

Professor Röntgen was a European ahead of his time

Wilhelm Conrad Röntgen was born in Lennep (now Remscheid-Lennep) , between Cologne and Dortmund , on March 27th 1845. His father, a cloth merchant, lived in the house at N° 1 Gänsemarkt. His father left Germany in 1848 and went to the Netherlands where he hoped to find better prospects for his trade; the Röntgens settled in the city of Apeldoorn where his wife's family lived. Young Conrad attended the primary and secondary schools there until he was 16. In addition to German, he spoke fluent Dutch, his mother's native tongue.

From 1862 he attended a small technical school in Utrecht, where boys from 14 to 18 years old were trained for jobs in industry .

After further private study he was able to enter the University of Utrecht, but only as an unofficial student, in January 1865. However, in November of that year he successfully applied to the Zürich Polytechnic to study mechanical engineering and was fortunate in being excused the entrance examination.

A **ludicrous incident** was to end this first period of his life, though the consequences were eventually to prove fortunate. One of his friends had drawn a caricature of their teacher in chalk on the heating stove. The teacher did not appreciate the quality of this masterpiece and asked Röntgen to give him the name of the artist. As a result of Röntgen's refusal to betray the name of his fellow student, he was expelled from the institution, despite being a brilliant pupil. Thus deprived of the chance to matriculate, he was failed in the University entrance examination, after studying at home, by one of his unsympathetic teachers.



Every year as a student he received congratulations from his tutor and by the end of the three year cycle he obtained the maximum mark in eight of the eleven topics, almost the maximum in two others and a very good mark for the last. In 1868 he graduated as an engineer of the Polytechnic Institute of Zürich. He decided to stay for one more year and prepared a thesis, "Studien Ober Gase", a theoretical study of the properties of gases which entitled him to apply for PhD at the University of Zürich.

Young Röntgen lived near the Institute and one of **the houses in the neighbourhood was to play an important part in his life**. On its ground floor was the inn "Zum grünen Glas", mainly frequented by professors and students. The German innkeeper Johann Gottfried Ludwig had fled to Switzerland following the 1830 revolution. As well as serving food, he was able to translate the essays of his young customers into Latin.

Röntgen was not only attracted to Herr Ludwig's good meals. In 1869 he asked him for the hand of the second of his three daughters, Anna Berta. Röntgen was assistant to Kundt, who in 1870 was chosen to be head of the department of physics in the University of Würzburg. Kundt took Röntgen with him in 1871 but because Röntgen had been prevented from completing his classical studies, his ignorance of Latin barred him from an official post. In the next year he became Professor Kundt's assistant in Strasbourg, a new university free from rigid traditions. On January 19th 1872 he went to Apeldoorn to marry Anna Berta Ludwig, with whom he returned to Strasbourg. The senior Röntgens joined them there.

One year later Kundt, with the support of the famous chemist von Sayer (a Nobel prizewinner in chemistry in 1905) had his young assistant promoted to "Privatdozent" (instructor) in the new physics institute. In 1875 Röntgen became professor of mathematics and physics in the Agricultural Academy of Hohenheim in Württemberg. Mediocre working conditions there impeded his researches, so he asked Kundt to arrange for him to return to Strasbourg. Back in this city he was promoted in 1876 as associate professor in theoretical physics.

Continuing his university tour he became professor in Giessen in 1879. During his stay in this city he lost his father and mother who are buried in the municipal cemetery.

In October 1888 the researcher was asked to become head of the Würzburg Institute of Physics. At the age of 43 he was invited at the institute to take the important post of professor, where, a few years before, he was denied access to the lowest rank of the university hierarchy. On January 2nd 1894 Röntgen was even chosen to be Rector (equivalent to Vice-Chancellor in an English university). It was in 1894 that he began to investigate the so-called "cathodic rays" identified by the two German researchers Hertz and his student Lenard. The new rays were perplexing all the physicists of that time. In 1892 Hertz had already noted that these rays, said by him to be "electrically neutral", passed through a very thin sheet of metal. Lenard showed in 1894 that the cathodic rays could emerge from the tube in which they were produced through a metallic sheet of 0.25 mm thickness which was strong enough to conserve the vacuum within the apparatus.

On the evening of November 8th 1895 Röntgen, alone in his laboratory, made the great discovery on which his fame rests.

Experimenting without any help and using a Hittorf vacuum tube entirely wrapped in black paper, he saw a sheet of paper coated with barium platinocyanide (which he was using to detect the Lenard rays) develop a luminescence which was crossed by a dark line. The line probably came from part of the apparatus casting a shadow on the screen.

"The line, said Rontgen, was the effect of 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.

...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... The rays penetrated paper, wood and cloth with ease."

The new phenomenon was so curious that Röntgen started to doubt his own intellectual integrity. He repeated the experiments endlessly. He went home late and sat absentminded at the table.

Frau Röntgen experienced several terrible days. The story goes that she "asked for an explanation". The professor took his wife to see the laboratory and then radiographed her hand.

At the end of the presentation his friend Professor von Kolliker A. lent his hand for the production of a radiograph in front of the audience. On March 9th 1896 and March 10th 1897 Rontgen published two other papers on this subject: no other works about this topic would follow.

From the start, the discoverer laid stress on a very important area of medical application by saying that:

"if the hand is held between the discharge tube and the screen, the shadow of the bone is seen to be darker than that of the smooth outline of the hand".

On December 28th, in the middle of the popular German Christmas celebrations, the secretary of the Medical-Physical Society of Würzburg received a document from the researcher entitled "Ober eine neue Art von Strahlen" (about a new kind of rays). It was Röntgen's first publication about his new discovery. On January 13th, in Berlin in the presence of Kaiser Wilhelm II, Prof Röntgen made his first presentation. The last time Röntgen spoke in public on the subject of X-rays was again in Würzburg on January 23rd 1896



At the beginning of 1896 the news became the subject of discussion in almost every country of the world. Although the researcher had posted accounts of his discoveries to his most illustrious German and foreign colleagues, it was mainly through the non-specialist press that the world came to know about the mysterious rays. Immediately, scientists showed great interest in the discovery. For example, in January 1896, less than three weeks after Röntgen's first communication, a large number of investigators were obtaining the first radiographic pictures in Belgium. At the time, these were known as cathodographs.

In 1901, though work and life were enjoyable in Würzburg, Röntgen moved to München. to take the directorship of the physics Institute of the City University. From thereon, he paid no attention to X-rays but resumed his previous research projects. His activities in physics were much more extensive than the discovery of X- rays. If the researcher seemed to withdraw from the world, the world did not forget him.

Following a proposal from the American Academy of Science, Columbia University gave him the Barnard Medal and the Academy of Medicine in Paris nominated him among its first foreign associates.

When, in 1901, the Academy of Sciences of Sweden was to give the Nobel prize for the first time, it was natural that Röntgen should be elected for the physics prize. He left for stock- holm to receive the award from the hands of the Crown Prince on December 10th 1901.

The odd thing is that, unlike the other laureates, he did not deliver a speech. After being honoured he escaped by a back door and returned to Munich. He resumed the directorship of his institute, the writing of lectures and the careful preparation of practical demonstrations for his students.

He lost his wife on October 31st 1919, at the age of 81 and after many years of suffering. He was very lonely. He retired from his chair in Munich in the spring of 1920. He died on February 10th 1923 in his house at 11 Maria- Theresienstrasse in München at the age of 78. He was buried in Giessen next to his wife and parents.