Terra	A short account on substances which flow from the earth, e.g., water, gases, and bitumen
1549	De Animantibus Subterraneis	A short work on animals who spent a portion of their life underground (serpents, lizards, etc.)
1550	De Precio Metallorum et Monetis	Description of minting, comparison of different coins and their values
1556	De Re Metallica*	A treatise on prospecting, mining, assaying, beneficiation, smelting, and other topics

- **Went through numerous editions in the sixteenth and seventeenth centuries and translated in German and Italian. First English translation was made in 1912 by the mining engineer Herbert C. Hoover (who became president of the United States 1929-1933) and his wife the geologist Lou H. Hoover.**

X-rays in popular culture (3): The beauty of the world, 'Tis but skin deep"

1958: eden plastics corp., n.y. X-rays revealing the skeleton in the girl.

A Brief History of the X-ray Tube.

Dr Adrian Thomas
Honorary Secretary, Radiology History and Heritage Charitable Trust.

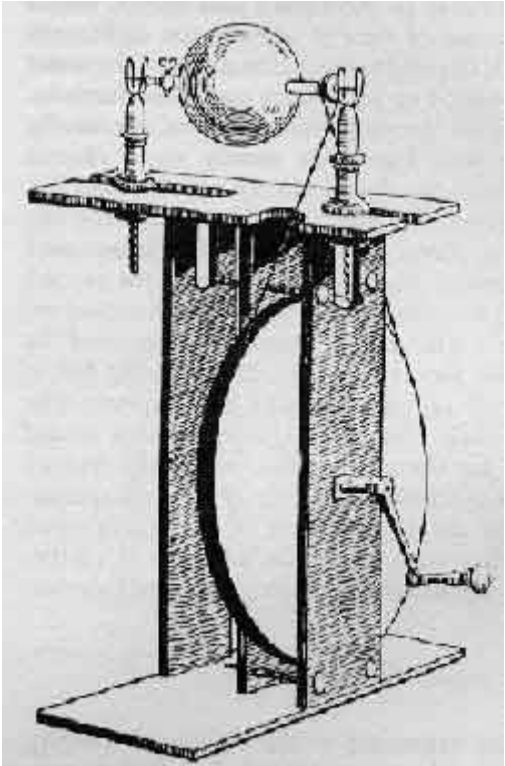
www.rhhct.org.uk

(Based on a presentation to the Clinical section of the Royal society of Medicine)

Humans have been interested in electrical phenomena since recorded history.

The development of electrical discharge tubes to produce X-rays requires the knowledge of both electricity and how to produce a vacuum.

The first electrical experiments concerned static electricity, which was produced by rubbing various substances. William Gilbert (1540-1603), physician to Queen Elizabeth 1, wrote his treatise 'De Magnete' reviewing all current electrical knowledge. Knowledge of electricity gradually increased. Otto von Guericke (1602-1686) devised the first frictional electrical machine and also constructed the first mechanical air pump. In England, Robert Boyle (1626-1691) investigated electrical phenomena and also devised a vacuum pump. He showed that magnetic and electrical attraction could occur in a vacuum. He is chiefly known for Boyle's law.

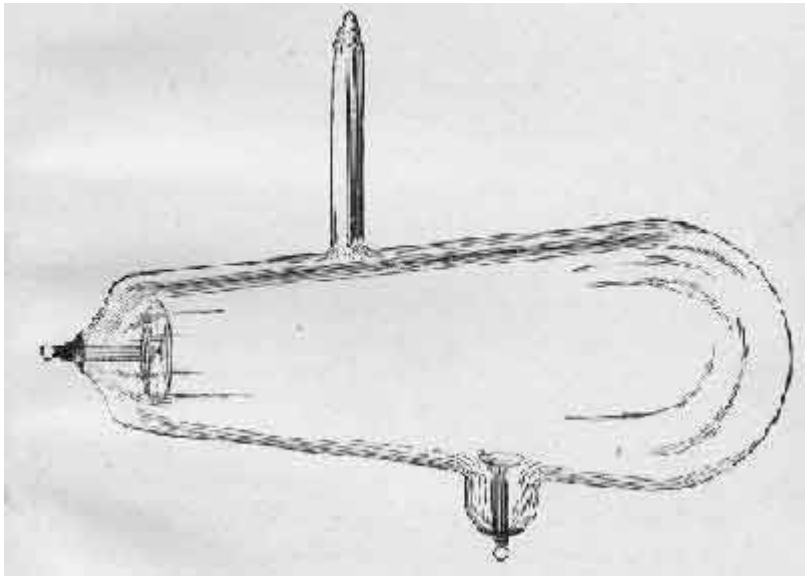


Illustr. 95.—Hauksbee's Electrical Machine

It was Francis Hauksbee (1666-1713) who first systematically investigated electrical discharges in a vacuum.

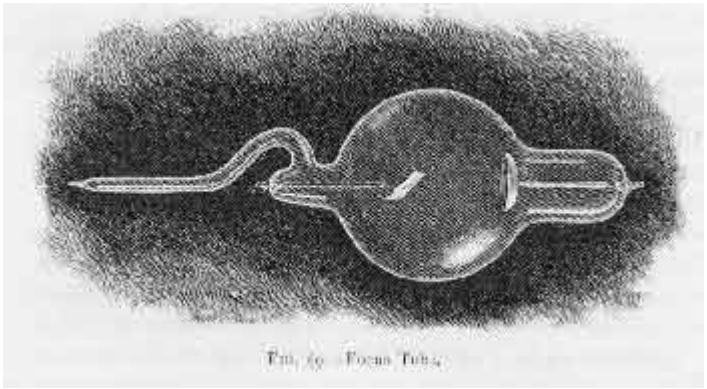
In the 19th Century there was increasing interest in passing electrical discharges across evacuated glass bulbs. William Morgan in 1785, Humphrey Davy in 1822 and William Faraday looked at what happened when two metal electrodes were sealed at the ends of a glass bulb and a current was passed as the pressure inside was reduced.

Some of these tubes would light up and these were called Geissler tubes.

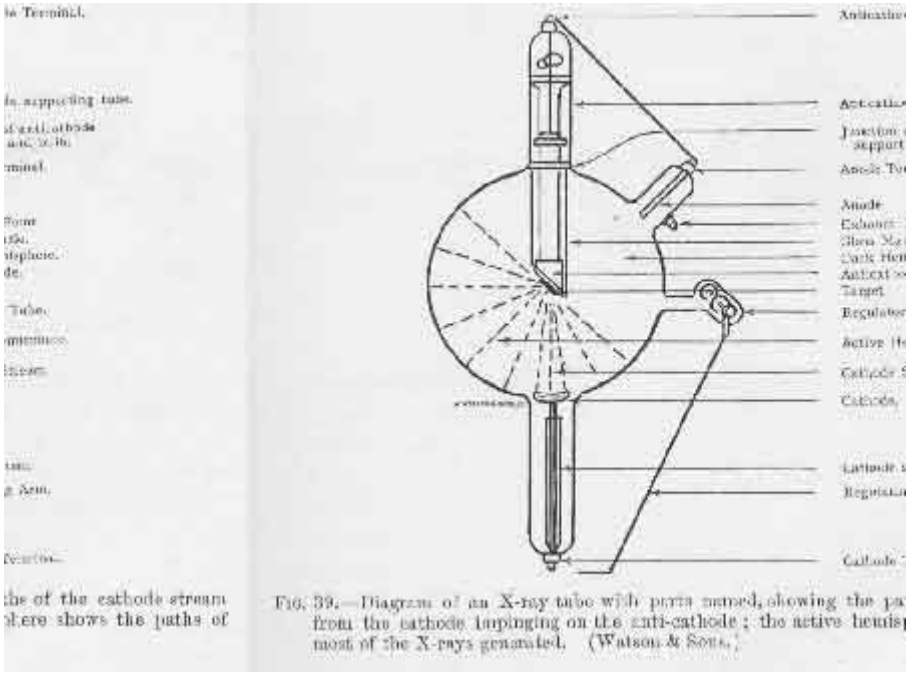


Sir William Crookes (1832-1919) investigated these phenomena extensively with a series of experiments in 1879. In these early tubes (Crookes-Hittorf tubes) the anode and cathode were simple electrodes projecting into the bulb and it was using one of these tubes that Wilhelm Röntgen made his discovery for which he was awarded the first Nobel Prize for Physics in 1901.

Crookes tube

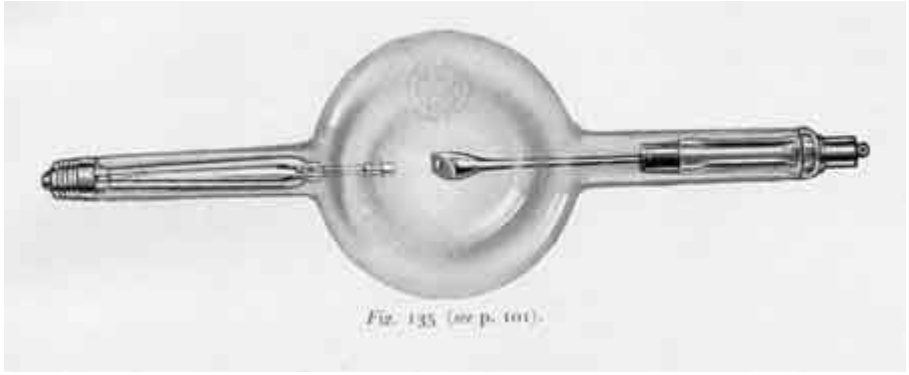


After Prof. Röntgen announced the discovery of X-rays in 1895, special tubes were made to study this new science. Herbert Jackson of Kings College London showed that the best results were obtained with a tube arranged in the illustration shown, where the anode is in the form of a platinum plate fixed at an angle of 40º to the cathode stream and placed in the "focus" of a concave cathode. Hence the term "focus tube".



These early X-ray tubes contained a small quantity of gas (and were called Gas or Ion Tubes). The passage of the cathode rays (electrons) from anode to cathode) depended on ionisation of the gas inside. As the tubes were used the vacuum increased (hardening) and it became increasingly difficult to pass a current through the tube. Current might then pass around the tube. A device was attached to the tube to produce gas and the tube was then useable. If there was too much gas in the tube there would be fluorescence of the gas and the tube was useless for producing x-rays.

Cooling the anode has always been a problem. The initial anodes were small. Heave copper bases to the anode conducted the heat away and therefore increase the capacity of the tube to withstand a high current. This was particularly needed with therapy tubes. The block could then be attached to fins or to a bulb of water (which boiled away) to assist with heat dissipation. Alternatively the whole tube could be encased in oil to absorb the heat.



William Coolidge (1873-1975) produced a major improvement. He replaced the cathode with a heated spiral tungsten filament and molybdenum-focussing bowl. The filament could be heated and a current would pass through the tube even with a very low vacuum. The anode of the standard Coolidge tube was set at 45º.

Coolidge Tube

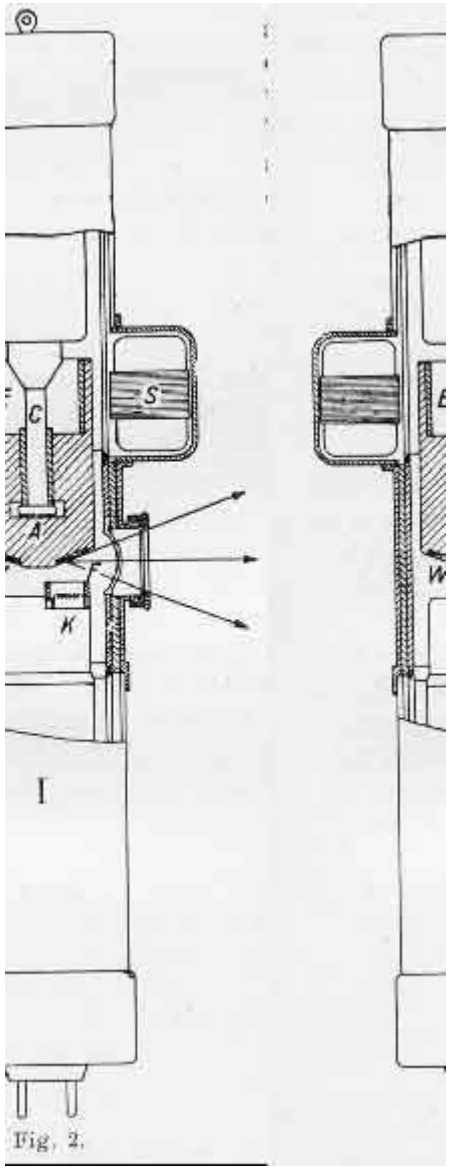
A Bouwers of Philips designed the Metalix tube in 1924.

The tube was made of chrome iron with a lead jacket.

This self-protecting tube was a considerable improvement on the larger gas tubes and enabled truly shockproof and portable apparatus to be produced.

The Metalix tube also incorporated the principle of line focus, the anode face being set at an angle of 19º to the cathode. This reduced the apparent size of the focal spot bombarded by the cathode rays and increased image resolution.

The tube on the right has a spherical metal bulb attached containing water which boils away to carry off the heat generated in the production of X-rays.



Finally the rotating anode tube was developed. It was also designed by Bouwers and was first marketed in 1929 by Philips and called the 'Rotalix' tube.

In the rotating anode tube the anode target is a heavy tungsten disc that spins so that the focal spot of the cathode rays is changing and the heat is dissipated.

S = Stator coils to induce rotation of the anode.

A= Rotating anode.

K= Filament (Cathode)

W= target on anode.

Contemporary tubes are variations on the theme of these earlier tubes. Modern tubes have to bear very high tube loading and this is particularly the case for tubes used for CT scanning (helical and multislice) and angiography.

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Joachimsthal on the southern slopes of the Erzgebirg Mountains was a major source of uranium and radium.

In 1912 the luxury Radium Palace Hotel was constructed and it became one of the best spa hotels in Europe.