



An Early History of Röntgen's Discovery

At Deakin University, we have recently been encouraging our students to investigate the early history and the pioneers who underpin what we often take for granted in our modern medical radiations professions.

In my supporting research, I came across several books^{1,2} that reproduce the work of a newspaper reporter known as H.J.W. Dam, writing in the late 1800s for the popular American public interest periodical, *McClures Magazine*.³

Immediately news of the discovery of x-rays broke, Dam had been dispatched to Würzburg to interview Wilhelm Conrad Röntgen, and his resulting 'word picture', appearing in the April 1896 edition of *McClures* is the most enlightening piece I have ever read, revealing with a refreshing clarity the wonder of his encounter with this new magic, but also the gently erudite humanity of its discoverer.

Extracts of his report are reproduced here, verbatim, with my own occasional comments, and to Henry Jackson Wells Dam, for his remarkable narrative skill and obvious foresight at that early encounter, I am forever indebted for opening yet another window into radiography, and giving me the means to effectively 'be there'.

The new marvel in photography

"I set out for Würzburg to see the discoverer and his laboratory... All knew the residence of Professor Röntgen (pronunciation: "Renken"), and directed me to the Pleicher Ring. The various buildings of the university are scattered in different parts of Würzburg, the majority being in the Pleicher Ring, which is a fine avenue, with park along one side of it, in the centre of the town. The Physical Institute, Professor Röntgen's particular domain, is a modest building of two stories and basement, the upper story constituting his private residence, and the remainder of the building being given over to lecture rooms, laboratories, and their attendant offices."³ (p. 409)
(BH note: As I described in a previous issue of *Spectrum*⁴, I have visited the preserved Röntgen laboratory in Würzburg, and this scene remains pretty much as described.)

"At the door I was met by an old serving-man... [who] conducted me along a wide bare hall, running the length of the building, with blackboards and charts on the walls.



The city of Würzburg

At the end he showed me into a small room on the right. This contained a large table desk and a small table by the window, covered with photographs, while the wall held rows of shelves laden with laboratory and other records. An open door led into a somewhat larger room, perhaps twenty feet by fifteen, and I found myself gazing into a laboratory which was the scene of the discovery – a laboratory which, though in all ways modest, is destined to be enduringly historical.³(p. 410)

"There was a wide table shelf running along the farther side, in front of the two windows, which were high, and gave plenty of light... There was a table in the left hand corner; and another small table – the one on which living bones were first photographed – was near the stove, and a Ruhmkorff coil was on the right. The lesson of the laboratory was eloquent. Compared, for instance, with the elaborate, expensive and complete apparatus of, say, the University of London, or of any of the great American Universities, it was bare and unassuming to a degree. It mutely said that in the great march of science it is the genius of man, and not the perfection of appliances, that breaks new ground in the great territory of the unknown. It also caused one to wonder at and endeavor to imagine the great things which are to be done through elaborate appliances with the Röntgen rays – a field in which the United States, with its foremost genius of invention, will very possibly, if not probably, take the lead – when the discoverer himself had done so much with so little."³(p. 410)

"Professor Röntgen entered hurriedly, something like an amiable gust of wind. He is a tall, slender, and loose-limbed man, whose whole appearance bespeaks enthusiasm and energy. He wore a dark blue sack suit, and his long dark hair stood straight up from his forehead as if he were permanently electrified by his own





enthusiasm. His voice is full and deep, he speaks rapidly, and, altogether, he seems clearly a man, who, once upon the track of a mystery which appealed to him, would pursue it with unremitting vigor. His eyes are kind, quick, and penetrating; and there is no doubt that he much prefers gazing at a Crookes tube to beholding a visitor, visitors at present robbing him of much valued time. The meeting was by appointment, however, and his greeting was cordial and hearty. In addition to his own language he speaks French well and English scientifically, which is different from speaking it popularly. These three tongues being more or less within the equipment of his visitor, the conversation proceeded on an international or polyglot basis, so to speak, varying at necessity's demand.^{3(p. 410)}

"Now then," he said smiling and with some impatience, when some personal questions at which he chafed were over, 'you have come to see the invisible rays.'

'Is the invisible visible?'

'Not to the eye, but its results are. Come in here.'^{3(p. 411)}

"He led the way to the other square room mentioned and indicated the induction coil with which his researches were made, an ordinary Ruhmkorff coil, with a spark of from four to six inches, charged by a current of twenty amperes. Two wires led from the coil through an open door, into a smaller room on the right. In this room was a small table carrying a Crookes' tube connected with the coil. The most striking object in the room, however, was a huge and mysterious tin box about seven feet high and four feet square. It stood on end, like a huge packing case, its side being perhaps five inches from the Crookes tube.

"The professor explained the mystery of the tin box, to the effect that it was a device of his own for obtaining a portable dark room. When he began his investigations he used the whole room, as was shown by the heavy blinds and curtains so arranged as to exclude the entrance of all interfering light from the windows. In the side of the tin box at the point immediately against the tube, was a circular sheet of aluminium one millimetre in thickness and perhaps eighteen inches in diameter, soldered to the surrounding tin. To study his rays the professor had only to turn on the current, enter the box, close the door, and in perfect darkness inspect only such light or light effects as he had a right to consider his own, hiding his light, in fact, not under a Biblical bushel but in a more commodious box.^{3(p. 411)}

"Step inside,' said he, opening the door which was on the side of the box farthest from the tube. I immediately did so, not altogether certain whether my skeleton was to be photographed for general inspection or my secret thoughts held up to light on a glass plate. 'You will find



Röntgen's Laboratory, visited in 2013

a sheet of barium paper on the shelf,' he added, and then went away to the coil. The door was closed and the interior of the box became black darkness. The first thing I found was a wooden stool on which I resolved to sit. Then I found the shelf on the side next to the tube, and then a sheet of paper prepared with barium platino-cyanide. I was thus being shown the first phenomenon which attracted the discoverer's attention and led to the discovery, namely, the passage of rays, themselves wholly invisible, whose presence was indicated by the effect they produced on a piece of sensitized photographic paper. "A moment later, the black darkness was penetrated by the rapid snapping sound of the high pressure current in action, and I knew that the tube outside was glowing."^{3(p. 412)} (*BH note:* This sound was almost certainly a 'chatterer' or 'interruptor' – the early mechanical means of creating, from a wet-cell D.C. supply, a crude form of alternating current that the induction coils/transformers need in order to function). "I held the sheet vertically on the shelf, perhaps four inches from the plate. There was no change, however, and nothing was visible.

'Do you see anything?'

'No.'

'The tension is not high enough,' and he proceeded to increase the pressure by operating an apparatus of mercury in long vertical tubes acted upon automatically by a weight lever^{3(p. 412)} (*BH note:* Almost certainly this was a form of Sprengel vacuum pump and Röntgen was increasing the x-ray tube's ability to carry current by lowering the pressure within.) "In a few moments the sound of the discharge again began, and then I made my first acquaintance with the Röntgen rays.

"The moment the current passed, the paper began to glow. A yellowish-green light spread all over its surface in clouds, waves and flashes. The yellowish-



green luminescence, all the stranger and stronger in the darkness, trembled, wavered and floated over the paper, in rhythm with the snapping of the discharge. Through the metal plate, the paper, myself, and the tin box, the invisible rays were flying, with an effect strange, interesting and uncanny. The metal plate seemed to offer no appreciable resistance to the flying force, and the light was as rich and full as if nothing lay between the paper and the tube.^{3(p. 412)}

‘Put the book up,’ said the professor.

‘I felt upon the shelf, in the darkness, a heavy book, two inches in thickness, and placed this against the plate. It made no difference. The rays flew through the metal and the book as if neither had been there, and the waves of light, rolling cloud-like over the paper, showed no change in brightness. It was a clear, material illustration of the ease with which paper and wood are penetrated. And then I laid the book and paper down and put my eyes against the rays. All was blackness, and I neither saw nor felt anything. The discharge was in full force, and the rays were flying through my head, and, for all I knew, through the side of the box behind me. But they were invisible and impalpable. They gave no sensation whatever. Whatever the mysterious rays may be, they are not to be seen and are to be judged only by their works.

‘I was loath to leave this historical tin box, but the time pressed. I thanked the professor, who was happy in the reality of his discovery, and the music of his sparks. Then I said: ‘Where did you first photograph living bones?’

‘Here,’ he said, leading the way into the room where the coil stood. He pointed to a table on which was another – the latter a small, short-legged wooden one, with more the shape and size of a wooden seat. It was two feet square and painted coal black.^{3(p. 412)}

‘How did you take the first hand photograph?’ I asked.

‘The professor went over to a shelf by the window, where lay a number of prepared glass plates, closely wrapped in black paper. He put a Crookes tube underneath the table, a few inches from the underside of its top. Then he laid his hand flat on the top of the table, and placed the glass plate loosely on his hand.

‘You ought to have your portrait painted in that attitude,’ I suggested.

‘No, that is nonsense,’ said he, smiling. ‘Or be photographed.’ This suggestion was made with a deeply hidden purpose.

‘The rays from the Röntgen eyes instantly penetrated the deeply hidden purpose. ‘Oh, no,’ said he; ‘I can’t let you make pictures of me. I am too busy.’ Clearly the professor



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was entirely too modest to gratify the wishes of a curious world.^{3(p. 413)}

‘Now Professor,’ said I, ‘will you tell me the history of the discovery?’

‘There is no history,’ he said. ‘I have been for a long time interested in the problems of the cathode rays from a vacuum tube as studied by Hertz and Lenard. I had followed theirs and other researches with great interest, and determined, as soon as I had time, to make some researches of my own. This time I found at the close of last October. I had been at work for some days when I discovered something new.’

‘What was the date?’

‘The eighth of November’

‘And what was the discovery?’

‘I was working with a Crookes tube covered with a shield of black cardboard. A piece of barium platino-cyanide paper lay on the bench there. I had been passing a current through the tube and I noticed a peculiar black line across the paper’

‘What of that?’

‘The effect was one which could only be produced, in ordinary parlance, by the passage of light. No light could come from the tube, because the shield which covered it was impervious to any light known, even that of the electric arc.’

‘And what did you think?’

‘I did not think; I investigated. I assumed that the effect must have come from the tube, since its character indicated that it could come from nowhere else. I tested it. In a few minutes there was no doubt about it. Rays were coming from the tube which had a luminescent effect upon the paper. I tried it successfully at greater and greater distances, even at two metres. It seemed at first a new kind of invisible light. It was clearly something new, something unrecorded.’

‘Is it light?’

‘No.’

‘Is it electricity?’

‘Not in any known form.’

‘What is it?’

‘I don’t know... Having discovered the existence of a new kind of rays, I of course began to investigate what they would do... It soon appeared from the tests that the rays had penetrative power to a degree hitherto unknown. They penetrated paper, wood and cloth with ease; and the

thickness of the substance made no perceptible difference within reasonable limits... The rays passed through all the metals tested, with the facility varying, roughly speaking, with the density of the metal. These phenomena I have discussed carefully in my report to the Würzburg society, and you will find all the technical results therein stated... Since the rays had this great penetrative power, it seemed natural that they should penetrate flesh, and so it proved in photographing the hand, as I showed you.’^{3(p. 413-4)}

‘What of the future?’

‘I am not a prophet, and I am opposed to prophesying. I am pursuing my investigations, and as fast as my results are verified I shall make them public.’

‘Do you think the rays can be so modified as to photograph the organs of the human body?’

‘In answer he took up the photograph of the box of weights.’ (BH note: I cannot locate a reproduction of this photograph which is of adequate quality for reproduction in *Spectrum* – however, as Röntgen seems to indicate, on the published image, the variations in image density speak of bone, soft tissue and gas bubbles). ‘Here are already modifications,’ he said, indicating the various degrees of shadow produced by the aluminium, platinum and brass weights, the brass hinges and even the metallic stamped lettering on the cover of the box, which was faintly perceptible.

‘But Professor Neusser has already announced that the photographing of various organs is possible.’

‘We shall see what we shall see,’ he said. ‘We have the start now; the developments will follow in time...’

‘When I have done it, I will tell you,’ he said, smiling, resolute in abiding by results. ‘There is much to do and I am busy, very busy...’

‘He extended his hand in farewell, his eyes already wandering toward his work in the inside room.’^{3(p. 414)}

Bruce Harvey

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