and surgeons begin to colonise. The dentist follows; then a modest display of wares in the parlour window indicates the modiste, or the brilliant red and blue jars give token of the druggist and apothecary. By-and-by a shop window is boldly put forth, radiant with plate glass and gold, and so gradually a change comes over the spirit of the locality; the tradesman pushes out the gentleman, and trade reigns supreme. Rodney Street is at present in the transition stage, but in the end the triumph of the trader is inevitable."

Probably the situation of the Medical Institution and University have been the chief instruments in preserving Rodney Street, but one sometimes feels with sorrow that, now that the consulting room is in so many instances merely an office, Picton's prophecy nears fulfilment.

Rutter and his colleagues rose superior to the spirit of their times, strove for improvement in the general conditions of the town and raised this Institution for the advancement of the Science and Art of Medicine. In addition, their record of research and thought has seldom been surpassed in the story of the Liverpool School of Medicine: Dawson connected glycosuria with diabetes, Park and Allanson secured primary union in amputations, Bickersteth saved life by blood transfusion, Moss and Duncan laid the foundations of State Medicine and Public Health—all being engaged in general practice at a time when, in addition to ordinary troubles, epidemics of typhoid, typhus and cholera swept the Black Spot on the Mersey.

Stevenson might well have had our founders in mind when he wrote "The Physician is the flower, such as it is, of our civilisation; and when that stage is done with, and only remembered to be marvelled at in history, he will be thought to have shared as little as any in the defects of the period and most notably exhibited the virtues of the race."

My thanks are particularly due to the "Daily Post" Printers for so kindly lending the blocks illustrating old Liverpool, also to the Staffs of the City Libraries and Museums, the Museum of Hygiene, and many others for their assistance.

X-RAYS IN 1896.

By C. THURSTAN HOLLAND, T.D., D.L., LL.D., M.Ch., F.R.C.S.

Honorary Consulting Radiologist to the Liverpool Royal Infirmary.
President of the First International Congress of Radiography, London, 1925.
Formally Lecturer on Radiology at the University of Liverpool.

On November 8th, 1895, X-rays were discovered.

On December 28th, 1895, Roentgen handed his famous paper announcing his discovery of these rays to the President of the Würzburg Physico-Medical Society for publication in its journal. Incidentally he formally read this paper at a meeting of the Society on January 23rd, 1896.

Roentgen's discovery was no accident. A trained investigator, he was following up the work of Lenard on the radiations in high vacuum tubes, saw something happen which was unusual, made investigations as to the cause of this, and discovered X-rays.

Before anything had appeared in any paper in England about the discovery, one Sunday morning when assisting my friend, the late Sir Robert Jones, at his free Sunday clinic at 11, Nelson Street, he called me to listen to a letter which a German lady, a Mrs. Wimpfheimer, had just received from a relation in Germany. This letter described the great discovery. I regret to say that we both of us laughed at it, and considered it to be just one more "tale from America."

On January 7th, 1896, the first note in England on the discovery was published in a London daily paper, the "Standard," and on the evening of that day the late Campbell Swinton, an electrical engineer living in London, made the first radiograph ever taken in this country (some of these were later on reproduced in the Journal of the Roentgen Society for July, 1905). Swinton happened to have the apparatus for producing X-rays which at this time, 1896, was practically only to be found in Physics Laboratories and such-like places.

My own introduction to X-rays was more or less accidental. Robert Jones had been consulted *re* a small boy who had shot himself in the hand. The wound was completely healed, and from an ordinary examination it was quite impossible to say whether a small pellet was present or if so where it was situated. Oliver Lodge, the then Professor of Physics at University College, was approached as to the possibility of X-rays, and the result was that I escorted the boy to the College on February 7th, 1896, and spent the afternoon watching the various attempts to get a picture showing the bullet. Many exposures were made and at last one plate not only showed the shadows of the hand bones but also a small area overlying the base of the mid-finger metacarpal, which was distinctly whiter (on the negative) than the rest. It was decided that this was in fact the shadow of the bullet, and later events confirmed this opinion. I still have a print and also a lantern-slide which Sir Oliver gave to me. I can still remember how excited we all were. At that time I had never seen an induction coil to recognise it as such: I knew absolutely nothing about electricity or vacuum tubes, and my knowledge of ordinary photography was so slight as to be negligible—I hadn't even got a camera of my own; so you see how well I was equipped to take up X-ray work. It is extraordinary to me how many writers do not take the trouble to verify many of their statements. In a long paper on Sir Robert Jones by the late Dr. Blair-Bell published in the "Medical Press and Circular" in July, 1935, amongst other things Robert Jones and my association with X-rays are alluded to, and Blair-Bell states that at the time I took up X-ray investigation I was already "well known as a most expert amateur photographer!" This was not the case—I had a mere nodding acquaintance with studio photography and nothing more.

Following this discovery for many months the newspapers, illustrated and otherwise, were full of items of interest in which X-rays were the prominent feature. They were utilized for the making of short stories for the various journals. The amount of ignorance amongst these writers—to say nothing of the general public—was colossal; and apparently no one ever stopped to think or enquire before rushing into print.

As an instance of this, one journal published a sea-shore picture in which a bathing machine with a lady inside was shown, and outside on the sands was an X-ray operator manipulating a piece of apparatus like a huge camera. The manipulator was portrayed as seeing through the bathing machine, seeing inside a lady in somewhat airy attire, with his X-ray camera.

Shortly after this had been published, with others of a similar description, a London firm advertised "the sale of X-ray-proof underclothing for ladies." This is not a joke, but an absolute fact.

Just one more. In a story in the "Strand Magazine" of July, 1896, amongst a series of sensational stories illustrating "The Adventures of a Man of Science," the following almost priceless statement was made. A man who is suspected of having stolen and swallowed a diamond is lured into the laboratory of the scientist, who narrates that "he followed me into the laboratory without a word. I desired him to strip, and then, after some difficulty, arranged him in such a position that the rays should pass through his body. I turned off the light in the room, my electrical battery worked well, the rays played admirably in the vacuum tube. I removed the cap from the CAMERA ——" and so on. Result: an excellent plate showing the diamond just below the region of the ileo-cæcal valve! But the real tragedy in this comedy of errors is of course that if the "diamond" was shown, then it could not have been a real one, as real diamonds are transparent to X-rays.

Before we consider the actual results obtained in 1896 it may be of some interest to recollect the conditions under which the work was done. Present-day radiologists would scarcely be able to realize these.

There were of course no X-ray departments at any of the hospitals. There were no experts. There was no literature. No one knew anything about radiographs of the normal, to say nothing of the abnormal. There were no special X-ray plates or films, no satisfactory bromide papers, and so prints had to be made on printing-out paper—P.O.P., as it was called—and this was a long and tedious process. It was only very slowly that knowledge began to accumulate, and yet looking back it seems to me now to be rather astonishing how much was done in those early days.

The Roentgen Society of London, the first X-ray society in the world, started in 1897, and brought together the medical men interested in X-rays, the pure physicists, the manufacturers, and many others interested in one way or another in the new discovery. This society performed valuable pioneer work and for many years was instrumental in advancing radiography in every direction. There is a tendency at the present time amongst the medical radiologists in England to keep aloof from such mixed company, but personally I am still convinced that the British Institute of Radiology is one of the most valuable societies we have, and one which the medical radiologists should support in every way possible. It has done a great deal to increase the prestige of British radiology internationally.

I was in general practice in Liverpool in 1896, and had been for eight years. It was my great good fortune during these years to have gained the friendship of the famous orthopædic surgeon, Robert Jones. More than this, I had for some years been one of his chief assistants at his Sunday morning clinics, and had a golden opportunity of seeing the earliest developments of orthopædic surgery in his hands, and also of becoming familiar with orthopædics. This knowledge became of immense value to me as X-ray work developed.

At the beginning of 1896 Robert Jones visualized some of the possibilities of radiography in respect to his own work, and one day in discussing this remarked that someone in Liverpool must be found to take it up seriously. He turned to me and said, " If I pay for an apparatus will you (*i.e.* myself) undertake it ? " Little thinking of what this would result in as regards myself I jumped at the offer promptly. From that moment the whole course of my life was to be revolutionised, and a wonderful career was opened up for me.

An apparatus was ordered from Messrs. Newton and Co., who then had a shop in Fleet Street close to Temple Bar. In May

Fig. 1. *May 29th*, 1896.
My first X-ray. My own hand.
2 min. exposure, 3 in. coil, 5 Grove cells.

Fig. 2. *June 17th*, 1896.
Congenital deformity of hand. Adult woman.
2 min. exposure, 3 in. coil, accumulator.

I went up to London to be shown by one of the staff how to set the apparatus working, and towards the end of May the apparatus was in Liverpool. On May 29th, 1896, I took my first radiograph —my own hand—and made a few other purely experimental exposures on various still objects.

The apparatus. (1) A three-inch spark induction coil—that is, a coil which could produce a very thin discharge between two metal points three inches distant from one another, the interrupter being of the platinum-flapper type built into the coil.

(2) To energise the coil a nest of five Grove cells. I refer you to any book of Physics for information on the construction of this poisonous piece of apparatus. It would produce, when in working order, an electrical current of say 10 to 12 volts. Its chief characteristic was a large supply of fuming nitric acid with which the five glass cells had to be filled every time one wanted to use the apparatus, and which had to be poured back into a large bottle when the work was finished. Fuming nitric acid in large quantities is an exceedingly noxious fluid.

(3) One pear-shaped vacuum tube without an anticathode. Consequently, when it did work—which wasn't always—whatever X-rays it disgorged came off its glass walls in every direction ; of course, sharpness of shadows was impossible.

Fortunately it was superseded in a few days by one of Herbert Jackson's " focus tubes." The suggestion of Jackson's of placing a small disc of platinum at an angle in the centre of the tube and the concave cathode which directed the cathode rays to a small spot on this target, was the first great advance in tube construction and made possible sharp radiography. In short, it made modern X-ray work possible.

(4) A tube claw in which the tube could be clamped, and a few yards of thin wire for connecting up.

Cost, about thirty pounds sterling.

I wonder what many of the modern radiologists would do if asked to produce radiographs with the above apparatus ; to keep the apparatus in working order ; to discover for themselves the reason for failures ; and to do all the photographic work as well. Remember that it fell to my lot to have to do this when entirely untrained and when there was no one to go to for help.

I believe that the modern-trained radiologist would find himself in a grave difficulty.

One of our great difficulties was a satisfactory supply of electricity. Although I did not finally do away with the Grove cells until the end of the year, we soon got accumulators, and for many years used these as a source of current. In those days, however, even an accumulator was not unmitigated bliss—in 1896 they differed very much from those of the present day. They gave off fumes; they tended to leak; the various connections had to be constantly cleaned; re-charging them was not the easy matter that it is now; and as they "ran down" very frequently this was a nuisance. One reason for their rapid discharge was the length of exposures we had to give, especially in attempting the thicker parts of the body—exposures of half an hour or even more were quite common. However, with all their faults they were to be preferred to Grove cells and nitric acid.

Then the tubes themselves: what of them? The focus tubes used in 1896 were about two and a half inches in diameter only; the platinum anticathode was very thin and rapidly became red hot; in a very short time, owing to the residual air being driven into the glass, they became hard, and if one was not careful so hard that the current suddenly shot over the tube and in many cases a perforation was the result, and, of course, a wrecked tube.

How were tubes regulated? There were no gadgets in those days for either lowering or raising the vacuum. When making an exposure the tendency was to harden—you had to use your own judgment as to when its hardness had reached that stage when it was necessary to interfere: you judged this from the appearances of the tube and by the sound it made—and the current was switched off. To lower the vacuum you warmed the tube to drive the residual gas in its glass walls back again into the vacuum, either by means of gas and a bunsen burner, or by the flame of a small methylated spirit lamp. Again great care was necessary, or (1) you might lower the vacuum too much, or (2) you might melt the glass wall so that it gave way and exploded inwards—patients, especially children, disliked this

Fig. 3. *June 19th*, 1896.
Piece of needle in the forearm of an adult woman.
My first case of a "foreign body."
4 min. exposure, 3 in. coil, accumulator.

Fig. 4. *July 20th*, 1896.
Male. Hypertrophic pulmonary osteo-arthropathy.

latter occurrence. In making an exposure of say half an hour with some tubes this performance of turning off the current, warming the tube and turning the current on again might easily have to be done fifteen or twenty times.

If you lowered the vacuum too much then there was nothing else for it but scrapping the partially exposed plate, changing the tube, and starting all over again. To try and harden such a low vacuum, probably the best way was to reverse the current through the tube, another process which required close observation and judgment. So much for tubes—they were very unstable, but very interesting, and required as much attention and as much humouring as does a woman!

There was only one great advantage about the tubes of those days as compared with those of to-day. One could at any rate buy a tube for eighteen shillings and sixpence!

It was some time before any material advance in tube design and manufacture took place, but the size of the coils and their efficiency rapidly increased. I did not discard the three-inch coil until the end of the year, but in the middle of July obtained one which gave a good six-inch spark; and that was as far as we got in coils in 1896.

The points to emphasize in this early X-ray work are shortly :—

(1) The small coils, giving a very thin discharge;

(2) The small tubes quite unable to stand heavy currents, and so giving only a very small output of X-rays, and with no regulating devices;

(3) No instruments for measuring a tube's output.

(4) No mechanical breaks for the coils.

Photographic. The purely photographic side of the work was both interesting and exasperating. As I have said, there were no special X-ray plates and we had to use one or other of the various brands—and they were innumerable—of ordinary photographic plates described as being fast, slow, and medium. The question to be solved was which, if any, was the most suitable for radiography, and it took a considerable time to solve this difficulty satisfactorily. The same applied to the many developers on the market, and the solving of this problem took time.

Every plate maker became a standing nuisance. An almost constant stream of travellers called, and each one had the same story to tell: "These," his firm's plates, "were the best, and no other firm had plates to compare with them." Then came a request to try them out there and then. Boiled down it came to this, that none of the ordinary photographic plates were really suitable, and we had to wait a long time before Messrs. Lumière—the well known French firm—produced a really good plate for radiography.

The position in 1896 was that after an exposure, if the negative was a failure, then in considering what the cause of the failure was the plate itself, the developer used, and the method of development—all came under suspicion.

I had a friend who was an expert pictorial photographer. He tried to give me his assistance in solving the purely photographic problem, but I fear in that he was not of much real help.

Making prints was a nightmare: they were made on P.O.P. paper by exposure to sunlight. It was a question of stopping the printing at the psychological moment, as under-printing meant a weak picture and over-printing resulted in blacking out of the image. These prints had to be toned, fixed, and washed after printing—a lengthy process. In summer in good light printing was very fast, and it was necessary to be constantly making examinations as the process went on: the time limit for error was often very small. In winter the difficulty was to get prints at all: sometimes it would take several days' exposure to get a satisfactory one. After completion, in order to get a good surface, the prints were squeegeed on to polished plate glass and allowed to dry off.

Lantern slides. In these very early days I had the use of a small photographic studio in which Robert Jones had cases photographed. I found that the easiest way of getting lantern slides was to photograph the mounted print on to a quarter-plate and then get a contact lantern slide from the latter.

The X-ray department. Very soon after my apparatus arrived the Surgeons of the Liverpool Royal Southern Hospital were asking me to try and examine some of their cases—practically all were bone cases. In October I was definitely given a post at this hospital and a room and apparatus were placed at my

Fig. 5. *July 20th*, 1896.
Male. Wrist and forearm.
Hypertrophic pulmonary osteo-arthropathy.

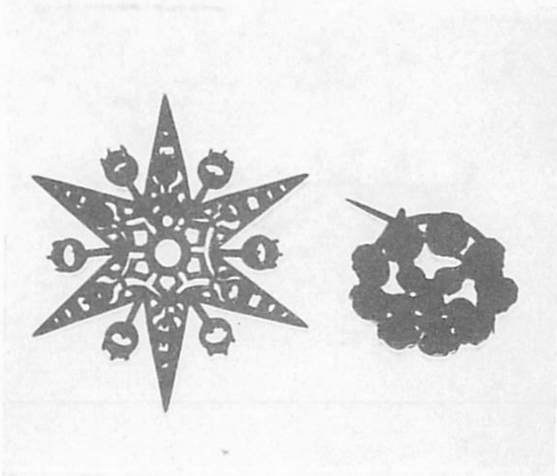

Fig. 6. *August 7th*, 1896.
A diamond star and a paste brooch.
2 min. exposure, 6 in. coil.

Fig. 7. *August 12th*, 1896.
Strumous dactylitis.
2 min. exposure, 6 in. coil.

Liverpool Medico-Chirurgical Journal, 1937.

Fig. 8. *September 17th*, 1896.
Hand of a child at the age of one year.
2 min. exposure, 6 in. coil.

disposal. I still remember that room. A cold, fairly large room on the ground floor with its own entrance from a yard. It had a sink and a supply of cold water. The floor was a stone one, and it had no fireplace or heating apparatus. Added to all this it was very damp. Probably no more utterly unsuitable room could have been chosen, but in it I not only did the work but I used it for a developing room as well. When I look at modern X-ray departments and contrast them with my first "department," it occurs to me that the difference is quite as great as the contrast between modern apparatus as compared with my first outfit.

I have forgotten the exact title of my appointment but it was an honorary one, though of course I had no status on the staff or a seat on the Medical Board. But most of the staff, even in those days, were personal friends, and it was all made very pleasant for me both by them and by the lay management. I could not get much money, but I got very sympathetic treatment and help from everyone; and when I remember during the course of my career the bitter complaints I have often heard from medical men in charge of the X-ray departments of various hospitals as regards the way they were treated by the medical staffs and by the lay committees, I have often wondered why.

THE ACTUAL WORK DONE IN 1896 FROM THE END OF MAY TO THE END OF DECEMBER.

As I have already said, the first radiograph I ever took was made on May 29th of this year. It was of one of my hands, and it may be of interest to note the exact conditions under which it was taken (Fig. 1).

The plate used was a fast photographic plate known by the name of "Cadett Lightning." These plates were in their day the fastest of all the plates; the apparatus the three-inch coil, and Grove cells. The exposure was two minutes, and the plate was developed in a solution sold under the title of "Velox." I still have the negative.

When I look at my note book of these early days I find that we took plates of various hands, such things as a match box with matches and a key inside, a purse with money inside, pencils, billiard chalk, and so on, and exposures varied from half a minute up to five minutes.

On June 5th my first pathological radiograph was produced. This showed a sub-ungual exostosis of the terminal phalanx of a great toe. Again a three-inch coil, but the source of current was now an accumulator, the exposure for a lateral view being two minutes.

This was followed on June 16th by radiographs of a boy's forearm, and definite evidence of necrosis with a considerable loss of bone was very well seen. The time of exposure for the two plates taken was four minutes for one and five minutes for the other. This case at once opened our eyes to the big question of interpretation. It was the first case of bone disease to come under observation, and although the pathological changes were gross we all of us were set wondering as to what it all meant. Here again it was necessary for us to read the riddle to the best of our ability. We had no X-rays for purposes of comparison nor were there any to be got. (When I say " we " it means in these early cases of bones Sir Robert Jones and myself, and it was a very fortunate thing from my point of view to have his help at this time.)

On June 14th came the first fracture case. An injury to a radius in a male adult. The exposure five minutes.

The interpretation of radiographs of fractures is nearly always a simple matter now-a-days. Let me say very definitely that this was far from being the case in 1896, and for very much longer after that. Material had to be got together gradually, and practically every new plate added something to our previous knowledge. I remember very well indeed the first recent Pott's fracture—the real Pott's with the internal malleolus torn off and the displacement of the foot—which we saw. The plates were very good indeed, and to-day the diagnosis would have been made, radiographically, in an instant. I remember quite well, as if it were to-day, the long time Robert Jones and myself spent looking at and discussing the radiographs, and wondering what it all meant. It may sound incredible, but it happens to be true.

On June 14th the first congenital deformity arrived, a baby

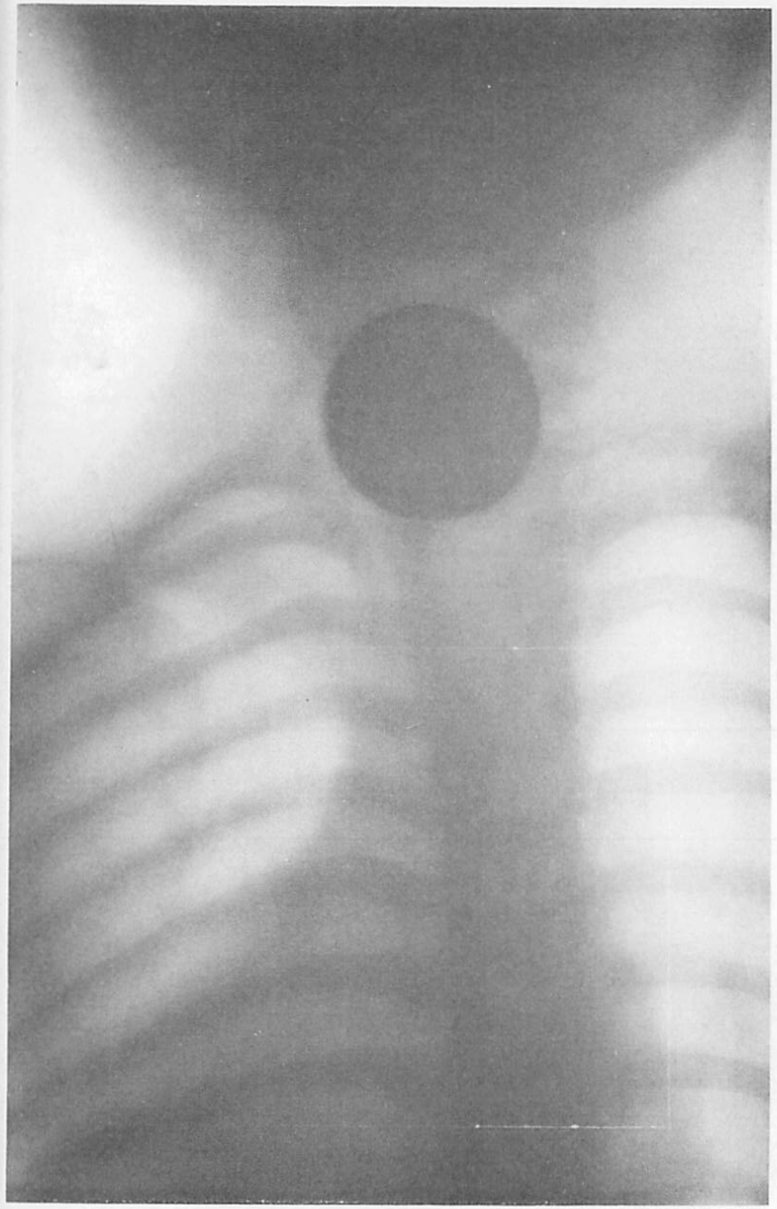

Fig. 9. *October 2nd, 1896.*
Coin in œsophagus. Boy 2½ years old.
13 min. exposure, 6 in. coil, accumulator.

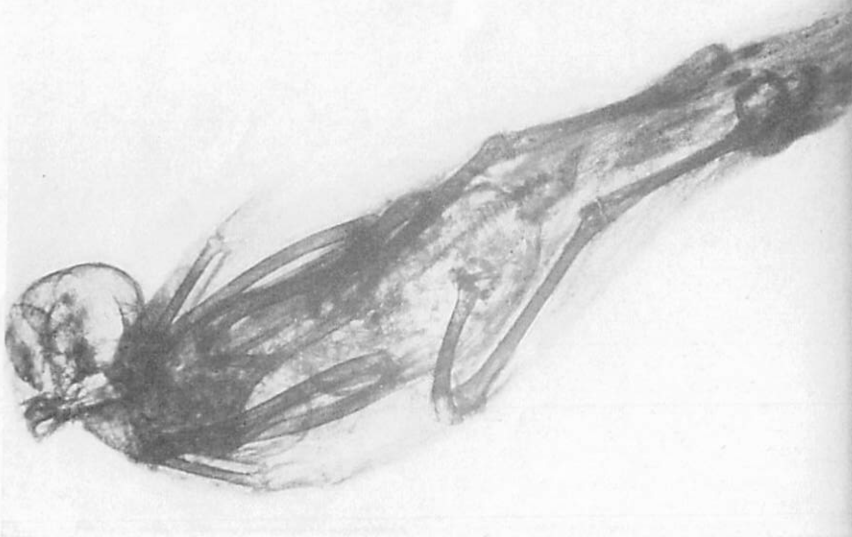

Fig. 10. *October 22nd*, 1896.
Mummy bird, from an Egyptian tomb.
3 min. exposure, 6 in. coil.

seventeen months old with a club hand. My notes inform me that the baby could not be persuaded to keep still, and our methods for fixation were of a very primitive nature, but radiographs to show the deformity and good enough for printing and the making of lantern slides were obtained with exposures of well under half a minute, even with the three-inch coil.

A few days later, June 17th, an adult woman was sent to me with a very ugly congenital deformity affecting both hands (Fig. 2). This time beautiful results followed on a two-minute exposure. The bone deformities were different in the two hands, were very extensive, and one was much struck at the time with the exact picture produced by X-rays, the exact nature of the deformities, and so on. This exact knowledge was quite unobtainable by the methods of an ordinary examination, and it was realized that the surgical treatment of many such cases would be materially influenced by radiography.

On June 19th I was asked to examine the wrist region of an adult woman to see if a piece of a needle was anywhere about (Fig. 3). This was the first case of a " foreign body " which came to me. X-rays found it all right, but I regret to say that the Surgeon did not. There was no localisation possible in those days other than two views at right angles to one another, and the surgery for the removal of pieces of needle—usually in the palm of the hand—was very uncertain, to say the least of it. Not infrequently worried doctors brought their patients to me after an unsuccessful operation and asked me to try and find the foreign body. Curiously enough I nearly always succeeded without any trouble.

On June 25th a six-weeks-old ununited fracture of an adult forearm showed both bones broken and in malposition, and no shadow of callus. Suitable treatment having been given radiographs taken just five months later showed firm bony union. This was my first " follow up " case and taught that uses of radiography in fracture cases by no means always stopped at the first diagnosis.

The next thing was what would X-rays show in cases of old standing " rheumatoid arthritis." Dr. Macalister asked me to take the apparatus to the Home for Incurables (you see we were mobile in the earliest of days) and take plates of a series of hands and of some feet of bed-ridden old women. This was done on June 27th and the results were successful and, at the time, of very great interest.

On July 20th a hand and wrist of a man suffering from hypertrophic pulmonary osteo-arthropathy showed in a marked degree the bone changes associated with this disease. I looked at the plates with interest and awe, but not recognizing what it all meant missed, I am afraid, an opportunity of being the first to describe the X-ray changes in this disease (Fig. 4, Fig. 5).

Just about this time a six-inch spark coil arrived and after this most of the radiographs were made with it.

On August 7th a woman was examined who had a more or less useless hand following upon an unreduced Colles fracture. Cases of this kind were much too frequent in those days.

We saw for the first time, radiographically the so-called "atrophic bone changes," which we learnt to know so well later on. At this time neither Robert Jones nor myself had sufficient acquaintance with the radiological findings to enable us to be sure as to the explanation.

I had noticed when I first began that in a radiograph of a lady's hand the diamonds in a large marquise ring did not cast shadows, and the gold claws appeared to be empty. So on August 7th I took a radiograph of a diamond star, a brooch with paste stones, etc., and realised that diamonds were very transparent to X-rays and that the paste was densely opaque (Fig. 6).

This recalls to me that I was giving a popular lecture on X-rays, illustrated by lantern slides. It was for some charity, and I had arranged a dark room so that, after my lecture, people could come in, after payment of a fee, and see their hands on a fluorescent screen. I had shown and explained lantern slides of diamonds and paste in the course of the lecture. A very over-dressed lady came in and looked very carefully at one of her hands. I looked also. She was obviously examining a very large ring and the stones were densely opaque to X-rays. From the quite unprintable and vitriolic remarks she made in an undertone as she took her departure it was quite evident that I had

(*a*) palm down. (*b*) on the side.

Fig. 11. *October 31st*, 1896.

Piece of an iron fork in the finger for three months.
Bone changes in surrounding bone, the foreign body being in the bone.
2 min. exposure for each, 6 in. coil.

A six-inch coil and an exposure of fifteen minutes. Little did I anticipate the huge numbers of these cases I was destined to examine in the ensuing years.

Immediately on this came a dramatic and signal triumph. On October 2nd Dr. Francis Johnston of Birkenhead sent over two small boys, one with a more or less positive diagnosis of having swallowed a half-penny six days previously, the other with a very dubious history of having swallowed a similar coin on September 25th of 1895, over one year ago.

The boys were $2\frac{1}{2}$ years and $3\frac{1}{2}$ years of age, and their examinations were not an easy matter. However, on a small and not very efficient screen I was able to make out that each had a coin in his œsophagus at the level of the upper end of the sternum. Plates were taken of each case, an exposure of thirteen minutes being given. These confirmed the positive screen observations. Both coins were removed next day by Dr. Johnston, without any difficulty, with an ordinary " coin catcher " (Fig. 9).

The history of the elder boy was drama. For a year, *i.e.*, from the time he swallowed the coin—he had had more or less a constant cough—he got up a lot of purulent expectoration, and was a very sick child. He was supposed to have some form of tubercle and had been seen by many medical men. Following immediately on the removal of the coin he made a rapid and complete recovery.

On October 14th the femora of a girl nine years of age suffering from osteomalacia were examined, and showed a somewhat rare condition. The exposures were one of ten minutes and another of fifteen.

On October 22nd an attempt was made to find out the density of a series of bladder stones from the museum, and certain facts were established.

We have heard in more or less recent years of the radiography of Egyptian mummies. Every now and then the daily press has something to say on the subject. On October 22nd a friend brought me a large red block, hard and smooth, the shape of and the look of a rather large red brick. I was told that it had come from an Egyptian tomb and was at least 2,000 years old, and the owner wanted to know if I could tell what was in it.

I radiographed the object, giving only a three-minute exposure. The result was a really beautiful plate. In the centre was the shadow of a small bird, all the bones clearly defined, and the rest of the " brick " was so transparent to X-rays that it cast no shadow at all. From the radiographic point of view the advantage of this class of subject is that there is no movement to contend with (Fig. 10).

On October 28th a girl of 17 years of age was examined to show the appearances of an outward and congenital displacement of a patella. Exposure fifteen minutes.

On October 31st a man aged 21 years was sent to me by Dr. Yeoman of Neston because of a sinus in a finger for three months which would not heal up. It had followed on a wound to the finger from an iron fork. Two radiographs at right angles to one another showed two things : one, that a small metallic foreign body was in the bone, and the other that it had caused bone changes—destructive in character—in the adjacent bone (Fig. 11). This was the first time we became radiographically aware of the latter, and it was also the first time we had seen a foreign body inside a bone.

On November 2nd I attempted to find if some false teeth had been swallowed, and also tried to find out if there was a foreign body in an eye. These were radiographic failures inasmuch as the plates obtained were not good enough for a negative diagnosis. However the attempts were made.

On December 4th a radiograph was made of a seven months foetus showing some deformities. It had six toes, a deformed face, and no nose (Fig. 12). This was the first time a whole foetus was exposed on one plate, and again was of interest from the ossification point of view. For the same reason as in the case of the mummy bird, it was a relief to have something to examine which would keep still and which was not frightened of our apparatus, the sparks, and so on.

On December 5th it is of interest to note that I obtained my breakfast fish from the cook, a whiting, and used it first for radiological purposes

The note book also records that on December 8th I examined an adult male as being a " stomach case." A plate was exposed for one hour with a negative result. Of course, it was not a Barium meal case, and I have no note of what the examination was for, but at any rate as early as this we had the temerity to attempt abdomens, even in adults.

An experimental plate was made on December 19th—some lead soldiers were placed in a cardboard box and a radiograph of them was successfully made through a block of wood $6\frac{1}{4}$ inches thick. It was a thirty minutes exposure.

The total number of plates taken was 261.

And that is all.

To summarize what was done :—

A number of plates for testing purposes.
Several cases of exostoses.
Congenital deformities of various kinds—club hand, talipes equino-varus, cases of deformities of the bones and hands.
Fractures, old and recent, to show cause of non-union, and follow-up cases.
Pieces of needle, mostly hands and feet.
Rheumatoid arthritis.
Osteitis.
Hypertrophic pulmonary osteo-arthropathy.
Strumous dactylitis.
Tuberculous disease of various joints.
Various dislocations, traumatic.
Congenital displacement of the patella.
Congenital dislocation of the hip.
Enchondromata.
Osteoma.
Fœtuses.
Coins in the oesophagus.
Foreign bodies such as bullets, swallowed coins, swallowed tooth plate, foreign body in the eye (an attempt to show), a swallowed trouser button (seen in the rectum and afterwards passed).
A series of children's hands to show bone growth.
Rickets.
Metatarsalgia.

A piece of an iron fork in a bone and resulting bone changes.
Attempts to examine chests and even the abdomen.
To show the density of various stones.
To show the density of diamonds and paste.
To demonstrate a " mummy bird."
X-ray of a fish to show the bones.
Sprengel's deformity.
Osteomalacia, etc.

Well, I have done my best to visualize to you how matters were in 1896, the apparatus we had, the conditions under which the work was done, and the results obtained.

From the purely monetary point of view it meant bankruptcy. It cost me far more than I made out of it.

It is not very easy to visualize it all now. Our utter want of knowledge from every point of view—it might take a whole morning or afternoon, to finish with one case—no assistance from anything, and no assistance, trained or otherwise, from anyone.

I looked after my apparatus, made the necessary examinations, developed the plates, made the prints, and made my own lantern slides ; midnight was often an early hour to knock off. However, it was done, and I don't regret it ; and it was the foundation-stone of the work which followed.

Looking back it was a wonderful experience, although at the time our disappointments were many, our difficulties very great, and I do not think that at the time one quite realized how wonderful it was, and most certainly one did not realize what, for me, it was going to lead to. It is quite certain that none of the later radiologists can have had the excitement and the thrills which we, who started in 1896, had in overwhelming abundance.

The first ten years of X-ray work, if it was at the time a bit of a nightmare, was an experience which it is a pleasure to look back upon. One has perhaps forgotten the failures, but one has not forgotten the successes.