

## Solomon A. Berson (1918-1972)

Solomon A. Berson helped develop the radioimmunoassay (RIA) technique in the US during the twentieth century. Berson made many scientific contributions while working with research partner Rosalyn Yalow at the Bronx Veterans Administration (VA) hospital, in New York City, New York. In the more than twenty years that Berson and Yalow collaborated, they refined the procedures for tracing diagnostic biological compounds using isotope labels. In the late 1950s they developed the RIA based on the ability to trace the competition between and ligands, or small molecules that bind to specific sites of other biomolecules, and proteins for the same molecular binding site, a process called competitive binding. Scientists widely used Berson and Yalow's RIA, as these methods permit the use of a minimal sample of blood for accurate measurements of biological molecules such as hormones that cause the production of antibodies. Berson and Yalow's research has advanced the study of physiology, including that of the reproductive system, with particular applications to the diagnosis and treatment of infertility.

Berson was born on 22 April 1918, in New York City, and was the eldest of three children. His father, an immigrant from Russia, studied chemical engineering before becoming a business owner. Throughout his early schooling, Berson played music and chess. In 1938 Berson completed his undergraduate studies at New York University (NYU), in New York City, and he tried to pursue a medical career. However, every medical school to which he applied rejected him, so he returned to NYU to complete a master's degree in science, which he received in 1939. Berson then accepted a teaching fellowship at the NYU College of Dentistry, which he held until he was able to start attending the NYU School of Medicine in 1941. While pursuing his MD, Berson married Miriam Gittleson in 1942, with whom he would later have two daughters, Wendy and Debby.

Berson completed his medical degree in 1945 and spent the following year interning at Boston City Hospital, in Boston, Massachusetts, before serving in the military for two years. After his time in the US Army, Berson completed a two-year residency in internal medicine at the Bronx VA Hospital. He planned to join the staff at the VA hospital in Bedford, Massachusetts, but he also considered staying at the Bronx VA to work with Yalow, Assistant Chief of the Radioisotope Service in the Radiotherapy Department.

Yalow was seeking a physician of internal medicine to provide background knowledge for her research. After an interview during which the two discussed various mathematical puzzles, Berson agreed to remain in New York to conduct research with Yalow. Berson and Yalow's diverse backgrounds, in internal medicine and nuclear physics, respectively, produced a partnership focused on nuclear medicine, more specifically on the development of medical applications of radioisotopes. The duo first focused on using radioiodine (isotope iodine-131) to study the rates of iodine production and degradation in humans—studies that contributed to the understanding of thyroid metabolism and disorders. Berson and Yalow further developed their radioactive labeling method to test whether abnormally rapid degradation of insulin by the enzyme insulinase caused adult diabetes, a hypothesis their findings did not support.

Berson, Yalow, and colleagues studied the metabolism of insulin in diabetic and non-diabetic subjects by monitoring how quickly insulin was cleared from the blood by the kidneys, referred to as the clearance rate. Clearance rates were tracked by using livestock-derived insulin that had been bound to radioactive iodine, creating radioiodine-labeled insulin. Berson and Yalow injected the insulin into human subjects and collected sequential blood samples to track clearance rates. They discovered that people previously treated with insulin could not clear insulin from their blood as quickly as untreated subjects. The research team postulated that human subjects that had previ-

ously been treated with insulin had a slower clearance rate because the bodies of these subjects recognized the livestock-derived insulin as a foreign substance. Recognition of foreign molecules would then trigger specific immune system globulins to bind to and degrade the insulin. The binding of globulins causes the body to retain the insulin over a longer period, rather than quickly clearing the unbound insulin from the blood through the urine. Berson, Yalow, and colleagues submitted their findings to *Science* and *The Journal of Clinical Investigation (JCI)*, but both journals rejected their submission, as reviewers did not support the idea that insulin could cause the body to produce antibodies. After much argument, the research team replaced the controversial term insulin antibody with the phrase insulin globulin binding and the paper was published in *JCI* in 1956.

In 1960 Berson and Yalow published "Immunoassay of Endogenous Plasma Insulin in Man," in which they described the details of the radioactive labeling method for the scientific community. They were aware of the commercial potential of RIA, yet they refused to patent the method, and they encouraged other researchers to expand RIA applications. By 2012, the 1960 article had greater than 2,500 citations.

Throughout the 1960s Berson served on the US National Advisory Council. He received several honors, including the Eli Lilly Award of the American Diabetes Association in 1957 and the William S. Middleton Research Award in 1960. In 1968 Berson became professor and chairman of the Department of Medicine at the Mount Sinai School of Medicine, within the City University of New York, in New York City. Yalow claimed that Berson's acceptance of that position was a great loss for the scientific community because he did less research than he had before. In April of 1972 Berson was elected to the US National Academy of Sciences. That same month, he died from a heart attack while attending a conference for the Federation of American Societies for Experimental Biology in Atlantic City, New Jersey.

In remembrance of Berson's contributions, Yalow requested that the Radioisotope Service laboratory be renamed the Solomon A. Berson Research Laboratory. In 1977 Yalow received the Nobel Prize in Physiology or Medicine for the co-discovery RIA. Though Yalow honored Berson for his involvement in that discovery, the Nobel Committee does not award posthumous prizes.

## Sources

1. Berson, Solomon A., Rosalyn S. Yalow, Arthur Bauman, Marcus A. Rothschild, and Katharina Newerly. "Insulin-I131 Metabolism in Human Subjects: Demonstration of Insulin Binding Globulin in the Circulation of Insulin Treated Subjects." *Journal of Clinical Investigation* 35 (1956): 170-90.
2. Chopra, Inder J., David H. Solomon, and Gildon N. Beall. "Radioimmunoassay for Measurement of Triiodothyronine in Human Serum." *Journal of Clinical Investigation* 50 (1971): 2033-41.
3. Rall, J.E. "Solomon A. Berson: 1918-1972." In *Biographical Memoirs*. Washington, D.C.: National Academy of Sciences, 1990.
4. Samols, Ellis. "Solomon A. Berson—A Brief Biography." *Seminars in Nuclear Medicine* 9 (1979): 173-7.
5. Saxena, Brij B., Hiroshi Demura, Hortense M. Gandy, and Ralph E. Peterson. "Radioimmunoassay of Human Follicle Stimulating and Luteinizing Hormones in Plasma." *Journal of Clinical Endocrinology and Metabolism* 28 (1968): 519-34.
6. Yalow, Rosalyn S., and Solomon A. Berson. "Immunoassay of Endogenous Plasma Insulin in Man." *Journal of Clinical Investigation* 39 (1960): 1157-75.