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HUMAN RADIATION STUDIES: REMEMBERING THE EARLY YEARS

Oral History of
Pathologist Clarence Lushbaugh, M.D.

Conducted October 5, 1994

United States Department of Energy
Office of Human Radiation Experiments
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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 As part of this initiative, the Department of Energy undertook an effort to identify and catalog historical documents on radiation experiments that had used human subjects.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*. The collected documents are also accessible through the Internet World Wide Web under `http://www.eh.doe.gov/ohre/home.htm`. The passage of time, the state of existing records, and the fact that some decision-making 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-two 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 his 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. CLARENCE C. LUSHBAUGH

Conducted on October 5, 1994 in Oak Ridge, Tennessee by Darrell Fisher, a health physicist from Pacific Northwest Laboratory and Roger Anders, chief historian of the Office of Human Radiation Experiments, U.S. Department of Energy (DOE).

Clarence C. Lushbaugh was selected for the oral history project because of his research at Los Alamos, his position as pathologist for Los Alamos County, and his research at the Oak Ridge Institute for Nuclear Science. The oral history covers Dr. Lushbaugh's pathological research, his research with human subjects while at Los Alamos, and his total body irradiation research at the Oak Ridge Institute for Nuclear Science.

Short Biography

Dr. Lushbaugh was [redacted] He received his B.S. (Anatomy 1938), Ph.D. (Pathology 1942), and M.D. (Pathology Honors 1948) from the University of Chicago. He has been married twice and has three children. Dr. Lushbaugh began his career as a pathology professor at the University of Chicago (1942–1949). From 1949 to 1963, Dr. Lushbaugh was a staff member in the Biomedical Research Group of the Health Division of Los Alamos National Laboratory and a pathologist at the Los Alamos Medical Center (LAMC). In addition, from 1950 to 1958, he was the Assistant District Health Officer for Los Alamos County. In 1963, Dr. Lushbaugh became Chief Scientist of the Medical and Health Sciences Division at Oak Ridge, where he led the Total Body Irradiation (TBI) Program, a position he held until 1975. From 1975 to 1984, Dr. Lushbaugh became Chairman of the Medical and Health Sciences Division at Oak Ridge and the Chief of Radiation Medicine. During this same period, Dr. Lushbaugh has held the following positions:

- **1974 to 1977—Director, Radiation Emergency Assistance Center/Training Site (REAC/TS) of the Medical and Health Sciences Division, Oak Ridge**
- **1979 to 1982—Acting Director, Center for Epidemiologic Research, DOE Health and Mortality Studies at Oak Ridge**
- **1980 to present—Adjunct Professor of Epidemiology at the School of Public Health, University of North Carolina, Chapel Hill**
- **1981 to 1989—Director, World Health Organization International Collaborating Center in Radiopathology and Radiation—Accident Preparedness, World Health Organization.**

Dr. Lushbaugh has published many times on total body irradiation; the effect of nuclear accidents and proper procedure for nuclear accidents; the effects of the use of isotopes; and radiation treatment. Additionally, he has focused on the subject of human radiobiology.

Upbringing, Family, University of Chicago

ANDERS: This is Roger Anders. I'm here with Darrell Fisher. We're in Oak Ridge, Tennessee, at the Oak Ridge Institute of Science and Education, in the Medical Department conference room on the second floor. It's Wednesday,

October 5, [1994,] and we're interviewing Dr. Clarence Lushbaugh. Mrs. Ann Sipe is here with us, assisting us with the interview. Having said that, we're ready to go.

FISHER: My name is Darrell Fisher. Dr. Lushbaugh, you participated in the golden era of radiation research, when radionuclides were discovered and then tested for biological and medical properties. But even before that, you did your medical training, and graduated before the Manhattan Project. One of the things that we would like you to do is tell us about how you became interested in the field, not only of radiation medicine, but pathology, and how your career developed after you graduated from medical school. Go ahead and feel free to talk.

LUSHBAUGH: Looking at my CV [curriculum vitae] here, which Ann Sipe just gave to me, I note that I was [redacted] It fails to mention a fact, and it was a very big factor in my life, which was that my father died in the flu epidemic of World War I when I was age two and a half. He died in October of 1918. I, at that very early age, developed an interest in death, [a] fear of death, and became interested in becoming an M.D. I was helped greatly by my mother, who, as a widow, never remarried. She received the magnificent sum of $300 from my father when he died. I had many expenses, of course, involved in my medical education. When I finally graduated as an M.D. in 1948, I received from my mother the same $300 that she had saved all those years.

To start out from the beginning, I started in school there in Cincinnati, which is across the river from where I was born in Covington [Kentucky]. We had just come back from living with my grandparents in Bridgeport, Connecticut. I, living with my mother, became enrolled in Hyde Park Grade School. I went through eight years of grade school there. Then I went to Walnut Hills High School[, which is also in Cincinnati]. At Walnut Hills High School, I graduated with honors and was also president of the senior class. That was in 1934.

Then from Walnut Hills High School, I went to the University of Cincinnati and there took the premed [courses]. Much to my horror, Dr. Arthur C. Bachmeyer, who was then head of the Cincinnati General Hospital, left and became the dean at the University of Chicago. So, of course, I followed him there. I got my bachelor's in Anatomy in 1938. That was about three [years] at University of Cincinnati and one year at Chicago. Then I became a fellow in pathology and sort of diddled and daddled about getting my M.D. I finally got a Ph.D. in Experimental Pathology in 1942. This was the same year that I was married, for the first time, to Mary Helen Chisolm, who was a nurse there at the University of Chicago.

I had three children from Mary Helen. One, a son, [born in 1944], who is now a full professor at the University of Mississippi and a professor in the Department of Preventive Medicine. Another son, born in 1949, who became a staff member at X–10, at [Oak Ridge] National Laboratory. He then was transferred to Y–12 and then transferred to K–25, where he is now a consultant. It is from him I have my three grandchildren: Jeffrey, who is now age 16; Sarah, age 13; and Kimberly, age 10—two girls.

I had, besides Bill, the firstborn, and Bob, the second-born, Nancy, the third-born. She now works at Y–12 as a technician and as a safety expert. These parallel what I did at the University of Chicago, in that I went to work at the University of Chicago as an instructor, first as a fellow in Pathology and then as an instructor in Pathology, and finally as assistant professor. I remember that in 1949, after I had been in these roles for about 14 years, following my graduation with a bachelor's in Anatomy, and a trainee in Pathology, I did get the Experimental Pathology degree in 1942, but I also married Mary Helen. Then, 14 years later, I got a call one day from Dr. Franklin McLean, who was then professor of Physiology and also head of the University of Chicago Toxicity Laboratory. I had been loaned to the University of Chicago Toxicity Laboratory by Dr. Paul Cannon, who was the head of the Department of Pathology at the University of Chicago. I was the pathologist there and we were extremely, I would say, experimental in that we used only animals.

It was a result of these animal studies and the work with nitrogen mustards, that I came upon the idea which was probably the greatest idea that I ever had in my career. That was the use of nitrogen mustards as a chemotherapeutic agent in the treatment of cancer. Although I was, I want to say, the 13th or 16th person [listed] on the paper that was written by then Dean Leon Jacobson, who was the hematologist at the University of Chicago. At that time I only had a bachelor's degree. But then I got the call from Franklin McLean. Franklin McLean wanted to know whether I would recommend the person who was a pathologist on the university side. Since I was making only $4,200 and had these three children [and] my wife, who was not working, I decided that the person I could recommend for that job in Los Alamos was Clarence Lushbaugh! So I recommended myself, particularly since the job carried a stipend of $10,000. In 1949 I left the University of Chicago and that was a year after I had gotten my M.D. But my M.D. was delayed by World War II. World War II was long over [by] 1949, when I finally left the University of Chicago.

FISHER: You said [that] World War II delayed your degree? Did you do some military service?

LUSHBAUGH: In the University of Chicago's Toxicity Laboratory where I worked as a pathologist, under Franklin McLean and the National Research Council, NRC, we studied all sorts of chemical poisons that could be put out as war gases. It was in that area that I worked. I worked with mice and rabbits and dogs and the like. It was there that we discovered [that] the nitrogen mustards were much like the sulphur mustards, which had been used in World War I, but which were water soluble. Although they were still vesicants,[1] they could be put in a solution and injected into a person so the precise dose could be gotten. Also, I discovered that the nitrogen mustards were lymphotoxic[2] and were, therefore, applicable to the therapy of the various lymphomas. It was that idea that I took to Jacobson that day and

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1 chemical agents that cause burns or destruction of tissue; and, agents or substances that produce a blister or blisters, as a medicinal substance.

2 poisonous to the body's lymphatic system

had to get permission from Dr. McLean in order to do the work in human beings. The human being research was carried on by Leon Jacobson and by his resident staff there in the Department of Hematology. Since he was a member of the Department of Medicine, he had all the physicians in the Department of Medicine on the paper plus all the people who had any "swat" at all. So I was C.C. Lushbaugh, B.S., at the end of that paper!

Since that time, my role in that area has been documented by the University of Chicago, although my name Clarence has been changed to Charles and my status as a pathologist has been changed to that of chemist. However, my name is Clarence C. Lushbaugh and I was a "Junior" until my father died. So I bore the name proudly and I resent very much the fact that I'm now Charles S. Lushbaugh from the University of Chicago!

Early Research and Publications in Pathology

One of the things I read as a graduate student there in the Department of Pathology was an article written by Drs. Warthin and Wellerd from the University of Michigan, who spoke about the radiomimetic activity of the sulphur mustards. They were reviewing the sulphur mustards [in their article]. This was about 1920 in the *Journal of Pathology*. It was they who put out the idea that there was a chemical that was radiomimetic, simulating the effects of radiation!

It was at that time, in talking with Dr. Cannon and the other associates of mine there in the department, that I learned that Dr. Shields Warren was the head U.S. man in radiation pathology and that he had been to the Hiroshima/Nagasaki bombings aftermaths. He had tried to organize the pathologists of the United States and get some concurrence with the lethal dose of radiation in man, and how it would kill when you were exposed to radiation. We found, much to his horror and later to mine, that there wasn't anything such as a radiation pathologist in the United States. In his articles, Shields Warren filled the role of a radiation pathologist in describing the pathology of the liver after radiation and the pathology of the lymph nodes after radiation. [(they were doing what later bacame known as radiation pathology)] He had written [this] as a review of the literature by persons that were on Shields Warren's staff at Harvard University.

It was at that time that I reviewed the Warthin–Wellerd article and learned about nitrogen mustards. I thought that here was a way to get radiation treatment taken away from the radiation oncologists[3] and given to the hematologists[4] so they could treat their patients in a forthright way. It was at that time that I learned of this first article, which Ann has given me. I guess it's 1946—Jacobson, Spur, Baron, Smith, C.C. Lushbaugh. That's not quite the whole list of authors on the article in the *JMA*[5] that appeared there.

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3 medical specialists who deal with tumors, including the origin, development, diagnosis, and treatment of cancer

4 medical specialists who study the nature, function, and diseases of the blood and of blood-forming organs

5 Journal of the American Medical Association

My first article in press was actually an article in 1941, about maternal pulmonary[6] embolism[7] in amniotic fluid. That was the second important thing that I really did, as far as being a pathologist was concerned. There was a disease called "obstetrical shock." This was a disease of unknown etiology[8] that occurred rarely in women in childbirth. No one ever knew why this disease caused them to hemorrhage and to clot and to die. It was a fatal disease. Except that one day, as a pathologist working at the University of Chicago, I did the autopsy that was the *sine qua non* of autopsies then on a person who died of this disease. The dead woman had not burst her membranes, but she had died with the fetus still attached by a placenta to the placental membranes. So having Dr. Paul Steiner there as a mentor and as a professor in the Department of Pathology, we had always been interested in this disease. He came down and supervised my autopsy so that I did it properly. We were able to show that it was the contents of the amniotic fluid which contained the smegma, which was the sebaceous secretions from the child's skin and feces, and contained the cells and debris from the gastrointestinal tract of the child, and also the other debris, which were the cells of the skin which were present, plus any blood that happened to be there. In the histology[9] of that case, Dr. Paul Steiner and I were able to show that the amniotic fluid embolism was the cause of death in obstetrical shock. We were able to show this also in dogs, and so we wrote this paper up.

Early Days at University of Chicago and Los Alamos

FISHER: You started to mention reasons for leaving Chicago and going to Los Alamos. [There is] one question I'd like to interject if you don't mind. While you were in Chicago, were you aware of any of the activities of the MET Lab[10] under the Manhattan Project in Chicago?

LUSHBAUGH: No, but I almost got fired by the secretary of our Chicago Toxicity Lab group who was there, and she also knew about the metallurgy project at the University of Chicago. I had come to the conclusion from listening around that the University of Chicago was somehow associated with the pathology of radiation damage, and that this pathology of radiation damage involved bone marrow, and therefore they were interested in anemia! I mentioned this to her one day, that the focus of the metallurgy [project] was on the pathology of radiation damage. For that reason, she accosted me for having broken the secret and had threatened to fire me. I explained that I had arrived at those conclusions all by my own and that I did not have to be fired at that point.

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6 of or affecting the lungs

7 the blocking of a blood vessel by a clump of tissue, a bubble, fat globule, or other substance that has lodged in a blood vessel

8 cause or origin of a disease

9 the branch of biology dealing with the study of tissues

10 Metallurgical Laboratory, the laboratory set up at the University of Chicago during World War II to lead the secret research and development of controlled nuclear fission under the Manhattan Project

Following, in 1948 and '49 when this question came through to me as to whether this pathologist on the north side [of Chicago] should be recommended for the job in Los Alamos, Dr. McLean was the go-between between the University of Chicago at Chicago and the University of California at Los Alamos. He was part and parcel of the medical staff at the University of California laboratory at Los Alamos. That's where I went in 1949, not knowing what the problems were in radiation death and the amount of radiation that would cause death in a person. That's what Shields Warren and his group had been working on. I learned [that] later from an article, and I don't know the title of this article anymore. But it was written by the NRC[11]. It was a journal of experimental medicine, and it listed in there all the persons who had ever studied persons who were irradiated, and then investigated, and then treated in various kinds of ways. So we had a whole list of persons there, since the article was very thorough [in its coverage] of persons who had irradiated people. That study involved my third major contribution in my pathology career, which was, I went around and visited all of these hospitals and laboratories and physicians who had irradiated people and tried to find out what was the human LD_{50}.[12]

FISHER: Which hospitals did you visit, if you can remember?

LUSHBAUGH: I remember visiting one in Boston, which I think is Brigham and Women's.

FISHER: Brigham and Women's?

LUSHBAUGH: Right. And I visited the Ann Arbor Hospital and I visited Warthin and Wellerd.

FISHER: Ann Arbor at the University of Michigan?

LUSHBAUGH: Right; and I also recall visitng one in New Orleans.

FISHER: Charity or Tulane?

LUSHBAUGH: It could have been Tulane, I guess.

SIPE: There's another one. Did you go to Memorial Hospital in New York?

LUSHBAUGH: I went there, but I went there for another reason. They were offering me a job.

FISHER: At Memorial?

LUSHBAUGH: Yes, in New York City. Heubline was one. Where [the] Heubline name comes into my career was the organization here at the Medical Division at the University of Tennessee, part of the Oak Ridge Associated Universities. This outfit had a Heubline-like unit. They had a METBI,[13] a medium-level unit. It was made with cobalt-60. (*glancing at an article held up by Sipe*) Is that the article? This is by Heubline himself. He was the one who developed this method of low-level spray radiation and he called it spray radiation, in that he had x-ray tubes in this large ward which he shows in this paper.

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11 Nuclear Regulatory Commission

12 the dose at which 50 percent of humans receiving or exposed to a substance will die

13 medium-energy total body irradiator

Establishing Safer Radiation Limits

FISHER: Heubline was then at which institution?

LUSHBAUGH: Memorial [Hospital, New York]. [He was] treating continuous radiation of the entire body at long distances. He had, in the various corners of the room, these x-ray tubes that were on swivels that were driven by motors that would sort of spray the whole room with radiation. Oak Ridge Associated Universities made a similar unit, but using, cesium-137 as the source of gamma radiation.

SIPE: They had a cobalt-60 [unit] that they made, [and] gave to [the] M.D. Anderson [Hospital]. We had a "cesium METBI." Cesium-137.

LUSHBAUGH: That was a medium-dose-rate irradiator. It used gamma rays from the cesium. I think that its output was 1.5 roentgens[14] (R) per minute.

SIPE: That was 1.5 per minute. LETBI[15] was a 1.5 R/hr [unit].

LUSHBAUGH: I had the opportunity to choose the radiation dose rate in the so-called LETBI facility, which was the low-exposure big facility that Ann and I ran for a long time. The radiation dose rate was expected to be a factor that was easy for me to remember, like 60. Since the rate of exposure in the METBI facility was 1.5 per minute and then the LETBI became 1.5 R per hour. All I had to remember was the time in hours. So it was 1/60th of the other one. We went around to discuss these various things. At one of the meetings, it was the national NCRP, National Council on Radiation Protection and Measurements, which was at that time chaired by a gray-haired elderly gentleman who subsequently retired.

SIPE: Lauriston Taylor?

LUSHBAUGH: Yes, Lauriston Taylor. He told me when I asked him how it was that the Army concluded at the time of the bombings at Nagasaki and Hiroshima that the dose was 450 R total body radiation. He said that everybody in the armed forces in the United States knew that number because that was the number that was given to them in their training that they got when they joined the armed forces. They had to know what the radiation dose was. The story was that Dr. Shields Warren and Dr. Stafford Warren, who was then head of the Manhattan District —

FISHER: Two doctors Warren?

LUSHBAUGH: One was Stafford Warren and the other was Shields Warren, and they stood at a bridge where a group of Japanese workers had been working at the time of the bomb drop at Hiroshima. Since 50 percent of the persons had been killed and their measurements seemed to indicate that 450 R was the magic number, that was [set as, determined to be] the LD_{50} for man, since 50 percent were involved. This number was picked up by the Army and was diffused through the Army Medical Corps, so it became the number that

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14 a unit of radiation dosage equal to the amount of ionizing radiation required to produce one electrostatic unit of charge per cubic centimeter of air

15 low-energy total body irradiator

was known to everybody who was involved in the Hiroshima bombs. It was also the number that I tried to find some basis for in the various kinds of radiation which were done with the Heubline equipment. I was unable to do that in the various kinds of hospitals that I visited. I think we studied the records of 260-some-odd patients that were involved in this study.

SIPE: Right.

LUSHBAUGH: We visited some 60 hospitals.

SIPE: We studied close to 3,000 patients.

LUSHBAUGH: Really.

FISHER: So what you're saying is you looked at data on up to as many as 3,000 patients who had received whole body radiation to determine what the $LD_{50/30}$ was.

LUSHBAUGH: Right.

FISHER: For gamma radiation. What did you conclude from this analysis?

LUSHBAUGH: I was thinking about this the other day and my conclusion was that 450 R was as good as anything. Subsequently, roentgens became rads and rads became rem, so 450 R became 400 rads or 400 rem—I invented in one of my articles that I wrote in *Radiation Research*, the epigastric[16] rad. My dear friend and high school chum who is presently emeritus professor of radiation at University of Cincinnati, Dr. Eugene Saenger, took askance at the epigastric rad. I think if I ever want Dr. Saenger to burst into a fit of laughter, I need only mention "epigastric rad" to him. He loves it. But the Britisher, Robin Mole, who was a radiation therapist and who was a physician and a physicist, subsequently wanted to reduce that number, I believe. I think it ought to be reduced, too, but I'm not certain by how much it should be reduced.

Move to Los Alamos

Going back now to Franklin McLean and his offer of a job in Los Alamos. I went to Los Alamos and looked at the job and found that there was a job there for a pathologist and that the pathologist would be loaned 50 percent of his time to the Los Alamos Medical Center. I subsequently took the job and went to Los Alamos; it was in 1949, one year after I received my M.D. at the University of Chicago in 1948. I took the examination for the State of New Mexico for the practice of medicine. I took the scientific examination, which was then given by the AMA in Denver, Colorado, and I did qualify. I passed the basic sciences exam and then, by virtue of the fact that I had spent another year at Chicago as the assistant professor of Pathology, I was given that time as radiation practice and medical practice and I was licensed in the state of New Mexico.

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16 lying upon, distributed over, or pertaining to the epigastrium—that is, the upper and medium parts of the abdomen, lying over the stomach

At New Mexico, one of my first jobs there as a clinical pathologist was to become chief of staff and to see to it that the Federal physicians at the Los Alamos Medical Center became private-practice physicians. This led to some of them having to be fired, because they didn't want to leave the cushy role that they played there. Then we replaced them. So we had adequate medical care. Then I became the chief of staff. I was chief of staff for how many years? Two or three years?

SIPE: About three.

Pathology Investigations

LUSHBAUGH: It was during that time that I was the pathologist at the Medical Center, and I was the pathologist there at the Medical Center until 1963, when I left to become a member of the Oak Ridge Associated Universities, which was then ORINS[17]. I began to investigate radiation accidents. The first radiation accident I ever investigated—there were several of them—had happened in Los Alamos before I had gotten there. The first one that happened when I went there in 1958. The first one, there was a woman, a murder there that I had to report to, in which a woman had been killed by her husband, who was a security policeman at Los Alamos. He parked his revolvers in his bedside table. After a tryst in the bed one evening, he decided that she wasn't measuring up, somehow or another. So, he let her have a blast in one shoulder blade that went through her heart. I subsequently found this bullet in the bed. In so doing, he became overwhelmed by his actions and he got another pistol from his bedside table and shot himself in the stomach. This bullet located in his vertebral bodies and penetrating his spinal cord and gave him paralysis of the lower extremities. He threw this dead woman, his wife, across the bedroom onto a floor furnace. Then the person who did the shooting called the police, and the police reported to the house. They opened the door and they found all this stench and a newborn baby crawling through the blood. The open door caused the floor furnace to turn on and the woman on the floor furnace began to cook. I faithfully noted her falling body temperature, because I had read the German literature about how you can determine the time of death and I had never had this chore before; this was my first time doing it. I took the woman's temperatures all the time with an ordinary old-fashioned mercury thermometer. I got reams and reams of data out of this.

I then took it to the thermonuclear scientists at Los Alamos to try to find out whether or not they could decipher this data for me and tell me when she had died. They said that there wasn't any way for them to decipher that data, and what I needed to do was get an apparatus built for myself that would record this data. It would have reference points, which would then actually allow you to extrapolate back to the normal temperature so you could find out when sudden death had occurred. With the help of Los

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17 Oak Ridge Institute of Nuclear Studies, established in 1946 by the Manhattan Engineer District and operated under a Manhattan Project (and later Atomic Energy Commission) contract. ORINS was responsible for selecting both students and established scientists for fellowships and other temporary research assignments.

Alamos's Physics Lab, we built a thermistor thermometer and invented the thermistor death probe at that time. We built a large thermometer that could be inserted into the rectum of the victim and could be pushed in as far as it could go. It was 10 or more centimeters[18] long. It led to large wires that went to a table, which allowed me to sit outside of the person's room and watch this meter record the central body temperature, and I could tell when the person had died.

Then, because Los Alamos was a sequestered town and had a fence around it, there were a lot of people there that should not have been in a sequestered town and they subsequently killed themselves. We had a lot of murders and suicides that allowed me to use this thermistor probe as a way to finding the time of death. This was one of my other major accomplishments.

FISHER: Was it patented?

LUSHBAUGH: It was not patented because it was put out in the public domain. The article was published in the journal of the police, *The Police Gazette.*

So it should have been available to departments all over the place. It was thought by the then-AEC[19] that if it were available to police departments, police departments would make their own and take it away from them. Your question reminds me that prostatic[20] cancer is the most frequent cancer in the male human being. One of the things I didn't know as an academic pathologist was that persons with cancer of the prostate often had their prostate removed. These persons often had infections, infections caused them to have hyperthermia,[21] so they were often cooled off by having them packed in ice cubes at the time of their operation. What my present wife and I—by the way, my present wife and I were married in 1963.

FISHER: And her name is?

LUSHBAUGH: Dorothy Bess Hale Lushbaugh. We were married in Oak Ridge. One of my craziest ideas was that there was a substance called *popop.*[22] Do you know that substance?

FISHER: Yes, I've heard of it.

LUSHBAUGH: Popop was a chemical that was made into a solution to measure the radioactivity that was in that solution, so that one could figure out what the radiation was coming from hydrogen or helium or some other water-soluble substance on radioactive chemicals. Then I got the idea that one of the ways that one could measure radiation exposure in people was to use popop, and of course, because I was an experimental pathologist, the first thing I did

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18 4 or more inches

19 Atomic Energy Commission

20 pertaining to the prostate gland

21 abnormally high fever

22 1,4 bis [2-5] phenyloxazolyl benzene, an organic chemical reagent used for radiation dose measurements in solutions

was to put this in animals. At that time we injected popop in mice and found, much to our horror, that mice became very cold. We subsequently found out that what popop did to mice and rodents was, it made them unable to regulate their body temperature, to keep up their body temperature when being refrigerated. If you took a mouse with popop in him and put him in the refrigerator, he became the same temperature of the refrigerator. So if you took a hold of him as a mouse, he became the same temperature as you.

We thought this was applicable to the therapy of prostatic cancer. This was a very good idea, but it turned out that it wasn't. It was obviously the kind of thing that needed a whole lot of work done by some kind of a radiopharmaceutical company. So in order to do that and maintain control of it, we thought the AEC should get a patent of this stuff and patent its use so that if it was investigated, the investigator would then have to report to the AEC what they found. An AEC official then met with me in Los Alamos, and felt that the best way to do this was the way we had done the thermistor probe and to just publish it and let it go out to the public domain as a fact in a published article. It was.

Early Animal Studies at Los Alamos

FISHER: You did some early studies at Los Alamos on a couple of interesting areas: the response of skin to beta radiation and the response of monkeys to acute gamma radiation.

LUSHBAUGH: Los Alamos is often concerned with the use of radiation in human beings. The area that I worked in, we didn't use human beings, except we did use patients, in that the patients were referred to me as the pathologist at the Los Alamos Medical Center. They were referred by other physicians.

FISHER: Or for cancer treatment.

LUSHBAUGH: For various kinds of treatment, for thyroid uptake and various other studies that we did. These were patients that did not react to therapy. There was once an aboveground atomic shot where a radioactive cloud drifted over southern Utah and northern Nevada. Cedar City [Utah] was one place where we had sheep. One of the sheep was sent to us in Los Alamos, where we called her Cedar City Sue. This sheep came from a flock from around Cedar City. This is how we got started on the beta radiation. We found out that all these animals had rather bare ears and they developed scabby excoriations[23] of ears, which was actually due to a virus and was not due to the fallout itself. The fallout was such that we subsequently [had] plaques that were made for us, by New England Nuclear. We put these on the wool of the animals, and found that it took something like 40,000 rep, which was equal to a rad, to actually get radiation burns of the skin. The lesions of the ears were due to a virus, which apparently was a well-known sheep disease. I had to spend a great part of my young life at the Federal court in Salt Lake City, Utah, educating the judge on how these lesions occurred. Since at that

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23 sites where skin has been stripped or otherwise removed

time, I was a professional, I had photos made of these sheep and the lesions that developed. I had to show the photos to the Federal judge. Because I had to designate which [of] these were with controls, we had one-two-three-four-five, hello honey, six-seven-eight, hello Dolly.

SIPE: I don't remember.

LUSHBAUGH: We had an H one. The judge knew the answer to that joke. He was a sheep herder from Utah. He reversed himself, in spite of the fact that I showed that these skin lesions could not have been due to a fallout from the radiation. He awarded the sheep owners.

FISHER: In the lawsuit.

LUSHBAUGH: Anyway, he awarded the people who were suing, the plaintiff's case. He awarded them money for the damages to the sheep, since quite a lot of them had died. Apparently they had died as a result of bad forage and bad water, etc.

FISHER: Some people have wondered if their deaths hadn't been caused by the ingestion of fallout on forage.

LUSHBAUGH: We took sections of their stomachs and we couldn't find any evidence that they had ingested radiation.

FISHER: You did some pathological analysis on their stomach?

LUSHBAUGH: Yes, we autopsied all the sheep. I forget the man's name, although he was an AEC official who was in charge of that study who went through Wright Langham and Dr. Shipman. Anyway, one of the other things I did when I was at Los Alamos was to expand the use of blood cell counters that were then being established. I started out with a cell counter which was made by a Florida concern. There was a physicist there at Los Alamos whose name was Marvin Vandilla. He was a physicist, which I never was. He showed that the artifact that intrigued me was, in fact, an artifact. And that everything that I did as far as the Coulter counters were concerned was wrong: I had made the mistake believing that the aperture, which I thought was merely a hole, actually had some depth. He showed that the aperture in the Coulter counter was too short, and needed to be elongated, and that in elongating the aperture as you were counting then prevented measuring the tumbling, and you actually measured the actual diameter of the cell. Vandilla's work with this counter became the way to go. Los Alamos still has a Coulter counter investigating team.

SIPE: We're talking about Paul Aebersold. You were talking about Shipman and somebody was having control over him. Wasn't it Paul Aebersold?

ANDERS: I don't think it would have been Aebersold. It would have been someone in the AEC Division of Biology and Medicine. Paul Pearson or maybe Charles Dunham.

NASA-Sponsored Studies

LUSHBAUGH: Charles Dunham was the man who got us involved here, the ORINS area into the NASA area. Charles Dunham raised the question as to here we

have this facility which simulates one and a half R per hour. Did you say 1.6?

SIPE: 1.6 R per hour.

LUSHBAUGH: 1.6 R per hour. That this was much too fast for NASA, so we needed to cut it down by some factor. This is why we came up with the number of 60. So we did it at 1.5 R per hour. Also, since that was the radiation flux in the Van Allen belts[24] and also in space, if there was a release of radiation from a starburst, or something like that. We were given the opportunity, and of course, we were all looking, as everybody did then, for monies that would support research, monies that would support your facility, money that would support your staff. We subsequently got this from the NASA people. Actually, it was a study that was unnecessary in a way, in that if the heat shield on the capsule had just been reversed, and they had put the heat seal between themselves and the burst, they would have been more than adequately protected from the radiation damage. Nobody actually got a sufficient amount of radiation to produce radiation damage in space. So that was a lost cause.

ANDERS: This happened after you came to Oak Ridge.

LUSHBAUGH: Right. In 1963!

ANDERS: Was NASA's interest in these kind of studies, did that predate your coming to Oak Ridge or did that happen after you came?

LUSHBAUGH: Afterwards.

ANDERS: And that was primarily because of Charles Dunham?

LUSHBAUGH: Charles Dunham was then the head of the Division of Biology and Medicine at [the] AEC.

ANDERS: He was the person—

LUSHBAUGH: He was the person who fingered Dr. Gould Andrews, who was then the head of the Medical Health Science Division.

SIPE: He was at the University of Michigan, was he not?

LUSHBAUGH: He was at the University of Michigan. And he had been brought down to replace the doctor who died the other day, Marshall Brucer.

SIPE: Dr. Pollard was the director.

LUSHBAUGH: But he was the director of ORINS. Dr. Marshall Brucer was replaced by Dr. Andrews and I replaced Dr. Andrews.

ANDERS: I want to make sure I get some of this down on tape.

SIPE: (*pointing to a copy of a resume*) That right there is going to be your own. This, I fixed for you. You have *your* CV, so that's for him [Anders]. I can make another copy. I also have one on the nuclear medicine about Brucer's book, which is fantastic. He said he didn't know much about it.

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[24] either of two atmospheric regions of high-energy charged particles, one at an attitude of about 2,000 miles (3,200 km) and the other at 9,000 to 12,000 miles (14,500 to 19,000 km)

ANDERS: Thank you. We appreciate copies of all this. It's helpful to us.

SIPE: Dr. Brucer had written these things called vignettes, and then the megacurie with garnet, which of course went on, too, while we were doing what we were doing when we were doing it here. This is when ORINS's Medical Division began. This is from Brucer's book also, but it will give you something until you got your book. These were some things that I had just done which will come in later when he gets here to ORINS. But I want you to know some of the things here that I have. The Brucer total body irradiation in 1929. I'm always trying to defend the things that were done so many years ago that nobody knows about. That was something else that came out of this Brucer's big book, which you can get out of the vignettes, which is great.

ANDERS: Thank you.

Primate Studies

ANDERS: This should be the third side of a taped interview with Dr. Clarence Lushbaugh. Roger Anders and Darrell Fisher are conducting the interview, assisted by Ann Sipe. On the first two sides of the interview tape, Dr. Lushbaugh was referring from time to time [to] lists of journal articles that are on his vita and other items on his vita. He also referred to an article by Arthur C. Heubline. This was published in *Radiology*, volume 18, no. 6, June 1932, and the title of the article is "A Preliminary Report on Continuance Irradiation of the Entire Body." Having done these housekeeping chores, I think we can resume now. As we mentioned, I think we'd like to go back to Los Alamos.

FISHER: Could you tell us a little more about what you learned from the studies on high-dose irradiations of primates?

LUSHBAUGH: One of the things that [we] did in Los Alamos, believe it or not, was to avoid purposeful irradiation of human beings. We only irradiated persons who were thought to be without any other hope of being cured of their cancerous disease. But in the business of trying to determine what was the effect of radiation upon primates and primate bone marrow, we were bugged at that time by an article by Leon Jacobson in which he shielded the liver of rats. Dr. John Storer, who is a fellow pathologist M.D. from the University of Chicago, whom I got to come out to Los Alamos, he and I developed a type of shielding of rats, in which we shielded the tail. We were trying to spoof Leon Jacobson at the time. We called the paper that we wrote, "The 'Piece of Tail' Factor." This was based upon studies of Dr. Charles Huggins, who was then professor of surgery at the University of Chicago, who showed that the tail of the rat contains yellow marrow and that one could make it, however, contain red marrow by transplanting the tip of the tail into the abdomen. So the rats went around the laboratory with their tail in a "U" as the tip [of the tails] was sewn into the abdomen. Then it became like a spleen and took things up. We were able to show that the splenic factor was not really a splenic factor but was due to the stem cells that were present in the marrow of the animal, as well as in man. These cell are [in] our vertebrae, and in our pelvis, at the head of our femurs. But they

are not in our fingers or hands or wrists. It was present in the warm parts of our bones and in primates.

It was for this reason that Langham had a primate colony in Los Alamos, in which one of my jobs was to try to keep these animals healthy and to help Langham, who was trying to irradiate them in various kinds of situations and to try to tell why the animals had died. The spinoff from that radiation, that kind of study, was the fact that we went and looked at the people who died in various kinds of things. We also looked at people who died following radiation accidents.

We had this one radiation accident that occurred in Los Alamos. We had another radiation accident—that was the "Kelley Case." We had another radiation accident that occurred at "Wood River Junction." We had another—that was the radioactive submarines. We had various kinds of radiation accidents that occurred, so I became a specialist in investigating radiation accidents. I also became Wright Langham's pathologist in investigating the effects of irradiated primates to see whether there was any difference between the radiation of primates from that of irradiated man.

FISHER: So the response of the man and the primates was similar?

LUSHBAUGH: Right, exactly. I guess I avoided telling you that in 1963, after getting divorced from my first wife, I decided to marry the woman, whom you know, Dorothy Bess Hale, who worked for me in Los Alamos. I was awarded the custody of the children from my first marriage and I brought them, with my mother, into Oak Ridge. My mother found that keeping track of these early teenagers was too much for her, so she demurred. My solution to the project was to marry Dorothy and make Dorothy the mother of my children and to give her the task. The other day we celebrated our 31st wedding anniversary and she's still the mother of the children.

SIPE: She sure is.

LUSHBAUGH: The youngest child was born in '52.

SIPE: She'll be 42 this year [1994].

Investigations of Radiological Accidents

LUSHBAUGH: In Oak Ridge, this is where we came in contact with Dr. Dunham. We also came in contact with the radiation accidents at your place, Battelle Northwest, which is the SL–1 accident.

FISHER: SL–1 was at Idaho.

LUSHBAUGH: Idaho Falls, right. I think of Idaho and Battelle as being the same place.

ANDERS: They're close enough.

SIPE: You came in contact with Y–12 too, in 1968, when you came here.

LUSHBAUGH: Yes, right. One of the things I did when I was in Los Alamos was to take charge of the REAC/TS program. The REAC/TS name is sort of funny. [It means Radiation Emergency Assistance Center/Training Site.] We did visit most radiation emergencies and provided emergency assistance. Our deal was that we would not try to horn in with these things, but we'd go and see

what we could do to help the persons who were investigating the radiation accident. So, we did this for a great number of people. One of the persons that I got coming along was Bob Ricks, whom I hope you have a chance to interview.

SIPE: We tried today, Dr. Lushbaugh, but he's going to Egypt.

LUSHBAUGH: He's presently the head of the REAC/TS program. He was a physiologist at the time. He came to me and was assigned to me one summer as a summer student. Then he stayed on and became my associate in the REAC/TS program and subsequently became my replacement in the REAC/TS program when I took over as the head of the Medical Division.

ANDERS: While you were at Los Alamos, did you become involved in the investigation of the SL–1 reactor accident?

LUSHBAUGH: Actually, my reputation—I guess was becoming so widespread that I was "Johnny on the Spot" at various accidents. Dr. George Voelz, who had been at Los Alamos as an intern in industrial medicine under Dr. Shipman, he was the person, the physician in the SL–1 accident who took care of the three persons who were injured there and who died.

ANDERS: They were all killed.

SIPE: But you found out something, too, while you went up there to do your thing. Do you remember about the tattoos? The identification. They had them identified wrong and where they were.

ANDERS: You mean the bodies were initially incorrectly identified?

SIPE: Two of them were.

ANDERS: Could you tell us what you did?

LUSHBAUGH: The way we did the autopsies was: You had this working station which the team of health physicists used, and they assisted you and helped you from getting yourself killed. We also had the team of pathologists and physicians; largely, that was a team of persons that was made up of George Voelz and his medical people, and me and the health physicists from Los Alamos. One of the guys at the SL–1 accident was a guy whose name was Colonel Jim Brennan. Jim Brennan suggested to a general by the name of General Humphries, my name as a person who could do the autopsies.

ANDERS: There was General Leudecke, who was a general manager of the AEC at that time, and he was deeply involved in the investigation of the accident.

SIPE: I don't remember if we had that in the paper.

LUSHBAUGH: I think I got called by General Humphries, who was asked by Colonel Jim Brennan to call me in Los Alamos and ask me to come up and do the autopsies on these people. We did the autopsies on these people and established the cause of death. First, we had them laid out on a table that was made by a couple of sawhorses with a used plank door laid on it. We went in and mapped the persons. One person had struck his head and died as a result. The accident was energetic, and it threw this one person, who was apparently bringing in the bell housing that was unused.

There was another fellow who was the fellow who was pinned on the ceiling. This was the guy who was the chief of the group. He was sitting on one of the control rods, and this control rod took off in the explosion and pinned him to the ceiling of the reactor. The persons who were on the scene at the reactor felt that if they dislodged him and he fell on the reactor, they feared they might have a criticality again. They spent a long time, up to a week, cutting a hole in the containment silo, where the reactor was, and then building a beam and a net, so that they could catch this person's body and bring this person down. By that time, we had done the other two accident victims. One of the fellows, was he lifting?

SIPE: They had identified one of them wrongly. There was a tattoo involved. They were Army guys and one had a tattoo.

LUSHBAUGH: What was the tattoo?

SIPE: I don't remember what it was. They said that was not the right one and you discovered that they had mixed up the bodies in different places. They were going to end up trying to bury them at the wrong place.

LUSHBAUGH: It was that time that we came to the conclusion that burying the person in the family graveyard was probably a very bad idea and that this would put a radioactive man into the town's drinking water! Unbeknownst to the town, they drank the groundwater that came from the cemetery. This was the first time the cemetery groundwater had ever been labeled[25] or threatened to be labeled. This person didn't get buried there. I remember that the third person was a navy Seabee.[26] who had a bumblebee tattooed on his shoulder.

SIPE: There was three Army guys. If I had known, I would have had it all here with me. I'll have it later if they'd like to know.

LUSHBAUGH: We wrote that one up pretty thoroughly.

SIPE: Were you involved in 1958 with Kelley?

LUSHBAUGH: Yes, I was involved in the Kelley case, but *you* were mostly involved in the Kelley case.

SIPE: That was at Los Alamos, where you had gone back to do some studies and autopsies on the Kelley case in 1958.

FISHER: Ann, were you at Los Alamos at this time?

SIPE: No. They're still covering a lot of the Los Alamos stuff.

LUSHBAUGH: I've written so many of these articles.

SIPE: This was part of our radiation accident registry, which I helped him put together after he came here. Maybe it would come to pass as an organization registry.

LUSHBAUGH: Kelley was in Los Alamos and he was working on an extraction drum that had triethyl phosphate in it. The phosphate solution was agitated by a

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25 incorporated with a radioactive isotope to make a substance traceable

26 member of one of the U.S. Navy's construction battalions

propeller, which took it down so that plutonium could be extracted from the various aprons, rubber gloves, masks, and the crockery that was used in the DP West. Then there was another fellow, named Rod Day, who was in the next laboratory working in a glove box[27] and Kelley and company, this occurred on a New Year's Eve.

SIPE: Yes it was. December 30.

FISHER: December 30, 1958.

LUSHBAUGH: They were having a party there at Los Alamos. After the party was over, then they went in and each went to his job to do some last-of-the-year analyses and recovery. It was at that time that Kelley punched the button. I've always thought, though I've never heard, maybe you have, that the propeller was wired wrong. So instead of the blades moving the stuff down, the propeller was fixed in such a way that the phosphate which was riding on the surface of the water was brought together as the propeller sucked the fluid down, dragged the fluid in, and caught this mass of plutonium in there. This guy was irradiated and he died at Los Alamos Medical Center. Rod Day apparently was irradiated by walking past the tank in question.

SIPE: He ran out.

LUSHBAUGH: Kelley thought he had been hit by acid, because he felt that his skin was burned. It was injured by alpha radiation.

SIPE: Did you do autopsies on him?

FISHER: Was that a criticality accident?

LUSHBAUGH: Yes, it was.

ANDERS: And Day got injured because right after it happened, he walked by?

LUSHBAUGH: Yes, the apparatus was radioactive and it contained radioactive material.

Congressional Testimony on the Use of Whole Body Counting in Medical Diagnosis

FISHER: Do you remember testifying before Congress in 1961 on the use of isotopes in medical diagnosis?

LUSHBAUGH: Yes, I remember that.

FISHER: Applications of whole body counting in clinical diagnosis.

LUSHBAUGH: I remember that I briefed the Congressional committee about that, and I think the chairman of the committee was a physician from the state of Kentucky. His name was Clarence. I do remember some of it. He actually made some derogatory remarks about Dr. Eugene Saenger. I pointed out to him that Dr. Saenger has not been invited to the meeting, that it was inappropriate for him to make remarks about him. What he should do is invite Dr. Saenger to the meeting and then make those same remarks about him, and I would dare him to do that.

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27 an enclosed compartment fitted with long gloves, used in a laboratory for handling contents without causing or incurring contamination outside the container

ANDERS: Do you recall why he was making those derogatory remarks?

LUSHBAUGH: Yes, he was making the derogatory remarks because Saenger, who is now radiologist emeritus and oncologist at the University of Cincinnati, had a NASA contract in which he was supposed to get, from persons that were irradiated, information concerning their thoughts, psychology. He used patients who were in the University of Cincinnati Medical Center, which was a large medical center for Hamilton County, of which Cincinnati is a part, in which there are huge slums. In such typical slums, these persons don't have any money and they're black and they're poorly washed. These persons were available in the University of Cincinnati Center to Dr. Saenger as persons who needed to be total body irradiated, and they were given total body irradiation by Dr. Saenger. I was on his committee, by the way, and I did review what he was doing, and I thought it was actually well done. These persons received radiation therapy which was really measured and put out by a trained oncological technician. The reason why the sensational Congressional committee member made these remarks about Dr. Saenger was that Dr. Saenger was still being mistreated by Congress for being involved in the Fernald defense in the AEC and DOE. This guy was from Kentucky, right across the river from Ohio and right across the river from Fernald, so he would, of course attack, Dr. Saenger.

ANDERS: He was concerned about safety at Fernald or health of the workers?

LUSHBAUGH: I don't know. All I've heard about Fernald recently and that is that DOE—that means you—has blinked, has paid off the class action suit. So Saenger is no longer in jeopardy.

ANDERS: That's why I was curious about why the joint committee would have perhaps felt this way in 1961.

LUSHBAUGH: I don't know. But I do know that in 1961 Dr. Saenger was beginning to build a whole body counter, which was a chair-type whole body counter with a sodium iodide[28] crystal. He was trying to measure some of the people from the Fernald area—some of the people who were supposedly saying that debris from that plant had injured their families and the like.

ANDERS: So the joint committee in Congress had some concerns about him measuring the Fernald workers. Was it because he felt that maybe this was going to reveal something about the classified activities of the plant in those days?

LUSHBAUGH: I doubt that. Because I think he just measured people from the environs around, family members.

ANDERS: Perhaps the concern was that it would show that Fernald was placing radioactive particles in the atmosphere that was getting into these people's bodies?

LUSHBAUGH: I guess so.

ANDERS: I'm curious as to why the joint committee would be concerned in '61?

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28 a crystal detector containing thallium impurity for detecting gamma rays

LUSHBAUGH: I think Clarence was very concerned about a lot of things. He might not be one of my favorite persons.

ANDERS: I'm sure there were other persons on the commission that also felt that way about the joint committee.

LUSHBAUGH: Right.

Other Human Radiological Studies at Los Alamos

ANDERS: One question, again referring to what you mentioned earlier at Los Alamos. The patients that were coming to you at Los Alamos?

LUSHBAUGH: As head of the laboratory at Los Alamos Medical Center, all of the patients were referred to me from the private practice of medicine in Los Alamos. The physicians who privately practiced had their offices there in the Los Alamos Medical Center. My office was there, too. They were referred to me by their own physicians.

ANDERS: So you would have then seen a social cross section of the Los Alamos community people at all the various occupations, various activities, various parts of the community. Rather than seeing any one particular group of people, you would have seen groups of people from all walks of life and all kinds of backgrounds.

LUSHBAUGH: Right.

FISHER: Your employer was the laboratory?

LUSHBAUGH: Right, although they got their money from the AEC in Washington. Their monies for me was divided in half. They gave half to Langham and half to the medical staff.

ANDERS: Did you have any more questions on the Los Alamos period?

FISHER: Were there any so-called lethal dose studies on humans at Los Alamos, or were these all in subhuman primates? Do you remember anything about that?

LUSHBAUGH: There was no lethal dose to any human being that was designed ahead of my time there, and then perpetrated.

FISHER: Do you recall experiments at Los Alamos while you were there on the use of fission products to determine biologic and metabolic behavior of fission products in man?

LUSHBAUGH: This is one of the things I did while I was there in Los Alamos. I worked with Langham on the scintillation counters. Langham developed the scintillation counters because he was trying to help some physicists identify some rare celestial event. In the course of doing this he found that *all* human beings were radioactive, that we all contain radioactive materials from living.

One of the things that I recall him doing, he was a very imaginative fellow and he saw this as a means of measuring body weight, body fat, and how well you were. He had a "males and females" thing. I was one of his guinea pigs in a study where we were weighed in a scale that was in water. You

were submerged in water and your weight was determined by water displacement. We were able to show that milk drinkers and men had more muscle than women. So you could tell a woman from a man by the potassium/cesium ratio. The cesium was in his muscle. If he was a milk drinker, the cesium was in the milk from the fallout. He had more cesium than he had muscle by weight. That was one of my situations.

FISHER: Do you remember ever being a participant in a tracer study where you were injected with any isotope?

LUSHBAUGH: I was a guy who liked to study the life span of red blood cells. One of the real problems—and I brought this study with me to Oak Ridge—was telling how long a red blood cell lived by labeling it with radioactive chromium. The trouble with this method was that the red blood cells that were labeled with the radioactive chromium didn't have the same life span of the red cells when done by a woman professor who measured these things using some kind of immunological tag. She could put red blood cells into a person and see what his body fluid was by the dilution of these red blood cells that she added. But you couldn't do that with radioactive chromium. The reason was that the radioactive chromium caused some of these red blood cells to be picked up by the spleen. Radioactive chromium-labeled red blood cells had a longer half-life[29] than the normal red blood cells.

FISHER: The mere labeling of the red blood cells changed their biological distribution?

LUSHBAUGH: Right, exactly.

FISHER: In retention and lifetime.

LUSHBAUGH: Right.

FISHER: How did that relate to the studies? You said you participated in a study?

LUSHBAUGH: I tried to figure this out and I was unable to. I remember giving this talk in front of a group in Los Alamos. It was a group of physicians gotten together by the Biology and Medicine Department who had a review committee that went around and reviewed the various projects. I remember saying, in my usual smart-aleck way, that even a Harvard scientist can make a mistake. The Harvard scientist was the one who developed the system of labeling red blood cells with chromium. The committee's comments was that even Lushbaugh was a smart aleck.

FISHER: Was there a resolution of that chromium-51 labeling problem?

LUSHBAUGH: As a matter of fact, the life span of the chromium worked okay. You just couldn't use whole body counters to do it. You could use sampling in a dilution, but you couldn't use whole body counters to do it because you always assay the radioactivity in the spleen.

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[29] the time required for half of the atoms of a given amount of a radioactive substance to decay; also, the time required for the activity of a substance taken into the body to lose half its initial effectivensss

Your question reminds me that one of the things I did [was that] I tried to determine thyroid uptake. I determined thyroid uptake there in Los Alamos, iodine-131. I was able to show that the iodine that was in unbound iodine was excreted with a half-life of nine days and that the bound iodine was excreted with a half-time[30] of 90 days. That was the radiological decay. We were able to use that in Oak Ridge, by the way, when I came there shortly afterwards. They had a girl who was apparently pregnant at the time that she was given radioactive iodine. She was given the usual dose of radioactive iodine, which was about 10 millicuries. Then, later on, it was discovered that at the time she had been given that larger dose of radioactive iodine, she was pregnant. At that time, we had in Oak Ridge whole body counters, which are very sensitive. (It was as sensitive, in fact, as the tank-type whole body counter that was made by Wright Langham in Los Alamos.)

A young student, whose name I've since forgotten, who was from Germany, wrote this up in an article, in which we showed that by using a very small, safe dose on that infant, we could do a thyroid study. We used something like one-hundredth of the dose. It was like one-tenth of a millicurie. We were able to show that the infant did not have a thyroid gland and that it would need thyroid injections for the rest of its life in order to keep it from becoming a cretin, so the little boy's life was saved.

FISHER: In other words, the woman was injected before it was known she was pregnant for a thyroid condition?

LUSHBAUGH: Right, exactly.

FISHER: And the fetus, the baby, you determined that it would not be born with a thyroid, because the radiation had destroyed it.

LUSHBAUGH: We determined that it didn't have a thyroid.

FISHER: Because it had been destroyed by the iodine.

LUSHBAUGH: Yes.

FISHER: Your determination was that it would need thyroid supplement for the rest of its life.

LUSHBAUGH: Right, exactly.

FISHER: Was there a follow-up on that, do you remember?

SIPE: He came back every six months for years. He got checked up. They watched over him. This was before the days, also, when things like that made people put signs, " Are you pregnant? Is there any chance that you may be pregnant?"

FISHER: Do you remember when it was that there was guidance to physicians not to use iodine-131 on women who were pregnant?

LUSHBAUGH: It was okay to use it if it was a very small dose.

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30 the time required for half of the atoms present in a compartment of the body to leave that compartment by normal biological processes such as metabolism or excretion

FISHER: Like for example?

LUSHBAUGH: Actually like one-tenth of a millicurie, but you had to have a very highly sensitive counter in order to count this radioactivity, in order to do a radioactive iodine uptake. That's what I was going to tell you about the radioactive chromium, that in that radioactive chromium studies, where I was a self-selected guinea pig. I found that Metracal was the control diet for all kinds of radioisotopes. If you took two cans of Metracal a day plus a martini, you were A–OK.

FISHER: What's Metracal?

LUSHBAUGH: Metracal is a commercially available diet. It contains about 100 milliliters of solution of highly nutritious stuff that, if you were on a diet of Metracal, is one of the ways of losing weight. I think I weighed 160 pounds then.

SIPE: Pretty thin.

LUSHBAUGH: I weigh 175 now.

SIPE: You're working on it.

LUSHBAUGH: I was working on bringing it down.

SIPE: You're bringing it down.

FISHER: So chromium-51 and Metracal. You took Metracal?

LUSHBAUGH: I took Metracal for the iodine, Metracal for the chromium, Metracal for the cesium, Metracal for everything, because it had radioactivity, but it was always the same. The contents of the Metracal was like being on a controlled diet.

FISHER: How did the activity get into the Metracal?

LUSHBAUGH: I guess by its manufacturer.

FISHER: Just as a result of fallout?

LUSHBAUGH: Right, exactly.

FISHER: So when you were a guinea pig as such, it wasn't by injection, it was by drinking the Metracal and then you were measured in the whole body counter?

LUSHBAUGH: Right. We used to have guys from the submarine program come through, and they had a basket where this whole body counter had a thing in it. We'd push this person in the hammock and then we'd drive the person [in] it with an electric motor. This one old captain of the submarine fleet used to always say, "Fire one." [*laughter*]

ANDERS: Was this at Los Alamos?

LUSHBAUGH: This was at Los Alamos.

Move to Oak Ridge (1963)

FISHER: What was your reason for wanting to leave Los Alamos and going to Oak Ridge?

LUSHBAUGH: They had this great program here in the Medical Division which was concerned with persons with radioactivity. They treated all sorts of persons with all sorts of radiation. This gave me an opportunity to see these persons with the disease who weren't normal people. I was using borderline normals as most. I had a carte blanche of all sorts of radioisotopes that were given in Oak Ridge. I'll never forget the time when some of these outfits came and reviewed the program, reviewed a program that Dr. Gould Andrews had, treating cancer of the ovary. He used to have these patients come in once every six months, when they were counted and were given a shot of some kind of radioactivity, radioactive phosphorous. Then they were taken to surgery at the Medical Division, and they had a laparotomy[31]. The surgeon used a counting apparatus to see whether or not there were peritoneal[32] metastases from the carcinoma of the ovaries. Whenever they would find one they would take it out. Well, at the time this committee reviewed that program, the minimum survival time of persons with cancer of the ovary with this treatment, was eight-something years. But they said it wasn't a good program. I always thought that was a terrible miscarriage of justice.

FISHER: Explain what the normal survival time was.

LUSHBAUGH: Six months.

FISHER: So six months versus—?

LUSHBAUGH: Eight years.

FISHER: Do you remember the isotopes that were used for that?

LUSHBAUGH: I don't remember. We used to sit around this table and we used to have all these chairs filled with staff members. Different persons were head of the staff. Dr. Gould Andrews was head of the Medical Division. The staff used to decide what patient was brought in, what had happened, and the doctor would present his case. The thing was, What kind of radioactive material would be helpful to him? What would be helpful to his doctor? One of the things that was discovered in the time I was here, by Dr. Lowell Edwards, largely when he was chief of staff at that time. I found it very hard to get people for my program, which was to study these various metabolic diseases and various cell life spans. I found there was a dearth of patients because Lowell Edwards was getting them all first. He was using germanium, because germanium was a very good compound that went to the stimulated reticuloendothelial system.[33] In regard to the reticuloendothelial cancers, you could use germanium as a total body tracer to find out whether or not this person had cancer and cancer metastases and whether they had lymph nodes that were involved. It was a very fantastic study. It was so fantastic that I couldn't do anything about it.

ANDERS: In coming to Oak Ridge, did you call Dr. Andrews and say, "I would like to work at Oak Ridge?" Or how did that come about?

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31 a surgical incision through the abdominal wall

32 relating to the peritonium, a membrane lining the abdominal wall

33 a family of cells that function in the immune system's defense against foreign bodies

LUSHBAUGH: Before that, Dr. Kniseley and I had been friends for a long time. He was a pathologist at Lovelace Clinic in Albuquerque. He helped me when I was chief of staff, at Los Alamos Medical Center [LAMC] trying to replace the LAMC staff. For instance, we had some surgeons there that didn't like to change over to the private payroll from the Federal payroll. So I fired them and had to replace them. In replacing them we had surgeons that went through Lovelace Clinic at some place and time, and we hired some of their staff. Dr. Kniseley and I were sent by the state of New Mexico to the Memorial Hospital in New York to work under the man who was Dr. Papanicolau. We were trained by Papanicolau to do pap smears. Dr. Ralph Kniseley did pap smears down at Lovelace, and I did pap smears up in Los Alamos. Then, when I came to Oak Ridge, Kniseley had left Lovelace at that time and he was now the associate director of the Medical Division at Oak Ridge. He used to live up the street on the hill up on Orchard Lane. I used to come into the Medical Division on occasions and to talk with him when Marshall Brucer was here, and also Ralph Kniseley was here. I used to visit him up there at that time. He was my contact. I'm not sure that Dr. Andrews was too pleased with me, but he was always pleased with whatever Dr. Ralph Kniseley said.

Dr. Andrews' child, who is Ellen Andrews, is now a physician, by the way. She practices in Oak Ridge. She is a pediatrician. I remember being once in her house when her father was still alive and her mother was there. She wouldn't walk for some reason or other. She would slide around the floor on her butt. I remember Dr. Andrews questioning me, did I ever see anything like that. I said, "Yes, there is an easy solution." "What was it?" I said, "You take her diaper away."

ANDERS: Was this one of the reasons Dr. Andrews was displeased?

LUSHBAUGH: Anyway they did it, they took her diaper away and she stood up and away. Because they had a rug made out of hemp.

SIPE: She came along a little late in life and it was very much of a surprise. I don't think she walked because they were so proud to have had such a surprise. She was so special. Dr. Andrews was not a real healthy human being, either. They were so surprised to have her. I think she could probably crawl even now.

ANDERS: And they still would have been just as pleased.

SIPE: I was trying to find that isotope in any of this stuff. The gallium-72 is the only thing that stands out that they used a lot of, but they never did corner it into the ovarian gallium-72 for metastasis. I can't find that it said ovarian-type products. I've looked. That was one of the ones that they were using an awful lot.

FISHER: When you mentioned that you had more opportunities at Oak Ridge to work with isotopes, was that because there were more available from Oak Ridge National Laboratory in close proximity to the Lab?

LUSHBAUGH: I don't know about that, because all AEC divisions had some chemists. At Los Alamos, there were chemists doing chemical refining. Los Alamos was nice; I liked working in Los Alamos. We used to have high-explosive

accidents there, in which trucks carrying various Spanish-Americans from down the hill would get blown up. I as a pathologist, I autopsied 150 percent of the persons who died in the Los Alamos Medical Center. We used to find that the best ways to find missing parts in an explosives accident was to go out with a pair of binoculars and watch the birds around radioactive dumps. You'd see the crows come in and take parts of persons that had been blown up into the trees. I remember once we had a woman who had a malignant melanoma[34] and who had an upper arm resection[35]. It was the whole arm, including her clavicle[36] and scapula[37] which were removed. I was given the arm, because I was given all of the surgical specimens. I used to be given every foreskin that was ever taken off in Los Alamos. Given this upper arm, I thought, "Why didn't I dissect that? Who has the skeleton of an upper arm, a perfectly normal upper arm?" She was dissected because of the lymph nodes underneath the arm. So I put it in the cooler, and then the person died within six months. I did get around to dissecting this muscle off the skeleton. Six months later this woman died from cancer of the lung, from a metastasis from her lymph node. I remember I gave the arm back to the undertakers so they were able to bury the whole body. They were appreciative.

SIPE: That's very important to people.

LUSHBAUGH: They didn't understand it, but they thought it was pretty good.

I also solved the problem of a murder there in a little town called Cebolla. Cebolla is the Spanish word for onion. That's why I know it very well. This fellow had some kind of lesion in his scalp. He had died during the night and the police brought him in. The New Mexico police took very good care of me. They'd bring in all the strange persons that had died. In this case, this fellow and his friend were two very drunken woodsmen and they were playing a game which I later called, "your mother's a son of a bitch." And the other guys would say, "No, she isn't; *your* mother's a son of a bitch." The way you played this was with a double-headed axe like all woodsmen use, and you sit there in front of each other with a whiskey bottle *here* [*(pointing down)*], and then you have an axe between you. One guy would try to hit the guy on the right temple and the other guy would pull it over, and try to get the guy to stop him from doing that by pushing it back. I was able to draw a cartoon using cardboard of a double-headed axe and fit it into the slice and show that this guy had died as a result of having lost the game fairly and squarely. You haven't heard of that game?

ANDERS: No, I haven't heard of that game. Did the police consider it a fair-and-square loss and forget it at that point?

LUSHBAUGH: Yes, they knew that when I said something it was usually true. They brought me the [vehicle] radiator of a person who was in their jail in Taos, New Mexico, because he had obviously been involved in a hit-and-run

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34 a type of skin cancer

35 the surgical cutting out of all or part of an organ or tissue

36 collarbone

37 shoulder blade

accident in which a man was killed. I looked for a man's red cells, and found bird red blood cells, which are nucleated[38] and oval. The human red blood cells are not nucleated. It was a matter of just taking a little bit of dried blood off this radiator and making a suspension of it and looking under a microscope and seeing all the nucleated red cells proving it was bird blood. They had to go up and put his radiator together back on his car and let him out of jail.

LETBI and METBI Therapy for Lymphatic Diseases

FISHER: We want to talk about all the work you've done at Oak Ridge from 1963 on.

ANDERS: 1963 on. We talked a little bit about how you came to Oak Ridge, why you came to Oak Ridge, and I guess we could start with the medical research that you began in the medical program you began working in when you started here at Oak Ridge.

LUSHBAUGH: I talked about the radioisotope program. And about how I was competitive with Dr. Lowell Edwards and his metastases of cancer and how I worked with Ralph Kniseley. I guess the great thing was that what we did, we got built this large what we called the LETBI [Low Exposure Total Body Irradiator] facility. Ann Sipe was the woman that became the actual day-to-day, hour-to-hour manager of the facility. I was sort of the doctor representative. I don't know what you'd call me.

SIPE: We used to call him co-investigator. It sounded really terrible. But that's what the lower echelon called you. Everybody. You were investigating.

LUSHBAUGH: The LETBI facility was an interesting one. This is where the major part of my research took place. It took place in a room where we had a console that measured the time that the person was in this room and being irradiated. The person that lived in this room was in a sea of radiation, much like that Heubline had made up years and years ago using x-ray tubes. But we used cobalt-60. We used cobalt-60 in an array around the ceiling, whereby a person in this area got a pretty uniform dose of radiation. We had a dose meter there. This thing sort of measured the amount of radiation. What he was not supposed to do with a patient was, he [(the patient)] was not supposed to get more radiation than we had said that he was supposed to get in a number of days. Days times 24 times [the exposure rate] was what the radiation dose was. We kept track of his radiation exposure. We found and what we had actually designed was a door that made these sources go back in the place so it didn't irradiate the patient unless the patient was in the room with the door closed. We didn't have any trouble with this, except for women patients. Women would always go to the bathroom together. Men would always go separately. We could have as many as two persons in this room at a time. So we had to keep track of the women.

SIPE: Yes.

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38 possessing a nucleus

LUSHBAUGH: The interesting thing was that as we watched, and we had remote-control cameras and the like so we could see. The person who was going to be irradiated would usually have arthritis or difficulty untying his shoes, or taking off his pants or getting into bed. If he got down in bed where he was sleeping all night, he had to roll out and climb the wall to stand and get up. It was terribly difficult for him to do. After he had been irradiated for a couple of weeks, and I do mean a couple of weeks, he would now be able to walk when—he had a double cane when he walked in. Now he would be able to give me the canes as he left. Now he would be able to get out of bed without having to fall out on the floor, roll on the floor, crawl up the walls. His arthritis would be gone.

FISHER: Could you describe the types of diseases that were being treated by the low-dose-rate facility?

LUSHBAUGH: We usually treated diseases that involved the lymphatic system[39]. We had chronic lymphatic disease. We had acute lymphatic disease and we had various kinds of myelogenous[40] diseases and the like.

FISHER: It would include both leukemia and lymphoma.

SIPE: We had the chronic granulocytic leukemias[41]. We had the lymphomas[42] and lymphosarcomas[43] and then the polycythemia veras and thrombocythemia[44][45].

FISHER: Polycythemia veras. Any Hodgkin's disease?

SIPE: No, we didn't have any Hodgkin's disease. There was a very large lymphocarcinoma[46]. This is out of the book. I can read it right out. I won't go from memory. This is your book. Everything was in a chronic state when we had them there, the leukemias. They were never in the acute state; they were always in the chronic state. There were criteria that were set up for this. In fact, sometimes even if blood pictures changed, when they decided they were going to have them in there, it would be stopped on the morning that they were going to start their treatments.

FISHER: Do you remember the protocols that were developed for these patients? What were the total body radiation doses that you wanted to achieve and what were the upper limits on those?

SIPE: LETBI strived for 250 rads in a period of eight days.

LUSHBAUGH: Ann knows more about it than I do.

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39 the system of glands, tissues, and passages involved in generating lymphocytes and circulating them through the body in the medium of lymph; it includes the lymph vessels, lymph nodes, thymus, and spleen.

40 produced in the bone marrow

41 leukemias involving the granulocytes (circulating white blood cells residing in the protoplasm)

42 tumors arising from any of the cellular elements of lymph nodes

43 malignant tumors in lymphoid tissue, caused by the growth of abnormal lymphocytes (white blood cells important in producing antibodies)

44 a disease characterized by overproduction of red blood cells

45 a disease characterized by overproduction of blood platelets

46 cancer of the lymphatic system

FISHER: 250 rads?

SIPE: Over a period of eight days. Five R per hour, approximately 20 hours a day.

FISHER: Five rad per hour.

SIPE: 1.5.

FISHER: 1.5 rad per hour.

SIPE: They had been doing this in METBI. That was the primary whole body counter. There had been some fractionated and protractive treatment, but not that much.

FISHER: So 250—

SIPE: —was the tops.

FISHER: —was the highest level.

SIPE: We did some 100s and some 150s, but 250 was the top in LETBI.

FISHER: What was the rationale for the medium dose rate versus the low-dose-rate selection? Do you remember which worked best and why?

LUSHBAUGH: It seems like the ones that worked best in the METBI were the younger persons. The older persons went better in the LETBI facility.

SIPE: Yes, I'm not questioning that. When METBI was there, I think [treatment choice] also had to do with the blood work, the picture, the acute state, the chronic state. One of the things that the Heubline treatment promoted was the hospitals all over the United States had been doing this way before LETBI had started. Giving small doses daily. Now this is an uneducated lady here. But learning from him, one of the things was it would attack the bone marrow and keep it from going into an acute state. If the white cells started climbing, the red blood cells a little bit everyday would try to keep a level picture. It also [made it] so that they [patients] could move around, they could stay in this area, and go out and visit and walk. Side effects weren't bad either. They didn't have the side effects they did from the 1.5 R per minute. The comfort of the patient was one of the things that they were really striving for.

FISHER: The low dose rate at 1.5 R per hour resulted in fewer side effects?

SIPE: The only people that ever complained of having nausea were people who had treatments in the METBI, the portal treatments, like to the spleen. There would be people who would tell us they could smell it. They would get nauseated going on the elevator, even going down stairs. There were only about three of those, but they had no side effects, nausea, vomiting, dizziness. They would get a little bit tired, the dormancy. We'd take them out. We'd get them out of there. The room was like a hotel room. They had their own television, and the paper, food, and [they could] come out and look outside or go outside and sit. They really were just hospitalized, so to speak, but still getting treatment. They had much fewer side effects than the ones who had it downstairs that we had noticed.

FISHER: Do you remember the year of the first full body irradiations?

SIPE: Where?

FISHER: Here at the Medical Division?

SIPE: That would have been before I came here in the fifties. That would have been in 1953 or '54.

LUSHBAUGH: There was a physician here on the staff whose name was Frank Comas. Frank Comas was in charge of radiation treatments. He had with him at the time Brucer who was here, he had with him a large focusing type of gamma camera. What would you call those things that he had downstairs?

FISHER: You mean the teletherapy room.

SIPE: He had that. He called it a "red menace."

LUSHBAUGH: Right. He was a good guy. He still is over there at the University of Tennessee. You should be able to talk to him.

SIPE: It was cesium-137 teletherapy. They put that in '55. I wasn't here. But 1960 approximately is when METBI was built, the middle exposure, the moderate exposure. Then we went in 1967 in LETBI. Dr. Comas was at UT [University of Tennessee]. He also possibly has retired. When I had my surgery in January he was supposed to retire by August [1994].

LUSHBAUGH: I didn't know that.

FISHER: So 250 rad either over a short period or a longer period. Twenty days?

SIPE: No, eight days. That was in the LETBI unit. In the METBI unit, they usually had, I don't know what the top was, I don't remember, although we have it in our history. They would have, sometimes they would have lower dosages. It's according to the child or the size. It was according to the disease. I think they would have it anywhere from possibly 50 R up to a little over 300. I think the maximum was 350 at one time. They usually stayed around 100 in METBI. Now in LETBI, we had a group of one hundred, one hundred and fifty, and two-fifty in LETBI.

FISHER: Do you remember the reason, Dr. Lushbaugh, for choosing 100, 150, or 250 R per treatment? Do you remember the protocol or the rationale why a certain dose level was chosen?

LUSHBAUGH: I think that the controlling reason was that the radiation dose was, and you didn't want to kill anybody. It's still pretty well unknown that 400 rads total body radiation is going to kill you; actually, if you had half of that, this was considered the therapeutic level. In the usual treatment of cancers, the daily dose to a cancer is about 200 rads. We were trying to prolong the time period it took to get such a dose into a person. And to be able to see some kind of an effect on a tumor.

SIPE: A lot of times these people had so many other treatments that they had other treatments in METBI, and one of the things, too, is that their cancers, their blood dyscrasias[47] would advance. Some of the times, knowing that something else did not bring it down to the level they wanted to keep it, sometimes they would try a little bit more. It is a known fact that all of those would reach a peak and then go over the blast process into acute

[47] imbalances of the constitutents of the blood or bone marrow

stages and then you had to take on another type of treatment, which would not be radiation.

FISHER: Blood counts were taken fairly often?

SIPE: Every day, blood counts were taken and the all of their history was known at staff meetings. The blood work. I did graphs for Dr. Lushbaugh. All the graphs distinguish between METBI and later [LETBI] and are the comparisons of where the blood stage was, where the bone marrows that were done. They did bone marrows before every treatment. If they decided it's a possibility to give them 100 in LETBI, a bone marrow was done the day before and then so many days after to see the nadir time and all the different things that would happen. In the meantime, also watching their blood picture to see if they got to a point where that might be doing some damage. They were watched over daily on that type of thing so the patient and his disease came first. It wasn't that their treatments were continued out, just to get an ending. Sometimes we've stopped because "something has happened here."

FISHER: Was there antibiotic support as well?

SIPE: If it was called for and needed, they got it. Some of the patients, some of the women would have some bladder infections. If something happened and it raised it's ugly head, then they would stop.

FISHER: Do you remember the comparison in therapy success between the METBI and the LETBI, in retrospect?

LUSHBAUGH: I was biased, of course. I always thought that the LETBI was much more effective than the METBI. The thing was, that in the METBI facility, it bordered on the amount of radiation that a person could stand in a day. And so you had nausea and vomiting and systemic reactions. Where you rarely had those things, if at all, in the LETBI facility.

FISHER: So there were fewer complications with nausea in the LETBI and you could still deliver the same total dose.

SIPE: Just over a longer period of time. I think also, you have a big psychological side here with the patients who are getting different kinds of treatment. They gave much support to each other. In the hospital, in the regular hospitals, it was always, "I've just talked to a patient three doors down and they're being given such and such, why don't you try that on me?" Although the patients did not pull that much here, there was such support and if someone was getting sick in METBI, everybody knew it. Then when LETBI started, it was like, "Let me try LETBI." There was such a psychological point of people in LETBI because they had one person, they were not a 20-patient hospital. Back there they were the only thing existing. Their every need, they're talking to their people, coming back at night. I've been here at two o'clock in the morning, where if there's something bothering them, I'll come right back up here. Although the nurses have a TV camera and could watch on a oscilloscope their heartbeat to make sure. They were watching over them in the nurses' station. They had so much care back there. It was such a hotel to go to. So the psychological factor also helped, I think sometime. I think that helped on nausea.

FISHER: You were able to treat as much as two at once in the same facilities.

SIPE: They didn't do that often, but, did that some. Some of the gentlemen, and Dr. Lushbaugh always came to meet them. We'd sit around and talk about it. They would come and sit with me for a little while. We'd go inside and sit for a little while, so by the time they started their treatment, they knew exactly how it worked. I never left unless I told them. Dr. Lushbaugh would sit with them for me to come home. Dr. Ricks did. When one was a preacher and one had a wife who couldn't drive. There was a thing about having treatment for eight hours and tending to their business. They wanted to do that. They were still in the chronic state of their disease. They had a big round table, the physicians, Dr. Lushbaugh, doing comparison of their blood work. These gentleman had probably five or six treatments in LETBI and METBI also. They had other treatments in METBI as other things changed. Or they had METBI before LETBI. So they were able to go home. They were still leading the normal life which was so important too, on that side of it, without the nausea and whatnot.

FISHER: What other facilities around the country were attempting the same types of procedures on lymphoma and leukemia?

SIPE: That part he'll have to answer, I don't know.

LUSHBAUGH: This is just a list of retrospective studies. That's not the answer to your question.

SIPE: That's not the answer you want. But I was giving that to the question they're going to ask in a minute. City of Hope was doing a study on leukemia.

FISHER: This wasn't the only facility in the country doing low-dose-rate whole body irradiations, was it?

LUSHBAUGH: No.

SIPE: No, these were two. Princess Margaret [Hospital] in Canada was doing a lot of those. Veterans Hospital was giving five R every day to veterans.

FISHER: Which veterans?

SIPE: It would be a VA Hospital in New Orleans. I did have at one time different hospitals, like Indiana and University of Arkansas.

FISHER: What was the most unique thing about ORINS in terms of treatment of leukemia and lymphoma patients?

LUSHBAUGH: I guess from the patients' point of view, it didn't cost them anything.

FISHER: Who covered the cost?

LUSHBAUGH: The AEC.

FISHER: Were they able to be treated because they belonged to the AEC family? Were they employees at Oak Ridge or members of the community or referrals?

LUSHBAUGH: This was the area cancer hospital. If you had some kind of cancer and cancer of the blood was one of them, you were sent to this hospital.

FISHER: Because it was a regional cancer facility.

SIPE: In 1946, when they first had their meeting and the isotope study became so prominent to people and isotopes per se that had been used so many years in the thirties. Right down the street they had ORNL [Oak Ridge National Laboratory] with isotopes. It was a meeting place that was close to isotopes and the expertise of the people involved. That's one of the reasons that they thought this would be a good place to start this. The Army was leaving and they were able to get the E–1 building. This was all the Oak Ridge Hospital in the old days. In '48, they acquired it. That was a basic reason, because of the isotopes that could be made, going in to peacetime.

FISHER: I seem to recall that Dr. Saenger was always doing these. Was it the same time, or did he come on later?

LUSHBAUGH: His regime was different. He didn't have a room, for instance. He had the usual radiation oncology room, which had a big source that could give doses. He would have oncologists who would look at the source or graph of its radioactivity and be able to tell how much radioactivity would come out. So they planned for a certain thing to be looked at in a certain way and delivered radiation to it for a certain length of time. Not total body irradiation.

FISHER: Was it a gamma source in a well?

LUSHBAUGH: Yes.

FISHER: Or was it a teletherapy machine that they converted into whole body irradiation.

LUSHBAUGH: I don't really know. All I know is that I have seen their printouts of the therapeutic arrays that they were going to have. I know that Saenger and I went on many occasions to Columbus, Ohio, where they had some kind of a radiation physicist who was moonlighting and trying to develop into a hospital physicist, a medical physicist. He apparently used the wrong graph paper and he depreciated this source. The hospital there didn't know that they were having any trouble, until one day the radiation therapist said that never in his life had he ever used roentgens, that were so strong. This is a quite well-known debacle. I don't know what his name is nowadays. Saenger could tell you.

LUSHBAUGH: I forget the name of the hospital.

SIPE: Yes, Riverside.

LUSHBAUGH: Riverside Hospital.

FISHER: Were these total body irradiations?

LUSHBAUGH: No, they were focused irradiations. The radiologist who complained about this was the head man, and he complained that he was getting many kinds

of dermatitises[48], ulcerations[49], and untoward radiation effects that he didn't expect to get.

FISHER: Because the actual dose rates were higher than calculated.

LUSHBAUGH: You're exactly right.

SIPE: Sometimes on purpose, sometimes because of neglect of the machinery, too.

FISHER: Was Dr. Saenger treating patients for leukemia and lymphoma?

LUSHBAUGH: I don't think so. Mostly his were inoperable cancers of solid organs.

FISHER: Using a directed beam.

LUSHBAUGH: Yes.

SIPE: (*pulls out a photograph*) Let me show you how they did the dosimetry work. Because of it being the room, they even arranged the furniture. There was one other. (*pointing to the photograph*) This is where the place is, with the couch, the door, the TV. It gave exactly, they went in and every inch of that place was totally controlled, exactly what was going to come in. Here's the patient. That wasn't the patient, that was a student. This is it. This is the control. Here are your sources. Then the door that opened and shut into the bathroom. It computerized all the information. It was just a nice little room. Here's the console. I have one here where they have every bit. Cutaway, electrodes. Tom Barkett was doing the study of how much radiation was hitting every bit of that place. I'm doing the dosimetry work, which was done for months and months and months. It was in really great control. I've got it here somewhere.

But anyway. Another thing that stood out. You asked him what was remarkable about the people being treated here. They were from all around this area, but they also came in from other areas. When they started, we had people in Washington that would call, and their mother was in here or their children in here. M.D. Anderson in 1951 took the cobalt-60 therapy and put it into their beams, the teletherapy machine. M.D. Anderson wanted it. Dr. Lushbaugh had brought a child here from New Mexico.

One of the things was that the whole town supported the place. Because they had above-average intelligence here also. We had so many Ph.D.s, medical doctors, etc. One of the things that was so great. When a doctor tells you there is no hope, there is one place. It's experimental to a point, but there's a lot of promise there. Somebody walks through the door that is half dead, limp, and in two days' time that child is running down the hall, eating. A mother has hope to live, to raise her children. We did have cures here.

We had to talk to them, not too long ago when all these wonderful things started happening. I have kept up with quite a few through the years

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48 inflamations of the skin

49 sores on the skin or a mucous membrane, accompanied by the disintegration of tissue, the formation of pus, or other effects

anyway. I've also kept up with the ones who didn't make up but were given extended lifetime. Ten years, 13 years. One case of acute lymphocytic leukemia who would in six weeks be gone, [lasted] three and a half years, which was unbelievable at that time. The word "experimental" also sort of put a thorn in my side, because really and truly even today when you are watching television, reading newspapers, magazines, or anything that you get, they are still doing the same thing that we did. M.D. Anderson, St. Jude, and they're still doing the same things that we did then. The laminar flow, the clean areas that we started here. The laminar flow that cleaned it completely bacteria free as much as possible is being used with these severely acute leukemic children. But what they're doing also is taking their bone marrow and freezing it now. Where before, in times of those days, they didn't know to do that. They were taking it from a child, a spouse, or whatever. So, everything that was done, nobody screaming, but the same thing is being done now that was being done then.

Charges That the Oak Ridge Radiation Therapy Was Not Effective

FISHER: It's been widely reported that the therapy performed here was not effective in treating cancer. Could you comment on that?

LUSHBAUGH: I don't know what you mean when you say it's widely reported.

FISHER: Well, you read in articles and magazines or you hear on some of these retrospective news programs, for example "60 Minutes," that the therapy was not effective in the cancer treatment. I wonder if you'd take this opportunity to describe the effectiveness of the treatment as you saw it as the principal physician in charge. Go ahead and comment as much as you want.

LUSHBAUGH: When I've commented on some things that Ann has said here, one of the things is experimental treatment. Experimental treatment says to me, and I've got a Ph.D. in experimental pathology, is that somewhere or other you had controls. Well, you don't have any controls. Actually, your controls are your experience. What we found was that we were able to treat people with various kinds of malignancies of the lymphatic and bone marrow systems that worked very well. They worked much better than if you tried to do it in another way.

FISHER: Like with chemotherapy.

LUSHBAUGH: Yes.

FISHER: Do you remember the available chemotherapies in the 1950s and sixties?

LUSHBAUGH: The only chemotherapeutic agent that I really know anything about is the nitrogen mustards that I already told you about.

SIPE: Cytotoxin[50] was one. It's still being used even in arthritic patients. I don't remember.

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50 a chemotherapy drug in cancer treatment

LUSHBAUGH: This is a field where you have to work in it everyday. Things are happening everyday. The names are changing. People are writing papers and you can't expect people not to claim that their treatment and their way of doing it is better than anybody else's way of doing it. We weren't trying to do that. We were trying to be as objective as we could be. Where it said that we used people as guinea pigs, this is not so. When a person came to this place, they usually came because of a physician. A physician referred him to this place and a physician told him what the reasons were and why he was being sent here. We had, for instance, a radiologist over at the medical center here next door to us, who used to say that a person who had a lymphoma or a cancer of the lung, he needed a little bit more ionization than his mediastinum[51].

SIPE: Dr. Ball?

LUSHBAUGH: Yes. That's tough to comment about that. Because you have somebody that's mouthing jargon and you've got your [tape-recording] machine on, so I can't really tell you what it is. I got a rock the other day that had "SHIT" on it and I got it for my 31st wedding anniversary. I put it out in my rock garden, by the way. A lot of people are saying this. Like people say, "Why don't you do this? Why don't you do that?" Well, how do you do it? How do you evaluate the things? What we saw here was that when people came to us with their problems and they came to us with their various leukemias, and they were treated by us in a certain way, then our LETBI facility really did its job. It did its job in the kind of a way that returned these people to life. They had hope where they didn't have hope before and they were able to do their job, living everyday, which was very, very important to them. And it was very important to us.

FISHER: In medical terminology, then, you achieved some long-term remissions.

LUSHBAUGH: Yes, we did. The thing that has happened is this. Roger [Anders] should know about this. The other day, Dr. Bill Bibb gave a seminar here at the Medical Sciences Division, or whatever it's called nowadays. He told for the first time the truth about a matter that I knew was the truth at the time it was said. Up until that time, this was our bone marrow program. There was a program in which we tried to replace abnormal bone marrow that had abnormal genetic defects with normal bone marrow that was going to respond in a different way. We had ways that were not well understood. One of the things I was going to say was that—

SIPE: —something Bill Bibb said.

LUSHBAUGH: We made bone marrow injections when our bone marrow program was not something that you could be proud of. Our bone marrows apparently didn't take. A review committee that was gotten together by the AEC to review our program came down, and they came over here and they said that Dr. Gould Andrews was practicing a kind of medicine which was not well founded and it was unethical. The reason why it was unethical was that he

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51 the area in the chest that lies between the lungs and contains the heart, esophagus, trachea, and other thoractic structures

was giving total body doses for the radiation that were so small. The reason was that he knew that the bone marrow might fail. Actually, the truth of the matter was that the AEC and your department was figuring up the cost and found that treating these people was too costly for AEC's programs, and so they had to shut down the clinical facilities because clinical medicine was becoming too costly for them. This almost broke Dr. Andrews's heart to have this kind of comment made about him. He left shortly after that.

ANDERS: Was this the AEC's Advisory Committee on Biology and Medicine that was making this comment, or some other part of the AEC?

FISHER: Reviewers or what?

LUSHBAUGH: I don't know. All I know is that I knew one person.

SIPE: I think it was 1973. I think that was the big review.

LUSHBAUGH: That was the time when I was left with largely an area in the LETBI facility and no furnace to keep this place warm during the winter time.

SIPE: You had a lot of expertise in one little building. You asked something on the treatments done in other areas. Daily, weekly, nightly, the hematologists, your physicians, your cytogeneticist, your radiotherapist, they constantly were in contact all over the world. They were all in the meetings speaking, "I just spoke to Dr. So-and-So and this is something that has really been improved, such and such." And then they talked to someone. They were always constantly sharing. When people would talk about people coming in here being guinea pigs, it's like the people on this side. This is what the media was doing, and even our forefathers at DOE. It never seemed like if you happened to be on the left side of the room you were going to get one treatment, you on the right [side] would get something else.

We had a young man that came here and worked under Dr. Lushbaugh named Dr. Guilimo Casteneda from Mexico City. Dr. Casteneda was a physician studying with this group because of his activities in Mexico. The one thing he always complained about is they took too long to decide what treatment would be best. They had these people here because in Mexico within twelve hours. I said, "What about bone marrows, what about such and such?" He said, "Oh, no." I said, "That's what makes this place special." Every patient was an individual, and if you had five acute leukemic or chronic granulocytic[52] leukemia, every one was going to be different. Everything was searched and looked. Because I was doing blood graphs and they were looking at the blood graphs and they were constantly trying to compare. Now *this* guy has too much of a T cell[53] something. And *this* one has some other thing. A lot of stuff I'd have to get my dictionary out or corner him. Everybody was such an individual that the treatments were just for them. That's even what made this place more special.

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52 pertaining to granulocytes (circulating white blood cells having prominent granules in the cytoplasm)

53 any of several closely related lymphocytes that circulate in the blood and lymph and regulate the immune system's response to infected or malignant cells

FISHER: You're saying that the therapy was customized to the degree possible for each individual.

SIPE: Yes, indeed. I would swear to that. I really feel that strongly. Like I say, not as one of the higher upper echelon and the knowledge of such a person, but you could listen and you could watch. A lot of times there could be possibly other experimentation using isotopes. The scans that were done to look and see what this treatment had done. To look at a liver, to look at a pancreas, to look at a spleen, to look at anything. We've had children come in here with aplastic anemia[54] that now are mothers. We had one girl who came in here. What did she have? She had two little babies, her husband left her. She's well. She was at death's door. They worked on her, and still they're having to work on her periodically, but she's a grandmother. There were so many good things that came out of this.

FISHER: There are quite a few long-term survivors of the therapy program.

SIPE: Oh, yes. There was an acute leukemia patient, and he is alive, working at Grovers in Knoxville.

FISHER: From some of the things that we've read, there were no survivors, you get that.

SIPE: Survivors of what now?

FISHER: Of the therapy program.

SIPE: That's not true.

LUSHBAUGH: People are always correct when they make statements like that because you can't live forever. So you have to measure things in a certain kind of way.

SIPE: Marshall Brucer said something about radiation aging, or something. You do live to get older. There's something he had in one of his books that was so neat. It is. We have some that are living. We have many spouses of mothers and fathers who still swear by the program. If they had to do it over again, because it gave their child extra hope.

FISHER: Marrow transplantation techniques were developed in the middle fifties, and you say you attempted some bone marrow transplantation here during the sixties.

SIPE: We did four.

FISHER: You did four.

SIPE: We had plates. I think it was really early seventies. There were four.

FISHER: Four cases with marrow transplantation. Did you want to comment anymore on bone marrow?

LUSHBAUGH: I don't know. I can't check out your figures because my brain is too soft for that. I think that everybody should be truthful about these things. I think the truth of the matter is that the people in this area benefitted from these programs. Like this man who brought these chairs in. His mother is the

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[54] severe anemia due to destruction or depressed functioning of the bone marrow, usually resulting from bone cancer, radiation, or the toxic effects of drugs or chemicals

mother of a child that I am said to have brought with me from Los Alamos. I didn't bring that child from Los Alamos. She talks the same way.

SIPE: He gave a talk at East Tennessee.

LUSHBAUGH: That mother brought that child with leukemia from Los Alamos where I was trying to treat that child with leukemia with a bone marrow transplant. We had irradiated that child and we had given it a bone marrow transplant from that boy that walked in here with these chairs. Did you know that?

SIPE: No, I didn't know that. But you didn't bring him here, but she came here because you were here. That's what I meant.

LUSHBAUGH: The other day, when my wife and I were trying to give away one more truck. We had to give an affidavit to the county that we were giving it without selling it so there was no tax involved.

FISHER: You were giving away a truck?

LUSHBAUGH: Yes. We did. That woman actually cried, broke down in the county clerk's office and cried when she saw my wife and me. We were the people who took care of her child. That child died.

SIPE: That's okay. He had about a year and a half.

LUSHBAUGH: Our treatment of that child was a failure. But because that child was a failure, we had other children that lived.

SIPE: He was also given about eighteen months to two years, when with acute lymphocytic leukemia it lasts two weeks or six weeks. They often brought them in here and they died before they could do anything.

FISHER: What did you do medically to improve your therapy over time, based on results?

LUSHBAUGH: I would say that medically, we actually stayed up with the medical times and that we benefitted from the other papers that were written. Where I talked about Warthin and Wellerd, and the radiomimetic drugs. That was a very important paper. For them to write. It was very important for me to have read it, because I didn't know what radiomimetic meant. Radiation was unique. Yet, I think that using radiation can be done knowledgeably in a way that you can produce a radiomimetic effect. And also you can use chemicals in such a way that you can produce by chemotherapy as a radiation effect. Today persons on chemotherapy—my daughter is 43 years of age. She's got 44- and 45-year-old friends supposedly dying with various kinds of cancer. They're on chemotherapy, they're on radiation therapy, they're on all sorts of kinds of therapy, and they're living. People are making progress and medicine is making progress. Medicine is making progress in the treatment. In a place like this where every day you come in and you work and work and work 12 hours a day, trying to stay up with all the things, reading all in the beautiful library. It's awful when you retire.

FISHER: It's tough to be out of it?

LUSHBAUGH: Yes, it is tough to be out of it, it really is.

Questioning the Propriety of NASA-Funded Studies

FISHER: Maybe today we've helped bring you back into it by asking you how things were many years ago. Some people have perhaps misinterpreted history when they have studied these projects and these programs. In particular, there's one area where you may be misinterpreted, and maybe you can help clarify this. That has to do with the involvement of NASA and whether or not funding from NASA in anyway contributed to the choice of therapy for patients. In other words, some people have either rightly or wrongly interpreted the fact that because NASA was contributing funding to the program that they were somehow able to dictate treatment levels or make medical decisions. Do you want to comment on that?

LUSHBAUGH: Everything you said isn't true. The comment is that the best physics that is concerned with space travel shows that there is a real chance of getting radiation exposure. How do you diagnose this from the ground? Say you're on earth. How do you diagnose the fact that the person is sick because he's been irradiated? How do you get treatment to him? NASA has the responsibility of doing all those things. NASA has to have the primary responsibility of investigating these problems. At the same time, you have the problem of trying to get financial support for staff that can attack these problems. You also have to have the monies that allow you to treat persons who have the problems even though they haven't gone in space. It is complicated.

FISHER: What would you say to critics who suggest that NASA had some choice in selecting either therapy levels or dose rates? What would you say to that as the physician in charge?

LUSHBAUGH: I would say that's completely wrong. NASA had certain areas that it had to fly through. It still has certain areas and problems in space. I don't think NASA can. It has to get the help that it needs to attack these problems. I think that the whole question about NASA's funding in these programs is crazy. It's like DOE not knowing what is happening to people who are in charge of the various kinds of places.

FISHER: Are you suggesting that the NASA funding was for data interpretation and to support the program, but the medical staff made the clinical decisions?

LUSHBAUGH: You say it very well. That's what I'm saying. But I say it a little.

FISHER: The reason I bring this is up is we hear people who may not know the truth or the facts, reinterpreting what you did. This is your opportunity to set things straight and to give your opinion and your interpretation of the way things really were.

LUSHBAUGH: Yes, but time flies and changes occur. You go up and down the halls here and here's a beautiful institution that's going to hell. It's going to hell, actually, because of the budget. Things are becoming expensive. You have to have budget in order to run things. You have to have people who are dedicated, people who want to do this sort of thing. You have people who have as their biggest task to get enough money [to] operate such a hospital. If you could cure the problems of radiation-induced vomiting in space, that

is a big hazard. Somebody has to think about that and has to think about it in detail. Somebody has to know about how to control vomiting, how to do that in space. For instance, I was on a panel for NASA once, in which they flew gophers. Gophers died, but they died from a lesion in the lung that was showing necrosis[55] that occurred at the bifurcations[56] of bronchi.[57] I knew exactly what was the cause of this disease but nobody bought it. NASA didn't buy it. In fact, NASA didn't do anything about it. But I knew what was the problem. The problem was that in spacelessness nothing weighs anything, kernels of corn don't. When you eat something, it doesn't have any weight either. Necrosis of the bronchi was occurring in these animals because of pellets of dry food that was floating in space in the cabin they were in, and it was impacting their bronchi. But no one wanted to believe me.

FISHER: I can understand that. That's very interesting. The NASA funding helped support the project here, but they didn't really dictate therapy, did they?

LUSHBAUGH: No.

SIPE: I think it's an insult also to physicians, to people involved in research. Everybody has their own ideas, their strong ideas. But they still have taken their oaths. I have really, and I'm not really overly wild about doctors. I even have a son-in-law that's one. He's okay. To me, it's an insult to people who have done so many good things. It's just like with your surgeons. Once there was an army surgeon in Oak Ridge Hospital and I was working in surgery. There was a man [who] had cancer of the tongue and had never been, he [the surgeon] had never done anything at all to that type of thing. He got out the book that was written by somebody who had done it 20 years before. He read a page and he cut a while and he read a page and cut a while. Somebody could have said, "Oh, my gracious. How terrible that could have been." But he was still trying to save that patient. Which he did. The man lived for a long time. The people that were here were dedicated to research and dedicated to this type of problem. How in the world they could say, "NASA is going to walk in and say, 'Now we want this many patients'"? What they would do, I don't know, but most places that money was involved in, they can draw off of what you get out of there. If ORINS irradiated patients from 50 R to 250 R, all of the data is there anyway, so they could take what they wanted. It wasn't that the patients were done for NASA or for some doctor somewhere is interested in such and such or a medical for your chemotherapy. There was not any trials on that type of thing. The treatments that were done here were strictly for patients. A lot of studies came in. St. Jude was interested. M.D. Anderson, City of Hope, just so many people, doctors were studying different types of problems and they would draw off the information. They drew off each other's information. In the meantime, since NASA built that little thing up there, they were just drawing off the information. But never did I ever see

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55 death of a circumscribed portion of animal or plant tissue

56 points at which something divides or forks into two branches

57 the two branches of the trachea (windpipe) that extend into the lungs

anything that was ever, that could substantiate them treating patients. Dr. Lushbaugh is a radiobiologist and he's a pathologist and it would be the Dr. Andrews—not Dr. Kniseley, he was a pathologist. But there were two or three others here at that time. They would have never done anything like that. NASA never came into it. It was another treatment and a much happier way and a much less side effects way of doing it. I never saw it, and don't you think I didn't look because these people were really special people. It just didn't exist or I wouldn't have been here. Do you not agree, doctor?

LUSHBAUGH: Oh, yes, I think we're great.

SIPE: They can tell that. I think people really end up and forget. Everybody has to have a reason when somebody dies. Everybody has to have something to blame it on. There are so few blaming ORINS at this time, but that's the only ones you hear are the very few. Lawsuits. We've been giving a little isotope to see where cancer is so that they can treat it. Which was done all over the world. There's a suit on that. Another one is because of the NASA thing, which had nothing to do with it whatsoever. But the people who I know which are so many of the wives, the husbands, the children, were so grateful to have had a place that would take care and bring life back to their family. They didn't blame the cancer. They still have to have a reason, and of course with some people they would say, "Here I am, an uneducated Appalachian person, and look what they did to my family." But you have another one who's got more common sense than the whole body of Dr. Lushbaugh, maybe. They say, "Look, I may be Appalachian but they saved my life and I'm still here and you can talk to me about it." So she didn't have anybody to blame, she had somebody to plug. But the other one, they also said in this area we could draw from the non-educated. They had that. That was a big to-do. Now we had Ph.D.s here. We had some that were able to come and go right out into the plant and work.

ANDERS: So patients treated here came from a diversity of backgrounds?

SIPE: Oh, yes.

Radiation Treatment Patients at Los Alamos and Oak Ridge

ANDERS: I was curious as to how the patients who were treated here at Oak Ridge might have compared with the backgrounds of patients that you treated at Los Alamos. Was it similar in that you saw a diversity of people from a diversity of backgrounds in the community?

LUSHBAUGH: When I was in Los Alamos, Los Alamos was usually fenced. You had to have a pass to get in, so you had to have Q clearance of some sort. This was true. The best place to eat was outside the gate. The gate was a front gate where you went through and you showed your badge to get in the place. So the Los Alamos people were a little bit more specialized. But, on the other hand, you had an awful lot of people that lived down in the valley, who were uneducated, who had poor education, who had poor family backgrounds, poor genetic things. I think that in the long run, if you take the whole thing in a whole day, you found out that what you really did was,

you did the best you could with what you had. You treated what you were faced with. In was not unusual for persons, for instance like myself, to go down, to go to a doctor in the little town of Espinola. He was a better surgeon than the surgeons in Los Alamos. I remember going down once to this surgeon down there to have a vasectomy. I had three children, and that was as much as I could afford, I thought, particularly at $4,200 a year. It was the best thing I ever did. But, while I was on his table and he was about to cut me, he decided, he said, "I've forgotten to have you sign my permission." He had already injected me with all sorts of drugs, opiates, etc. I would have signed anything.

SIPE: That was another thing they brought up here, too, in the days about signing permissions and how it was a possibility that these people didn't know. People just don't know unless they've sat there and listened to people. Not only did all the different physicians, the nursing staff, the other patients who were very wise, on the treatments. At any time they [the patients] could terminate, at any time.

FISHER: So it was totally voluntary?

SIPE: Totally. They were told when they were entered here, there was a "sign in" to sign to become a patient. Then at every other thing that was done. They even were told they could walk away. At every other thing they did, they signed. "We're going to give you an isotope and this is what we're going to do. Because we want to see if your malignancy has spread to such and such."

LUSHBAUGH: By the way, one of the leaders in this whole area that Ann's talking about right now was Gould Andrews. He was far and far, many years ahead of permission.

SIPE: One of the kindest human beings that watched over.

LUSHBAUGH: But he was unethical because he was using too low radiation for bone marrow irradiation. He had the right intentions.

SIPE: He worked so hard. He tried so hard.

LUSHBAUGH: He really did.

Institutional Review Board at Oak Ridge

ANDERS: Along those lines: In 1967 an Institutional Review Board met here to review the clinical research proposals in which human experimentation was involved. Do you remember why that happened in 1967?

LUSHBAUGH: 1967?

SIPE: 1966?

ANDERS: 1966, 1967—in that time period.

SIPE: I don't know. I know I had to look that up for Dr. Frye and I don't know. I'm sorry. I didn't go into it that far. I did find the paper, but I just xeroxed it and gave it to him.

ANDERS: I was just curious.

SIPE: Did they not have great big get-togethers like that periodically, about boards coming in and your human usage, as I call it? The people call in to—they call in the Human Use Committee. Was that the foreleader of it, really?

ANDERS: That would be. And they seemed to be formed at different times, at different AEC facilities. I was wondering why this particular time.

LUSHBAUGH: The reason why humans are used and get disparaged of this thing is because a human, an ordinary person writing such a remark would think that a human being isn't very perspicacious. He thinks that a human can be tricked. Every guy sees a physician who wants a free patient; a patient who comes and pays his fee, he's very free. But now he wants him. Look—he's got a cancer, or something. Why don't we try this isotope to see whether it goes there? That isn't the way it's done. It really isn't. I can say that truthfully. One would not say that "You're a patient of mine, because I have a radioisotope in the refrigerator. I'm looking for a patient that has your disease. Why don't I try it on you?" That's being a guinea pig. That's what everybody thinks. I think that people are thinking wrong—because that's not the way it's done.

SIPE: Abbott Laboratories proved that in the thirties. Or was it the forties, Abbott Laboratories, when they started? They even had a place here, and I worked there. But they had done massive animal studies before it was ever approved to go out. Robley Evans did the thyroid. But there were so many things. The different types of things that go to different parts of the body, which had been studied and studied and studied before it was ever given here. My brother's on one now because he has no heart. He's on a study with a pharmaceutical group down in the big Washington—in Portland, Oregon, heart hospital. His muscles are gone, they don't know why. He'll either have a placebo or he'll have one-half of it or three-fourths or a whole. But people say, "They're experimenting on him." I said, "But it may save his life, or his son, who is now developing it." It may save that 29-year-old. To me it's not an experiment. I told somebody one day, "When you mention the word "experiment" to me, when was the last time you went to a doctor? What did he do? He gave you an antibiotic. And he said, 'If this doesn't work in two or three days, come back and we'll find something else.'" You can call that experimental.

LUSHBAUGH: Not with experimental qualities.

Controversy Over the AEC's Use of Human Subjects in Radiation Research

FISHER: Dr. Lushbaugh, one of the things that would be most useful for the Department of Energy, for historians, and for even the President's Advisory Committee would be your perspectives on the use of humans as subjects in radiation research. Your perspectives, your thoughts, your feelings. You've been involved in a number of different experiments or projects, starting with your earliest days as a new medical graduate, through your work at Los Alamos and then at Oak Ridge. Would you like to comment on human

radiation experimentation, the value, the things we've learned from it, its place in future research?

LUSHBAUGH: I thought I had.

FISHER: Is there anything you'd like to comment on, in addition to what you've already said?

LUSHBAUGH: I really truthfully think that where radiation is going along, and with the machinery and the various radioactive isotopes, the various chemotherapeutic agents, and the various committees and the various controls that are in place, that a physician has a hard time these days to just do something frivolously. The physicians that I know—and I think I know a good cross section of them—are all persons who are dedicated to doing their best. I think that the everyday physician who sees an everyday patient, that he doesn't sluff them off. I know *I* never did. I know that none of the people I ever worked with did. We were always self critical and critical of others. And that the whole thing that thinks that somebody by the name of Hazel O'Leary, for instance, can come in now and set the scale right, this is crazy.

Anyway. I think that the average physician needs to stand up on his hind feet and say that he didn't do that. That should be enough. I know I didn't do that. The other day, wearing my blue chenille bathrobe and being fully retired, there comes a knock on the door. I'm down in the basement doing something in my shop. I come up in my bathrobe and there is a little man who wrote the Sexton case for *Mother Jones*. He's knocking at my front door, and I don't know that he's got a hidden camera out in the truck and a man working the camera.

SIPE: He would have had to or he wouldn't have got that beautiful picture of you standing down there trying to shake your hand.

LUSHBAUGH: Have you seen me on "60 Minutes"? This young man that we talked to about Rick's being head of the REAC/TS program. Ricks does a very fine job in the REAC/TS program, but he does a terribly poor job when he gives "60 Minutes" my address out in the hills of Tennessee.

SIPE: You told him not to come and he came anyway. He's not easy to find.

LUSHBAUGH: He said to me, "How would you like to come out on your front lawn and have your picture taken with me?" I said, "I do not want to do that." Very plain. Then he said, "How would you like to come out to the truck where we have a camera so we can take your picture and have you say, 'No comment.'" I said, "I do not want to do that." He said, "How would you like to meet with Mrs. Stahl about this whole interview?" I said, "No thank you, I do not want to do that."

FISHER: Was this recently?

LUSHBAUGH: Yes, very recently.

SIPE: Back in the spring [1994].

LUSHBAUGH: What happens is that they show this whole interview on "60 Minutes," and me in my blue bath robe.

SIPE: He wouldn't shake his hand even, I was very proud of him. You didn't shake his hand.

LUSHBAUGH: I know I didn't. In fact, I could have killed him.

SIPE: He's one of the ones that helped stir it all up anyway.

LUSHBAUGH: I was too poor to do anything about it.

SIPE: They came here in January. I told Dr. Lushbaugh, and he said, "Why weren't you on there?" I said, "I decided to go have a hysterectomy in Knoxville to keep from being on that thing." Or I would have been here and I probably would have pinned her against the wall, no doubt about it, because of the things she said: "Do you mean to tell me that [you] put your child in remission for a month? That's not very long, is it?" I had to go around town and talk. Let me tell you something: I didn't do it on purpose. I said, "If you have a baby that you're holding for one extra month. That's a remission."

LUSHBAUGH: Who is this Stahl?

SIPE: Leslie Stahl. She was so brutal.

LUSHBAUGH: You're rubbing on a sore spot.

SIPE: We really have it terrible. That's what takes it away. That's what takes things away from all the good that was done.

FISHER: It's important to get your perspectives on this. I know you've been injured in a lot of ways.

LUSHBAUGH: I don't really care about that.

SIPE: It's just not fair.

LUSHBAUGH: I don't want to be continuously injured the rest of my life.

SIPE: One of the things, also, and Dr. Lushbaugh will back it: it injures the people. It injures the people who had hope. It injured the people who these people are trying to make them, let them say such terrible things that was done to their loved ones. It makes us so angry, because we saw what it did. We saw the faces, the hope. We've seen the ones who made it. Last week, one of the mothers who lost her child called me to tell me how her daughter has cancer, her husband is dying of cancer, and then she called me three days later to tell me he was dead. This boy died in '69 and they still come to me. I don't go to them. The camaraderie. She also went to Washington with us in '83. It's the damage it does to the people who were here. Because one lady called and said, "Why don't they stop this? You gave my husband five years. Why don't they leave us alone?" It's not saying "ORINS" and it's not saying "Dr. Lushbaugh," it is saying "them." Why don't they leave us alone? That's the tragedy. And when O'Leary says the terrible things that happened to people; they need to be reimbursed; they need money back. And then later she says, "I don't know where we get the money." That was in Oak Ridge. But the tragedy that "Oh, yes, we did do terrible things and that we need to pay you back." They *didn't* do terrible things. Some things have happened in the past all over the United States that's not too pleasant, but it wasn't here. It's not fair. He gets tired. I get tired of it.

Interview Wrap-Up

FISHER: It sounds like the program, at least the whole body radiation program was canceled in about 1974?

SIPE: Yes.

FISHER: Because of budget cutbacks?

SIPE: Yes.

LUSHBAUGH: Right. You see, at the same time, the thing that gave me a hint as to what DOE was actually doing was that they closed down at that time the medical facility at Brookhaven National Laboratory, and they also closed it down at the University of Chicago.

FISHER: Do you know what the reasons were?

LUSHBAUGH: Yes. They were becoming too expensive. Let's have some truth in this.

FISHER: We ought to wrap this up by mentioning that you received in 1984 the Distinguished Scientific Achievement Award of the Health Physics Society.

SIPE: So why are they hammering you, huh?

LUSHBAUGH: So what?

SIPE: He's gotten a lot of awards.

FISHER: Your acceptance speech, if I remember right, was very short.

LUSHBAUGH: Was it printable?

FISHER: Then you retired in 1989?

LUSHBAUGH: I retired actually October 1, 1990. There is some give and take about that because ORAU has one person, Pam Boni, who was supposed to be at that conference today. She keeps one number and I keep another number, so we don't agree on when I retired.

SIPE: He's sort of retired twice, like I have. He left the position of chairman and he came over to REAC/TS, and he and I worked on some programs and whatnot. I didn't recall you retired then. Just like I'm retired now. It was '91 when you retired.

FISHER: At the age of 75.

ANDERS: Looking back on your life, what do you consider your greatest accomplishments and achievements?

LUSHBAUGH: Starting chemotherapy. That was done when I was a little boy, wet behind the ears.

FISHER: In recent years, who were your colleagues that impressed you the most, and why?

LUSHBAUGH: I have trouble with the expression of "your colleagues." I've been impressed by a lot of people. Actually, in my retirement I'm impressed mostly by a man named Lewis who writes scientific articles. This fellow, Lewis, works at, or did work at, the Memorial Hospital in New York City. I remember when I first came across him way long ago and some of his

writings, and he writes beautifully. My professor Paul Cannon at the University of Chicago had never read him. I think that's terrible. I think that here is a guy who should be widespread. He's a very knowledgeable writer about biological medical topics and I think he's great.

FISHER: Who does he write for?

LUSHBAUGH: Himself. He writes for books.

FISHER: His last name is Lewis?

SIPE: The doctors had personalities a like sometime. I had to work in-between them and I learned. I used to be real gentle and soft and real soft-spoken. Let me tell you, I learned, didn't I?

LUSHBAUGH: You've got to tell it like it is.

FISHER: It's important that we hear your comments and your history and your opinions for history. Like I said at the very beginning, you've worked through the golden era of radiation research and a lot of this work cannot any longer be done, nor is it possible, and a lot has been learned that doesn't need to be relearned. You've had many wonderful opportunities to both practice medicine and do scientific research.

ANDERS: I think if you were to remember such things, jot them down in a letter form or something like that, we could always attach them to the transcript of the oral history interview.

FISHER: Incidentally, were you classmates with Eugene Saenger in high school?

LUSHBAUGH: Yes. I ran against him for senior class president and I won.

FISHER: Isn't that amazing that you both would end up in the same field both with M.D.s and somewhat controversial in your old age?

SIPE: You get those two together and you think, "controversial."

FISHER: Both have appeared before Congress to answer questions.

SIPE: They're something.

ANDERS: Dr. Lushbaugh, Mrs. Sipe, I want to thank you very much. We really appreciate your taking this time with us to put your perspectives and your recollection on the record. I would like to read the titles of the documents, Mrs. Sipe, that you were referring to earlier, into the microphone, so we'll have them for our records. This was one of them. One of the documents that Ann Sipe was referring to was entitled "Studies Relative to the Radiosensitivity of Man Based on Retrospective Evaluations of Therapeutic and Accidental Total Body Irradiation—Final Report." The report was written and compiled by R.C. Rex and C.C. Lushbaugh. Study completion date June 30, 1975.

SIPE: I think you've got it.

ANDERS: She also referred to a book entitled *ORAU From the Beginning*, written by William G. Pollard with Gould A. Andrews, Marshall Brucer, et al., which was published by Oak Ridge Associated Universities, Oak Ridge Tennessee, 1980. Goodbye, thank you very much. ■