# INTERVIEW WITH FRANK HUNGATE

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Interview with Frank Hungate

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Hungate, Frank

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Woman one: That'd be kind of cool if that was that.

Man one: That's exciting, because they pop when they do that.

Robert Bauman: [LAUGHTER] Well, it'd wake you up, anyway, right? [LAUGHTER]

Man one: Yeah.

Bauman: Wow.

Man one: Okay, are we about ready? Yeah? OK? Go ahead and roll. Is it rolling?

Woman one: Record.

Bauman: All right. Well, let's get started then. Let's start by having you say your name, and then spell your last name for us, please.

Frank Hungate: Frank Hungate. And H-U-N-G-A-T-E.

Bauman: All right, thanks very much. And my name's Bob Bauman. And today is August 14, of 2014. And we're conducting this interview on the campus of Washington State University, Tri Cities. So I'd like to start maybe by asking you to talk about when you came to Hanford, and how that came about.

Hungate: My wife and I came in August of 1952. And previously I had been teaching at Reed College, and had been doing some work in radiation, including treating a patient—helping advise and treat a patient who had advanced melanoma. And that was quite exciting because we were at Reed College, and we were consultant to the local physician. And this woman had big nodules the size of a fist around on her body.

Bauman: Wow.

Hungate: And we gave her a massive dose of I-131. And I prepared it and gave it to her. And the bottom line was I received Christmas cards from her from over ten years. And it was far as I know, was the only case that I ever heard of where that treatment was efficacious. And I guess partly because of that, and also I had become acquainted with the person from at the MAAC who was hiring. And they convinced me to come up here to Hanford. And we came in August, and it was bloody hot. And we were assigned a ranch house out on Cottonwood. And I guess one of the things--I came up a month early. And then my wife sort of cleared the house. And at that time, General Electric was the hiring person, there the governing body. And they paid for the move and everything. And it was sort of interesting, because when they moved, and we opened up the truck, here was a garbage can full of garbage to increase the weight that they could charge to you. [LAUGHTER] We moved, of course, from Portland. So that's sort of the basis on which I come up here.

Bauman: Okay. And so what position were you hired into when you first came?

Hungate: I was hired in as a research scientist in the biology department. And that department again, I had become acquainted with Harry Kornberg, who is the Director of the Biology Department at that time.

Bauman: About how large was the biology department, at that time?

Hungate: As I recall, the biology department at that time was about 110 or 120 people. And of course, at that time, it seems strange now, but at that time, we knew basically nothing about what the effects of radiation on living systems were. So our goal was to elaborate and expand our knowledge of the effects of radiation on living systems, and whatever system.

Bauman: Right. So how do you go about testing that?

Hungate: Well, of course, in addition to understanding the effects, one of the big problems was to monitor and determine the extent and magnitude of the dissipation of radiation from the reactors and from separations. And of course at that time, I-131 was a major factor. So we had extensive monitoring programs to evaluate where the radiation is going, how much was being released. We sampled milk from farms all over the Northwest here to determine the spread extent—potential impact on people. One of our programs was for monitoring rabbits, because they were a stand in for cattle. And we would monthly go out in the same area, collect half a dozen jack rabbits. And they were always plentiful. [LAUGHTER] And then evaluate their thyroid gland for the content of I-131 as well as bones for other isotopes. So monitoring was a major problem. And then of course later, this program was expanded to look much more widely. And we had a very extensive program on people. And Alaska was a big place, because it was observed that the Eskimos up there had periodic very high levels of radiation. I say high—that's relative to nothing—levels of radiation. And it was interesting because we discovered that the content of cesium--that's a law fairly long lived isotope that was prevalent in release. And this of course, was not from Hanford release, this was from bomb testing release, that we expanded to Alaska. And there the cesium became a significant factor. And we observed a number of things. One of the things I found quite very interesting was the seasonality of intake of--or our observing higher levels of the cesium in the Eskimos didn't appear to be like it should be. It was sort of displaced by six months. And we discovered that the reason is that the Eskimos hunted the reindeer during their migration period, after they had been browsing on lichen. That was their forage during the winter. And then the Eskimos would deep freeze these caribou—or reindeer--deep freeze them in their permafrost pits. And then they would eat them during the following six months, so that the high

levels of cesium were offset. [LAUGHTER] And lichen is an interesting plant because it does not die back like annual plants. It continues to grow, and that's the reason that it accumulates, because it accumulates from the time it starts exist until it's eaten. And so you have an accumulation of material over a period of time. [LAUGHTER] As I think about it, another interesting thing, to me at least, was that among the cities that had levels of strontium higher than others was San Francisco. And we puzzled about that and finally concluded that probably the reason they had a higher level was that they ate a lot of whole wheat bread. And the whole wheat would contain typically higher levels of calcium. Well, strontium is a counterpart of calcium, so it would be taken up just like calcium would. And that's the only reason we could think of why San Francisco would have higher levels of that. So it was exploring not only the effects of radiation, but the distribution of radionuclides, not just from the plant here, but worldwide.

Bauman: Interesting. So you mentioned that you studied rabbits onsite. What sort of findings did you have? Did they have any unusually high levels of iodine?

Hungate: Well of course, they were very close in to the plant. And so their content of iodine was higher than as you go on out. So they sort of gave us an indication of any variation which would be interesting to follow up on.

Bauman: So you came in 1952. How long did you work at Hanford?

Hungate: Well, I really can't remember exactly when I retired, but I worked here close to 30 years. And then I had a very interesting period of about five years post-retirement from Pacific Northwest labs. I was hired to examine record literature. The cardboard boxes that contained all of the research notes, everything pertaining to Hanford, which had--amazing to me--had been stored and was looked at. And it was looked at because suddenly people became very interested in potential effects on people. And this came about during that period when there was quite a little agitation to reimburse people who could have taken up higher levels of radionuclides, either workers or downwinders, or whatever. And I had the opportunity of looking through the boxes. And I was telling my son, Tom, that one of the things that I was so interested in, and I was able to read the diary of Matthias, who had located this land. And also the descriptions of the construction. Our labs, at that time, in the earlier part, were out of 100F. Were just across the road from 100-F Reactor. And I was so interested to see the comments that were made during construction of it. This is--and I don't remember the dates--but those reactors were built in basically a year, when we knew nothing about radiation. Now of course, it takes about 15 or 20 years to build one, because there's all kinds of hurdles to go through. Anyhow, as I was reading, why, here was this diary of the--and I can't remember his name—the officer who was in charge of the construction. And it said, and we've finished the third layer of carbon block today. [LAUGHTER] It was just very exciting.

Bauman: You mentioned when you arrived in 1952, that it was really hot.

Hungate: August, August, yes.

Bauman: Yeah. What were your other first impressions of the area? Had you been here previously at all?

Hungate: Well, I was born in Cheney, and we—many times we were driving down to visit my brother in Vancouver, or go to California, or one thing, and we had seen this area. In fact, I don't remember why, but on one occasion my wife and I were traveling with the children back from Priest Lake, and we came through on the 4th of July, late. And I remember we didn't know what was going on here at all. And here was fireworks-- [LAUGHTER] --celebration out in the midst of nothing. And so it was a bit later that then we discovered when the--of course when the bomb was used everything became very public. And I also had had an earlier sort of indirect exposure to this area. My brother's brother-in-law used to teach out at White Bluffs. And it was very notable because I remember they had a very heavy duty problem because Norm had come into Kennewick for some kind of a party or something. Movie maybe? And on the way back home, some kind of an accident occurred, and the fellow teacher was killed. And the whole family of course was quite upset, and trying to console Norm and make him feel not too miserable with the whole arrangement. So I had known a little bit about this area. In retrospect it's interesting, as a kid all this area between Spokane and here was sagebrush. Just endless sagebrush. Rolling hills of sagebrush.

Bauman: [LAUGHTER] What was the community of Richland like when you arrived in 1952?

Hungate: The big barracks that had been out at North Richland, had already been moved down to Vanport in Portland. And one reason that I know that had occurred was that they had the big Vanport flood while we were still in Portland. Where the dikes broke, and those huge dormitories went floating out into the Columbia on down the river. Anyhow, but we still had a lot of basically what I'd call shacks out in North Richland. And the town was sort of in a stage of recovery from heavy duty construction to operation. And the bypass was in place. We had the wind break around there. And that was a godsend, because those wind storms coming through were—I know our neighbors out on Cottonwood—we had a ranch house assigned to us—and our neighbors reported that previously when they had one of those dust storms come through, they'd put their--moist their towels and put them inside the windows, and still they'd have wind rows of dust. [LAUGHTER] And of course those were called termination winds. Termination because a lot of temporary construction disappeared. Blown away. And a lot of workers disappeared, moving away. [LAUGHTER]

Bauman: And when you moved into the ranch home on Cottonwood, I know Richland was a government town at the time. Were you able to own the home at that time?

Hungate: Oh, no. That was assigned. We felt extremely fortunate in getting a reasonably nice sized home for the family and actually lived there three years, but then felt the pressure of needing a bigger place, and build over in Kennewick. It was sort of an interesting occasion because my wife and I, that night, each discovered that we found a piece of land that we were interested in. And when we went, we'd each seen the same piece. [LAUGHTER] A two-acre piece over in Kennewick.

Bauman: I guess it worked out that you saw the same piece, then? [LAUGHTER]

Hungate: It was fortunate it was the same piece.

Bauman: So let's go back and talk a little bit more about the work you were doing. So you came as a research scientist in the biology department. I interviewed Bill Bair a while back, and he said that you hired him?

Hungate: Yes. And I think after--there were a number of sort of group heads out there. Roy Thompson was a very heavy standard part, and gave me a lot of counsel in coming in. And I think it was either two or three years after we were here that we were able to get Bill to come and join us. And of course, he took over a lot of the animal work. I was initially a research scientist, and then became the head of the--I think it was called at that time, Plant Nutrition and Ecology, or something like that. And that's when I was in charge of monitoring the distribution of isotopes in Alaska, and one thing, and another. And then later the ecology group was split off. And I think I was then in charge of the Plant Nutrition Group. And instead of continuing to do individual research, I then carried on a program and gradually moved away from my prime field of genetics into a variety of other things. And I became heavily involved in looking at the use of radiation in foods. And became with my research, very, very much a positive--or my attitude was that it's very unfortunate we don't use radiation more in processing foods. I remember at that time they were using, and they may still be using, chemicals to inhibit sprouting in potatoes. And

we found that a dose of--really a modest dose of maybe 5,000 rads--would inhibit sprouting. So I had access to it. And I typically always irradiated the potatoes I took home, because my wife really felt that they just kept much better. And so we used irradiated potatoes essentially all the time we were here. And one of the foods that I was very aware of was the papayas that—coming in from various places, and Hawai'i was a major one. They were treated with chemicals. And they came in and spotted and just not very--I had tasted and used when I was over on the island, irradiated papayas. And if they'd used irradiation instead of chemicals, they would have come in as basically just like they picked them off the tree. And the radiation of course was used—or the chemicals was used to get rid of noxious insects, pests that you didn't want to come into this country. Quite legitimate treatment, but I just felt they were using the wrong thing when they used chemicals. Then at a later stage, we became quite interested in just an evolving bone marrow transplant to treat leukemics. And one of the major problems that that kind of treatment, moving tissue between people is rejection. And early rejection was very serious when I first got involved. And we thought that there would be a possibility that irradiating the irradiation preferentially kills off actively dividing cells. And those who would be the white cells that cause leukemia, and also are the initiator of rejection. And so we scratched our head and came up with an idea for a blood irradiator. And that led to some work, and we evolved a unit using the radio isotope thulium as a radiation source. And there were three of us. Roy Bunnell was the chemist involved, and he made the units. Bill—hmm, can't bring up his last name—was the person who put everything together, and I was the sort of coordinator. I had to conceive the idea. Anyhow, we made and tested these blood irradiators in a variety of animals, mostly dogs. And our test was to transplant a kidney into the dog from another dog, and then determine how long it would survive as compared with unirradiated—dogs that had not been treated with the blood irradiator. And we found that there was always a significantly longer period of retention of the kidney. And in one particular case, there was—and I don't remember why it was so notable in that dog, except that he was on a little longer than others—when we autopsied, as we always did, to see what was going on, we examined the spleen. And a spleen typically is a mass about that size. In this case, it was hardly the size of an eraser on a pencil. It was just—all of the lymphocytes had been taken away. And that's the home for the lymphocytes, is in the spleen. And it shrunk the spleen down to basically nothing. But about the time we were well into that program, then they discovered a chemical—and I don't remember which one it is—which was very effective in suppressing rejection. And so there was a lack of interest in pursuing the blood irradiator. I think it's a possibility for treatments, various treatments that are resistant to other thing. One of the interesting features of the thulium is that you can make your object in the laboratory with no radiation whatsoever. And we use vitreous carbon to be the housing for the thulium. You put the thulium in whatever form you want, and then you get all your material formed, then you put it into a reactor and activate the thulium to become radioactive. So it's a very neat way of getting a radiation source where you don't have the problem of exposure during fabrication. Because of the advent of the chemical, there was no incentive to pursue and develop the blood irradiator into a human application. So although we had a patent, of course it's long lapsed.

Bauman: Around what time period was this that you were working the blood irradiator?

Hungate: I beg your pardon?

Bauman: Around what time period would this have been that you were working on this?

Hungate: Oh, I suspect we may have worked on that for I guess four or five years, maybe.

Bauman: During what time would this have been? What years would it have approximately been?

Hungate: I lose time. [LAUGHTER] I lose time. It's not--

Bauman: Yeah, that's all right. I know in talking to Bill Bair, when he used dogs for his experiments, he used beagles. Did you use beagles for the experiments as well?

Hungate: Yeah, we used the beagles as they say for--as our prime material. We also used both sheep and goats. And I look back with a great deal of pleasure because the goats were so interesting. They're quite an individual animal. And I remember of course, with the animal, the blood irradiator works by putting in what you call an AV shunt. An arteriovenous shunt. And the arterial pressure pushes the blood through. And the trick is to make your irradiator, or whatever it is, so that it doesn't cause clotting of the blood. And that was another part of the scenario, but I won't get into that now. But I would, at least once a day, check to make sure the flow was going. I used a Doppler flow meter, which measures the flow rate. And I remember as I was working with a goat, checking, and suddenly I realized that he was cropping my head. I didn't have much hair, but what little hair there was here, he was cropping. [LAUGHTER] He was trying to find something to munch on. [LAUGHTER]

Bauman: [LAUGHTER] That's crazy. Where did you get the goats, and sheep, and dogs, were you able to [INAUDIBLE]?

Hungate: We had, let's see, we had dogs, we had goats, we had sheep, we had miniature pigs. These were our primary experimental animals. And there were a lot of different experimental programs going on simultaneously. In fact, one of the programs that was going on was we were looking at the possibility, it wasn't my group, the possibility of using plutonium-238 to drive a heart pump—have an artificial pump for the heart. And one of the things that was relevant was whether the body could easily dissipate the heat associated with the decay of the Pu-238 in the amount that would be needed. And I remember one autopsy that was performed. And we would take an electrically--a battery driven electric heater and put in the dorsal aorta to simulate what the plutonium-238 heat would be. We were looking at whether the body could tolerate that much extra heat. And so they had these electrically-driven battery pack driven heaters. And on one occasion we autopsied a pig that had had one of these right in the thoracic dorsal aorta, and discovered that the heater had somehow fractured and broken, and yet we had never seen any sign of body function failure or anything. And it's quite amazing to think that the auxiliary circulation could take over so immediately from the failure of that main thing that feeds the kidneys, the gut, the whole thing, back legs, everything--but the auxiliary circulation had taken over without ever noticing any big damage. Quite amazing. The body is an amazing function—amazing machine. Another major program that I have always looked back on was the use of what we call void metal in bone replacement, or bone fracture, or whatever. And the theory—we would have these things that we were putting in—basis for teeth—basis for repairing a break in a bone. We'd have our metallurgy department make these void metal prostheses, and then put them in and the tooth work was done on pigs. And we'd put in this post in the pig. And then put the cap on, just like is done now in artificial teeth. And then the pigs would be chewing on metal bars, and one thing or another. And we never lost one. And I remember on one occasion--this was not my program, this was in biology department--on one occasion, we took a section of femur out and put in a sleeve of void metal. Put it in there and repair the—suited up. And put the goat right out to pasture. Never saw any effect. Goat walked around just as though it had nothing except a slight—the operation itself. And as a consequence of all this, when I had my hip transplant back before I retired in fact, I had had a bad injury on the hip. And when I had a hip transplant, I had the void metal put in. And they were available. And I still have that. [LAUGHTER]

Bauman: So you've benefited directly.

Hungate: Yeah. I've benefited from my knowledge. Yep.

Bauman: So, you and your unit worked on a wide variety of research projects.

Hungate: Well of course, some of those--the void metal and many of those were not in mine. I was simply involved as one of the team that was interested in what's going on.

Bauman: Right. So when you came in 1952, you worked for GE, is that right?

Hungate: Yes, and they were here for basically 10 years. I felt GE was an excellent organization to work for.

Bauman: I guess—what made them an excellent organization to work for?

Hungate: They had a policy where if there were corporate meetings, everybody in the company would know within 24 hours what happened. They were very interested in everybody being interested in the company. And since retirement and so forth I—on a number of occasions—have run into former GE people, and uniformly I have found that they were all pleased with working with that corporation. And I guess, I believe, GE is the only member of the original--what do they have? 25 corporations that form the basis for one of the big evaluation, the national evaluations we have. And I think they're the only one of the originals that still is a member.

Bauman: And then when GE left--

Hungate: Then GE of course, found itself in a conflict of interest situation where they felt that they could not operate this for the government, and then be building reactors for private applications. And they bowed out. And that's when Battelle took over. And again, Battelle is a very, very good organization to work for. Nothing but pleasure.

Bauman: I want to ask you about President Kennedy came out to the site in 1963.

Hungate: [LAUGHTER] That was--what a flap!

Bauman: What do you remember about that?

Hungate: Well we, along with large numbers of others, went out and at that time my son, Jess, was a member of the band that was asked to play when he came in. And so we were all crowded around there and watching, and then here comes a helicopter. And the band the strikes up Hail to the Chief. Well, this and that got out. Not Kennedy. So then another helicopter comes in, and they strike up the band. Some people got out, not Kennedy. I think there were at least three or four that came in before Kennedy actually came in. [LAUGHTER] It was quite--but the band played for every one of them. And he gave a very, very good talk. I thought it was quite a nice occasion.

Bauman: Mm-hmm. During your roughly 30 years or so that you worked at Hanford, you obviously must've seen a lot of changes take place.

Hungate: Oh yes, of course.

Bauman: Obviously one of them being the change from GE to Battelle. But what are other changes?

Hungate: Well, of course, one of the most dramatic changes. We used to have this lab out—a cement block building out there, three or four stories, right near F Reactor. So that we drove out and went through the security and all that kind of thing. And I must say, those drives were sometimes pretty exciting because we carpooled. And I guess I got the reputation of being a fairly speedy driver. And I remember one occasion we were driving out there, and we'd had a freezing rain. And it was just sheet—slick. In fact, it was so slick that when I stopped out here on Harris to pick up the last member of our carpool, I put on the brake and we just sort of kept on going. That's when I learned that with an automatic, you do not just let it drive; you put it in neutral, and then put on the brake. Because the driving force—the engine is still pushing you, unless you take it out of gear. So my philosophy on driving was when you go quite a distance and it's a fairly straight road, you keep your momentum going forward. And so I guess I developed a reputation for being a fairly rapid driver on that kind of road. But we never had any accident in that occasion. I guess the worst time was one of our members of the car pool at one time was a young woman who had one of these cars that had the high fin on the back. And as I got out, having gotten through security, the security checkpoint, not the first one, the second one right as we went into F Reactor, I inadvertently slammed the door and didn't get my finger out, and cut off one of my fingers in that fin. So I had to take me back in, get it sewed back in place. But it's still there. I just have a little scar there. [LAUGHTER] Anyhow, the driving out, then—and I can't tell you when it was--they abandoned that lab and moved Biology into a lab here in the town, next to town, still on government land. And that of course negated the big drive out, so that we didn't have that big commute. That's one of the major things. Then of course, as initially when we were with GE, the object was a very general one. Of studying the effects on whatever living system it was. One of the projects that I was involved with, we were very unsure what was the rate of deposition of I-131 on vegetation. So we set up a tower and deliberately released I-131, and then monitored downwind at a distance, to see what the deposition on the vegetation was. It was this kind of thing. As I mention this, another of the programs—and this was not our program, but one that we had reviewed and approved was there was no knowledge of the recovery of cells from radiation—the ability of cells to recover. And one of the men—scientists from Seattle had proposed a system where they could irradiate the testes and then recover cells, because that's a fairly rapid reproducing system. Recovering cells at periodic times. And they used inmates at Walla Walla for that program. And later that become extremely critical--there was a great criticism of that program. I had mentioned earlier reading these boxes of literature. It was interesting, I came across a letter from an inmate, a Walla Walla inmate, complaining that he had not been selected to go into this program. [LAUGHTER] This was done--the reading of the letter—my reading was at the time when all this heavy criticism of that program. So times change. When you learn more about things, then you become more interested in some of the details. And we wanted the big picture. We wanted to explore the big picture of effects. And I don't remember where we were in the discussion, but—[LAUGHTER]

Bauman: Yeah, you were answering a question I had asked about changes taking place. And you mentioned a couple times security, having to go through security. Obviously, security was very much emphasized at Hanford. I wonder what ways that impacted you at all? Your work in any way? Or was it more just everyday you had to go through security to get--?

Hungate: Had to be sure you had your badge. I guess in the security, that's a mixed bag. I guess one of the most troublesome times I had--and I don't remember what timeframe this was, except it was very early--was during the McCarthy era where we were forced, if we wanted to continue employment, to sign some kind of an agreement they were non-communist. I don't remember what it was. And I had quite a lot of soul searching to determine whether I was going to sign it or not. Because the whole era I felt so strongly was not appropriate. But when I actually read what was there, I decided I would sign it and stayed on. But if you didn't sign it, you were let go.

Bauman: Did you know people who chose not to sign it at all?

Hungate: I think I knew two or three, but there was a general signing, yeah. This was the era of course, when so many of the people in Hollywood were being heavily hit with this whole attitude. They didn't have to sign, but they certainly were abused.

Bauman: Mm-hmm. Did security at the site get relaxed at all over the years? Or was it always pretty--

Hungate: Always pretty rigorous, yeah. And of course speaking of security, one of the things that I learned early on is how to put clothes on and take them off without getting any contamination on yourself. [LAUGHTER] You learn techniques of clothing, and how to handle radiation so that you are not seriously exposed, damaged. And we had very excellent so-called health physics people who monitored how we handled things. And if we were working with radiation, we always had a health physicist right there indicating—if we made a misstep, they'd tell us right there. Now that's not security; it's security in a different manner. But as far as I guess in security, very early on, we would, several times a day, see a security car going around through town. And almost immediately when we moved in, there was a security guy came and checked to make sure it was appropriate. And speaking of driving through town, that was a period when DDT was extensively used, and we were sort of appalled by—the mosquitoes were a serious problem. They had the potholes around the rivers here and so forth. And they had heavy duty sprayers going through town, putting out a fog--literally a fog--of DDT in this—whatever the carrier was. And it was so sort of shook my wife and me to see kids riding their bicycle right in this heavy fog following these foggers around town [LAUGHTER] breathing diesel or whatever it was that they were putting out, plus the DDT. I guess the kids survived well. [LAUGHTER]

Bauman: Going back, you've mentioned the special gloves that you wore, what other precautions did you have to take when you were working with radioactive material? Did you have other special clothing you had to wear?

Hungate: Oh, yes. You always--when you were working, you always used at least a lab coat. If you were working where there was any potential for anything, then you had--you would have a coveralls, your shoes would be covered with canvas. Everything would be taped so that you were basically--here your face would be out, but nothing else. Your hands--these would be taped to the sleeves of the coveralls so that you were using--and when you got out of it, then you had to take these off in a manner so that if there was contamination on the clothing, you didn't get yourself contaminated. Now again, always with a health physicist.

Bauman: And did you have to go through any sort of training—safety training for that?

Hungate: No, we just really sort of were guided by the health physicists. And of course I had--while I was still teaching at Reed--I had taken a one-month course at Oak Ridge. And that had sort of prep me for this whole program. I took that because Reed had a reactor. And may still have it. I don't know. Anyhow, and that's of course why I got into that treatment of that patient who had the melanoma, because I had had some training in the use of radioisotopes.

Bauman: You've mentioned a number of different research programs or projects that you were involved in. I wonder, in your 30 years working at Hanford, what were some of the more challenging aspects of working Hanford? Some of the challenging things you worked on, and maybe some of the most rewarding?

Hungate: Well, of the things about being a research scientist, is that you sort of set your own agenda. And I guess after Battelle took over, there was not a ready access to overall programs. And one of the challenges that we had to move into was writing a proposal for funding. And that came with Battelle. And then your program was dependent on that being accepted for use during the next year or two. And I think many of us found that one of the more challenging problems. And of course any scientist nowadays is doing the same thing every year—writing a program by which they get funded. And as a scientist, I think that's one of the biggest challenges that you have. Once you get the funding, then you have different challenges, but they're much more easily visualized and taken care of. That it was quite an awakening when we moved from the overall general funding, where there was a great deal of cooperation among different physicists, chemists, whatnot, biologists, to having individual programs that were funded. And at the time, we thought it was a regression. But it was just simply a maturation of programs that had to occur.

Bauman: And how about the most rewarding aspect of working at Hanford, what was it?

Hungate: Oh, I think we had a great group of people to work with. And I think the association with minds and people that were similarly involved was in my opinion, just wonderful, quite great. I had the great opportunity of being asked to spend a year in Greece as a consultant to the Greek Atomic Energy Program. And that was--let's see. That happened in--was still with GE at the time. So that would have been in the late 50s. And the family and I—there were a number of us. Spent a year in England, various places. I think one of--Jack Cline spent a year in Tunisia. One of my biology--Bob Euler spent a year in England. So there was quite a lot of worldwide exchange. And one of the features that I look back on that I don't remember--I think we had about five or six groups in biology--and when we would have an annual research get together, an international get together, and be hosts here, then our group--all our heads would get together with Harry Kornberg and whatnot, and host these. And we would have these people come to our home. And I remember one occasion when Harry Kornberg was hosting. And he had a big barbecue pit behind his house, and somehow or other, a little over hot, hot. And he was having these chickens on--with huge flames coming. [LAUGHTER] It was somewhat seared. But as a group, we just worked together to make these nice occasions. And I had a couple of acres over in Kennewick, and I had planted pie cherry trees, because when teaching at Reed, Reed had some pie cherry trees. And they had you pick, so you could go and pick. And I thought that was so great, so when I had this acreage, I planted about, as I recall, something of the order—30 or 40 pie cherries, and the same number of peaches. And so I produced the pie cherry. I discovered that you could not allow people to pick peaches, because the branches were much too brittle. They'd break the branches off when they'd reach. Pie cherries are much tougher, and you could allow you pick. Anyhow—and I had all--quite a little excess fruit which I then began to ferment and make into wine. And on one occasion, we were having a group over to our house for the dinner and evening, and I was serving wine. And it was in the fall. And I looked around, and practically everybody's glass had at least three or four drosophila. You know, these fruit flies had settled in their glass of wine. [LAUGHTER] So it's just one of the things that happens, particularly when you have a lot of fruit around. So anyhow, these sort of personal reactions were very, very gratifying.

Bauman: I just want to go back a bit and clarify, so what building did you work out of initially? Where were you located?

Hungate: 100-F. And I forget the number of the building. That brings up another idea. When I was in charge of a cesium irradiator. And it was a big tub of lead, and had six tubes. And the cesium was stored down in this big tub of lead for shielding, so you could access without having exposure. And then you would have these pellets of cesium raised up into tubes that you could adjust to different sizes and spread. And you'd close a big door this thick of concrete, to provide shielding. And then irradiate. That's where I had to rad my wife's potatoes. And we, at one stage, became involved with a group over in Seattle who was interested in the same kind of thing that we got in with the blood irradiator, providing sterile food to the people who had the bone marrow transplants. So they wouldn't become infected with something that they couldn't fight off because they were being compromised in their immune reaction. And so we had, I'd say two or three years, where we were working with the head of food to irradiation over there, Fae Dong, and her students, looking at ways of producing in that case, primarily dairy products. And we examined the radiation of ice cream and things you can't sterilize really, any other way. And a lot of them were just great. It turned out that milk and some of the milk products, develop what's called the Wet Dog Syndrome. You know the odor of a wet dog? Well, this food developed that kind of odor. But we were irradiating with massive amounts. Somewhere on the order of 5 million rads to get it totally sterile. These are the same kinds of treatments that the astronauts--the kind of food that the astronauts had--they were treated with similar kinds of doses—very massive. And I also used the irradiator as a service unit for various people in the industries. I know I irradiated some soil samples for folks up in the Forest Service in Idaho. And there was a private guy who was developing high yield mint. Mint used to be a big crop around in this area. He was from Corvallis. And maybe two or three times a year, he would bring me slips of mint, and then I'd put them around this irradiator and irradiate them. And the reason you're doing that is you're creating mutations. Then he would take them and plant them, and then select those that produce the higher amounts of mint oil. And I think we were quite successful in improving the rate of mint production by his process of selection. We did a number of—I was working with another man over in Pullman. He was interested in irradiating beans, as I recall. And in talking with him later, he said that, you know, those beans that you

irradiated, they cooked in about half the time that it normally would take to cook. Well, that makes good sense, because ionizing radiation breaks long bonds. And that's basically what happens with cooking. So you're pre-cooking your beans with irradiation. [LAUGHTER] And as far as flavor is concerned--oh yeah, mentioning flavor. We were also working with a group—I don't remember which one of the big canning corporations—and they were bringing in corn. And we irradiated corn with massive amounts of radiation. Sterilizing amounts. And then we would take the irradiated and the non-irradiated around, and have the folks around the lab taste them. And I was very interested because when we did this, the preference on the average, was they preferred the irradiated corn over the normal corn, unirradiated corn. The flavor was enhanced by the irradiation.

Bauman: Interesting. Wow.

Hungate: Yeah. That's one thing that I think we've really missed the boat. I think we should be using nuclear power more, much more. And I think we should be using irradiation much more. And you'd never know until you get into using something, what are the things that are positive versus those that are negative. And it's just a process of experimenting. And one reason I became convinced in that was that corn experiment we did. Where people were actually preferred the irradiated over the non-irradiated. I wouldn't have believed it until we did it. [LAUGHTER]

Bauman: You mentioned earlier when we were talking about chemicals being used on foods versus irradiated foods. So why do you think that that has been that we haven't done more of that irradiated foods, or used chemicals more than radiation?

Hungate: The press has chosen to make irradiation a very bad thing, whether it's for generating power or whatever. And my wife commented that had we been introduced--had the public been introduced to electricity with the electric chair, their attitude toward electricity might be quite different than it is. The US public was introduced to radiation with a nuclear bomb. They knew basically nothing about it. In fact, I remember going in to shoe stores and sticking my foot into an irradiator to see how my foot fit in the shoe. You thought nothing about it. And I think her comparison was quite apt. It gave the press the pressure to be a negative thing about radiation.

Bauman: Well—

Hungate: And also, so few people have the opportunity of working with it like I did. To realize that it's just there, and you just treat it with respect. And I guess also, I am—and there is some literature to back this up—I have for a long time felt that a small amount of radiation is a very positive thing. The literature that I refer to is some studies that were made in the spas, these hot springs in Europe, where people went in and sat in these caves or whatever. Those were high radiation situations. And the studies that I am talking about looked at those people who worked in these facilities, where there were periods of eight or 12 or whatever hours, compared to a comparable number in the town—comparable people in a town who did not work there. And they found that the average health and longevity was better among those who worked in those facilities than in those that did not. And I remember my uncle and aunt used to go over to Montana and go down in a mine and sit in a radiation exposure mine. And so I think that furthermore, all life has evolved in much higher radiation environment than we now have. By the nature of radiation, the earth is gradually losing its radiation, because it's decaying. And so we literally are losing the radiation to which we have grown up with and evolved with. So personally, I think a low level radiation is a positive thing. That's contrary to the current philosophy.

Bauman: Let me ask you one more question. That is, I teach a course on the Cold War. My students are all too young to remember the Cold War. [LAUGHTER]

Hungate: The Cold War? Yes.

Bauman: Why do you think it's important for people to learn about Hanford and some of the work that was done there?

Hungate: Well, I guess my feeling is that, as I said earlier, few people have had the opportunity of working with radiation. And the more you know about people who have worked with it, and—for instance, myself. I'm 96, and I've been working with radiation a long—major part of my life. And I think it's essential that people learn more about everything. For instance, very few people realize that the radiation put out from burning coal is more than you get from a nuclear plant. That does not make me a person who is interested in more coal to get more radiation, despite my comments. [LAUGHTER] But I just think we need to know more about our history and things that we don't get in touch with on many occasions. It's like everybody's interested in Cousteau because he's in an environment that we really aren't able to get into. It's that kind of attitude.

Bauman: Well, I want to thank you very much for coming in today and sharing your stories about all the work you did. I really appreciate it.

Hungate: It's my pleasure.

Bauman: Thanks very much.

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## Hanford Sites

100-F

## Years in Tri-Cities Area

1952-2014

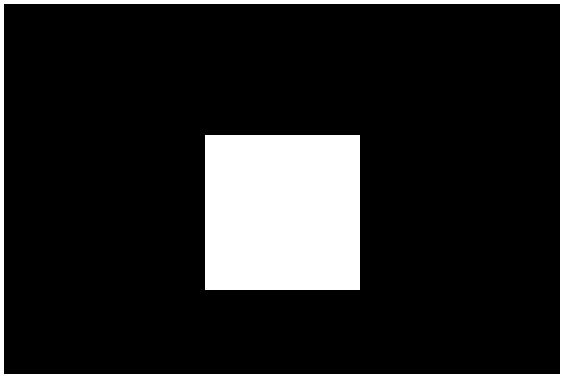
## Years on Hanford Site

ca1952-1982

## Names Mentioned

Cline, Jack
Euler, Bob
Kornberg, Harry
Dong, Fae

## Files



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