Special Article

EARLY DAYS OF ROENTGEN PHOTOGRAPHY IN BRITAIN

BY

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[WITH SPECIAL PLATE]

A great deal has been written about Roentgen's sensational discovery, and there were so many papers and demonstrations during the first three months of 1896 that it has always been difficult to place the events in their proper order. A comprehensive account of them by E. Ashworth Underwood in 1945,[1] the centenary of Roentgen's birth, shows how rapid was the progress of medical radiography.

I have recently been delving into some family papers and contemporary English literature, and if I have made much of Arthur Schuster's part in introducing Roentgen's work to the medical profession it is because I remember my father's stories and have the photographs to hand. Considering that they were taken close on 70 years ago they are remarkably well preserved.

It was on December 28, 1895, that W. C. Roentgen[2] published his discovery of a new type of radiation, and at the turn of the year two physicists in Great Britain are known to have received his paper, together with some photographic prints. One was Lord Kelvin in Glasgow. He, being ill at the time, handed it to J. T. Bottomley, who sent a letter to *Nature*[3] consisting of extracts of some lectures of Lord Kelvin's ten years previously and just a few lines relating them to Roentgen's "speculations." He did not give any account of the experiments in that letter. The other recipient of the little monograph was Arthur Schuster[4] in Manchester. He was so immediately fascinated by it that he kept his pretty young wife, the cabby, and the horse waiting outside in the chill winter evening (on the way from the railway-station) while he read the pamphlet twice over in his laboratory. As he came out he excused himself by saying that he had had an extraordinary communication "from that man Roentgen who had been so rude in Pontresina." He too wrote a letter which appeared in the same number of *Nature*[5] on January 23, and which contained some preliminary comments on the nature of the rays, but they had already had a good deal of publicity before that date.

On January 7, 1896, the Manchester Literary and Philosophical Society[6] held an ordinary meeting, and, according to their records, "Dr. C. E. Lees, on behalf of Dr. Schuster, showed photographs by Professor Roentgen of Würzburg, by means of radiations of an apparently new kind." Among the prints was the skeleton of Frau Roentgen's hand, a compass (both of which were reproduced in *Nature*[7]), a coil of wire (Special Plate, Fig. 1), and the shadow images of different metals. The demonstration must have provided British scientists with the first indisputable evidence that *x* rays were a genuine discovery of great importance. The photographs have survived, but the monograph has unfortunately vanished. The next day, January 8, there was a letter from Arthur Schuster in the *Manchester Guardian* giving a clear, concise account of Roentgen's work and offering to show the photographs to anyone interested in the subject.

A JOURNALISTIC SCOOP

The journalists had been busy during the same week and many of the newspapers contained exciting accounts of the "new photography." So far as I can discover, the first one appeared in the *Daily Chronicle* of January 6, 1896, and came from Vienna; it was repeated in the *St. James's Gazette* that evening and in the *Manchester Guardian* the following day. The London *Evening Standard* of January 7 and 8 contained detailed descriptions of Roentgen's experiments from the Vienna *Presse*, and it was from some or all of these newspaper reports that A. A. Campbell-Swinton was able to pick up the technique and produce excellent *x*-ray photographs of his own.

One might fairly say that Roentgen's discovery was presented to the English scientific and general public by the daily press. There were a few errors in their dispatches, discernible to physicists, but on the whole the correspondents had done well. Vienna was the principal source of information, and except for Roentgen's own paper, which was very difficult to get hold of at the time, no news came from Germany until January 14. The Berlin correspondents of the *Daily News* and the *Westminster Gazette* then reported on a reception at Potsdam given to Roentgen by the Emperor, at which the photography was demonstrated. On January 18 the *British Medical Journal*[8] and the *Lancet*[9] mentioned a meeting of the Physical and Physiological Society of Berlin, at which photographs had again been shown, and on January 22 the *Daily News* reported a lecture by Dr. Spiess to a large mixed audience in Berlin. No particulars of the experiments, such as had been received from Vienna, were sent from Berlin.

Not all the newspapers greeted the discovery with enthusiasm. *The Times* made no mention of it throughout the whole of January. The *Morning Post* was lukewarm after having interviewed Captain Abney of the South Kensington Science Museum and found that he "did not see very much in it." Others were hesitant, facetious, or alarmed. Some of the correspondents cast doubt on the novelty of the work by recalling Hertz's and Lenard's experiments, but most of the scientists saw at once that Roentgen's rays were different from those with which Lenard had obtained somewhat similar results. The rival claim did, however, continue for some little time, until Sir George Stokes gave it the *coup de grâce* at a river party on the Clyde during a jubilee celebration for Lord Kelvin (1896). He said to Professor Quincke, one of the delegates, who had been supporting Lenard's priority, "Lenard may have had *x* rays in his brain, but Roentgen got them into other people's bones." Quincke enjoyed the retort, but one wonders whether, if Stokes had been a doctor, he would have used just those words.

ACCOUNTS IN THE MEDICAL PRESS

Once the journalists had finished with their scoop, the physicists and doctors got down to the business of studying the strange new phenomenon and its application to medical practice. The *Lancet*[10] appears to have been the first to venture into print with a cautious, semi-jocular annotation on January 11, 1896. On January 18 the *British Medical Journal*[11] published a note by Arthur

Schuster giving the gist of Roentgen's paper so that the medical profession might have some reliable information and realize its importance. The *Lancet*[12] of the same date drew attention to Campbell-Swinton's successful photography, by which it had been almost won over, and by the following week, after having inspected his laboratory, its conversion was completed.[13]

Finally, on January 23, *Nature*[14] printed a full translation of Roentgen's paper with two of the photographs. Schuster relates that he sent this to *Nature*, and there is extant a letter from the Editor thanking him for it, but it is the name of Arthur Stanton, his first assistant, which appears in the footnote. We may therefore presume that Schuster gave him the task of translation, and the editorial office possesses a note that Stanton received the fee for it. Up till then *Nature*[15] had had to be content with the newspaper reports. The physicists in general were delighted with the discovery. All the great guns—Lord Kelvin, J. J. Thomson, Lord Blythswood, Oliver Lodge, Silvanus Thompson—were trained on Roentgen, who (according to Schuster) had not until then been particularly prominent in scientific circles. They were, naturally, mostly concerned with the physical properties and nature of the rays, and they proceeded at once to do experiments and get interesting results of their own, which were discussed at the Royal Society from February onwards. Many of them were quick to appreciate the diagnostic value of *x* rays and worked together with the doctors, who, except for Dr. Macintyre, were entirely dependent on them for the photography.

Lord Blythswood and J. T. Bottomley combined with J. Macintyre to give a demonstration in Glasgow on February 5; Oliver Lodge and Robert Jones contributed a joint article to the *Lancet* of February 22[16]; Sidney Rowland demonstrated to the Medical Society of London on February 24; and Silvanus Thompson lectured to the Clinical Society on March 30, 1896.*

Arthur Schuster gave a lecture at Owens College on March 2, during which he took a photograph of the foot of his 6-year-old son, who can remember to this day the anxiety of keeping still for the comparatively long exposure, recorded on the plate as five minutes. The epiphyses show up well (Special Plate, Fig. 2). His first patient, some weeks earlier, had been a dancing-girl from the local pantomime, and the photograph showed a needle in her foot. Another patient had a fracture-dislocation of the elbow (Special Plate, Fig. 3).†

On March 3, at a meeting of the Manchester Literary and Philosophical Society, he again showed pictures which he had himself taken; one of them was of a frog with a healing fracture of its hind leg (Special Plate, Fig. 4). On March 18, in a lecture to the Manchester Medical Society, he suggested that, until a suitable place in the hospital could be provided, some rooms near by should be fitted up where a technical assistant could deal with patients. He was not happy at spending so much time taking photographs, and complained of once having had to travel to a remote mill townlet in the north of Lancashire to locate a bullet in a dying woman who had been shot by her husband. Portable *x* rays indeed! The photograph shows the bullet, apparently in the base of the brain. His assistant, Arthur Stanton (not to be confused with Campbell-Swinton's capable assistant of the same surname), was so shattered by the experience that he had a nervous breakdown from which he never fully recovered. With no adequate assistance and his laboratory inundated with patients from the Infirmary every day, Schuster was prevented from getting on with his own research into the new radiation and he never forgot it.

*Thompson[17] also showed the skeleton hands of several famous people at the Royal Institution during 1896.

†His principal medical collaborator seems to have been Leopold Larmuth, a versatile, rather eccentric, aural surgeon in Manchester.

First Organized X-ray Department

Among doctors, J. Macintyre was undoubtedly the most distinguished pioneer, and he had the great advantage of a profound knowledge of electricity. His career and achievements have been admirably described by A. Goodall.[18] Macintyre contributed much to the photography of the soft tissues, and in March, 1896, Roentgen himself wrote to ask for his methods. On March 10 he addressed the Glasgow Medico-Chirurgical Society, and during the rest of 1896 his publications were numerous and original. He was responsible for the first properly organized radiological department in a hospital, and the opening of this at the Glasgow Royal Infirmary was announced in the *British Medical Journal* of June 6, 1896.[19] Macintyre showed more awareness of the dangers of *x* rays than many of his colleagues, and, by dint of strict precautions early on, no one in his department ever suffered any ill effects.

Technical advances in *x*-ray photography were of great importance to medical men, and in this field the electrical engineer A. A. Campbell-Swinton was paramount. He thoroughly understood the basic principles of the original experiments, and even before Roentgen's text was available to him he published his own photographs in *Nature*[20] and in the *British Medical Journal*[21] and *Lancet*.[22] One, of a hand, dated January 13, may well have been the first *x*-ray picture taken in Britain. On January 24 he gave a demonstration to the Physical Society of London, and on March 14 he announced[23] a service in his laboratory at 66 Victoria Street for *x*-ray photography of patients sent by doctors.

On February 8, 1896, the British Medical Association[24] announced that it had commissioned Sidney Rowland to investigate the application of Roentgen's discovery, and it invited doctors to send suitable cases. Rowland was not a medical man, but he had been a Shuter scholar at St. Bartholomew's Hospital, and during the succeeding months he sent a series of interesting reports to the *British Medical Journal*.

T. J. Gifford also made contributions to the photography of the human skeleton and was one of those who managed to reduce the time of exposure, which was a welcome improvement. He gave a demonstration to the Royal Photographic Society as early as January 21, 1896, and his exhibits remained on view to the public at the society's rooms in 12 Hanover Square.

One outcome of all the publicity was that W. Friese-Greene,[25] the inventor of the cinematograph, realizing the entertainment value of this new line in photography, some time in 1896 ran a show at the old Oxford Music Hall, London, which was profitable—unlike most of his ventures. Friese-Green also took apparatus of his own design to parties in the great houses, where, with his technical skill combined with good showmanship, he gave very popular displays. It is strange that he did

not turn his inventive powers to cineradiography, but that was Macintyre's triumph, first shown in public in 1897.

By April, 1896, the first excitement was over and the potentialities of the *x* ray as an aid to diagnosis were known to all. There had also been some trial of its bactericidal effect, which Délépine[26] and Schuster had found to be negligible at ordinary dosage. Therapy was tried later in the same year for a skin condition and even for a tumour.

To-day, looking at the old photographs and recalling the voices of past friends, one captures some of the double joy of discovering a fresh wonder of Nature which is at the same time an undefiled benefit to mankind.

My thanks are due to Dr. Philip Zorab for his interest and helpful advice.

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"It makes a great difference to out-patients if they are received in a pleasant and business-like fashion by some member of staff, made welcome and reassured, and then not left so long that they have the feeling that somehow or other, in spite of the to-ing and fro-ing of busy doctors and busy nurses, they have been overlooked. Few of us are always punctual and there are, of course, always emergencies in hospital which upset any carefully worked out timetable. But the patient's time matters as well as the doctor's time and the nurse's time, and the patient's time becomes more important as patients have to travel considerable distances to the new and more centralized hospital services. We have, of course, moved away almost everywhere from the days when there were no appointments systems at all. . . . At many out-patient clinics the appointments are now carefully spaced so that no one is likely to have to wait very long. But there are still some [hospitals] where the practice is to summon ten or a dozen people for the same time, on the assumption that one or two won't turn up and that it doesn't matter if some of the others have to wait, perhaps even missing the only train or bus home and having to stand the expense of a night away. Sometimes this is lack of imagination; sometimes there are very real difficulties in finding the space and the staff to make better arrangements. But I am very anxious that, wherever it is possible, particularly in the new buildings such as this, the practice generally should be brought up to the very high standards which some hospitals have set in this important matter." (Secretary of State for Scotland opening Perth Royal Infirmary's new out-patients department, October 19.)

Preliminary Communications

Relationship Between Respiratory Syncytial Virus and Newcastle Disease—Parainfluenza Group

Respiratory syncytial (R.S.) virus was first isolated in 1956 from chimpanzees (Morris, Blount, and Savage, 1956), and from human patients in 1957 (Chanock, Roizman, and Myers, 1957). Its taxonomic affinities have been uncertain, but recent papers (Kisch, Johnson, and Chanock, 1962; Bennett and Hamre, 1962) suggest that its cytopathology resembles the Newcastle disease-mumps-parainfluenza group and the measles-rinderpest-distemper (M.R.D.) group, the common feature being the formation of syncytia with eosinophilic inclusions.

As the particles of both these major groups of viruses have a similar fine structure, it might be supposed that R.S. virus would share this structure with them. The particle size has been estimated by filtration to be 900–1,300 A.U., and the virus is known to be ether-sensitive. Concentrates of the virus grown in MS cells (Kanda and Melnick, 1959) have been examined by us and found to contain particles of greatest diameter, as seen on the grid, of 1,200–3,000 A.U., using the phosphotungstate negative staining technique. These are similar to those of N.D.V., and of the measles group in structure.

In other respects, R.S. virus has some affinities with the N.D.V. group and some with the measles group (see Table) but does not completely conform with either. (1) It does not agglutinate red cells. All of the N.D.V. group do so, but of the M.R.D. group only measles agglutinates red cells, and it possesses no neuraminidase. (2) It does not cause the production of type A intranuclear inclusions, as the members of the M.R.D. group do. (3) In infected cells there is a sparing of the nucleus when cells are stained with fluorescent antibody (Kisch *et al.*, 1962). This is very characteristic of the N.D.V. group (Traver, Northrop, and Walker, 1960; Wheelock and Tamm, 1961; Massab and Loh, 1962), but studies of the M.R.D. group exactly comparable with these are not yet available.

	N.D.V. Particle Structure	Syncytia and Eoeinophilic Cytoplasmic Inclusions	Haema-glutination	Neur-aminidase	Type A Nuclear Inclusions
Influenza group	−	−	+	+	−
N.D.V.-parain-fluenza group	+	+	+	+	−
Respiratory syncytial virus	+	+	−	−	−
Measles ..	+	+	+	−	+
Distemper ..	+	+	−	−	+
Rinderpest ..	+	+	−	−	+

From these data it appears that a wider taxonomic grouping is necessary which would include the larger myxoviruses—that is, the N.D.V.-parainfluenza group—and also these four viruses (R.S. and the three members of the M.R.D. group), which are so similar to them in particle form and in cytopathic effect in tissue culture. This similarity also emphasizes the distinction of the true influenzas from these viruses (Waterson, 1962). The one important feature common to the influenza and N.D.V. group is the ability to elute enzymically from mucoproteins—that is, the possession of neuraminidase.

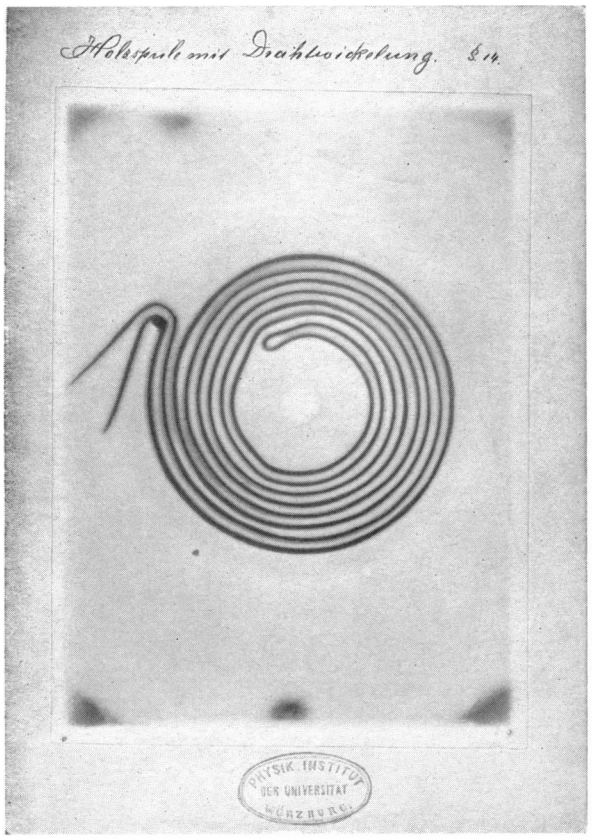

FIG. 1

FIG. 1.—Professor Roentgen's *x*-ray photograph of a coil of wire on a wooden spool. It is headed "Holzspule mit Drahtwickelung." Below the photograph is the stamp of the University of Würzburg Physical Institute.

FIG. 2

FIG. 2.—Part of *x*-ray photograph taken by Professor (later Sir) Arthur Schuster of his 6-year-old son to show the epiphyses. The date on the plate is March 8, but there is other evidence to suggest that the photograph was actually taken on the 2nd.

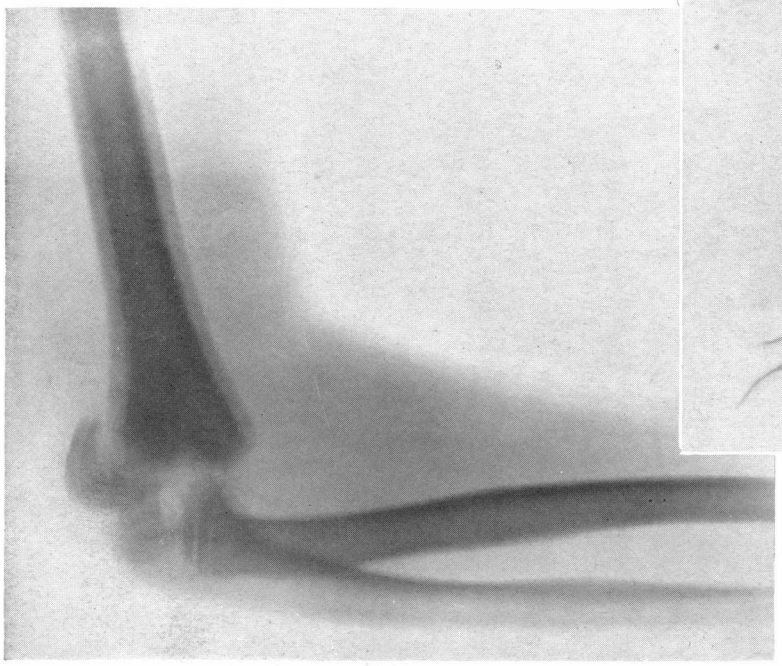

FIG. 3

FIG. 3.—*X*-ray photograph of a fracture-dislocation of the elbow.

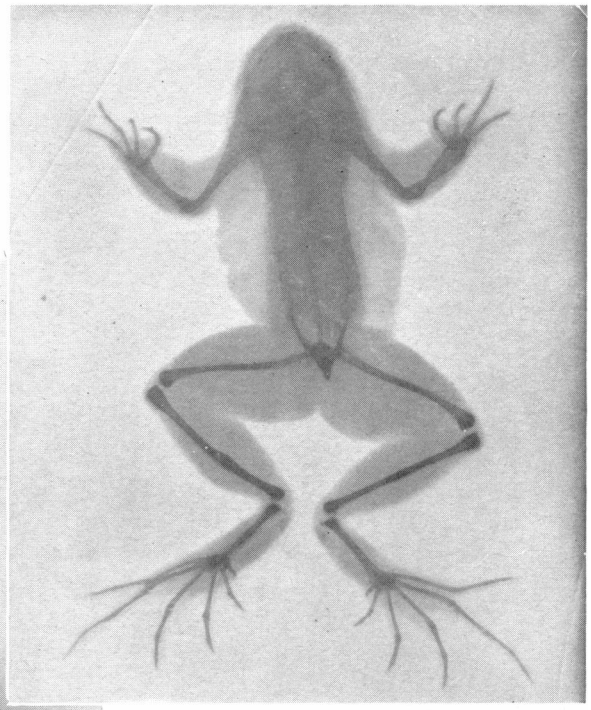

FIG. 4

FIG. 4.—*X*-ray photograph of frog showing healed fracture of hind leg.

All these pictures were taken in 1896.