X-RAYS IN SINGAPORE

PART II. SECTION 1, 1901-1914*

By F. Y. Khoo

SYNOPSIS

(a) The present article, Section I of Part II of "X-rays in Singapore" covers the period 1901-1914.

(b) ***General***

World interest was centred on radium in the 1900s, much of which was publicised by the Straits Times which carried many items on radium, and fewer on X-rays and cancer. The first articles on radium appeared in the British Medical Journal and the Lancet in 1903. The dangers of excessive exposure to X-rays and radium gradually came to be recognised. Experience was being accumulated on the use of radium and X-rays in the treatment of cancer and other diseases. Cancer research was being stepped up at this period.

(c) ***Local***

1. **It was known that the X-ray apparatus installed in the Municipal Office, Singapore, in January 1898, was used for over two years. Its subsequent fate could not be ascertained.**
2. **A notice appeared in the Straits Times of July 9, 1901, that Mr. R. Frost would deliver a lecture on "X-rays" at the Princep St. Church. The outcome of this lecture was not known.**
3. **The resuscitation of the Journal of the Malayan Branch of the British Medical Association was commented upon in the Straits Times of June 29, 1904.**
4. **The formal opening of the Straits Medical School was reported in the Straits Times of September 28, 1905. These two events could not but greatly benefit the progress of medicine locally.**
5. **The first record that a skiagraph was shown was at a medical meeting in Kuala Lumpur in December, 1905. It was a coin in oesophagus.**
6. **The Straits Times reported the demonstration of X-rays in the General Hospital, Kuala Lumpur, in February, 1910. The installation of an X-ray apparatus at the General Hospital, Penang, was announced in September, 1910.**
7. **The first official announcement by Government that a new X-ray apparatus was to be acquired for the General Hospital, Singapore on the grounds that "the existing instrument which had been in use for several years is practically useless for diagnostic purposes" was made in 1911. In the same year, an article appeared in the Straits Times stressing the necessity of Government acquiring an up-to-date X-ray apparatus as well as securing the services of trained staff.**
8. **An effort was made to trace the "existing instrument" in the General Hospital, Singapore, mentioned in paragraph 7. The writer scanned several years of the Straits Settlements, Annual Departmental Reports, the Straits Times, the local medical journal, some relevant books and other writings on the medical department, but without success. Two of the most senior graduates of the Straits Medical School did not recollect having seen an X-ray apparatus in the General Hospital at that period. Finally, enquiries directed to some U.K. institutions and manufacturers were also fruitless owing to the discarding of old records, although some very interesting comments of historical interest were obtained and recorded in this article. It is the hope that someone may one day come across the required information in some obscure archive.**
9. **A new X-ray machine was installed in the General Hospital, Singapore, in 1913. It was stated that the machine worked satisfactorily, after some correction of leakage of current due to damp. A follow-up 1914 report stated that the X-ray machine was working well during the greater part of the year. It also listed some diseases treated by X-rays, including epithelioma, ulcers, eczema and ringworm. This would appear to be the first report of its kind indicating the use of X-rays for treatment locally.**

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Part II of "X-rays in Singapore" is divided into two sections†. The first section deals with the period 1901 to 1914, which latter marks the beginning of the World War I. The second section covers the years 1915 to 1941, that is, up to World War II.

SECTION I, 1901-1914

A. The early part of this period was a relatively inactive one as far as development of X-rays in local hospitals was concerned. The striking feature, however, was the great interest shown the world over in the newly discovered radium and other closely-related radioactive elements in the hope of finding an agent that might provide a lasting cure for cancer. Probably because of this, world interest in cancer would appear to be suddenly aroused. These trends were reflected on the many articles on radium, X-rays and cancer which appeared in the Straits Times from 1901 to 1914. The writer found that articles on radium appeared about 86 times, X-rays 36 and cancer 25.

The accounts of relevant newspaper articles are to be found in Appendix I.

B. Local Medical News

It would be pertinent at this juncture to trace certain developments of medical interest which might in one way or other influence the development of X-rays locally.

The Straits Times of June 29, 1904, has this comment on the medical journal. Quote:

MEDICAL JOURNAL

> The Journal of the Malayan Branch of the British Medical Association makes a fresh start this year. Hindrances in the way had delayed publication since 1897. Changes for the better may enable the *Journal* to re-appear with greater chance of regularity in issue, under the supervision of the editorial committee with Dr. Kirk as chairman. But the local branch of the Association could not sit almost until Dr. McDowell, the P.C.M.O., stirred them up. The articles and contents are generally of the technical nature. But Dr. Lim Boon Keng arrests the attention by showing how prevalent is consumption among the Singapore Chinese. Dr. More . . . on dengue fever. Dr. Galloway's notes on malarial fever . . . most prevalent in the Japanese quarter of Singapore, and among the Chinese . . . about Pearls Hill and Mount Wallich.

The Straits Times of August 11, 1904, reported on the meeting of the British Medical Association, Malayan Branch, at Kuala Lumpur, with Dr. Middleton as Chairman. The President, Dr. C.W. Daniels, read on "The Diffusion of Disease". Most of the papers presented were on infections.

STRAITS MEDICAL SCHOOL

The formal opening of the Straits Medical School by Sir John Anderson was fully reported in the Straits Times of September 28, 1905.

MISCELLANEOUS

The Straits Times of July 3, 1907, noted that the Government would be spending about $650,000 on improving and increasing the hospital accommodation in Singapore, as follows: Some $91,000 would go for the new maternity hospital for 29 patients near the General Hospital. The new Tan Tock Seng Hospital in Moulmein Road for 500 patients would absorb $484,481. An extension at the General Hospital for the resident surgeon's and general offices would require $50,000.

The Straits Times of November 8, 1907, suggested miscellaneous reforms for the General Hospital. There was no mention of X-rays.

The new Tan Tock Seng Hospital at Moulmein Road was fully described in the Straits Times of March 19, 1909. There was no mention of any X-ray equipment. There were also many comments on the Tan Tock Seng Hospital throughout the year 1909. The presentation of prizes and final diplomas of the first batch of graduates of the Medical School was reported in the Straits Times of July 1, 1910.

The Straits Times of February 17, 1911, noted the appearance of the Malaya Medical Journal after a lapse of nearly 4 years. Dr. Gilbert E. Brooke was the Editor.

C. X-rays in Local Countries

In contrast to the prolific western reports, accounts of the development of X-rays locally

*Part I of the history of X-rays in Singapore, from 1896 to 1900, appeared in Vol. 12 No. 6 issue of the Singapore Medical Journal. In Singapore, the discovery of X-rays was first announced in the Straits Times of February 14, 1896, which carried an account of Roentgen's demonstration before Emperor Wilhelm on January 13, 1896. The first Roentgen rays apparatus was demonstrated in Taiping, Perak, on February 3, 1897. A Roentgen rays apparatus was donated to the Government Hospital at Ipoh around October, 1897. The first Roentgen rays apparatus was installed in the Municipal Office, Singapore, on January 4, 1898.

†The writer had continued to draw heavily from the Straits Times and subsequently from the Straits Budget for foreign news on the development of X-rays and of radium. Much useful information on local hospitals was obtained from the Straits Settlements, Annual Departmental Reports, particularly from 1910 onwards. The results of some personal enquiries are also given.

were relatively meagre in the early 1900s, but picked up somewhat after 1910.

(a) **Singapore, 1901**

A notice appeared in the Straits Times on July 9, 1901. Quote:

> On behalf of the Chinese Christian Association, Mr. R. Frost will give a lecture on the "X-Rays", with experiments and illustrations, at the Prinsep St. Church on Thursday, at 8 p.m. The meeting is open to the public.

Comment

There appeared to be no follow-up account of the meeting, and therefore there was no way of ascertaining what X-ray apparatus was used.

(b) **X-rays in India, 1905**

The Straits Times of August 22, 1905, carried the following report. Quote:

> The establishment of an X-ray Institute in India is now practically assured and Delhi seems well suited as a centre for the instruction of classes of medical officers and subordinates in the mysteries connected with one of the greatest scientific discoveries of the age. It is also proposed to keep in the Institute a certain amount of apparatus, and to have a small skilled staff for the carrying out of repairs.

(c) **First record of a skiagraph shown in a medical meeting, Kuala Lumpur, 1905**

The first meeting of the Native States Division of the Malayan Branch of the British Medical Association was held in Kuala Lumpur, on the 18th and 19th December, 1905; the minutes of this was read at the Annual Meeting of Singapore, January 28, 1906 and recorded in the British Medical Association, Malayan Branch Journal, 1904-07. It noted that Dr. Travers, Vice-President, was in the Chair at that meeting in Kuala Lumpur, with six other members present. Many items were presented. Dr. Travers showed a child who had been operated on for an impacted coin in the oesophagus. Dr. Fletcher showed a skiagraph of the coin in position.

Note: This would appear to be the first official record of a radiograph being shown at a medical meeting.

(d) **X-rays in Kuala Lumpur, 1910**

The Straits Times of February 15, 1910, gave an account of the British Medical Association Local Branch Conference of doctors held in Kuala Lumpur with Dr. James Kirk as President, on February 15. Lectures and demonstrations were held. It mentioned that on Saturday, the members visited the General Hospital, and witnessed a demonstration of the X-rays for diagnostic purposes.

(e) **X-rays at Penang, 1910**

This notice from the Correspondent of the Straits Times in Penang appeared in the Straits Times of September 21, 1910. Quote:

> Messrs. Siemens Bros., have installed an X-ray apparatus at the General Hospital here, and a demonstration will be given before a number of medical men on Friday next.

(f) The Straits Times of April 4, 1914 and April 28, 1914 carried news of the impending opening of Bangkok's Red Cross Hospital. This new hospital would be provided with the most improved X-ray tubes and ophthalmic equipment.

(g) **Further development of X-rays in Singapore**

1. After the report of the Straits Times of July 9, 1901 about the lecture on X-rays to be given by Mr. Frost, there appeared to be no further news on X-rays for a decade till 1911.

2. In the Straits Settlements, Annual Departmental Reports of 1911 was the following item under the General Hospital, Singapore. Quote:

> The use of efficient Roentgen Ray apparatus is badly needed, the existing instrument which had been in use several years is practically useless for diagnostic purposes, while no provision is made for photographic work. A new machine is to be obtained next year.

3. About the same time, a lengthy editorial appeared in the Straits Times on December 6, 1911, on medical needs in the Colony, with special emphasis on X-rays. Quote:

> WANTED: X-RAY EQUIPMENT
>
> There is one other urgent want, and it has been suggested that the public might supply it by voluntary contributions. In modern surgery the greatest revolution within living memory has been brought about by the introduction of the X-ray apparatus. To the skilled eye of the trained surgeon and doctor that apparatus has made the human body a transparency. It reveals even deep seated abnormalities of conditions . . . the position of any hard foreign substances, as a bullet or a splinter of metal . . . but the power of the X-ray goes far beyond that. It will reveal a tumour, or a rupture, or a stoppage, or almost any morbid condition, and treatment becomes accurate and intelligent instead of being, perhaps, erroneous and blind.

We are told that at least one of our younger men on the medical staff has undergone through a full course of X-ray work, and is perfectly capable of using the apparatus if available.

We are told that a cheap, primitive apparatus is actually possessed by the Hospital though it would be more at home in a musuem of antiquities.

The best of our medical men . . . deplore the antiquated equipment with which they have to work. It takes the heart out of them to know how things should be done, yet to be denied the means of working in a manner worthy of the high standard of the profession.

There is electric light and no electric fans in the General Hospital. It is more behind the times than the tin-shed hospitals of many a pioneer camp on the edge of beyond. But it should at least have an absolutely up-to-date equipment without delay, and if the Government is so poor . . . may not the people be asked to do so by public subscription? It is very hard indeed to raise any money in Singapore just now, but this would not be an excessive responsibility to undertake. $10,000 probably would more than suffice, and it is a matter in which everyone of us has an interest, for we do not know the day when our lives may depend upon the correct diagnosing of some internal complaint.

Comment

It was indeed strange that after a lapse of over ten years, two entirely different sources, one Government and one public, should stress the need of an efficient X-ray apparatus for Singapore. Or could it be due to the constant report of the medical uses of X-rays through the 1900s that the public finally came to realise the usefulness of X-rays, as expressed in the Straits Times editorial.

Furthermore, the Government report which stated that "the existing instrument which had been in use several years is practically useless for diagnostic purposes" was the first indication that the General Hospital had been in possession of an X-ray apparatus for several years.

This immediately poses the question: When did the General Hospital acquire the first roentgen ray apparatus? Another perplexing question is: What happened to the first roentgen ray apparatus which was installed in the Municipal Office in 1898?

(a) **The Municipal Office roentgen ray apparatus**

There was no clue in the newspapers as to the fate of the apparatus. The writer had made a special point of looking into the newspaper Municipal reports from 1897 through the 1900s, but there was no mention of the roentgen ray apparatus. Reports of injuries or accidents were every now and then reported in the newspapers, and except for the account of the injured seaman of the S.S. Dante (see Part I), there were no other reports that X-rays had been employed.

Fortunately, the writer had been able to contact Dr. Winchester* who kindly supplied the following information. Quote:

Before the war, I was in possession of the original record book of the X-ray Department in Singapore, and of the receipt for payment of the total X-ray apparatus.

This was bought from the firm of Cossors which was familiar to me in later days as a manufacturer of radio equipment, although I have not heard of it some years. The cost of the apparatus, if I remember correctly, was just over £20!

It was bought in 1899†, so Singapore was quite go ahead at the end of last century. It was in the charge of Dr. Middleton, who was then the Medical Officer of Health, Singapore, whose name survived in MIDDLETON HOSPITAL, the isolation hospital.

It created a great deal of public interest, and there were several public demonstrations given at large gatherings at Government House in the few months after its arrival.

The first X-ray taken for diagnostic purposes was of the femur of a seaman who fell into the hold of a ship, and the record shows that a good picture of the fracture was got with an exposure which lasted 7 minutes!

The apparatus was left in the Municipal Office, and was lent out to any doctor who wished to use it.

The record book extended over a period of just over two years, and shows that just over fifty patients were X-rayed during that period.

Unfortunately, I lost the record book and the receipt for the apparatus, along with much more material, during the Japanese Occupation.

*Dr. J. W. Winchester was Senior Radiologist, Singapore from 1939 to 1951. He was interned in Singapore during the Japanese Occupation. On his retirement from Singapore in 1951, Dr. Winchester settled down with Mrs. Winchester in N. Ireland and worked as Radiologist for a group of hospitals, but has retired recently. Dr. Winchester's note was written in response to an enquiry of the writer made in early 1969. In fact, his account of the first X-ray apparatus in Singapore gave the writer the necessary lead as to what to look for in the local newspapers.

†The correct year should be 1898, as reported in the Straits Times (see Part I).

From the above account, it would appear that the Municipal roentgen ray apparatus was in service for over two years, but probably not much longer because of problems of maintenance of equipment as well as the great technical difficulties encountered in radiography. As recorded by Dr. Winchester, an exposure required 7 minutes. With the depreciation of equipment and corresponding increasing difficulties of operation, it would be expected that interest would wane and finally peter out through lack of funds necessary for maintenance. That no mention of the roentgen ray apparatus could be found in the Municipal proceedings could be attributed to the fact that the roentgen ray apparatus which was acquired by public subscription was maintained by public funds, and therefore could not be regarded as a Municipal project.

(b) **The question of the roentgen ray apparatus at the General Hospital in the 1900s (Please see Appendix II)**

4. **On the installation of the new X-ray apparatus in the General Hospital in May 1913**

In the Straits Settlements, Annual Departmental Reports of 1912 is the following paragraph under the General Hospital, as recorded by Dr. Gilmore Ellis, Principal Chief Medical Officer:

> The installation of electric lights and fans for the European wards is near completion and a new X-ray apparatus is on its way from Europe.

And Dr. F.B. Croucher, Senior Medical Officer in charge of the General Hospital, recorded the following item in 1913:

> The installation of electric light was completed in May, replacing the gas which was so often unsatisfactory, and the better light and the fans have effected a great improvement in the condition of the patients.
>
> The new X-ray apparatus was put up in May and although a good deal of trouble was experienced by leakage of current due to damp, it has worked very satisfactorily on the whole.

And in 1914 was the following progress note:

> The X-ray apparatus was working well during the greater part of the year, and the trouble due to moisture of the atmosphere was to a great extent overcome. In addition to the radiographic work, 21 cases, including Epithelioma, Ulcers, Eczema, and Ringworm, were under treatment by exposure to the Rays.

Comment

This is the first indication of the use of X-rays in therapy. The diagnostic X-ray machine available then could also be used for superficial X-ray therapy.

THE FIRST WORLD WAR

The Straits Times bore the following headlines:

August 3, 1914 — Germany at war with Russia. Troops massed at French Border.

August 4, 1914 — Germany invades France.

August 5, 1914 — War between Britain and Germany.

The First World War brought on a drastic change of conditions of life not only in the West, but to a lesser extent in the East. It also marked the end of a relatively quiet phase in the medical history of Singapore to be followed by a period of unprecedented development the next decade.

ACKNOWLEDGEMENTS

The writer is indebted to Dr. J.W. Winchester for his notes on the roentgen ray apparatus in the Municipal Office, 1898, to Dr. Chen Su Lan and Dr. E.W. de Cruz for recounting their experience in the late 1900s, and to Mr. S.K. Lingam for obtaining the many interesting reports from the U.K. through the Crown Agents, London. Mr. Ee Cheng Hoe, Medical Librarian, University of Malaya, has been most helpful in supplying a list of useful references.

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APPENDIX I

PRESS REPORTS ON RADIUM*

February 5, 1901. Under Scientific News Items are the two following items. Quote:

1. M. and Madam Curie, the French Chemists, the discoverers of radium, which gives out cathodic rays and roentgen rays, have separated from this body a new gas, which is intensely phosphorescent, and a sample of which of a few cubic inches will glow in the dark for months.
2. Roentgen rays, we know, may have an ill-effect on the skin; but it appears from Herren Geisel and Walkhoff, in the *Beriche*, that the rays emitted by radium, and probably other substances which yield similar rays, are also unfavourable to the skin. A gramme of radium placed near the skin of the arm reddened it in 2 hours. Inflammation followed with loss of the skin . . .

Comment

It would appear that this is the first time the discovery of radium by the Curies was announced locally. The work of the Curies was not mentioned in the British Medical Journal and in the Lancet till 1903. The phosphorescent gas would subsequently prove to be radon. The early investigators were not aware of the dangers and potent effects of even minute quantities of radium, let alone one gramme of the element.

An editorial on February 6, 1901 stated that one of the most extraordinary mysteries of modern science lay hidden in the blazing heat of the new element, radium. It made mention of the recent lecture given by Becquerel before the French Astronomical Society in Paris, where he recounted his experience of the inflammatory effect of the element on the human skin. After much theorising, it was felt that radium might one day be useful as an illuminant, although the price at that time was around £6,000 per ounce.

April 25, 1903. An account was given of the communication of M. Curie to the Academy of Sciences, on the extraordinary properties of radium, namely, of continuously emitting heat, without combustion, without change of molecular structure, among other findings. Radium had excited the keenest interest by throwing off rays, vibrations or emanations. It could cause barium platinocyanide or zinc sulphide to glow. Sir William Crookes stated that Curie had introduced forces of a totally different order of magnitude. The Curies calculated that radium was 500,000 times as powerful as uranium.

In the issue of June 24, 1904, under the caption of "The Mystery of Radium", was an account of a lecture by Prof. Ernest Rutherford at the Royal Institution. Prof. Rutherford described the three kinds of rays of radium emanation, namely, alpha, beta and gamma rays. He demonstrated the spintharoscope of Sir W. Crookes by which a chemically prepared plate, in a darkened room, could be seen bombarded by brilliant scintillations of these almost infinitesimal corpuscles. Sir W. Ramsay and Mr. Soddy had shown that about half of the energy of radium would be exhausted in about 2,000 years (this estimate was not far from the present accepted figure of 1,650 years).

Further accounts of radium continued to appear every year, and the outstanding ones include "What we know of Radium" in Harper's Magazine (July 18, 1904); "Radium Ridden Curies" (August 22, 1905); "Corpuscular Theory of Matter" delivered by Prof. J. J. Thompson at the Royal Institution (May 4, 1906); "The Transmutation of Element" by Sir W. Ramsay (March 1, 1907); on the wonders of radium by Ramsay (January 20, 1908); the success of Curie and Deblerne in obtaining metallic radium (September 8, 1910) and an account of Curie's labours in the Evening Standard (October 11, 1910).

Radium is a radioactive element. Hence, with the passage of years, more and more mention was written on radioactivity (June 24, 1904; March 1, 1907; April 13, 1908; April 27, 1908; April 3, 1909; November 19, 1913).

The peculiar and novel properties of radium, together with its potent effects on human tissues, very early established radium as a suitable agent in the treatment of certain diseases, particularly cancer.

Because of the scarcity of radium and the difficulty of its extraction from pitchblende which originally came from Joachimsthal, Austria, there were frequent allusions to the high price of radium. Thus, one report on January 5, 1904 stated that the price was £50,000 for one fifteenth of an ounce. Because of the virtual monopoly on radium held by the Austrian Government, attempts were made to obtain radium from other sources. Sources in Cornwall proved useful for some time, as reported on January 6, 1908, and November 15, 1909. There was also concern over the high price and the cornering of radium (February 5, 1914).

The hunt for radium even went as far as French Indo-China (July 19, 1904) Australia (December 29, 1910), and Japan (January 16, 1914). Many attempts were also made to find cheaper substitutes, but without success (August 5, 1907). Thorium had also been proposed as a substitute (March 29, 1909).

TREATMENT OF DISEASES WITH RADIUM

Accounts of the usefulness of radium in the treatment of diseases began to appear in the local press in the late 1900s. On March 28, 1908 was mentioned the use of radium in birthmarks. Sir Frederik Treves listed some of the diseases which were suitable for radium treatment, including tumours of face, angioma and rodent ulcer (March 1, 1909). A Radium Institute was set up in London (July 22, 1909). An account from the Middlesex Hospital (October 14, 1913) gave good results on cancer of the ear and throat, and abdominal tumours.

X-RAYS

Many of the earlier newspaper accounts were on the localisation of foreign bodies swallowed accidentally. A case of bullet in the brain was described on March 29, 1906. Of the later accounts, one described X-ray examination of the lungs for the detection of consumption in Guy's Hospital (October 3, 1910), one on X-ray advances by Dr. Morton (January 21, 1911), and one on bismuth examination of the alimentary tract (May 25, 1914).

As was to be expected, there were unconfirmed sensational reports on other mysterious rays. One writer, N. Blondet wrote on N-rays (June 10, 1904) and there were many reports on these rays up to March 3, 1906, when finally interest died out because of lack of confirmation.

Other uses of dubious value to which X-rays were put to included the artificial ageing of violins (October 2, 1903), and the restoration of grey hair to natural colours (October 17, 1903).

Of more serious import was the increasing awareness of injuries sustained through ignorant or careless exposure to X-rays or radium. Edison, the American inventor, very nearly lost his eyesight through indiscreet experiments with X-rays, and Dally, his assistant, had one arm amputated (August 31, 1903). A law suit was reported from London

*As all the items are drawn from the Straits Times, only the dates of relevant articles will be supplied and the name Straits Times will be omitted in order to save constant repetition.

whereby a specialist in electrotherapeutics was sued by the husband of a patient who claimed that his wife sustained "burning" of the skin (June 8, 1904). A list of Martyrs of Science (October 4, 1912) included those working with X-rays.

X-RAY TREATMENT

The usefulness of X-rays in the treatment of certain diseases soon became established, particularly for superficial tumours like rodent ulcer, and skin diseases like lupus (July 3, 1902). A report on January 17, 1905, stated that the King had a rodent ulcer at the root of the nose which was successfully treated at the St. Thomas' Hospital. Although keen over the beneficial effect of X-rays on cancer, Dr. Christopher Williams of the West London Hospital expressed caution and would prefer to use the words arrest and alleviation rather than cure when discussing results of the X-ray treatment of certain types of cancer (December 23, 1905). An over-enthusiastic report by Dr. Saleaby in the London Press (February 2, 1907) stated that the reign of the knife in the treatment of cancer was over, to be replaced by roentgen rays. A report of September 11, 1913, mentioned a certain Dr. Roberts of Hobart General Hospital who employed secondary roentgen rays filtered through a silver, copper, or tin plate, in the treatment of cancer.

THE CANCER PROBLEM

There was a sudden awakening of interest over the problem of cancer at the turn of this century, possibly influenced by the hope of cure following the early experiences with X-rays and radium. There was talk of establishing a cancer Research Fund in the U.K. with hope of support from India and the British Colonies (July 7, 1903). An editorial of October 7, 1903, stated that Mr. Wm. Waldorf Astor donated £20,000 to the Cancer Research Fund to determine the aetiology of cancer and the use of X-rays and radium. There was mention of the Imperial Cancer Research Fund on August 22, 1906. The Barnato Memorial for cancer research in London was established with an endowment of £250,000 (April 20, 1910).

A survey of the newspaper accounts of the 1900s show a surprising number of problems, many of which are still with us today. Such include a new cancer serum (December 10, 1903); cancer not infectious (August 4, 1904); is sunlight a cause of cancer (May 4, 1906); smoking and cancer (June, 1906); the increase of cancer (September, 1906); the cancer bacillus (September, 1908); influence of heredity (December 14, 1911).

MISCELLANEOUS ITEMS

A good number of newspaper articles concerning atomic science appeared in the 1900s. There was also a notice on March 5, 1901, regarding Nobel's request for prizes to be awarded in the fields of Physical Science, Chemistry, Physiology and Medicine, Literary Work and Peace. On July 18, 1906 was an article quoting the "Indian Engineering" which stated that one was living in exciting times, as there had been hardly any department of science in which a flood of light was not cast on what was a mystery a few years or even a few months prior to that time. Prof. J. J. Thompson's book the Corpuscular Theory of Matter was mentioned on December 30, 1907. Millikan's work on the ion's track appeared on August 3, 1910.

MEDICAL JOURNALS AND RADIOLOGICAL SOCIETIES

Despite the fact that radioactivity and radium were discovered in 1896 and in 1898 respectively, the first articles on these did not appear till 1903 in the British Medical Journal. Interest in radium, however, soon outstripped X-rays as more was written on radium than X-rays in the succeeding years. A good account of the physical and chemical properties of radium appeared on February 6, 1909. An editorial dealing comprehensively on the therapeutics of radium appeared on January 25, 1913. Reports on the uses of X-rays were more diversified. Mention was made of the use of roentgen rays in the teaching of anatomy in the University of Aberdeen (February 21, 1903). Bolton (October 24, 1903) found X-rays useful in the diagnosis of pulmonary conditions and stated that he could reduce the time of exposure of a chest radiograph from the usual 3 to 4 minutes to about one and a half minutes. An account of the nature of roentgen rays appeared on January 11, 1913.

Journals and Societies devoted to medical radiology began to be established in many countries. Mention had been made in Part I of one of the earliest journals, namely, the Archives of Clinical Skiagraphy, which appeared in London in 1896. This later became the British Journal of Radiology. The Roentgen Ray Society, London, was established in 1897. In the U.S. the American Roentgen Ray Society was established in 1905. The American Quarterly Journal of Roentgenology appeared in 1906; this was renamed the American Journal of Roentgenology in 1913.

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APPENDIX II

After reading the announcement of the Straits Settlements, Annual Departmental Reports of 1911 about "the existing instrument which had been in use for several years", an effort was made to ascertain the date of acquisition of the machine.

1. Naturally, the first source to turn to was Straits Settlements, Annual Departmental Reports, but there was no mention of purchase of X-ray apparatus following a search of all reports from 1897 to 1910.

2. The next source was the Straits Times. As already mentioned, the only two references on X-rays for this period were in 1901 and in 1911. Reports of severe accident cases brought into hospital were also scanned (for example, July 7, 1899, July 23, 1902, November 23, 1904) but there was no mention of the use of X-rays. Social events like Christmas celebrations in the General Hospital (December 23, 1902, December 27, 1905) were read in the hope of finding some allusion to X-rays, but again without result.

3. The available volumes of the British Medical Association, Malayan Branch Journal from 1904 to 1907, and the Malayan Medical Journal of 1911 and 1912 were scanned. There was mention in the minutes of the 6th monthly meeting held in Singapore Club on October 31 of a letter from the Principal Chief Medical Officer who invited members of the medical profession to visit the theatre of the General Hospital on operating days. There was no mention of X-rays. The various articles published in these journals also made no mention of X-rays in Singapore.

4. The only book describing Singapore in detail at that period was by Wright and Cartwright (1). Of the General Hospital near Sepoy Lines, they said: "The premises were rebuilt in 1882 and enlarged in 1906, at a total cost of 102,310 dollars. The institution is now replete with modern equipment, and has a splendid staff of men and nurses." There was no mention of X-ray apparatus. The Souvenir of Singapore published by the Straits Times (August 10, 1904) did not contain any item on hospitals. In the academic exercise for B.A. Honours Degree by Khoo Heng Hock (2), in the article by MacGregor (3), and in the section on "Medical Work and Institutions" by Brooke in the book of Makepeace, Brooke and Braddel (4), all made no mention of X-rays. The first author, in line with our experience, noted that all institutional records of the early days could not be traced.

5. Then, an attempt was made to see whether any staff attached to the General Hospital of the early 1900s could

be traced, but as anticipated none could be found. However, the writer was fortunately able to contact Dr. Chen Su Lan and Dr. E.W. de Cruz who were two of the earliest students to join the Straits Medical College in 1905, and who with ten others graduated in 1910.* Dr. Chen Su Lan said that he was not aware that the General Hospital had a roentgen ray apparatus in his undergraduate days, and that the first time he had even seen a radiograph was about 1917 or 1918 shown to him by Dr. Hunter. Dr. de Cruz wrote: "As senior medical students in 1909 and early 1910—the year I graduated—we had to do night casualty work at the General Hospital Sepoy Lines and throughout our duty there we were not shown any X-ray room nor even X-ray plates of our cases.—They were non-existent."

6. Finally bearing in mind Dr. Winchester's statement that Messrs. COSSOR supplied the first roentgen ray apparatus to the municipal office in 1898, an attempt was made to contact the firm in the U.K. in the hope that clues might be obtained on subsequent machines supplied to Singapore. The Chief Pharmacist† was approached to help out in this problem. This set into operation a series of enquiries leading from one organisation to another, and although unfortunately still leaving the question of the General Hospital X-ray apparatus unanswered, it is deemed worthwhile to record the various letters which can truly be regarded as minor researches containing much interesting historical information on X-ray firms in the early 1900s which would otherwise have never come to light.

(i) The following is the note from the Chief Pharmacist to the writer dated June 10, 1969. Quote:

RE: X-RAY MACHINES

Further to my minute dated 21.4.69, I attach, herewith, a copy of Crown Agents letter dated 4.6.69 and letters from Mr. Cuthbert Andrews, Watson & Co. and Cossor Electronics . . . .

(ii) The letter from the Crown Agents, London, to the Chief Pharmacist dated June 4, 1969, reads. Quote:

YOUR LETTER REF: GPLS. 77/59
DATED 10.3.69. X-RAY MACHINES

Further to my letter of 11th April I now enclose letters from Mr. Cuthbert Andrews, Watson and Co., and Cossor Electronics. While some of the information may be of interest to Dr. Khoo it seems that there are no records of these early sales.

Any further information supplied by Messrs. Watson will be sent on to you, but it seems that is all the assistance I can give, I am sorry I have not been able to help you more in this matter.

E. Musson
Pharmacist for the Crown Agents

(iii) The note from Messrs. Cuthbert Andrews, Watford, Hertfordshire, to Mr. E. Musson, Crown Agents, Millbank, London, S.W.1. reads. Quote:

G2/403/166

Your letter of 7th May addressed to the British Institute of Radiology has been handed to me with the request that I should reply direct to you.

It is perhaps scarcely necessary to say that I had no personal knowledge of X-ray conditions in 1898. My first contact with the subject was in 1903 but my entry to the radiographic world was not until 1909. However, from a general knowledge of the earlier conditions I would suggest that in 1898 the source of current to activate the simple tube then in use would be an induction coil giving probably a 6″ to 8″ spark. This was possibly fitted with a hammer break and a handle for reversing the polarity. There was probably no protective material surrounding the tube. Although this was the kind of thing which was supplied at that time it is surprising to find that intensifying screens and fluoroscopes had been put forward, together with induction coils giving up to a 40″ spark, by Max Kohl of Chemnitz early in 1898. At this time the firm of Cossor mentioned in your letter were advertising as "makers of focus tubes and transformers" which would probably account for that firm receiving an order from Singapore.

Batteries for use with X-ray apparatus were advertised at about this time by the Lithanode Company, John J. Griffin & Sons, Newton & Company and Watson & Sons. There was also a maker of coils called Leslie Miller and probably a little later Mr. Alfred Dean. Most of these disappeared in course of time although the firms of Dean & Watson are still connected with X-ray apparatus in a much larger and more modern way.

Induction coils and small gas tubes were certainly included in X-ray sets in 1903, but by this time and up to 1913 headway was being made with much larger tubes and heavy transformer generators.

Automatic contact breakers were also introduced very early, so that there were various possibilities in the case of the Singapore machine.

As I am I believe, the oldest member of the B.I.R. it is very unlikely that you would find anybody who had any first hand knowledge of X-ray apparatus in the early period you speak of; but it is always possible that some records may have been preserved of apparatus, even of 1898, which was only three years after the discovery by Rontgen. It is, however, quite amazing to see the possibilities which were forecast by Silvanus Thompson in his presidential address to the Rontgen Society in November 1897.

I am sorry that I am not able to give you any more exact information in reply to your question but hope that the few particulars in this letter may be of interest.

Cuthbert Andrews

(iv) The reply from Messrs. Watson & Sons (Electro Medical) Limited, Wembley, Middlesex, to the Crown Agents, reads. Quote:

RE: X-RAY APPARATUS

We are in receipt of your letter of the 21st instant concerning Dr. Khoo's interest in the supply of X-ray Units to Singapore many years ago.

Like yourself, our records will have been disposed of in these early years and as this Company has never had a link with Cossor, we feel it is probably unlikely that any records exist.

However, we will make enquiries of our Vice-Chairman, Mr. A. J. Minns, to see whether he has any recollection of early records concerning X-ray equipment, as he has spent most of his life in the industry or if he is able to make any contacts with people who have been concerned with the manufacture of X-ray apparatus during the early years after the initial discovery of X-rays.

We will write to you again on this matter as soon as we have any further information.

R. H. Bourne
Office Manager
Export Department

*Both doctors, who were brilliant students, are now in retirement. Dr. Chen Su Lan was not only highly successful as a medical practitioner, but was a leading social and community leader for several decades. Dr. de Cruz spent several years in Government Service in Singapore, practised surgery, did teaching work, and held a responsible post equivalent to that of Medical Superintendent in the Tan Tock Seng Hospital in the late 1920s.

†Mr. S. K. Lingam, Chief Pharmacist, who is in charge of the Government Pharmaceutical Store & Laboratory, very kindly cooperated in contacting the Crown Agents in London.

(v) Lastly, the note from Messrs. Cossor Electronics Ltd., Harlow, Essex, dated June 2, 1969, to the Crown Agents, is as follows. Quote:

Dear Mr. Musson,

Thank you for your letter of 21st May about X-Ray equipment which is very interesting, but I am afraid that we are unable to help you. Like yourselves, our records for the dates mentioned were destroyed long ago.

We do know that Mr. A. C. Cossor was making X-Ray equipment in 1896 when he had a small workshop in Farringdon Road, London and was the first manufacturer of X-Ray tubes in this country. A. C. Cossor was formed as a Limited Company in 1908 and, we believe, continued to manufacture this type of equipment until about 1919 or 1920. It would seem quite likely that Cossor X-Ray equipment was supplied to Singapore in 1898 and 1913, but I am sorry to say that we have no information available which would be of interest to Dr. Khoo.

F. Brittain
Sales Liaison Department
Instruments Division

Comment

From the above, it can be seen that despite detailed research by the representatives of various institutions and manufacturers, no further light could be thrown upon the first X-ray apparatus of the General Hospital, Singapore.