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ROSALYN S. YALOW, PhD

Interview conducted by  
Adolph Friedman with William Bauman  
March 24, 1999

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## **FAMILY BACKGROUND AND EARLY EDUCATION**

Friedman: This is Dr. Adolph Friedman [with William Bauman] interviewing Dr. Rosalyn Yalow in her home in New York on March 24, 1999. Dr. Yalow, do I have your permission to do this interview?

Yalow: Yes.

Friedman: You were telling me you have a sibling.

Yalow: I have a brother who works in the postal department.

Friedman: Your parents were not professionals?

Yalow: Hardly, my mother graduated sixth grade, and [my] father graduated eighth grade.

### **Two remarkable high school teachers**

Friedman: And then we were talking about the fact--you were telling me since you were involved in so many phases of science--you were going to tell me how you got involved doing this. You also mentioned that your teachers stimulated you to go into science.

Yalow: In high school, I had three male teachers, who were there for a very short period of time, but two of them were sort of remarkable. One was [Duane] Roller, who is a co-author of a textbook with [Robert] Milliken [*Mechanics, Molecular Physics, Heat and Sound* by Robert A. Millikan, Duane Roller, and Earnest C. Watson]. He was one of my teachers. Another was Jerry Zacharias, who went to MIT. And so I had a lot of interaction with these wonderful teachers. Initially--it had been historic--that they wouldn't take a woman and give her a graduate assistantship. So it was suggested that I study phonography, and that could be the way I would get into science.

Bauman: Into *sciences*.

### **UNIVERSITY OF ILLINOIS**

Yalow: Into sciences. It turned out that--perhaps it was the war in Europe that started it--that I was admitted to the University of Illinois graduate program. Interestingly enough, there were three Jews admitted to this--given scholarships--the first since World War I.

Friedman: What year was that?

Yalow: Nineteen forty-one.

Friedman: And all three of them received the fellowship?

Yalow: All three Jews received fellowship.

Friedman: Did the other?

Yalow: One of whom [A. Aaron Yalow] I even married.

Friedman: That was a good recommendation. Did the other two go into science, also?

Bauman: At least one of them.

Friedman: So there is only one left. There were three: one was your husband, and you were one.

Yalow: The difference is physics.

Friedman: Oh, I see, okay. And what did you do after that?

### **HUNTER COLLEGE TEACHING POSITION**

#### **SOL BERSON**

Yalow: I came back to New York, and then I returned to Hunter. I did work on the side. You know various facilities needed help in physics, and I give that. And then in 1950, a miracle happened. The head of the department arranged for me to meet with Sol Berson. And when we met, the two of us sat and spoke to each other for three to four hours. And we became partners. And that started my career.

### **DOING NUCLEAR MEDICINE WITH BERNIE ROSWIT**

Bauman: At that time you were in nuclear medicine as a consultant at the [Bronx] VA [Hospital] with Bernie Roswit?

Yalow: Yes, I had lot of little jobs.

Bauman: But that was one of the jobs.

Yalow: That was one of the jobs.

### **BERSON AND YALOW**

Friedman: And once you got involved with Dr. Berson, did you each approach problems from a different point of view, or did you seem to work in synchrony?

- Yalow: He was an excellent physician, and I never had a course in biology in my life, but we shared the office, and we spoke to each other. It was a rather interesting thing. We had a big office with two desks, and we interacted all the time.
- Friedman: Did his medical training influence him to approach the same problems [that] you were [working on], [but] from a different point of view, or did you both seem to approach these problems in parallel?
- Yalow: There were varieties of problems. Actually, nuclear medicine was increasing rapidly at this time, and he and I interacted.

### **Earlier training in nuclear medicine**

- Friedman: But you had had no previous training in nuclear medicine except for the physics.
- Yalow: I had, by the time he came into it, about three or four years--after I had gotten back to New York, after my PhD. And, of course, I had the beginning of training--and then interaction--with nuclear medicine.

### **GETTING STARTED ON RADIOIMMUNOASSAY**

#### **Insulin**

- Friedman: I was fortunate enough to have been very close to Arthur Bauman, so I know about some of it. But how did you get started on the initial radioimmunoassay (RIA)?
- Yalow: It was probably the experimental work we were doing.
- Friedman: One of you just thought of it, and you started to try it?
- Yalow: Yes, we spoke to each other about it. It was a possibility.
- Friedman: What was the first thing you used RIA on?
- Yalow: Insulin. There was an albumin; there were blood volume determinations. You know, we--
- Friedman: With the radioimmunoassay?
- Yalow: No.
- Friedman: Without it?
- Yalow: We had done it with a technique at that time.
- Friedman: In another words, your first step was to apply the radioimmunoassay to insulin.

Bauman: I think there was an observation that individuals with psychiatric ailments who had received insulin shock therapy had a delayed clearance of radio-labeled insulin from the circulation. And that--Roz and Sol deduced--was due to the presence of insulin antibodies.

Friedman: Where did you go from there in terms of your research and progress?

Yalow: Well, we first did the radioimmunoassay for insulin. And then we started doing it with a host of other substances.

Friedman: Do you recall which they were? What were the first couple of papers that you reported? In what field did you start to report?

Yalow: Are you asking, did we do other radioimmunoassays?

Friedman: Yes, did you work on other subjects?

### **Blood volume determinations**

Yalow: Well, we were part of radiology. And we had the responsibilities to [determine] what uses isotopes might have for this medical specialty. So we did blood volume determinations of albumen.

Bauman: Blood volume determination of heart disease and liver disease, and there were initial studies on iodine turnover and iodine clearance by the thyroid, some of which were published. So Roz will have to go back and look that data over.

Friedman: You'll have to do that to help--help you kill time.

Yalow: If he just reports on the published data, that will be enough.

Bauman: And, of course, the initial work on radioimmunoassay was done on insulin and the disease that we all know insulin treats, diabetes. The radioimmunoassay was described first by Berson and Yalow. So the initial work describing the physiology of diabetes was done in the early work.

Friedman: In what year?

Bauman: That was done in the '60s--late '50s or early '60s.

Yalow: Sol and I started working together in 1950, and the stuff you are talking about is probably in the late fifties or early sixties.

Friedman: When did Berson die?

Yalow: In 1972.

Friedman: So you continued to work on the insulins and on diabetes all through that period of time?

Yalow: You mean after he died?

Friedman: Yes, until the time he died; because my next question is going to be, did you do any other work, or did you diverge after he died?

### **Assays for glucagon, gastrin, secretin, cholecystokinin, and VIP**

Yalow: We did radioimmunoassay initially for insulin. And then we moved into a large variety of hormone studies.

Bauman: There were other--another hormone in diabetes [is] glucagon, and there was an assay developed for glucagon. Roz was not the principle worker, but there was work done on glucagon in the laboratory. Roger Unger did most of the work on glucagon, but he wasn't in the lab--no--there was a glucagon assay developed in the lab that was for diabetes. The lab was interested in other hormones in the gut, since the pancreas is part of the gut. And there were assays developed for gastrin, secretin, cholecystokinin, VIP [vasoactive intestinal peptide], and others.

Friedman: All in this one laboratory?

Bauman: All in the one lab. And many basic studies were done on these hormones from the Berson laboratory. Gastrin, which was first described as small gastrin—right, Roz?--then there was big gastrin.

Friedman: What is the difference?

Bauman: Roz will tell you.

Yalow: The difference is molecular weight. And the old gastrin was--what was its molecular weight?

Bauman: Seventeen amino acids.

Yalow: Well, something like that.

Bauman: Give or take, couple of thousands.

Friedman: What is Unger's first name?

Yalow: Roger.

### **Developing an antibody to growth hormone Jesse Roth and Shimon Glick**



Bauman: Roz also developed a very important antibody to growth hormone. Jesse Roth was in the laboratory as a fellow.

Friedman: He followed your father [Arthur Bauman].

Bauman: He followed my father. And Jesse did initial work with Shimon Glick.

Yalow: Shimon was in the lab at the time.

Bauman: On growth hormone.

Yalow:

Bauman: Jesse was in the lab; Shimon Glick was in the lab. Roz and Sol were working on growth hormone and did some of the basic work in acromegaly. Also, they showed that the late phase of the glucose tolerance test--at four or five hours when there was a rebound--that rebound was due in part to the increase in growth hormone--a counter-regulatory hormone.

Friedman: Dr. Yalow nodded assent to Dr. Bauman's comments.

### **RIA is used to explain disease physiologies**

Bauman: The physiologies of many diseases were explained. If you have the tools to explain them, those tools were available because of radioimmunoassay.

Friedman: What other interests do you have, Dr. Yalow, in medicine and science?

### **INTEREST IN VIROLOGY: DEVELOPING AN ASSAY FOR THE HEPATITIS VIRUS**

Bauman: I'll jog your memory a little bit. You were also interested in hepatitis, right? Out of the hormone field--that was in the field of virology.

Yalow: You remember the patients?

Bauman: In hepatitis--and that was because you developed an assay for the virus, right? It was a hepatitis virus.

Friedman: Was that radioactive, also?

Bauman: That was radioactive, also.

Yalow: Once we described radioimmunoassay--

Friedman: You didn't stop?

Yalow: We didn't stop; the field didn't stop.

Friedman: The fact the field didn't stop, I'm well aware. It's like a snowball.

Yalow: That's right; radioimmunoassay touched everything in medicine.

### **AWARDS**

Friedman: I was fascinated by all the awards you received. Bill [William Bauman] took me through your office just to show them to me. Were most of them for the radioimmunoassay? Or were any of the awards for other reasons?

Yalow: They essentially grew out of the radioimmunoassay field.

### **WOMEN IN SCIENCE**

Bauman: But it was also because you had a very strong feeling for women in science.

Yalow: I didn't get a particular award for that.

Friedman: No, but you expressed yourself. Part of my work was to study the proceedings of the council of the Endocrine Society, and you spoke up.

Yalow: Actually, of the various fields in medicine, I think women are most highly represented in endocrinology.

Friedman: They are. No question. What have you been thinking since you have retired? What are you thinking [about] that you wish you had time to do? Or was there anything you wish you had done?

### **THE CRUSADE TO DISPEL FEARS CONCERNING LOW LEVELS OF RADIATION**

Bauman: Let me back up one second, Adolph. One of your major interests was dispelling ignorance: in general, on the misuse of scientific thought; in particular, on the absolute nonsense with regard to low levels of radiation. That was the crusade you had. Maybe you should tell Adolph how you got into that, and how you fought for it.

Yalow: I was a physicist.

Bauman: Okay, but who were the good guys? Who were the bad guys? How did you want to change the public debate, and how did you try to do that?

Yalow: Who's the good guy?

Bauman: You are the good guys.

Yalow: Yes.

Friedman: Dr. Yalow responds, "It was a good cause."

Yalow: Many well-educated people who came through my laboratory--and there were too many concerns with the effects of radiation.

Bauman: Of low-dose irradiation radiation?

Yalow: A low dose of radiation.

Bauman: You talked all over the country and all over the world. You addressed the issue of low-dose radiation.

Yalow: I did, and a number of other people--

Bauman: Right, and you wrote articles.

Yalow: Yes. And to make use of the benefit of radiation, it is necessary not to be too fearful--enough to keep me from working.

### **Disposal of radioactive medical waste**

Bauman: It was also the cost of disposal of radiation.

Yalow: Right.

Bauman: The great cost to society of disposing of minute quantities [of] radiation was one of things you enjoyed showing people; there was more radiation in rainwater than in some of the radioisotopes being disposed of by commercial laboratories.

Yalow: Yes, the fact it was in rainwater was partly because the people who were using it were running it.

Friedman: It was part of the fallout, too.

Yalow: Yes.

## FELLOWS AND ASSOCIATES

- Friedman: Outside of the Bauman family, Jesse Roth, and [Shimon] Glick--whom I know--who are some of the other fellows who made names for themselves and gratify you for the time that you spent teaching them?
- Bauman: Marc Rothschild.
- Friedman: He was there at the beginning.
- Bauman: Right, Roth, himself, and Eugene Straus. He called Adolph, Virginius, the son of--
- Yalow: Gene Straus is probably the one who I have the major interaction with. I started with him in 1972 when Sol died. And he actually had major interaction in gastroenterology at Downstate. He wrote my biography.
- Friedman: I objected to that, but I won't waste your time.
- Bauman: But Gene Straus was the one who initiated much of the work on growth hormones.
- Friedman: Which we already discussed.
- Bauman: Yes, we already discussed it. Are there other people keeping the lab in India? There are innumerable individuals.
- Yalow: Yes, all right.
- Friedman: How do you spell "kachipola?"
- Bauman: \_\_\_\_\_ went back to India and determined goiter belt in India, and then was instrumental in having the government provide iodine to prevent cretinism and severe hypothyroidism in major sections of India--and that was a fellow from Roz's lab.

## DEVELOPING ASSAYS FOR THYROXINE (T<sub>4</sub>) AND TRIIODTHYRONINE (T<sub>3</sub>)

- Friedman: And you say he developed an assay for T<sub>4</sub> (thyroxine)?
- Bauman: He developed an assay for T<sub>3</sub> (triiodthyronine) and T<sub>4</sub> in the laboratory--or at least used it.
- Friedman: Who used it?
- Bauman: For T<sub>3</sub> and T<sub>4</sub> assay.

Friedman: Thank you. I appreciate this copy of your Nobel acceptance speech. You know, I mentioned before I was quite--not quite--tremendously impressed with all the awards I observed in your office, which you had already received.

### **WORK ON BRAIN PEPTIDES IN THE LAST TEN YEARS OF THE BERSON LAB**

Bauman: There was--in the last ten years of the Berson lab in operation--work on brain peptides. That's certain. Butler said that the brain secretes thoughts like the gut secretes juice, and little did he know--over a hundred years ago--that there were identical peptides in your brain and in the gut. And a major thrust of the interest of the Berson laboratory under the direction Dr. Yalow was to describe the peptides that were down in the gut, and the brain, and the locations in the brain, and also to purify the peptides, and to elucidate their immunoacid sequences in various points.

Friedman: That was a bit of a diversion from insulin.

Dr. Yalow, I'm most grateful for you to give me this time, considering your limitation and your illness. And with Dr. Bauman's help, I was fortunate enough to get here. I'm most appreciative!

### **AT THE FOREFRONT OF FORENSIC SCIENCE: WILLIAM BAUMAN RESURRECTS THE INSULIN BUSINESS AT THE BERSON LAB**

Bauman: I might also say that the insulin thread still kept running through the lab. It was like a bad dream. I came to the lab and resurrected insulin because very early--I'd say within the first week or two that I stepped foot in the Berson lab--I knew the history of the laboratory and went to the freezer. I took out all the old insulin antisera that were collected and started to do standard curves with them because I had nothing better to do. And because I liked to potchke around, I did the standard curves with all types of insulin--with human insulin, beef insulin, pork insulin, dog insulin, and whale insulin. I tried to generate different standard curves, and--as fate would have it--there was a patient who presented with hypoglycemia. As it is said, discovery favors the prepared mind, and as chance would have it--after looking through Roz's freezer and doing all these standard curves--I was able to show that this patient was injected with an animal insulin--not a human insulin. Then our laboratory was on the forefront of forensic science: diagnosing the serum, tissues, administration of insulin, the accidental administration of insulin, and the malicious administration of insulin for the next several years. We also looked at the immunogenicity of the new recombinant insulin preparation. So we were, as you can see, still in the insulin business up in the airways. At the same time there were many other things that were concurrent.

End of Interview

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