

[Rosalyn Sussman Yalow \(1921-2011\)](#) ^[1]

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Rosalyn Sussman Yalow co-developed the radioimmunoassay (RIA), a method used to measure minute biological compounds that cause immune systems to produce antibodies. Yalow and research partner Solomon A. Berson developed the RIA in the early 1950s at the Bronx Veterans Administration (VA) Hospital, in New York City, New York. Yalow and Berson's methods expanded scientific research, particularly in the medical field, and contributed to medical diagnostics. For this achievement, Yalow received the [Nobel Prize in Physiology or Medicine](#) ^[4] in 1977. The RIA technique is used to measure more than one hundred biochemical substances, including infectious agents, narcotics, and [hormones](#) ^[5], such as those used to diagnose [infertility](#) ^[6] and hypothyroidism.

Yalow was born on 19 July 1921, in the South Bronx borough of New York City. Her mother, Clara Zipper, migrated to the US from Germany at the age of four, while her father, Simon Sussman, was raised in New York City. Neither of Yalow's parents attended school beyond elementary grades, but they hoped that she and her older brother Alexander would both attend college. By age eight, Yalow said she wanted to be a scientist. During her early education, she showed interest and talent in mathematics and chemistry. After graduation from Walton High School, she attended Hunter College for women in New York City, which offered free tuition for New York City residents. During college, Yalow studied physics, due to the influences of her professors and the story of Marie Curie, a two-time Nobel laureate. In 1941, at the age of nineteen, Yalow graduated magna cum laude as Hunter College's first physics major.

Yalow had difficulty being accepted into a graduate program. In 1940 she became a secretary at [Columbia University](#) ^[7]'s College of Physicians and Surgeons, in New York City, a job that enabled her to attend classes for free. Soon, many male teachers left their university positions to serve in World War II, providing more teaching opportunities for women. Yalow accepted a teaching assistantship as part of her graduate studies program in physics in 1941 at the College of Engineering at the [University of Illinois](#) ^[8], in Urbana-Champaign, Illinois. She was the only female among a group of 400 faculty and teaching fellows. In graduate school Yalow studied nuclear physics, completing her Master's of Science in 1942 and continuing on to pursue her doctorate. Those studies increased her ability to develop and implement methods for detecting radioactive substances. Maurice Goldhaber, who would later become the Director of Brookhaven National Laboratories, advised Yalow throughout her graduate career.

In 1943 Yalow married Aaron Yalow, the son of a Jewish rabbi from Syracuse, New York, whom she had met two years earlier. Later they had two children, a son, Benjamin, and a daughter, Elanna. While Aaron remained in Urbana to continue his graduate program in physics, Yalow completed her graduate work, earning her PhD in nuclear physics in 1945. She then returned to New York City, where she became an assistant engineer at the Federal Telecommunications Laboratory (FTL). She was the first female engineer at the laboratory. Aaron finished his program and joined her in New York later that year. In 1946 the FTL relocated and Yalow was hired at Hunter College as a physics professor teaching pre-engineering courses to veterans returning from the war. Aaron supported his wife's career and encouraged her to pursue research in medical physics. Yalow sought out Edith H. Quimby, the co-founder of [Columbia University](#) ^[7]'s Radiological Research Laboratory in New York City, and volunteered in her research lab. Eventually, Yalow worked part time at the Bronx VA Hospital and worked concurrently at Hunter College. At the VA hospital, she designed, built, and organized one of the first radioisotope laboratories in the US, starting with the facilities of an old janitor's closet. In 1950 Yalow left Hunter College to concentrate on her research in the Radioisotope Service at the VA Hospital.

Yalow met her long time research partner Solomon A. Berson in the fall of 1950 and they soon began using radioactive isotopes as markers, or labels, for biological molecules of interest to their studies. Because specific radioactive atoms are rare in biological material, those atoms can be used to label larger molecules so they can be traced within the body. Yalow and Berson used this technique to assess the effectiveness of insulin derived from cows and pigs when used as a treatment for [humans](#) ^[9] with diabetes. To label insulin with radioactive iodine (I^{131}) labels, an iodine ion (iodide), is oxidized to form iodine, then extracted, and then added to the insulin in solution so that the two materials can bind together. Yalow and Berson used I^{131} -bound insulin to monitor the rate at which the human body removed the insulin from the circulating blood. If the labeled insulin was degraded by the body, the radioactive label was quickly removed from the body through the urine. However, if the insulin was recognized as a foreign agent, molecules produced by the immune system would bind to the insulin and retain it within the body for longer periods of time. The [humans](#) ^[9] that retained the insulin were both diabetics and healthy subjects, but the immune

response only occurred in those that had previously received insulin treatments. Yalow and Berson proposed that the immune system's response to the animal insulin was to form antibodies, a defense mechanism that, during secondary and later exposure, decreased the rate at which the insulin would clear from the body. They submitted their findings to *Science* and *The Journal of Clinical Investigation (JCI)*, and both journals rejected the paper. Reviewers criticized the researchers for the use of the term insulin antibody, as their peer researchers believed that insulin was not large enough to induce antibody production. Yalow and Berson modified the term to insulin globulin binding and *JCI* published the paper in 1956.

Berson and Yalow devoted the next few years of their partnership to expanding methods of labeling and measuring molecules using radioactive isotopes. Yalow and Berson published a detailed account of their refined method of RIA in 1960. The article, "Immunoassay of Endogenous Plasma Insulin in Man," remains highly cited, with greater than 2,500 citations by 2013. Yalow and Berson recognized the potential commercial use of the RIA, but they refused to patent their method. They predicted that RIA could revolutionize medical diagnosis and treatment.

In 1963 Yalow and Berson co-authored a paper with Jesse Roth and Seymour Glick in which they described an RIA for the measurement of human growth [hormone](#)^[10]. By 1970, Yalow and Berson developed and published articles regarding several RIA applications, including: RIA of gastrin, a polypeptide [hormone](#)^[10] related to the secretion of stomach acid; RIA of adrenocorticotropin (ACTH), a polypeptide tropic [hormone](#)^[10] associated with the biological response to stress; and RIA of human parathyroid [hormone](#)^[10], which regulates serum calcium in tissues of bone, kidney, and intestines. Additionally, during the late 1960s, researchers used RIA to measure follicle stimulating and luteinizing [hormones](#)^[5], which stimulate the production of [sperm](#)^[11] and testosterone, respectively, in males, and trigger [ovulation](#)^[12] in females.

Though Berson decreased his research activity in the years before his death, Berson and Yalow's partnership did not end until his death in 1972. Between 1970 and 1980, Yalow served as the chief of the nuclear medicine service for the Bronx VA. In 1975 she received the [American Medical Association](#)^[13]'s Scientific Achievement Award and she was elected to the US [National Academy of Sciences](#)^[14]. The following year, she was first woman to receive the Albert Lasker Medical Research Award, and she received the 1977 [Nobel Prize in Physiology or Medicine](#)^[4] for development of the RIA. Berson didn't share the prize, as it is not granted posthumously. However, Yalow requested that the laboratory she and Berson had shared at the Bronx VA Hospital be renamed The Solomon A. Berson Research Laboratory, so that his name would be memorialized in her future publications.

In 1979 Yalow became distinguished professor at the Albert Einstein College of Medicine at Yeshiva University in New York City, a title she held through 1985. Meanwhile, from 1980 to 1985, Yalow chaired the Department of Clinical Science at the Montefiore Hospital and Medical Center in Bronx, New York. In 1989 she was named Solomon Berson Distinguished Professor-at-Large at the Mt. Sinai School of Medicine in New York City. Yalow and Berson's RIA methods improved the ability to measure biochemical substances, advancing medical research, including the diagnosis of [infertility](#)^[6] in [humans](#)^[9], hypothyroidism in infants, and measurement of vitamins and viruses in blood. In 1991 Yalow retired from the VA hospital and she died on 30 May 2011 at the age of 89.

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Subject

[Yalow, Rosalyn S. \(Rosalyn Sussman\), 1921-2011](#) ^[16] [Radioimmunoassay](#) ^[17] [Berson, Solomon A., 1918-1972](#) ^[18] [Immunoassay](#) ^[19] [Veterans Administration Hospital \(Bronx, New York, N.Y.\)](#) ^[20] [Isotopes](#) ^[21] [Physiology](#) ^[22] [nuclear medicine](#) ^[23] [insulin](#) ^[24] [Diagnosis, Laboratory](#) ^[25] [Radioisotopes](#) ^[26] [Quimby, Edith H. \(Edith Hinkley\), 1891-1982](#) ^[27] [Hypothyroidism](#) ^[28] [Diagnostic Techniques, Radioisotope](#) ^[29] [Binding, Competitive](#) ^[30] [ligands](#) ^[31]

Topic

[People](#) ^[32]

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- [2] <https://embryo.asu.edu/keywords/radioactive-isotopes>
- [3] <https://embryo.asu.edu/keywords/human-growth-hormone>
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- [5] <https://embryo.asu.edu/search?text=hormones>
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