Biography

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A contribution of Józef Rotblat, a winner of the Nobel Peace Prize, to the development of nuclear medicine

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Many prominent scientists have an indisputable contribution to the rise and development of nuclear medicine. Over a dozen of them have won the Nobel Prize. Some have received this award for their fundamental achievements in the discovery of natural and artificial radioactivity, describing a number of laws governing these phenomena and extracting first radionuclides (Henri Becquerel, Maria Skłodowska-Curie, Piotr Curie, Ernest Rutherford, Frederic Soddy, Frederic Joliot, Irena Curie-Joliot, Enrico Fermi, Ernest Lawrence) [1].

George de Hevesy (often perceived as the "father of nuclear medicine") was awarded the Nobel Prize for the first use of radioisotopes as radiotracers in a study of biochemical processes in living organisms [2]. Other Nobel Prize winners, Emilio Segre and Glenn Seaborg, discovered, among others, basic radionuclides which are used in nuclear medicine: radioactive iodine -131 (^{131}I) and radiotechnetium (^{99m}Tc) [3, 4], and Robert Hofstadler invented a scintillation counter for the detection of ionizing radiation [5].

All the above scientists have become Nobel Prize winners in the field of physics and/or chemistry. Józef Rotblat (1908–2005) is the only laureate of the Nobel Peace Prize with important, though slightly forgotten, services for nuclear medicine, which gave him a permanent place in the history of this field. Like Maria Skłodowska-Curie, he was born in Warsaw; he was a nuclear physicist by education, and devoted a significant part of his subsequent scientific activity to the research on the practical application of radioisotopes in medicine and to radiobiology issues.

Rotblat graduated in 1932 from the Faculty of Mathematics and Natural Sciences of the Free Polish University in Warsaw, from 1933 on he was an assistant to prof. Ludwik Wertenstein (student of Maria Skłodowska-Curie) in the Radiological Laboratory of the Warsaw Scientific Society and from 1937 the deputy director of the Institute of Atomic Physics of his home University. A year later, at the University of Warsaw, he defended his doctoral dissertation devoted to the study of neutron disintegration processes. Fascinated with nuclear physics, Rotblat dealt with nuclear reactions, neutron research, radionuclides of uranium, radium, cobalt and nickel, and published the results of his research in the years 1934–1939 in the prestigious journal Nature [6–9].

Already in 1939 he realized that the construction of the atomic bomb was possible. In spring 1939, as a promising nuclear physicist, Rotblat went on a scholarship to Liverpool, where the university's Faculty of Physics was led by Professor James Chadwick, who had been awarded the Nobel Prize for the discovery of a neutron several years earlier. The British Nobel Prize winner was impressed by the scientific potential of the young Pole and quickly granted him a British scientific scholarship named after Olivier Lodge (the Pole was the first foreigner who received it). In view of the relatively favorable financial situation, Rotblat took a short vacation and set out to Poland in August 1939 to bring his wife to Liverpool. He did not know that she had just undergone acute appendicitis and her trip to England was at that time impossible. Rotblat returned to Liverpool alone; the wife was supposed to arrive after a dozen or so days. Unfortunately, the outbreak of the World War II changed this plan. Attempts to organize her later departure from Poland turned out ineffective. Tola Rotblat shared the tragic fate of the majority of Jews in Poland occupied by Germans; in 1942, she was murdered in the German Nazi camp in Bełżec. It wasn't until after the war that Rotblat found out about the extermination of his family by fascists [10].

The Pole has been conducting secret research on uranium weapons in Liverpool since 1940. In 1944, as a member of the British mission led by prof. Chadwick, Rotblat participated in the Manhattan Project. He was the only scientist working in Los Alamos with Polish citizenship. When it became clear that the Germans would not be able to produce an atomic bomb in the coming years, and the production of this weapon at Los Alamos was only intended to ensure the military domination of the United States in the world, Rotblat abandoned the Manhattan project. He was the only scholar who resigned from the work on this project for moral reasons [10].

After the war he stayed in England (he accepted British citizenship) and started a campaign against the nuclear arms race. He devoted himself to the peaceful use of radionuclides and nuclear radiation for medical purposes.

In 1948, he went down in the annals of nuclear medicine by obtaining, with external measurements, the first "image" of the function of an internal organ accumulating an introduced earlier

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radionuclide. This primitive, from today's point of view, distribution map of radioiodine (^{131}I) in the thyroid of the patient was generated by Rotblat together with doctor George Ansell. They registered gamma rays with a collimated Geiger counter at many points of the neck and chest of the patient [11, 12]. Rectilinear scanners for scintigraphic images became available only a few years later [13].

Rotblat was also involved in studies of usefulness of radio-phosphor (^{32}P) and radioiodine (^{131}I) in the diagnosis and therapy of several types of cancer [10].

In 1950, he became a professor at the University of London and a head of the Department of Physics of the Medical College at the Saint Bartholomew Hospital in London. He contributed to the development of this institution by creating, among others, a Scientific Research Committee. As a medical physicist he focused his attention on radiobiology and dosimetry [14]. Working in the Hospital Physicists Association, he took part, in 1956, in launching of the now-renowned scientific journal "Physics in Medicine and Biology" [10].

Professor Rotblat remained committed to nuclear medicine for many years.

At the same time, as a critic of the concept of the strategy of military deterrence with regard to the use of nuclear weapons, he founded in 1957, along with an English philosopher Bertrand Russell, an international peaceful movement of scholars from around the world for the eradication of weapons of mass destruction – Pugwash (from the name of a small Canadian town where the first movement conference took place). He became the first Secretary General of this organization and its long-time activist, whose overriding goal was the idea of science serving peaceful purposes, applying high ethical standards in science and bearing responsibility for the results of scientific research.

In 1995, Józef Rotblat and the Pugwash movement were honored (half each) with the Nobel Peace Prize.

In 1998 he was granted a noble title in England. He maintained close ties to his homeland for the rest of his life (among all by holding the position of the chairman of the Faculty of Natural Sciences of the Polish Academic Society in Exile and a by staying a member of the Polish Academy of Sciences), always stressing that he was "a Pole with a British passport" [10].

References:

1. Lawson RA. Nobel history of nuclear medicine. Nowotwory. J Oncology. 2012; 62: 385–390.
2. Myers WG. Georg Charles de Hevesy: the father of nuclear medicine. J Nucl Med. 1979; 20(6): 590–594, indexed in Pubmed: 395289.
3. Livingood JJ, Seaborg GT. New isotope of iodine. Phys Rev. 1939; 53: 1015.
4. Richards P, Tucker WD, Srivastava SC. Technetium-99m: an historical perspective. Int J Appl Radiat Isot. 1982; 33(10): 793–799, indexed in Pubmed: 6759417.
5. Hofstadter R. Alkali Halide Scintillation Counters. Physical Review. 1948; 74(1): 100–101, doi: 10.1103/physrev.74.100.
6. Danysz M, Rotblat J, Wertenstein L, et al. Experiments on the Fermi Effect. Nature. 1934; 134(3399): 970–971, doi: 10.1038/134970a0.
7. Rotblat J. Induced Radioactivity of Nickel and Cobalt. Nature. 1935; 136(3439): 515–515, doi: 10.1038/136515a0.
8. Rotblat J. Application of the Coincidence Method to Testing the Lifetime and Level Scheme of Radium C'. Nature. 1939; 144(3640): 248–249, doi: 10.1038/144248b0.
9. Rotblat J. Emission of Neutrons accompanying the Fission of Uranium Nuclei. Nature. 1939; 143(3629): 852–852, doi: 10.1038/143852a0.
10. Górlikowski M. Noblista z Nowolipek. Józefa Rotblata wojna o pokój. Znak, Kraków 2018.
11. Ansell G, Rotblat J. Radioactive iodine as a diagnostic aid for intrathoracic goitre. Br J Radiol. 1948; 21(251): 552–558, doi: 10.1259/0007-1285-21-251-552, indexed in Pubmed: 18893269.
12. Harkness-Brennan L. An Introduction to the Physics of Nuclear Medicine. 2018, doi: 10.1088/978-1-6432-7034-0.
13. Cassen B. Instrumentation for 131I use in medical studies. Nucleonics. 1951; 9: 46–50.
14. Boag JW, Dolphin GW, Rotblat J. Radiation dosimetry by transparent plastics. Radiat Res. 1958; 9(6): 589–610, indexed in Pubmed: 13614646.