The discovery of radioactivity

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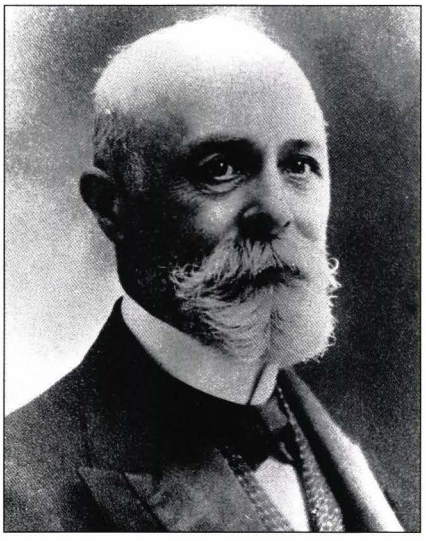
The image age began in 1895, when Wilhelm Conrad Röntgen discovered X-rays while experimenting with cathode-ray tubes. Within weeks, radiological photos taken in Vienna, Paris and London were already enabling doctors to make diagnoses.

As he examined one of those pictures, in Paris in January 1896, Henri Becquerel became interested in the mechanism by which X-rays are produced and particularly in its links with fluorescence. Two months later he showed that a natural element, uranium, spontaneously emits rays closely resembling X-rays. It is from this discovery of natural radioactivity that emerged, first radium – isolated by Pierre and Marie Curie in 1898 – and then its medical applications, greater understanding of the structure of the atom, radiochemistry, artificial radioactive isotopes and – eventually – atomic energy. The discovery of the electron in 1897 by Joseph John Thomson laid the basis for modern electronics and specifically for its medical applications.

Thus, within the space of three years, three discoveries – of X-rays, radioactivity and electronics – were made which were to dominate the 20th century. In 1934, the discovery of artificial radioactivity by Irène and Frédéric Joliot-Curie gave a new boost to the medical applications of radioactivity. We learnt how to manufacture radioactive isotopes from most of the natural elements and, thanks to the radiation that they emit, we could track them or the molecules into which they had been introduced in the interior of the organism. This method of using trace elements had been pioneered by Georg von Hevesy with natural radioisotopes since 1913. Antoine Lacassagne discovered the principle of autoradiography in 1922. It was on these foundations that nuclear medicine was to be rapidly built up between 1935 and 1939, and especially after 1945.



Henri Becquerel discovered radioactivity at the age of 44 when he was examining Röntgen's early X-ray images.

Using trace elements

From 1948 onwards, patients were being injected with artificial radioisotopes to see what became of them, thus permitting the study of their topographical spread within the body. For instance, by examining what happens to radioactive iodine introduced into the thyroid, we can measure the radioactivity of this gland and observe its morphology. Subsequently scintigraphy and the scintigraphic camera provided high quality images which can be analysed to assess the functions of different parts of a single organ. Since 1970, scintigraphy has become an essential tool for exploring the functioning of a great number of organs and associated tissues. Thanks to the positron camera, tomoscintigraphy and functional imaging, nuclear medicine is today one of the most dynamic branches of medical imaging.

The use of radioactive tracers has afforded biology a great leap forward because of its extraordinary sensitivity which enables us to track small numbers of atoms or molecules. It has been a decisive tool in the birth and development of molecular biology.

Alongside radiodiagnosis and nuclear medicine, radiotherapy forms the third branch of radiology. It was born in 1896, but the discovery of radium in 1903 gave it a new dimension. The progress made over the past hundred years has confirmed it as one of the principal weapons for treating cancer. In any effective cancer control programme today, radiotherapy – alone or in association with surgery or chemotherapy – is needed for over half of the patients suffering from cancer.

Radiobiology and radioprotection also deserve a mention. From the first years of this century, it was known that ionizing radiation can cause cancer and leukaemia. Between 1920 and 1939, the frequency of leukaemia among radiologists was ten times higher than among other physicians. In 1934, we first began to understand the relation between the dose and the risk of cancer; a number of simple rules of radiation protection were laid down and a maximum permissible dose limit was introduced. Although this was relatively high compared with the levels enforced today, those recommendations were sufficient to check the excess of leukaemia in radiologists; since 1950, that frequency is no higher among radiologists than among other doctors. ■

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