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The early years of chest radiology in Britain

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'It would appear desirable that some attention should be paid to the history of the subject, as this would impress the worker with the necessity of honesty, caution and patience by making him familiar with the failures and successes of the past.'

(Sheridan Delépine, 1913)

The story of the reception of C. W. Röntgen's discovery of *x* rays (1895) has often been told (Glasser, 1933; Shanks, 1950; Schuster, 1962; Posner, 1970). In Röntgen's two classic papers (1895, 1896) the only reference to the possible application of his discovery to medicine was this: 'If the hand is held between the discharge apparatus and the screen, one sees the darker shadows of the bones against the less dark shadows of the hand'. However, even the very first comment made in the lay press (*Die Presse, Vienna,* 1896) prophetically ended with the words, 'we can foresee that one day these rays will be so perfect that only one layer of the body's soft tissue will be transparent to them whereas deeper layers will be shown. . . . This could be of immeasurable help for the diagnosis of countless diseases other than those of bones'.

In contrast, the first British scientific journal to comment on Röntgen's discovery contemptously referred to the 'new photography' with—'there are few persons who would care to sit for a portrait for two hours which would only show the bones and rings of the fingers' (*The Electrician,* 1896a) but admitted three weeks later (*The Electrician,* 1896b) 'with the stethoscope it has become possible to listen to the working of the human frame, with the new radiation it is to be hoped that the human frame will become—to skilled vision—something akin to transparent and that it may be possible to practically see into it as well'.

On 1 February 1896, the leader writer of the *British Medical Journal* condescendingly referred to 'the uneducated imagination' of lay people who immediately asked for more specific benefits in the field of tuberculosis and chest disease. Also in February 1896 the annotator of the *Lancet* complained: 'all sorts of crude ideas . . . seem to be current. We had an enquiry from a lay correspondent as to where the apparatus producing these new radiations could be obtained, as it was needed for a case of consumption' (*Lancet,* 1896). Dr. Willoughby Wade (1896) of Birmingham suggested 'direct experiments to see whether the new radiant has or has not a sterilizing effect upon the tubercle bacillus . . . as it would place in our hands that which has been for some time our highest aspiration, a means of sterilizing the tubercle bacillus in situ within the body'.

According to Jupe (1961), an attempt to take a radiograph of the chest of a 10-year-old girl was made in 1896 (exposure time 30 minutes) at St. Thomas' Hospital, but Britain's foremost pioneer of thoracic radiology was without doubt Glasgow's aural surgeon John Macintyre (Fig. 1). He

FIG. 1. *John Macintyre.*

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first located a halfpenny piece which had been lodged in a boy's oesophagus for about six months and 'had caused uneasiness at the pit of the stomach during swallowing' (Macintyre, 1896a). Sir Joseph Lister referred to that achievement in his famous presidential oration at the 1896 meeting of the British Association for the Advancement of Science but had to admit that subsequent attempts to extract the coin were unsuccessful. It is pleasant to report that the surgical manipulations resulted in pushing down the halfpenny which was eventually discharged *viis naturalibus* (Lister, 1896). Soon after that incident Walsh (1897) comforted his readers by saying 'in the oesophagus it is fairly easy to locate false teeth'.

Among Macintyre's many other 'firsts' are a radiograph of a renal calculus (Macintyre, 1896b) and the first cineradiographs (Macintyre, 1897), and he and J. M. Bleyer may rightly be called the grandfathers of miniature mass radiography by first photographing the fluorescent screen (Macintyre, 1896c; Bleyer, 1896). Macintyre emphasized 'the advantages of so doing will be at once evident because large plates are expensive and difficult to manipulate'.

The early days of chest radiology were best described by David Lawson, senior physician to the Sanatorium at Bauchory, Scotland (Lawson, 1906). He started his paper with the intriguing, but unfortunately, inaccurate information 'that the possibility of utilizing those rays, as a means of diagnosis in the wide domain of pulmonary disease, at once suggested itself to Charcot, of Paris, who with characteristic energy forthwith applied himself to the problem. As a result, there appeared from his pen in 1896 the first contribution to the now fairly voluminous literature . . . in the form of a paper, entitled 'X-rays as a Diagnostic Agent in Pulmonary Disease'. Understandably no reference to this paper by Jean Martin Charcot (1825–1893) can be found anywhere as the great neuropsychiatrist had died two years before Röntgen's discovery. The explanation for Lawson's mistake is probably this: In 1868 Charcot published a joint paper with L. Bouchard on microaneurysms of the brain which are still known under their names (Charcot and Bouchard, 1868; Pickering, 1970). It was Bouchard of the Charité Hôpital who published in December 1896 a paper under the above title (Bouchard, 1896).

He proudly announced that he had conquered ('j'ai pu triumpher') the resistance of the thorax against *x* rays, and described in detail four cases of pleural effusions (one of which seems to have been a case of right lower lobe atelectasis) and the first radiologically recorded case of dextrocardia (ectopie du coeur). In the field of tuberculosis Bouchard believed 'that the new method will be subject to similar limitations as physical examinations', but he nevertheless hoped that in future earlier diagnosis will be possible. One year later an anonymous reviewer in the *Revue de la Tuberculose et de Pneumologie* (1897) reported on the work of Bouchard and his colleagues who had demonstrated 'belles radiographies' of tuberculous lesions which had been missed by the methods of Auenbrugger and Laennec. By then the writer had no doubts that radiology would give a great service in the early diagnosis of pulmonary tuberculosis.

This gallic enthusiasm and optimism sharply contrasted with British caution and reserve. Fifteen years later the standard textbook on diseases of the chest (Powell and Hartley, 1911) valued *x* rays as 'of but little use in the early diagnosis of phthisis' and another 10 years later in the sixth and final edition of their book Powell and Hartley had not yet relented: 'In regard to the early diagnosis of phthisis, symptoms and physical signs have in our experience manifested themselves as a rule before any characteristic *x*-ray changes' (Powell and Hartley, 1921; Bishop, 1965).

Fowler and Godlee, in their well-known textbook from the Brompton Hospital (1898), ignored *x* rays for the diagnosis of chest diseases but at least showed an excellent skiagram of finger clubbing. William Osler, in the third edition of his famous textbook (1898), did not mention *x* rays at all and in a subsequent edition dispairingly remarked 'in the majority of cases the *x* rays tell us no more than a careful clinical examination' and thought 'radiographers need the salutory lesson of the Dead House to correct their Visionary interpretation of shadows. . .' (Osler, 1920). One who may have profited from Osler's advice was Ward (1896), who printed one of Macintyre's chest skiagrams over the title 'The Human Heart, in situ' upside down as the frontispiece of his book (Fig. 2). He proudly called it 'the greatest triumph up to date in this direction'.

Not surprisingly, therefore, Lawson (1906) complained that the work of the early Anglosaxon radiologists (Williams, 1901; Stubbert, 1903) 'had failed to fire the imagination or to inspire the enthusiasm of investigators to a degree commensurate with their work . . . or with the potentialities with which an enquiry into this branch of medicine might be attended'.

RADIOGRAM BY DR. MCINTYRE
The Human Heart, in situ

FIG. 2. *Frontispiece from Ward's* Practical Radiography (1896).

However, when the British Congress on Tuberculosis and Prevention of Consumption met in London in 1901, the organizers allowed time for a 'Discussion on the Use of the Röntgen Rays in the Diagnosis of Pulmonary Tuberculosis'. Before an audience, which included Robert Koch, the session was opened by Hugh Walsham (Fig. 3), one of the victims of radiation cancer with three questions:

1. Can the Röntgen rays show tubercle in the lung?
2. If so, at what stage of their development?
3. Can they detect tubercle before the other means of physical diagnosis?

After pointing out some pitfalls of fluoroscopy and radiography—faulty positioning, large breasts, and other problems which are still with us—Walsham answered the first rhetoric question unequivocally in the affirmative. As regards his second—and crucial—question he admitted that 'the very earliest stage' of the tuberculous process cannot be detected by *x* rays but added that this applied to all other diagnostic methods. He produced impressive films of cavitating tuberculosis (Fig. 4), but, significantly enough, when he demonstrated miliary tuberculosis he preferred to show a skiagram of a lung from the post-mortem room and not from a living patient (Fig. 5). However, he also showed two slides of radiographs of truly early tuberculosis which 'had been suspected but not confirmed on stethoscopic examination'. Implicitly this answered his third question.

Walsham's hopes that 'detecting an early tuberculous shadow brings a little nearer the day when internal tubercle may perhaps be treated with chemical rays' and that 'in the future we may perhaps be able to say of pulmonary tubercle: it comes as a shadow, so departs' have now fortunately become reality although not through chemical rays but with the help of chemical substances.

A. Béclère of Hôpital St. Antoine in Paris, who followed Walsham, supported him in every respect (Béclère, 1902). He thought that 'examination by radioscope and radiography supersedes all other methods' and somewhat prematurely declared that the mode of this examination in the field of tuberculosis was now 'universally recognized'.

This was not the opinion of the Vice President of the *X*-ray Society, James Mackenzie Davidson

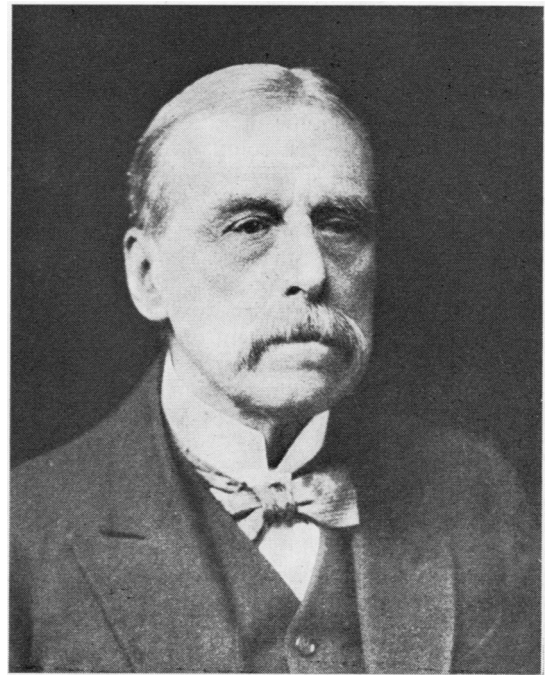

FIG. 3. *Hugh Walsham, M.A., M.D., F.R.C.P.*

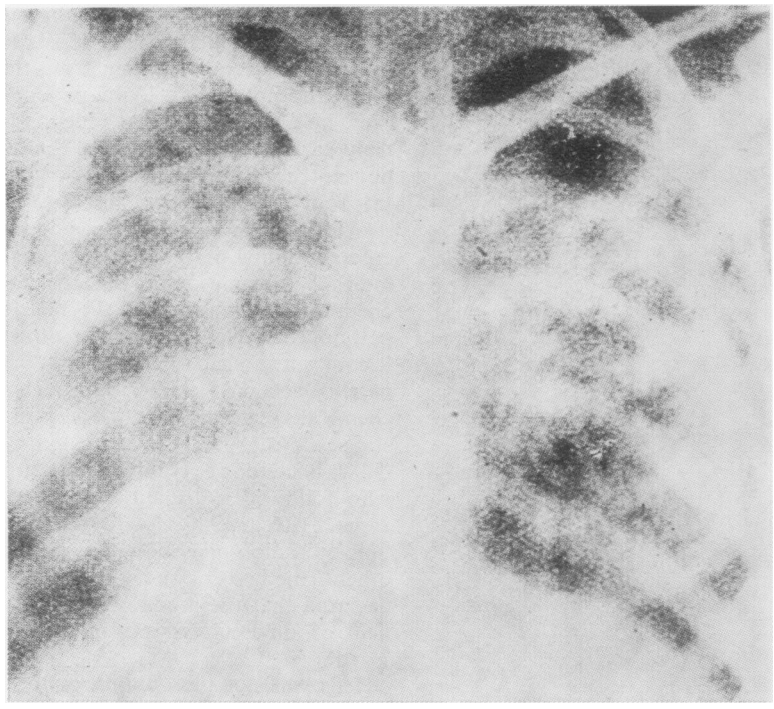

FIG. 4. *Hugh Walsham's 'cavities'* (Transactions of British Congress of Tuberculosis, 1901).

(1902), who wrote in the third edition of *Quains Dictionary of Medicine:* 'Gradual progress is being made but meantime the aid that the *x* rays afford the physician is comparatively limited'. With tuberculosis he simply dealt by stating that 'the lesions are less transparent than the normal lung except in the case of large cavities, easily recognized by other means'.

Almost without exception, the relevant papers published during the first decade after Röntgen's discovery record the excitement of early observers whose mesmerized eyes witnessed the diaphragms moving downwards on inspiration and upwards on expiration (Walsham, 1902 ; Williams, 1901 ; Dally, 1903 ; Lawson, 1906 ; Cooper, 1906).

Agostoni and Sant' Ambrogio (1970) recently referred to the 'classical dispute' centring on the function and movements of diaphragms which started with Galen who thought that they 'expand' the rib cage whereas Borelli in 1680 heretically opposed that view by stating that they 'constrict' the thorax.

By the middle of the last century physiologists generally believed Galen (Duchenne, 1867), but Lawson (1906) remarked that until the advent of

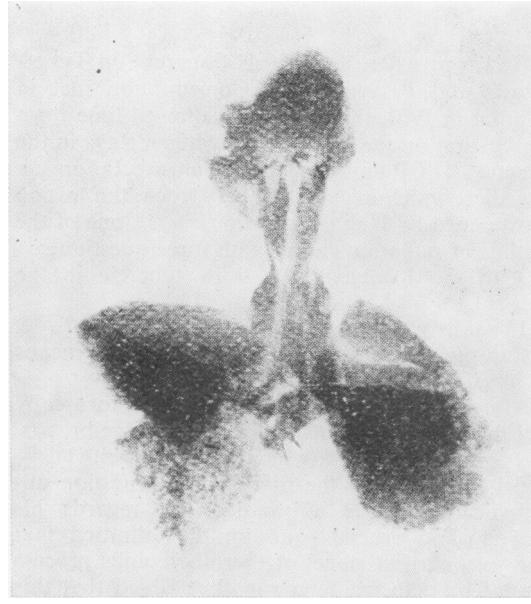

FIG. 5. *Hugh Walsham's 'miliary tuberculosis'* (Transactions of British Congress of Tuberculosis, 1901).

fluoroscopy physicians had 'an implicit faith in the teaching of physiologists . . . that the movements of the diaphragms were those of contraction and expansion towards the central tendon'.

Dally's (1903) paper is perhaps the most outstanding among the few British publications dealing with chest radiology during the early 1900s. At the time of its publication J. F. H. Dally was only an Assistant Resident Medical Officer at the Royal Hospital for Consumption at Ventnor but later became Physician-in-Charge of the Tuberculosis Department of St. Mary's General Dispensary at Welbeck Street, London. With regard to the movements of diaphragms, an obsession he shared with his contemporaries, the accuracy of Dally's observations is perhaps best shown by comparison with the findings of modern authors:

	Dally (1903)	Shanks and Kerley (1951)	Cotes (1968)
Quiet respiration	1·5 cm	2·0 cm	1·5 cm
Maximum respiration	7·0 cm	8·0 cm	10·0 cm

It is true that Dally's belief that 'the earliest stage of invasion of the lung by tuberculosis cannot be recognized except by impaired mobility of the diaphragm' has not withstood the test of time, but his astonishingly accurate description of radiographic signs of asthma and emphysema have. He also thought that 'bronchitis per se cannot be diagnosed by *x* rays' and warned his readers that the new diagnostic tool is not the 'royal road' to the art of diagnosis. His parting shot, 'A good radiograph in some respects may be said to resemble a painting by Turner, without intuition or previous study the one is almost as incomprehensible as the other . . .' is perhaps a little unfair to the great artist, but was well aimed at those who consider the interpretation of chest radiographs an easily acquired art.

For some years the Scottish laments on the slow acceptance of chest radiology continued. F. Gardiner (1902), from the Royal Infirmary Edinburgh, complained, 'The use of *x* rays in the diagnosis of pulmonary tuberculosis has now spread to many lands but as yet comparatively little has been done in Scotland'. David Lawson (1913), in his attractive Celtic prose, reviewed developments seven years after his first paper. He thought that whereas many other new diagnostic methods had 'been ruthlessly destroyed at the hands of time', Röntgen's rays had not only passed the test but that experience 'had exalted and glorified them'. He severely censored those consultants who in the diagnosis of obscure lung lesions were not using chest radiography and thereby 'failed in their duty to themselves and to their patients'. In even harsher terms he spoke of those who, without preceding diagnostic radiology, pushed troicards into chests for want of a differential diagnosis between effusion and consolidation, and thus converted a sterile effusion into a disastrous empyema—'an unpardonable accident'.

The long and arduous road to the full acceptance of chest radiology in Britain is nowhere clearer outlined than in volume I of *The Tuberculosis Year Book and Sanatoria Annual (1913–1914)*. Its editor had asked every establishment in Great Britain and Ireland for a 'condensed, informing and serviceable account of their facilities'. He also included a series of original papers by 'well known experts dealing with questions now under consideration'. Of the 31 contributors, only Leslie (1913–14) specifically dealt with radiology and incidentally included two excellent reproductions of chest radiographs. The Professor of Public Health at Manchester, S. Delépine, dealt with postgraduate instruction in tuberculosis, deplored the insufficient training, and demanded that 'the Tuberculosis Officer must free himself from the fetters of dogmas upon which ordinary routine practice is necessarily based' (Delépine, 1913–14).

However, when Delépine listed the subjects requiring further investigations he did not mention radiology. The Year Book contained the reports by 17 local authorities in Great Britain on their dispensaries but radiology facilities were mentioned for only five clinics. Ninety-six sanatoria for adult pulmonary tuberculosis in Britain replied to the editor's questionnaire; seven—four in England and three in Scotland—mentioned *x*-ray sets and/or departments. The Midhurst sanatorium's report—the most comprehensive of all—included a detailed sketch which, among other things, showed the position of a 'stink cupboard' and entrances for 'well-to-do' and 'necessitous patients' respectively. It listed a darkroom but did not mention for what it was used.

A further section of the Year Book referred to 'Hospitals for Tuberculous Cases', two of which, the Brompton Hospital and the Royal Sea Hospital at Margate, mentioned *x*-ray departments.

This analysis almost certainly does not do justice to the true position in 1913–14. The officers in charge of dispensaries, sanatoria, and hospitals had been asked for 'condensed' reports and may not have thought their radiological facilities sufficiently important to be included. This only underlines the prevailing climate of

opinion just before the outbreak of the first world war.

The *British Journal of Tuberculosis* did not publish an illustrated paper on chest radiology until 1914 (Bishop, 1970) but *Tubercle* had reasonably good illustrations with an article by Rivière on artificial pneumothorax treatment in its first volume (1919).

It would be easy to ascribe this slow acceptance of chest radiology in Great Britain to a backwards looking 'silver knob mentality' of physicians at the turn of the century. This may have played some part but the main reasons were technical. The trials, tribulations, triumphs, and sacrifices of the early radiologists have never been better described than by Holland (1937), to whose collection of early monographs, now at the Chester Beatty Institute, this paper owes much of its material (Brunning, 1958).

It is a story of erratic electricity supplies, nitrous fume-producing cell batteries, ineffective electrolytic rectifiers, and temperamental gas tubes which had been 'invented for the specific purpose of trying men's souls' (Hodges, 1945). Many of the electrical supply problems had been solved by the beginning of the first world war, but the most significant advance for chest radiology was no doubt the invention of the hot-cathode high vacuum tube by Coolidge in 1913 and—compared with other specialities—the somewhat belated advent of contrast media in thoracic medicine and surgery. It was only when Forestier and Leroux (1922) started to use iodized oil that bronchograms became relatively safe and useful.

Finally, it must not be forgotten that in the field of chest radiology, *x* rays in the early days meant more often fluoroscopy than skiagrams, with the inherent increased radiation exposures and hazards. Lister, in his previously mentioned oration (1896), concluded his account of the new Röntgen rays with the all too prophetic words: 'It is found that if the skin is long exposed to their action it becomes very much irritated . . . the transmission of the rays through the human body may not be altogether a matter of indifference to internal organs. . . .'

In 1909 Adamson prematurely pronounced 'the roll of martyrs is now closed' but it continued for many years, and the simple memorial erected to martyrs in Germany (Fig. 6) carries many English names, including that of Hugh Walsham, to whose memory this article is dedicated on this 75th anniversary of the invention of *x* rays.

Without the help by Mr. P. J. Bishop, Librarian of the Institute of Diseases of the Chest, and Mr. D. A. Brunning, of the Chester Beatty Research Institute, this paper could not have been written. I also thank Mrs. Woosnam of the North Staffordshire Medical Institute and the staff of the Department of Medical Illustration of the North Staffordshire Hospital Centre for their help. The Secretary of the Royal Faculty of Physicians and Surgeons in Glasgow has kindly permitted the reproduction of Figure 1.

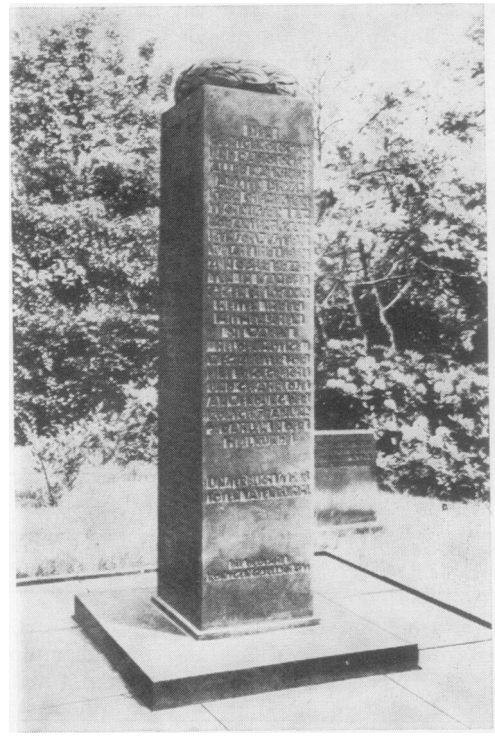

FIG. 6. *Memorial to the martyrs of röntgenology in Hamburg.*

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