DOE/EH-0465

HUMAN RADIATION STUDIES: REMEMBERING THE EARLY YEARS

Oral History of
Dr. Nadine Foreman, M.D.

Conducted August 19, 1994

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MASTER

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FOREWORD

IN DECEMBER 1993, U.S. Secretary of Energy Hazel R. O'Leary announced her Openness Initiative. As part of this initiative, the Department of Energy undertook an effort to identify and catalog historical documents on radiation experiments that had used human subjects. The Office of Human Radiation Experiments coordinated the Department's search for records about these experiments. An enormous volume of historical records has been located. Many of these records were disorganized; often poorly cataloged, if at all; and scattered across the country in holding areas, archives, and records centers.

The Department has produced a roadmap to the large universe of pertinent information: *Human Radiation Experiments: The Department of Energy Roadmap to the Story and the Records* (DOE/EH-0445, February 1995). The collected documents are also accessible through the Internet World Wide Web under `http://www.ohre.doe.gov`. The passage of time, the state of existing records, and the fact that some decisionmaking processes were never documented in written form, caused the Department to consider other means to supplement the documentary record.

In September 1994, the Office of Human Radiation Experiments, in collaboration with Lawrence Berkeley Laboratory, began an oral history project to fulfill this goal. The project involved interviewing researchers and others with firsthand knowledge of either the human radiation experimentation that occurred during the Cold War or the institutional context in which such experimentation took place. The purpose of this project was to enrich the documentary record, provide missing information, and allow the researchers an opportunity to provide their perspective.

Thirty audiotaped interviews were conducted from September 1994 through January 1995. Interviewees were permitted to review the transcripts of their oral histories. Their comments were incorporated into the final version of the transcript if those comments supplemented, clarified, or corrected the contents of the interviews.

The Department of Energy is grateful to the scientists and researchers who agreed to participate in this project, many of whom were pioneers in the development of nuclear medicine. ❑

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DISCLAIMER

The opinions expressed by the interviewee are her own and do not necessarily reflect those of the U.S. Department of Energy. The Department neither endorses nor disagrees with such views. Moreover, the Department of Energy makes no representations as to the accuracy or completeness of the information provided by the interviewee.

ORAL HISTORY OF DR. NADINE FOREMAN, M.D.

On August 19, 1994, Ms. Anna Berge of the Lawrence Berkeley Laboratory Archives and Records Office interviewed Dr. Foreman at her residence in Sebastopol, California.

Dr. Nadine Foreman was selected for the oral history project because of the position she held at the University of California, San Francisco (UCSF). This oral interview covers Dr. Foreman's work on the radioiodine project conducted at UCSF during the late 1940s, and her career in general.

Short Biography

Nadine Foreman was born in Berkeley, California. Dr. Foreman received her undergraduate degree from the University of California, Berkeley (UC Berkeley) and her M.D. from UCSF. In 1947, after completing her internship and residency, Dr. Foreman received a fellowship from the U.S. Atomic Energy Commission (AEC) and worked with Dr. Earl Miller and Dr. Mayo Soley on a radioiodine project. This project studied the use of radioiodine in the treatment of thyroid disease.

In 1948, she went with Dr. Soley to the University of Iowa and helped him establish a thyroid clinic. However, after Dr. Soley's untimely death in 1949, Dr. Foreman returned to California and took a position in the Metabolic Research Laboratory at Highland Hospital in Oakland, California. She has since retired from this position and now lives in Sebastopol, California.

Medical School; Work With Dr. Soley at UCSF

BERGE: This is an interview with Dr. Nadine Foreman by Anna Berge of the Lawrence Berkeley Laboratory Archives and Records Office on the 19th of August, 1994, at her residence in Sebastopol.

I thought maybe we could start if you could tell me a little bit of background: where you're from, what you were doing before you came to UCSF Hospital, and how you ended up at UCSF Hospital.

FOREMAN: I'm a local product. I was born and raised in Berkeley. I went to Berkeley High School, UC Berkeley, and UCSF Medical School, and, following an internship and a year of residency, I was asked to join Dr. Soley in the thyroid[1] clinic. That was Mayo Soley: he was a professor of Medicine at UCSF. They were in the initial phases of exploring the use of radioactive iodine for the treatment of hyperthyroidism.[2] I worked part time with Dr. Soley in the thyroid clinic, but the bulk of the time was spent with Earl Miller[3] in the Department of Radiology, where we did the clinical work and the ancillary studies that went along with both diagnosis and treatment of hyperthyroidism.

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1 an endocrine gland located at the base of the neck and secreting two hormones that regulate the rates of metabolism, growth, and development

2 overactivity of the thyroid gland, resulting in increased metabolism rate

3 For the transcript of the interview with Miller, see DOE/EH-0474, *Human Radiation Studies: Remembering the Early Years; Oral History of Radiologist Earl R. Miller, M.D.* (July 1995).

BERGE: Can you tell me a little bit more about your work with Dr. Soley?

FOREMAN: We saw patients in a clinical setting in the Outpatient Department [of the UCSF Hospital], for the most part. Some were inpatients. [We] evaluated thyroid function; if there was a goiter,[4] [we] attempt[ed] to estimate its size and weight. Dr. Soley had done quite a bit of this, confirming his clinical impressions with patients that went ultimately to surgery, where he was able to get an anatomical corroboration of his guess as to how much the gland weighed.[5] With that information, plus doing tracer[6] uptake studies with radioiodine [(^{131}I)], you could come up with an estimate as to dosage—in other words, how many microcuries[7] of radioiodine would actually enter the gland and have an effect upon it.

Treatment of Hyperthyroidism

BERGE: With respect to the patients that underwent surgery, how did that work? Did he do the studies? I don't know anything about that kind of surgery. Is it that they take out the thyroid?

FOREMAN: The traditional treatment for hyperthyroidism, prior to radioiodine and about the same time as antithyroid drugs, was to treat the patient with elemental iodine,[8] which would produce a remission[9] or amelioration of symptoms and permit a surgeon to then remove most of the thyroid gland. That usually was a cure, but not always.

Antithyroid drugs came out, too—I guess it would have been in the late '30s or early '40s. Those, too, were used in cooling down the thyroid to make it possible to remove it safely from the patient. Dr. Soley would examine the patient preoperatively and estimate how much that gland should weigh, based on its volume; and then, when the surgical specimen was removed, they could tell pretty much how much was left. Of course, they could actually weigh what was taken out and attempt to correlate those two. He got to be pretty good at estimating weights.

BERGE: I forgot: why do you need to estimate the weight?

FOREMAN: In an attempt to quantify the dose of radioactive iodine being administered. If you knew how much the thyroid was going to take up[10]—for example, if it was going to take 90 percent of what was given—and you knew the weight of the gland, you could figure how much radiation per gram of tissue was actually being administered. It was, I suppose, fairly crude, but at least it gave an ability to compare one patient with another, or one group of patients with another group of patients.

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4 an enlargement of the thyroid gland on the front and sides of the neck
5 The thyroid would be weighed after being surgically removed.
6 a radioactive tag on biomolecules, used to study biological or chemical systems
7 a measure of radioactivity equal to one millionth of a curie
8 two atoms of iodine forming a molecule
9 a temporary or permanent decrease or subsidence of the manifestations of the disease
10 assimilate

BERGE: Was it only patients with hyperthyroidism [who were seen at the thyroid clinic], or was it also cancer of the thyroid or other thyroid diseases?

FOREMAN: I think there were a few cancer patients that were treated. But the difficulty with that is that thyroid cancer didn't take up very much iodine, ordinarily. It was not a hyper*functioning* tissue: it was just a hyper-*growing* tissue, but not -functioning. So there were few, if any, patients treated with it. When I was there, we didn't have all that many patients with thyroid cancer—one or two, maybe.

BERGE: If you did use patients with cancer, you probably had to give them a large dose?

FOREMAN: You would. And then you have the problem of disposing of the [radioactive] urine. We had to store it until it decayed. Fortunately, iodine doesn't hang around too awfully long.

BERGE: Why was that a problem in terms of disposal?

FOREMAN: It wasn't considered wise to just dump it in the sewer system, especially if you're giving large doses, because nobody really knew what the effects might be on other systems or others. It depends, I guess, where the wastewater goes. We used to have gallons of that stuff stored around there. If 90 percent of it goes out in the urine within 24 hours, that could conceivably be quite a bit to just flush down the sewer. But as I say, we didn't happen to have that many thyroid cancer patients when I was there, and most were treated with x-ray therapy and/or surgery.

BERGE: Do you know anything about how they discovered that iodine would help the thyroid disorders?

FOREMAN: It was generally known that the thyroid was rich in iodine. You know how scientists are when they get ahold of something. Counts were made on the necks of people just to see how much ^{131}I a normal thyroid would take up. It was observed that overactive glands took up proportionally more iodine than normal glands; it [(the realization)] evolved from there.

We used to do radioautographs also. [We'd] give a test dose prior to surgery; then, when we got the tissue sections [and] the pathologic[11] slides, [we] put the slides in contact with dental film. It would make its own picture of the nodule[12]—or of the gland—in cross-section; you could see if there were little "hot" spots or "cold" areas.

BERGE: That's what an autoradiograph[13] is, basically, a picture?

FOREMAN: The tissue takes its own picture, because it's radioactive.

BERGE: At what point did they stop having to do surgery as a general procedure?

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11 of or pertaining to pathology, the science or the study of the origin, nature, and course of diseases

12 a small, rounded mass or lump

13 use of photographic film placed over thinly sliced tissue to record, in image form, the radiation tracks from the tissue that pass through the film's emulsion

FOREMAN: They never stopped: they still do surgery. Sometimes it's a matter of preference on the part of the patient. Although I personally think radioiodine is the neatest, slickest way to do it. Unless it's a nodular[14] goiter. I think [that] whether it's thyroids, or breasts, or whatever, lumps are better off in a jar, so you know what you have. That's my personal opinion, and I think it's shared by others, depending on the size and nature of the goiter.

There are still other exceptions. For example, a pregnant woman—you wouldn't want to treat her with radioactive iodine. Antithyroid drugs allow you to defer that operation or that iodine treatment. In fact, you can delay deciding on definitive treatment until after a pregnancy. You can keep them under control with an antithyroid drug and then turn them loose, as it were, afterwards and hit them with radioiodine. People have their biases and their preferences.

Radioiodine as a Therapeutic Agent

BERGE: I think I understand how radioiodine works as a diagnostic tool. Can you explain a little bit how it works as a therapeutic agent?

FOREMAN: As a diagnostic tool, you rely on the gamma emissions,[15] which are relatively few in comparison to the [beta] emissions.[16] The latter penetrate tissue only one or two millimeters, but if you put a substantial dose—say 5 or 10 millicuries[17] of radioiodine—in a gland, the hyperactive tissue will take up most of it and essentially burn itself out.

BERGE: What were the normal doses at that time?

FOREMAN: Maybe 10 or 15 microcuries for a tracer dose. If you were going to do a[n imaging] scan, you might use 25 microcuries, but a really very small, insignificant dose.

BERGE: What was the general procedure for therapy? How many times a week or a month would they be seen?

FOREMAN: We tended to aim at a target dose right off the reel.[18] That's when the uptake is maximal—when you're going to get maximal concentration in the thyroid and it's not going to be circulating around every other place. Or going out in the urine.

As I say, it would depend entirely on the size of the gland. Obviously, if you had a very large goiter, we would expect to give two or more doses. It would vary. If you had a very small hyperactive gland, you might give as little as five millicuries, or four. But ten or twelve was not unusual, either.

BERGE: And all at once.

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14 characterized by nodules (small, rounded masses or lumps)

15 highly penetrating photons of high frequency, usually 10^{19} Hz or more, emitted by atomic nuclei

16 release of electrons or positrons during radioactive decay

17 a measure of radioactivity equal to one thousandth of a curie or one thousand microcuries

18 "Right off the reel" means from the start/beginning.

FOREMAN: One swallow.

BERGE: It's ingested.

FOREMAN: Just like water. Tastes like water, looks like water.

Duties at UCSF and University of Iowa

BERGE: I forgot if I asked you what your particular function in all of this was.

FOREMAN: I was a clinical associate of Dr. Soley—seeing patients, treating patients, some teaching. I was a lab associate of Dr. Miller. There [at the San Francisco outpatient clinic] I also saw patients that were referred for treatment; did the uptakes; actually gave the tracer doses; measured the uptakes; charted the uptakes; collected the urine; [and] counted[19] the urine to see if we had accounted for everything: If it wasn't in the thyroid, it was supposed to be in the urine. I made autoradiographs, gave the therapeutic doses, followed the patients clinically, wrote a couple of papers.

I was only with Dr. Miller about a year, and then I went with Dr. Soley back to Iowa. He went back as the Dean of the University of Iowa Medical School. We were supposed to begin a thyroid clinic and an ^{131}I diagnostic and treatment clinic. Unfortunately, they weren't ready: their laboratory wasn't ready. Mostly, we just did the clinical part of it for about six months and then we were able to begin setting up the lab. But I didn't do a great deal there. As I say, they just weren't prepared. Then Dr. Soley died, and I returned to California. I didn't stay on after he left.

BERGE: What year was it that you came back?

FOREMAN: I was at UCSF with the radioiodine project from '47 to '48 and then went to Iowa. I was in Iowa from September of '48 to July of '49.

Selection of Patients for Radioiodine Project

BERGE: A question about the choice of patients: Would you routinely do this type of work on all patients with hyperthyroidism, or was it still an experimental process?

FOREMAN: The surgeons liked to treat them surgically, obviously. So it was a mix. If it was a nodular goiter, for example, most of them were prepared and operated on. It was mostly the diffuse toxic goiters that we treated.

There was one elderly patient with "thyroid storm," which is such a profound degree of hyperthyroidism, on the brink of multiple organ failure, where you get hepatic[20] damage and beginning heart failure. There, time is of the essence and you've got to do something pretty fast. The normal treatment would have been inorganic iodine, and—by the time I was working with this—probably antithyroid drugs. But this

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19 counted the rate of radiation emissions, using radiation detection instruments

20 pertaining to the liver

patient was so ill, we put a tube down and gave her a big dose of radioiodine. They could operate on her later—that's fine—but the point was, she was going to die if she didn't get cooled off *fast*. For the most part, I would say [that for] the diffuse, nice, smooth, hyperactive gland, [it] was best to give radioiodine.

BERGE: What's the difference between nodular and diffuse?

FOREMAN: A nodular goiter is one that's probably gone through a lot of ebb and flow so that there are areas that become uneven areas of activity and slowing, to form nodules, rather than just the entire gland becoming hyperplastic[21] and hyperactive.

BERGE: And diffuse?

FOREMAN: In diffuse goiters, hyperactivity and hyperplasia affect the entire gland.

Communication With Patients

BERGE: Was there ever any discussion with the patients as to what kind of therapy they'd get?

FOREMAN: Yes. They knew it was radioactive. I don't think even the doctors knew what the long-term effects would be. There was always a concern that way down the road, as with x ray[s], there might be a danger of cancer. But I don't believe that's proved to be true. Consents were signed, as they would be with any form of treatment. You sign for medical treatment even if you're given aspirin in a hospital—you just sign when you come in. Especially in those days, you either signed or you didn't come in, too—I probably shouldn't say that: times have changed a lot.

BERGE: Can you describe a little bit how they've changed?

FOREMAN: I think maybe I'd better leave that one alone.

Work With Dr. Earl Miller

BERGE: Could you tell me a little bit about your work with Dr. Miller?

FOREMAN: We had two rooms. One had a Geiger counter[22] mounted in an old x-ray machine so that you could position it up and down, back and forth, and across. Mostly we were measuring the neck area, but we could also scan other parts of the body. We had a whole bunch of counters and scalers,[23] and we had what looked like a little microwave oven. It was a little lead house with a [Geiger] counter in it, where we could count the specimens [and] the doses that we were going to give, and calibrate the material we were going to administer to patients.

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21 characterized by an abnormal multiplication of cells
22 an instrument for detecting ionizing radiation and measuring dose rate
23 analog counters, for counting the number of pulses in the detector

We used to get a bottle. I guess it came from Donner,[24] and it might have 50 millicuries, or 60 millicuries. Obviously, to get 20 microcuries out [(0.033 to 0.04 percent of the bottle)], you can't work with that. It was that concentrated.

When I first went to work there, Dr. Miller had just an ordinary laboratory pipette,[25] probably a 20-cc[26] pipette, with a syringe and a rubber hose on it. He would suck up a drop, and then transfer it into a bottle, and then lift that up and add water to dilute it. I got the idea of making it 10 millicuries per cc or one millicurie per cc or something you could work with [because it would be sufficiently dilute to allow easy, precise measuring and dispensing]. If you knew how much was in there to start with, you just put the water in the main supply, and then it's easier to work with.

Then we got a two-way burette,[27] one that you could suck stock into, and it measured to a fiftieth of a cc. We could measure very small doses just with this little burette: Suck it up from the main bottle and then drop it into a vial and add water so the patients could drink it. That's mainly what I did, plus seeing the patients, following the patients, measuring the doses, measuring [the circumference of] their necks daily,[28] collecting urine—24-hour urines[29] on a lot of them. Then counting how many microcuries per cc of urine there were to account for all of the ^{131}I administered.

BERGE: How did you end up with Dr. Miller, as opposed to staying on with Dr. Soley?

FOREMAN: Because they were working together. The whole point of the fellowship that I had that year was actually a clinical instruction in medicine and radiology. I think the AEC[30] funded it, and it's always a matter of where the grant money comes from. That's how I wound up in radiology, plus that it was a radiologic approach, really, to treating this condition.

Connections to Donner Labs and the AEC

BERGE: You mentioned Donner Laboratories before. Can you tell me a little bit about the connections that the radiological [therapy] laboratories had with Donner?

FOREMAN: I didn't have any direct connections with Donner. Our project didn't, I don't think, but obviously the medical physicists and the materials and so on all came from Donner. Dr. Miller, I am sure, had more of a con-

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24 a laboratory set up at the UC Radiation Laboratory in Berkeley during the 1930s specifically to conduct experiments in medical physics

25 a slender graduated tube for measuring liquids or transferring them from one container to another

26 20 cubic centimeters (about 0.7 fluid ounce)

27 a graduated glass tube with a stopcock at the bottom, used in a laboratory to measure or dispense liquids

28 to determine the rate at which the goiter was shrinking

29 urine samples taken 24 hours after radioiodine had been administered

30 the U.S. Atomic Energy Commission, predecessor agency to the U.S. Department of Energy and Nuclear Regulatory Commission (NRC); established January 1, 1947

nection with Donner than I did. Plus, Dr. Kenneth Scott used to manufacture Geiger tubes. I worked with him some. Particularly after I came back from Iowa. He was a medical physicist. I take that back: he was a radiobiologist. He was of assistance in providing the Geiger tubes that we used to count specimens, but I didn't have any direct connection with Donner.

BERGE: First of all, what exactly would be the difference between a radiobiologist and a medical physicist?

FOREMAN: A medical physicist primarily is a physicist. You probably know John Gofman.[31] John was an intern when I was a resident at UCSF. He was a class or two behind me; one year, I guess. Of course, he was a brilliant physicist. Of course, he wasn't too shabby a doctor either, for that matter. But he was primarily a physicist. Dr. Scott was a biologist who then took up the necessary study to become acquainted with using radioactive materials and so on in his research.

BERGE: Can you tell me a little bit more about Dr. Scott? Obviously he died quite a while ago.

FOREMAN: Yes, he died about seven or eight years ago. He got a Ph.D. in Biology from UC Berkeley, I believe. I don't know about his training in biophysics. I know he worked for Donner or maybe Crocker Lab [at UC Berkeley], and I'm not sure which.[32] There is a distinction, and I'm not sure what it is.

BERGE: I think it was Crocker. What kind of work did he do? I know he moved to UCSF later on. Were you there when he was there?

FOREMAN: No. But I know he was doing work with mouse tumors.[33] Even in immunology[34] and things like that. I really don't know exactly what he was doing. I knew him socially after he left Crocker—when he was at UCSF—but I didn't work with him.

BERGE: You also mentioned the AEC.

FOREMAN: They had fellowships. I'm not certain of this, and I don't know that it's important. I know I had to have an AEC clearance to work with the radioiodine. I think they probably paid part of my stipend.

BERGE: Why did you have to have a clearance?

FOREMAN: Anybody who worked with anything that had anything to do with Donner Lab, Crocker Lab, or radiation had to have AEC clearance. Some of it was considered secret. I don't think what we were doing was

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31 For the transcript of the interview with Gofman, see DOE/EH-0457, *Human Radiation Studies: Remembering the Early Years; Oral History of Dr. John W. Gofman, M.D.* (June 1995).

32 a peer of Joseph Hamilton's at Crocker Laboratory. Scott severed his ties with Crocker in the early '50s, moving his operations to San Francisco, where he took a tenured position, setting up and running UCSF's radioisotopes laboratory. (Source: Durbin interview, DOE/EH-0458)

33 tumors: uncontrolled, abnormal, circumscribed growths of cells in any tissue; neoplasms

34 the branch of science dealing with the components of the immune system, immunity from disease, the immune response, and immunologic techniques of analysis

particularly secret. It [(the clearance)] was just routine; I suppose you might have some contact with people who were working on classified clearance. What we were doing was not really classified, I don't believe.

BERGE: I'm getting towards the end. After you came back from Iowa, did you continue doing this kind of work?

Work at Highland Hospital

FOREMAN: No. Because I had done it: When I went to work at Highland Hospital in Oakland, I worked in the Metabolic Research Lab there, and they did a few patients—they did a few [imaging (of the thyroid) using rectilinear] scans, a few uptakes, and treated a few patients—but it never really flew there, I don't think.

BERGE: Why not?

FOREMAN: What they could do is, if they did an uptake,[35] we had a liaison with Crocker Lab in Berkeley, and patients were referred there for study and treatment for that matter. It was through other people, not me.

BERGE: Do you know who the liaison was?

FOREMAN: There was a hematologist.[36] What was his name? They had a medical staff there. There was John Lawrence[37] and there were other guys. I didn't actually refer any patients to them, so I don't really remember now.

BERGE: I'll throw out a few names, because I happen to know these names. It might not be any of these. Dr. Paul Ageler?

FOREMAN: I knew Paul Ageler. Was there a Polloc?

BERGE: [Myron] Pollycove.

FOREMAN: Yes, that's it.

BERGE: You don't really know Pollycove?

FOREMAN: I met him, but I didn't work with him.

BERGE: What was your relationship, or lack [thereof], with Dr. Ageler?

FOREMAN: I was a student of his in medical school. In fact, as an undergraduate, too: I took a course from him. I knew him, but I didn't work with him.

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35 an excess assimilation of radioiodine in the thyroid, indicating abnormality

36 a medical specialist who studies the nature, function, and diseases of the blood and of blood-forming organs

37 Dr. John Lawrence, brother of Ernest O. Lawrence, was Director of the Division of Medical Physics at University of California, Berkeley. He operated a clinic at Donner Laboratory, where he treated leukemia and polycythemia patients with radioactive phosphorus. For a colleague's recollection of Dr. Lawrence's clinic, see the interview with Dr. John Gofman (DOE/EH-0457), the sections "From Research to Laboratory Production of Plutonium," "Medical Treatments With Radioactive Phosphorus (^{32}P)," "Conflict Between University of California San Francisco and Berkeley," "Heparin and Lipoprotein Research With Human Subjects," and "Radiophosphorus Therapy for Polycythemia Vera."

Metabolic Unit at Highland Hospital; Collaborations; Other Research

BERGE: I was wondering if you could maybe tell me a little bit about how the Highland Hospital got its Metabolic [Research] Unit [(Laboratory)], if you know anything about that.

FOREMAN: It was well established before I ever went there. Dr. Lawrence Kinsell. He got Federal grants, and he had been at UCSF briefly. He started it with grant money. I think [from the] National Institutes of Health or something like that.

BERGE: Could you spell his name for me, please?

FOREMAN: K-I-N-S-E-L-L. He had a biochem lab at Highland Hospital, and there were, I think, four hospital beds. He had several physicians on-staff, part-time. For example, when I went there, I worked ostensibly for him, only half-time and then part-time in the outpatient clinics [and] general medical clinics, and also took care of the student nurses and [UCSF] student health. It was sort of a combined thing.

BERGE: How did the Donner and Crocker connection come in? Were they supplying the radioisotopes, or was there anything else?

FOREMAN: Yes, they consulted not only with the Metabolic [Research] Lab, but with the residents on all patients, whatever the problem might be. If there were a need for some particular study that had been done at Donner, or treatment—and that was things like thyroids and polycythemia[38]—various hematologic disorders were referred there for study. I believe Dr. Pollycove was a hematologist.

BERGE: Was your specialty also hematology?

FOREMAN: No. If I had one, it was internal medicine.

BERGE: Did you ever do any other studies with other types of disorders?

FOREMAN: Not using anything radioactive. No, just the iodine.

BERGE: When did you start working with Dr. Soley and UCSF?

FOREMAN: Later part of '46.

BERGE: So you were still in school before that? [I'm] just trying to figure out who else you might know from UCSF.

FOREMAN: Actually, I guess it was in '47.

BERGE: Was there anyone else at UCSF that you worked with?

FOREMAN: I'll tell you somebody that worked in our lab with us. Do you know Lawrence Feigenbaum? He's a professor of Medicine. I think he's been one for most of his years in practice at Mt. Zion [Hospital], which is affiliated with UC, but his wife and I worked together in Dr. Miller's

[38] polycythemia vera, a disease characterized by overproduction of red blood cells

lab. She was a graduate of the optometry[39] school. She was recently written up in one of the special sections of the [San Francisco] *Chronicle*. Mrs. Feigenbaum. I forgot her first name. She worked there.

BERGE: When you working with both Dr. Soley and Dr. Miller, was the purpose mainly clinical, or was it mainly research at that time?

FOREMAN: It was mainly clinical, because, to the extent it was research, it was clinical research. Actually, using the isotope to assess patients clinically as well as treat them.

BERGE: Did you ever work in collaboration with other hospitals during that time? For example, Children's Hospital [in San Francisco]?

FOREMAN: No.

Radioiodine Treatment of Diffuse Toxic Goiter, Myxedema

BERGE: A couple of silly questions perhaps, but I think it helps give us a perspective on that time: How do you feel about the benefits of the research or the results that you came up with during that time?

FOREMAN: Of course, we weren't the only people that were doing it. I'm not in practice, haven't been for years, and I haven't kept up all that well either, but I personally think it [(the greatest benefit of our clinical studies back then)] is the treatment for diffuse toxic goiter. Assuming the goiter isn't too huge.

BERGE: What would happen if it's too huge?

FOREMAN: If there's a mechanical problem, of course you can [treat it] even so, but if there were an objection to—if you had an upper limit of the amount of radioiodine you'd want to give to an individual, that might exclude [treating] the very large goiter. I personally wouldn't be afraid to *take* it. I might be afraid to *give* it, especially in this day and age. You get sued for everything.

BERGE: What would be the immediate effects of someone who was given so much iodine?

FOREMAN: They might actually get a [chemical] burn. The problem with destroying the gland, if it has an enormous store of thyroid hormone in it, when it's hyperactive, which it's apt to have, just as if you coax that excess into the circulation, you might have a while getting rid of it. Whereas an antithyroid drug apparently not only blocks production, but also aids the excretion of thyroid hormone. That might be a better way to go: antithyroid drugs and surgery or, later, radioiodine.

But I think nodular goiter, unless it's a very elderly person or a very sick person, should be treated surgically. I think iodine goes where you want it, and it does its work, and it's neat. Neat as can be. No risk, as far as

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[39] the practice or profession of examining the eyes for defects of vision and eye disorders in order to prescribe corrective lenses or other appropriate treatment

I'm concerned, not like with an anesthetic or something else.[40] You don't risk cutting any blood vessels or nerves or anything else. I personally think it's the treatment of choice for toxic goiter.

BERGE: That reminded me of a couple of questions. I remember reading in one of the reports that treatment use of iodine could induce something called myxedema.[41] Could you explain what that is?

FOREMAN: Myxedema is the ultimate hypothyroidism.[42] In other words, if you deplete, if you don't produce any thyroid hormone at all, you develop what's called myxedema.

BERGE: Wouldn't that be the same if you remove the thyroid surgically?

FOREMAN: Yes, you could get it either way. Indeed, it occurs spontaneously. I thought it was a disease of adaptation when I was in Iowa—I'm kidding: strike that. It does happen spontaneously. Great disease to treat.

BERGE: Why?

FOREMAN: It's so simple to cure.

BERGE: How?

FOREMAN: With thyroid [hormone replacement]. That's why with radioiodine, the worst case, as far as anyone knows, would be to produce myxedema in somebody; but that's also one of the best things in the world to treat; probably one of the most satisfying medical conditions to treat, because it's so dramatic, and so complete, to just restore somebody completely to normal.

Radiophosphorus, Radioiodine Programs; Dr. Low-Beer

BERGE: The other question I had was—again, one of the reports I was reading was one by Dr. Stone[43] concerning this whole project during that time—1946 to the early '50s—on the radioiodine program. He mentioned that early on, it was originally designed to study phosphorus in patients.

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40 Radioiodine (^{131}I) is still a highly effective therapy for hyperthroidism, Graves' disease, and thyroid cancer.

41 The depletion results in thickening of the skin, blunting of the senses and intellect, and labored speech and, in children, cretinism (stunted growth, deformity, and mental retardation).

42 deficiency in thyroid secretions

43 A pioneer in radiation therapy, Robert Stone, M.D., had conducted human radiation studies before World War II. He was an early researcher at the Lawrence Radiation Laboratory and became a major figure in radiobiology research. When Joseph Hamilton began operating his 60-inch cyclotron at Crocker Laboratory, Stone requested that fission products be made on the cyclotron and that their fate in mammals be systematically studied in small animals. That information would be used for radiation protection proposes. In 1942, while chairing the Department of Radiology at UC San Francisco's medical school, Stone was recruited to lead the Medical Division of the Manhattan Project, overseeing all biological, medical, and radiological protection research. Accordingly, he moved to the University of Chicago, where he served as Associate Director for Health under Arthur Compton. In the 1950s, after serving in the Atomic Energy Commission, Stone returned to his post at the UCSF as head of the Department of Radiology. Under Stone, UCSF acquired a 70-MeV synchrotron for conducting therapeutic research.

FOREMAN: They had a ^{32}P [(phosphorus-32)] study. I think Professor [Bert] Low-Beer[44] was doing most of that work. They were using it for diagnosis of breast masses. I think they were trying to diagnosis breast cancer with ^{32}P. And also to treat polycythemia vera.

BERGE: How did it develop into a study of radioiodine?

FOREMAN: I'm just guessing now, but I think ^{32}P became available first, and when iodine became available, then people began thinking about what they could do with it.

BERGE: Did you know Dr. Low-Beer at all?

FOREMAN: Yes.

BERGE: Can you tell me a little bit about him?

FOREMAN: I know he was trained in Europe. He came to the United States already a radiologist, and he had to intern at UC (to become licensed in California). They tell me he was the world's worst intern. Don't quote me. It's tough enough to intern when you're fresh out of medical school. God knows. He'd been out of medical school for 20 or 30 years, and of course he had been trained elsewhere. He was a professor of Radiology. He was the radiotherapist at UCSF. He would be the one treating thyroids with external radiation and treating whatever he treated with radiation, whether it be a brain tumor, breast tumor, thyroid tumor.

BERGE: By external radiation, you mean x rays?

FOREMAN: Yes.

BERGE: Did he ever switch over to a use of radioiodine?

FOREMAN: I don't know. After I left, I don't know what he did. All I know—it wasn't too much later, some years after I left there, I think he developed leukemia.

BERGE: From exposure?

FOREMAN: Presumably from working with whatever. X[-ray] radiation or ^{32}P. But I don't think he did that much with iodine-131.

Treatment of Polycythemia Vera; X-Ray Therapy

BERGE: He was doing blood studies for that program. What were those for?

FOREMAN: Polycythemia.

BERGE: Oh, he did work with polycythemia?

FOREMAN: Yes, he worked with ^{32}P [to treat polycythemia vera].

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[44] a researcher at the University of California, San Francisco who died prematurely of leukemia, probably brought on by overexposure to radiation in the course of his career, which included work with radiophosphorus in England. Low-Beer, a physician, had been trained in his native Czechoslovakia. He served as an associate professor of Radiation Therapy before heading the Radiation Therapy Division of the Department of Radiology at UC San Francisco.

BERGE: That's right. Can you tell me a little bit about the treatment of polycythemia with ^{32}P?

FOREMAN: Not very much. All I know is that I think ^{32}P does go to the marrow,[45] and that's where the action is. Sort of like with iodine to the thyroid: ^{32}P to the bone marrow.

BERGE: Why is it that these different substances go primarily to these particular places?

FOREMAN: Because that's the grist for their mill. Thyroid hormone is rich in iodine; phosphorus goes to bone.

BERGE: And can you tell me a little bit about the x-ray therapy?

FOREMAN: There were patients that either because of other illness, age, or infirmities of one sort or another, were not suitable candidates for surgery. X radiation was one way to cool off the thyroid.

BERGE: You mean unsuitable for surgery?

FOREMAN: The risk of anesthetic, operation.

BERGE: By age, would that be the upper limit or the lower limit?

FOREMAN: Upper limit. I don't think you would use x-ray therapy on a little baby. I don't know who was the youngest patient we ever had with Graves' disease.[46] Thyroid cancer is not too unusual in younger people. I know there was a little boy, I think he was only about eight or nine years old when he first went to UC. I saw him when I was working with Dr. Miller and Dr. Soley; I think he was fourteen or fifteen and his lungs were riddled with tumors, but he clinically got along pretty well. He was one that was studied with radioiodine. I think that it was determined that his tumor didn't take up very much iodine.

BERGE: How is that possible?

FOREMAN: Because it's not functioning tissue. It looks like thyroid, comes from thyroid, but it doesn't act that much like it. It's not organized into a working glandular structure.

BERGE: Is there anything else you can tell me about Dr. Low-Beer? The reason I'm asking is that we really don't have very much on him. We're very much behind.

Reflections on Miller, Soley, Stone, Others

FOREMAN: I remember him as an instructor. He was a typical European, very didactic. Seemed to know his stuff. That was not a large segment of the curriculum in the medical school. Diagnostic radiology was something we dealt more with, and Earl Miller was super with that; he was excellent.

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45 the soft, fatty vascular tissue in the cavities of bones; it is a major site of blood-cell production.

46 a disease characterized by an enlarged thyroid, rapid pulse, and increased basal metabolism due to excessive thyroid secretion

He did most of the teaching in Radiology. What little bit of x-ray therapy was taught was done by Dr. Low-Beer.

BERGE: How did Dr. Miller become so good at that? My understanding was that—

FOREMAN: Good at what? Diagnostic radiology? That was his field; he was trained in it. That's what he did. The iodine-131 was sort of a sideline that came along with it.

BERGE: I see. How did he and Dr. Soley differ in terms of what they did?

FOREMAN: Soley was an internist. He was trained in internal medicine. His interest was clinical. Miller's was more—was not so much evaluating the patients clinically, but evaluating the method and the treatment and the measurements, the radiation dosage.

BERGE: Did you know Dr. Stone at all?

FOREMAN: Yes, I knew Dr. Stone. He was a professor, head of the Department [of Radiology]. I didn't work with him particularly. He did mostly diagnostic radiology, and was of course involved with the administration. He was not involved in our project.

BERGE: You weren't around when he later got his own special radiological laboratory?

FOREMAN: I guess not. What was he doing? I always remembered Dr. Stone, because people would request a "flat plate of the abdomen," and he would say, "Don't say 'flat plate'—we used our last plate in 1918. *(laughter)* It's a film!"

BERGE: What was he like as a person?

FOREMAN: Kind of gruff, [but] a nice guy. I remember he was a great gardener. He must have been, because he was one of the main customers for the waste products that came out of the sewage treatment plant in Golden Gate Park. In fact, he may have been the one that suggested that they dispense or disperse to gardeners in the community. The price was right for Dr. Stone: It was free.

BERGE: Was that human waste?

FOREMAN: Yes.

BERGE: And they used to send it over to where?

FOREMAN: Not to UC: he used it at home in his garden. I assume he had a nice garden, I don't know. I never saw it.

BERGE: You mentioned that Dr. Stone was responsible for the administration.

FOREMAN: He was head of the Department of Radiology.

BERGE: I don't suppose you ever had any connection with how things were run administratively?

FOREMAN: No.

BERGE: Do you know anything about that at all?

FOREMAN: No, not really.

BERGE: Is there anything else you can remember from that time?

FOREMAN: Nothing that would probably go into that sort of report.

BERGE: Any nice anecdote about it?

FOREMAN: No, I don't think so.

BERGE: I honestly think that I can't think of anything else to ask you, really. Maybe a little bit more about procedures. What about follow-up? Was there ever any follow-up?

FOREMAN: The patients were followed in the [San Francisco] thyroid clinic.

BERGE: Where was the thyroid clinic?

FOREMAN: It was in the [hospital's] Outpatient Department. It wasn't an area used exclusively for that purpose. It was a multiuse area, like it might be a diabetic clinic one day a week or two days a week and a thyroid clinic one afternoon a week.

BERGE: Where were the patients originally coming from?

FOREMAN: They would be patients seen either as inpatients or outpatients in the clinic there. As you know, a lot of patients are referred in by local physicians in and around San Francisco or Northern California.

BERGE: Now I do remember something else—and this is going to keep happening: I know that Dr. Soley worked for a while in the late '30s with Dr. Hamilton from the [UC] Radiation Laboratory.[47] Did you ever know anything about Dr. Hamilton?

FOREMAN: No, I didn't. I have a couple of their papers, but I didn't know him. I think he probably was at Crocker. That was before my time.

BERGE: I know very little about these people. Did you ever know of Drs. Friedell[48] or Pecker? They were early 1940s, too. I think they were all over there at the administration for the radioisotopes for therapeutic uses in cancer patients.

FOREMAN: They had quite a big clinic, I gather, at Crocker Labs. I was never there.

BERGE: To my knowledge, they mostly were providing the isotopes and not actually administering them. I think most of that went on at UCSF. I guess that's it.

Thanks very much for your time.

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[47] The UC Radiation Laboratory was founded by Ernest Lawrence in 1936 on the campus of University of California at Berkeley. Upon Lawrence's death, the lab's name was changed to Lawrence Radiation Laboratory. The name changed again, in 1971, to Lawrence Berkeley Laboratory, a National Laboratory under the U.S. Department of Energy.

[48] For the transcript of the interview with Friedell, see DOE/EH-0466, *Human Radiation Studies: Remembering the Early Years; Oral History of Radiologist Hymer L. Friedell, Ph.D.* (July 1995).

One more question: Is there anyone else that you can think of that I ought to talk to?

FOREMAN: All of the people. Like there was a pathologist, Stewart Lindsay, who used to do the pathology on the gland; but he's deceased. That's about it.

BERGE: Did you ever know of or partake in any injections?

FOREMAN: Injections? No, all of this was administered orally.

BERGE: How about inhalations?

FOREMAN: No.

BERGE: They must have been different programs.

FOREMAN: *(smiling)* I might have inhaled a little of it along the way.

BERGE: *(smiling)* That probably wasn't part of the game plan. ❑