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Lebanon Valley College Archives—Vernon and Doris Bishop Library

Oral History of  
**Elizabeth Miller Bains**  
Alumna, Class of 1964

Date: April 13, 2014  
Interviewed by Art Ford  
Professor *Emeritus* of English and Alumnus, Class of 1959

Transcribed by Jessica Oliveri  
Vernon and Doris Bishop Library Student Worker and Alumna, Class of 2015

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**Dr. Elizabeth Miller Bains '64**—Bains was one of the earliest female physics majors at The Valley. She spent most of her career with NASA where she worked primarily with the Space Shuttle program. Dr. Bains received the Distinguished Alumna Award from LVC in 2015.

A: All right, I'm here with Liz Bains in my home. The date today is April 11, 2014—I think that's right, isn't it?

E: It's the 13th.

A: Oh, April 13 (laughs). I missed two days there—I'm here with—as I said—with Liz Bains, and we'll be talking about—about her, about her life, but mostly talking about the experiences she had at Lebanon Valley College—thoughts, memories, that sort of thing. So let me begin, Liz, first of all, with your hometown. Where were you born?

E: Well, I was born in Philadelphia.

A: In Philadelphia itself, or—

E: Yes.

A: Suburb, or—

E: No, I was born in Philadelphia, my family was living in a suburb, but the hospital I was born in was in Philadelphia.

A: Oh, OK. And what did your mother and father do?

E: My father was an engineer. He first worked for Day and Zimmerman in the '30s and '40s and then owned his own engineering business in Philadelphia.

A: Really? Did your mother have a job—or was she at home?

E: No, she was a homemaker.

A: OK. Siblings? Brothers, sisters?

E: I had two sisters and one brother. The first daughter, Mary, died before I was born. Then I have a brother, Sam, who first worked as an architectural evaluator of colleges, and then became a minister.

A: Really? That's interesting. What's an architectural advisor do?

E: It's—

A: Looks at the buildings and such?

E: No, he evaluated colleges of architecture.

A: Oh I see.

E: So he's part of the evaluation teams for them.

A: Oh, OK. Alright—and then he went to college obviously to?

E: Yes—yes he went to Ursinus—and then he got a master's at Catholic University.

A: Did your parents have a college degree?

E: My father had two degrees—two bachelor's degrees. His father had gone to Muhlenberg and wanted all his sons to go there, so he did. If they did he would send them to a second college if they chose. My father wanted to study engineering, which was not available at Muhlenberg, so he completed a degree at Muhlenberg and then went to MIT for engineering. He graduated in 1929 to very poor prospects (laughs).

A: (Laughs) Yeah that's a bad year.

E: It was (laughs).

A: OK, what high school did you go to?

E: I went to Souderton Area Joint-High School. It was a large, consolidated high school.

A: Now, that's outside Philadelphia, isn't it?

E: Yes, it's—probably about 30 miles north of Philadelphia and a bit north of Norristown.

A: Oh, OK. And what year did you graduate from high school?

E: I graduated in 1960.

A: OK. Did you have any extracurricular activities that you were involved in when you were in high school?

E: I was manager of the softball team—my eyes are not good so I didn't make the team, but I was a manager. We lived on a farm and I went to school by bus, so I wasn't involved in a lot of activities.

A: OK, and then you went to Lebanon Valley College—and graduated from there in '64 obviously—

E: Yes, yes.

A: And then after graduation—we'll come back to your experiences at Lebanon Valley in a minute—but, going on with your education, what about degrees after college?

E: Well, I worked for a year for the Navy and then went to University of Tennessee in Knoxville, and got a master's and Ph.D. there.

A: What did you do with the Navy?

E: I was working at validating a computer program. They had computer programs that calculated trajectories of missiles and—projectiles. It was started in World War II to calculate trajectories from guns on ships and then progressed to missiles. They were changing computers, and so I was hand calculating the trajectory and matching it up with the results of the computer program.

A: You mean as to kind of test the new computer program?

E: Right.

A: OK. Then you went to Tennessee. Why did you go to Tennessee? Why did you leave the job that you had and go to Tennessee?

E: I had thought about going to graduate school, but put off the application process too long, and also my parents had largely paid my way through college, but could not cover any more schooling. So I was getting some money to go to graduate school.

A: OK, and what did you do in graduate school then? What were you interested in? Was there a major or something like that?

E: Tennessee worked closely with Oak Ridge National Lab and had strong atomic and nuclear programs. After I started, I found those didn't interest me so much. I had always liked more the classical physics—and they had a strong program in ultrasonics, and so that's what I chose as my field of emphasis.

A: OK. And then after that where did you work—did you stay for your degree straight through to the Ph.D. and then leave?

E: I—yes—I stayed straight through, I did not leave immediately because I had met and married my husband, and he was a year or two behind me. So, we were there until—he graduated in '74.

A: Also with a Ph.D.?

E: Also with a Ph.D. In fact, we met in the ultrasonics lab—well, got serious in the ultrasonics lab.

A: Really? (laughs) That's an interesting thought.

(Laughs together)

E: Well—(laughs)

A: I hope—I hope you kept it quiet enough that it wasn't picked up by these really sensitive—  
(laughs)

E: (Laughs) Everyone knew we were dating and there was no objection. Also, I was better at working with the machine shop than he was, so I helped him build his equipment (laughs).

A: (laughs) OK.

E: Some things we could do publicly (laughs).

A: (laughs) And then after your Ph.D. you went to?

E: There were a couple of years of—when the economy was not good—and then we stayed around working some postdoctoral work, and I had one job at Davidson College, replacing somebody who was on sabbatical. In 1976, I got a permanent job at Alcorn State University in Mississippi, and we moved there. It was a very good environment for me. It was only undergraduate teaching—but not for my husband, who was more of a research type. So in '79 he got a job in Houston and we moved there. I did not get a teaching job there, because the undergraduate teaching that I liked was largely filled by graduate students from Rice and the University of Houston. And after a time it was suggested by a friend that I look at NASA—and I applied, got a job, and loved it.

A: OK, but you liked the teaching?

E: I did like the teaching—had I gotten a job in Houston, I would've stayed in teaching. But, I enjoyed the NASA work so much that, I think it was two or three years later, I got an inquiry from Huntsville, which was north of Houston. It would have been a little inconvenient, since my husband's job was in South Houston. I liked the job I was doing so much that I stayed.

A: Well what was the job you were doing? Tell us a little bit about that.

E: Interestingly, it started out very similar to the work I did for the Navy. I was working with a flight simulator and testing it to make sure that it was working correctly. At that time, it was a

stimulator for the space shuttle which was just coming close to its first flight. I tested a lot of the basic equations initially, and then got to focus more on the robotic arm, as that simulation was added to it. I worked in that for a number of years.

A: You say you worked in it, what exactly did you do or as much as you can say?

E: Most of it was not classified—there was a little bit (laughs). But the—it was a complex simulation, and so my group was involved with setting up training sessions or engineering sessions, testing particular operations, and making sure that the set up was correct—and if there was any question about whether the results were correct, we determined whether or not it was correct. If there was a problem, we fixed it. If the simulation was correct, we provided proof to the person who questioned it.

A: Is this basically what you did the whole time you were at NASA?

E: It's what I started with. Later, I got into more of the engineering analysis. A lot of that was tests to show, as flight software was changed, to see if the change worked the way they really intended it. It didn't always (laughs). And our tests resulted in modification. Some changes were totally rejected because when crew looked at it they said that it didn't do anything close to what they wanted, so they just never wanted the software changed.

A: So did you have to work pretty closely with various crews then?

E: Early on, I did a lot with the first crews that were learning to operate the shuttle, and I worked a lot on STS-7. That was the first time they released a satellite, had it move away from the shuttle, and then later retrieved it with the arm.

A: With the arm?



E: Yeah, with the Canadian robotic arm on the shuttle. That was a major flight with Bob Crippen and Sally Ride. It was a—

A: Did you ever meet Sally Ride?

E: Oh, many times.

A: Is that right?

E: Yeah.

A: What was she like?

E: Oh, very nice.

A: Really?

E: Yeah, very nice, very thorough and competent—and then there was a John Fabien, and those two were probably the best operators of the arm that I had met, because they had been working with different simulations from the time the concept of the arm was developed. And, they probably knew it better than some of the engineers did (laughs).

A: Well that—the arm, of course, stayed with the shuttle all through. Did you—were you involved in any major changes that had been made because of different jobs it had to do?

E: All the changes that I was involved with were changes to the software. Early on, we found that if you tried to move the arm in a straight line very slow—it didn't move in a straight line because there were seven joints, different motors, they wouldn't all come up to speed at the same time, they had limited precision, and so it would go wondering off. Later in the program, we added software which would keep track of what direction it was commanded to go and where. It was actually going, then it would bring it back to the commanded path. So things like that were added.

A: This all sounds sort of like science fiction excitement and that sort of thing—

E: It was (laughs).

A: Was it? It was? (laughs)

E: Oh it was. It's very much. It was very exciting being a part of so many first things that they did.

A: So you're actually making history right in the middle of it and didn't even know you were doing it?

E: Yes (laughs).

A: That's the excitement.

E: Yes.

A: And also I guess just seeing that the job you were doing was successful.

E: Yes.

A: A lot of satisfaction in that.

E: A lot of satisfaction in that, and there were a number of times that we were called in when things weren't working correctly on orbit, and we had to develop a work around, get it tested by crew, and get the new procedure sent up to the crew on orbit.

A: Under some pressure I imagine?

E: Under some pressure (laughs).

A: (laughs) Was that the exciting part of it too? The pressure?

E: It was, yes.

A: You liked that?

E: I enjoyed it, I did not mind the pressure and—

A: Of course you weren't floating above the earth (laughs).

E: I wasn't (laughs). I would like to have been but I wasn't (laughs).

A: Well that's another question, did you ever—you never had an opportunity to go in the shuttle?

E: I never did. I—

A: But you wanted to?

E: I did. But my eyes were not good enough.

A: So then do you think with better eyesight you might have been able to do that?

E: I might have, because—

A: Do they actually take some of the people working with software up there?

E: Yes – and people who understood the operation. In fact, one of the ground support people— one of the people who developed procedures for crew that I worked with on STS-7 later became a crewman. Which was one of the linkages over the years. His name was Rick Hieb, and he was one who questioned early on some of the motion of the satellite they released on STS-7. There was a test where they failed a jet and so it started spinning rapidly—and he questioned the way it tumbled. He thought that the velocity should be constant. He could speed it up and slow down. That's where my physics education helped a lot because he said it ought to be constant speed, and I said no, it ought to be constant momentum. And, in rotational motion there's a term, instead of mass, it's a rotational analog, but if you have an asymmetric thing, the different axes aren't the same, and so the motion can transfer from one to another. So my husband and I worked out a small computer program on a programmable calculator and we programmed only the rotational equations of motion, and printed it out on a long piece of

paper, and matched it up with the simulator and proved that that was correct. And then later, there was a satellite—you may remember the satellite that they hand caught—Rick was on that flight. We were hearing the transmission down to the ground and as the three astronauts were outside, he was telling them, 'now we're gonna have to coordinate it very carefully because if one person touches it and starts it spinning—the motion will be very unpredictable and we'll not be able to catch it, so they coordinated, and it was rather satisfying to hear that Rick remembered the predicted motion from STS-7.

A: And it worked.

E: It did work.

A: It might be a good time to bring your husband into all of this. You mentioned that he helped you out with something, but he wasn't working for NASA I guess, was he?

E: No, no he wasn't. He had gotten a job in the oil field business. He designed equipment which was a perfect job for him. Yeah, we talked about our work, and—

A: He understood what you were doing, I guess?

E: Oh yes, he understood every bit as well as I did.

A: Did you understand what he was doing?

E: Pretty much. In fact, there were suggestions going both directions, and I hold a patent from his company.

A: Really? (laughs)

E: Because of a suggestion I made (laughs).

A: Do you have any patents from other job position?

E: No, it was not—

A: Not patentable? (laughs)

E: Not patentable, yeah. And I was part of team, but mostly I don't think there were any patents that came out of that. Most of the patents at that time were hardware, and the Canadians had built the hardware, so there was no real opportunity for patents.

A: So now you're retired, sort of.

E: Sort of, yes.

A: OK, when did you retire?

E: I retired in January of 2013.

A: OK, and you're consulting with them now?

E: Yes. Half-time, a one-year appointment.

A: Now the shuttle program—is it done now?

E: Oh it's done. It finished—I should know this—2011 or 2012.

A: Yeah, so what are you doing if the shuttle's not running now, and that's what you always did?

E: Well, when the space station program started—having worked with the robot arm on shuttle—I also worked with the one on station, so that's what I'm doing now.

A: Still in operation obviously.

E: Yes.

A: There's still some need there.

E: Yes.

A: How long do you anticipate you'll be working part-time with them?

E: Oh, I think the one-year appointment will do.

A: OK. So you intend to enjoy some retirement years then?

E: I do (laughs).

A: And your husband's name is?

E: James.

A: James.

E: Jim.

A: Jim—and is he about—he's about to retire too I suppose, isn't he?

E: Yeah, he has been doing mostly consulting in recent years—and with the downturn in 2009 that fell off, so he hasn't been doing that much consulting, and he's about to—just close the business down.

A: OK, well let's turn then to Lebanon Valley College, and you came here in 1960 you said.

E: Yes.

A: Why did you choose Lebanon Valley?

E: Jake Rhodes.

A: Oh, really? (laughs) But you were in Philadelphia and he was in Annville.

E: I first met him because my sister was interested in music—and so she came out to interview with the music department. I was a junior, so the admissions office asked if I wanted to tour anything. I was interested in physics, so they took me over to see Jake Rhodes and he gave me a tour of the entire physics department and talked to me at length. I've heard since he did with a lot of people.

A: Yeah.

E: And then later, in my senior year, he was going around on—recruiting trip—there were nights where representatives of different colleges would come to the high school.

A: College nights.

E: Right, and I met him again, and liked him. I had felt I had a personal connection at that point.

A: OK, so when you came up with your sister is that was the first time you were actually on campus?

E: Yes it was.

A: OK, but briefly I imagine—

E: Mhm.

A: And it was mostly to talk with Jake?

E: Mhm.

A: Then you came back later as a student—I'm interested in your impression of the College, physically, when you first arrived. Do you have any reaction to the way it looked? The way it felt?

E: Well to me it—it felt—very liberating. I was from a small town, and being female, my activities were very closely supervised by parents. So, I was still closely supervised here—there was curfew and—restrictions on girls being out, typically at night.

A: Could you be a little more specific about that?

E: I'm not sure I remember all the detail (laughs).

A: (laughs) A lot of restrictions, huh?

E: A lot of restrictions. There was a dress code. We couldn't go to classes in slacks, always skirts or dresses. The dinners were formal-sit down meals with, again, skirts or dresses were required.

A: They were held in the new dining hall?

E: Yes, at that time it was new.

A: Now it's a part of the larger college center.

E: Yes.

A: All right, in fact I think the new college center—that location now is a living room almost, the fireplace and all of that.

E: I—yeah, I think it is. Yes. Yeah, I think the main entrance is the same location as we had, but then it opened only into the dining hall with the kitchen behind.

A: OK, you said it was sit down meal. Does that mean you didn't have a choice in what you ate—whatever they brought?

E: Oh absolutely. Everybody ate the same thing (laughs).

A: (laughs) So you had a choice—you eat it or you didn't eat it.

E: Right (laughs).

A: (laughs) What did you think of the meals?

E: Generally, I liked them—the first year. The second year, I liked them a little less, and then by my senior year, I didn't like most of them.

A: So you were there for all four years on campus?

E: Yes.

A: What about the other restrictions? Walking downtown on weekends, and whatever.

E: (Pausing to think)

A: Or your hours?

E: Hours—



A: Did you have to be in a dormitory at a certain hour?

E: Yes. And I think it was nine o'clock, unless you were out at a college function, in which case, you had 10 minutes to get back after the college function (laughs).

A: (Laughs)

E: Fortunately, they never knew when the physics activities were (laughs), so I had a little slack.

A: (Laughs) So what about the library, if you wanted to stay at the library after nine o'clock?

E: Oh, I think they closed the library at the time that we had to be in the dormitory.

A: Is that right?

E: Yeah.

A: OK, did you chafe against these restrictions, or did you just assume they were a natural part of being on college?

E: It was a natural part of being on college and it was freer than I had been at home, so it wasn't a problem for me.

A: And the men had different restrictions?

E: Men had—

A: Well, no restrictions—

E: Almost none—that I know of.

A: Did you resent that as a woman?

E: No, I mean it was—

A: Seemed normal?

E: So normal, yeah.

A: OK, any other restrictions, anything else over your four years there—were there any of them that you thought were unreasonable, or you didn't understand why they were there? Were these, again, just part of naturally being at a school?

E: I think it was just a natural part.

A: What about chapel, did you have to go to chapel?

E: Oh yes I did. By then the entire student body didn't fit in the chapel, so you could miss a certain number. I think as a freshman you could not miss—but as an upperclassman you could.

A: Where was the chapel held?

E: In the church.

A: In the church. In the corner?

E: In the corner, yes. The gray stone church.

A: Say that again, you said that the upperclassmen didn't have to go to as many chapels, or?

E: They had a certain number of allowed misses.

A: Oh, allowed misses.

E: And if you missed too many, then you had to take an extra course.

A: Really?

E: You had extra hours added to your graduation requirements.

A: You had to be better educated if you missed chapel. (laughs)

E: If you miss chapel. When I was a senior, I had extra hours, so I defied chapel cuts.

A: You didn't take chapel real seriously then did you?

E: You didn't, yes.

A: Did anybody else you remember—was there a lot of resentment or resistance to chapel? It didn't last too many years after that.

E: Yeah, there was a lot of grumbling, but there was variety in the types of chapel programs. Some were religious and some were cultural programs. So the seniors always went to the cultural programs and pretty well tried to miss the ones that they didn't want to go to.

A: Did the campus seem to be a fairly religious—have a fairly religious environment while you were there?

E: Some students were—well there were pre-theology students that were very serious about it. It was an assumed part of the College. One year of religion was required. Most students went to church, but I don't know—I wouldn't have said it was a heavily religious, but it was an assumed part of the life.

A: For four years, what were your feelings about the campus? Was it generally a positive, or?

E: Very much positive.

A: Was it? OK.

E: And it—at that time, it was not architecturally unified, as it has become.

A: Did you notice that as a student?

E: I noticed it. I didn't object to it, I rather enjoyed it. The diversity of architecture showed how the College developed. I was in the new—newer dorms all my four years.

A: And which were they?

E: That was Mary Capp Green, as a freshman. They always put the freshman on—in the north side, right next to the railroad (laughs). Upperclassman got to choose.

A: (laughs) Was that a problem by the way?

E: Well, only for a few nights.

A: Would it keep you awake at night?

E: Only for the first few nights.

A: Is that right? You just got used to it?

E: You just got used to it and slept right through it.

A: OK (laughs).

E: (laughs) The first night was—it was startling (laughs). At two in the morning (laughs).

A: At two in the morning (laughs). And then after that, you were in one of the other dorms?

E: Yeah, I went into Vickroy.

A: OK.

A: Mary Capp Green, was that the earliest?

E: That was the original of the new women's dorms.

A: The original. OK.

E: And Vickroy was being built when I was a freshman.

A: Oh, OK.

E: And I think I moved in there as a sophomore, and I was there the rest of the time.

A: Oh, what was dorm life like?

E: It was very nice, it was two to a room. No suites, but we did have cooking facilities in the center of the building and laundry in the basement. So, it was convenient, there was a large common area, and I can remember my freshman year. All the freshmen were in there typing their term papers, the night before they were due (laughs).

A: So, your major was physics—did you—you obviously came as a physics major?

E: Yes.

A: —since Jake was so instrumental in doing that. And I know that you were the second major—female major—at the College, this was about 50 years after the physics major was established (laughs), so for the first 50 years it was all male.

E: Yes.

A: What did you think about that, when you came? Were you aware that you were kind of a pioneer in that aspect?

E: Yes, and my father had his doubts about it, because when he had been a student at MIT, there was an occasional woman at MIT apparently. But he always thought though that they were the ones that were a little odd, and he was worried about my prospects for marriage (laughs).

A: Really (laughs).

E: I was—well it was assumed that I should get married.

A: Yeah, well you could marry a physicist.

E: And I did.

A: So your dream came true. (laughs)

E: (laughs) So it worked out well.

A: But to get back to the idea of being a pioneer female at Lebanon Valley College, how aware were you of—kind of the groundbreaking of this? Did you think of this as—this was long overdue, or did you think that this was going to pave the way for people coming after you, or did you just do your work?

E: Mostly, I just did my work. Since now I have very bad eyes, and I'm physically not attractive. I always felt that I couldn't compete with the other girls in beauty.

A: Oh, OK.

E: And so, I was—even in high school—more comfortable around the boys and the men. Not for dating, although I did date, but just—the companionship and the friendship. My friendships tended to be with men, early on.

A: Do you think it was hard because you were interested in physics and they were, and so, there were simply more men interested in physics.

E: Oh yes (laughs), there were very few women interested in physics.

A: Did you feel any reaction from any part of the College—students, physics majors, faculty, administrators—to the fact that you were a woman in the Physics Department?

E: I didn't feel anything from the students certainly. There were a lot of biology and chemistry majors and math majors that were women, much higher percentage than physics. I was lumped with the science students as far as the other students were concerned. Jake and Bob O'Donnell were always very fair and, Dr. [Samuel O.] Grimm was more a product of his time, and—

A: What does that mean?

E: Well, like my father, he wasn't certain that physics was a place for a woman.

A: Oh, OK.

E: The first course I had from him was the optics course. And he always did his problems worked out on an adding machine, and—adding, multiplying—and so he would calculate his answers to great precision, and write them down to six or seven places. The students were all

working with slide rules. With them you got about three place accuracy. So he would correct you by marking the extra places that you should have had.

A: Did he not use a slide rule at all?

E: I never saw him use a slide rule.

A: Is that right? What's the advantage of a slide rule over his way of doing it? Since—

E: Portability is one big thing.

A: Is it? (laughs) Can't carry one of those machines around (laughs).

E: (laughs) And find a place to plug it in, because there was no battery powered computing at that point.

A: Do you think there was a manifestation of his reluctance to accept women in a particular area?

E: Well—

A: Or did he do that to all the students?

E: Oh he did that to all the students, although some got As and I got Bs.

A: With the same answers?

E: With the same—pretty much the same answers. Then there was this optics lab. Russ Hertzog and I partnered together. We did that through a lot of the coursework. But I think the optics labs was one of the first time we did experiments together, but then wrote up our own lab books. And I—part of this is hearsay, but—Dr. Grimm made his decisions about students as to what level they were and then it seemed like he graded to that expectation. So, I got a B in optics course, which is not surprising after the Bs on the tests. But I had turned in a lab book. The story was that in his house there was a stack of lab books that went back to the '40s that he

had never read, because he knew the students, he could grade them without reading the book. Well, that year Jake insisted that he actually read the lab books. So, reluctantly he did, but he turned in his grades before, because he didn't have to read the labs to know what grade they deserved. The next semester he came to me and he said, 'I read your lab books, and actually you do understand the material (laughs). So thereafter I got As, whether—whatever my level of work was (laughs). So there was some compensation in that.

A: So he pigeon-holed you as an A student, that's not bad (laughs).

E: That's not bad (laughs). But he also, you know, he had his assumptions, but then he could change—he did change.

A: How was he as a person just working with him, was he a pleasant person, or?

E: (laughs)

A: I really don't know, I didn't know him much at all.

E: I would categorize him more as an interesting person (laughs).

A: (laughs) We all know what interesting means.

E: Russ would get purple-faced, because Dr. Grimm would come in, when we were setting up an experiment, and just about to take data, and he'd come in and say, 'Oh and what happens if you change this,' (laughs) and we'd have to restart. At one point, Russ locked the doors (laughs) so he couldn't come in and we could actually finish our lab (laugh).

A: (laughs) When did he retire then? He retired while you were there?

E: He had officially retired, as I found out last night, before Jake came. But he was still teaching a lot of the lab courses—he taught the optics. I remember he taught the E&M lab, electricity



and magnetism. I'm sure Jake taught the course. He was very strong in the labs, especially the classical labs.

A: Oh, OK. That was the question. Did he really know his stuff?

E: He certainly did on—in the equipment.

A: In the equipment?

E: Yeah, and the optics and a lot of the electricity and magnetism labs were very basic—going back many years, so yes, he did know his stuff.

A: I know his wife was pretty much involved with activities on campus as well. The auxiliary and some other—other things like that. Did you ever get into his house? Did he ever invite students over?

E: No, I never did.

A: You never did, huh? OK, is there rumors that he had piles of old equipment?

E: Oh, I wouldn't be a bit surprised (laughs). There were piles of old equipment in all the labs (laughs).

A: So, it's just Jake and Bob O'Donnell and then sort of part-time—that was the whole department at that time?

E: Yes.

A: Until you graduated?

E: Well, no. John Morris came—I think when I was a junior. He taught the quantum mechanics, so I took that as a senior.

A: He was there, for what, just a year or two.

E: Yeah—he—maybe four years. He stayed after I left, but he left shortly thereafter. Went off to G.E.

A: That's right. So, was he pretty good?

E: He was. I—everybody learns differently. And I learned very effectively from Bob O'Donnell. As it turns out, less effectively from Jake. Although, Russ had the opposite experience. He found Jake a much better instructor. And John Morris and I—John Morris was more like Jake, so—he was a good instructor, but I didn't learn from him as well.

A: You had other courses at Lebanon Valley besides the physics courses. Do you remember any of them that you particularly liked?

E: Well I liked a lot of them. Everything except the biology (laughs). Biology, I—the first semester was fine, the plant biology. I had been hearing about the dissecting cats for years, so I wrangled some acceptance of taking genetics instead of second half of biology.

A: So you never actually cut up a cat (laughs).

E: I never cut up a cat (laughs), or frogs, or any of the other animals (laughs).

A: So you said most of them, but any stand out in your mind?

E: Well, I always liked English. And, English and History, and I wound up with some extra time as a senior, so I took the American Literature course from Dr. [George] Struble.

A: So how was that?

E: I enjoyed it thoroughly—read some things I hadn't read. I don't think the English majors were particularly pleased that I got one of the As (laughs).

A: (laughs) He probably read your papers too.

E: He might've, I think he did (laughs), but I think that was normal for him.

A: Yeah, and you said history. Who were the history profs at that time?

E: Now you're going to embarrass me (laughs).

A: No, I—the only one I can remember is Betty Geffen. I don't know if you had her.

E: Yes. She was the one I had. Then I had the Pennsylvania history. And that was taught by a man, and I'm afraid I cannot remember his name.

A: I didn't even know they had a course called Pennsylvania history.

E: It was required. And, because of the load of lab courses, Charlotte Knorr, my roommate, and I wound up taking it as seniors. That was a great advantage because, by then, we were used to the college way of doing things. So, we had an easy time of it, and freshman were all struggling, learning about college.

A: Yeah. Well let's go to something else then. I know that you were friends with the O'Donnells, can you talk about them a little bit, and your relationship with them?

E: Well they—I first knew Bob well, of course, he was my instructor for general physics. And then later for analytical mechanics—I think that's when we became closer friends.

A: What did you like about him from the beginning?

E: He was always very thorough in explaining things, and in fact, he was legendary for writing out notes that could've turned into a book. And I found that very clear and learned that logical approach to problems, which has put me in good stead for many years. A lot of Jake and John Morris—it's hard to put into words the differences, but they somehow were not as detailed and thorough—they covered the material, they did explain the principles, but I think they did more talking about them, and maybe not with as much detail as Bob did. And that extreme thoroughness suited me.

A: You said you got to know him better than as what, a person later on?

E: Yes, I became student assistant assigned to him. By then, Agnes was teaching English. I never had her. I think she taught mostly freshmen, and she started when I was a sophomore, I think. And—and I don't remember exactly how it happened, but I would start spending time with them on weekends, and by the time I was a senior I was largely eating at their house (laughs). I had gotten thoroughly tired of dorm food (laughs).

A: What was it about them that made you want to spend time with them, I guess?

E: It was very casual, it was just natural to be included in the conversation. Bob was interested in so many things. He was interested in the classical guitar, which got me interested in it, and so we would listen to music, talk. He also started a book club, and we read many things. One of them was *Great Experiments in Physics* in my junior year. In my senior year there was a more general group. We met at the O'Donnell's house. That senior year, we were reading a variety of things—*Death in Venice*, *Camus*, and again, meeting to discuss them. I think Ag may have joined in some of that.

A: I was going to say it sounds like some of Ag's suggestions as well.

E: It could have been.

A: Was she usually at these discussions as well?

E: Not the *Great Experiments in Physics* (laughs). But she was—she was there. She wasn't always in the discussion, but then she always provided something, some refreshments, and made it a very casual and congenial atmosphere.

A: And then over the years you—did you stay connected right from the beginning, or was it later on that you started to?

E: Oh, with them I stayed connected from the very beginning, because Bob had—was providing references. But I can remember when I was working for the Navy in Virginia, I would come up for weekends occasionally.

A: So, the connection was primarily through the Physics Department?

E: Yes.

A: Yeah, in later years then, your connection was to the College, kind of as a whole, rather than a particular department?

E: That started with President [John] Synodinos. At the time, I think I contributed occasionally to the alumni giving, but he was touring around visiting alumni when he was starting the building fund. That was when they started so much expansion of the buildings. And so he came to visit me at work, and he did a sales pitch. By then I was able to contribute more, and that started it.

A: Now, as you look at the campus now, which you have been doing lately, and see the differences, what are your reactions to that? It's a bigger school now than it was.

E: It's much bigger, especially in terms of dorm space. There are many more dorms than in the '60s.

A: And the luxurious sense of some of those dorms I guess. Quite different?

E: Quite different, yes. I stayed in one for a reunion, and it was a little suite—and very nice, in terms of—compared to what we had. But I had no complaints about what we had. Having a roommate, we got very close.

A: Do you still keep in contact?

E: Some, not with all of them. In fact, with the reunion, I'm glad to get addresses that I had lost over the years.

A: OK, and as we speak, that is a couple weeks from now.

E: A couple of weeks from now.

A: 50th anniversary.

E: 50 years, yes.

A: Yeah, what are your thoughts about that?

E: (laughs) Time flies (laughs), and I'm very much looking forward to meeting some of the old classmates again.

A: Good, good—and again, as we speak, last evening you went to the 100th anniversary of the founding of the Physics Department. What was that like?

E: Well it was very interesting. There were only two other people there that I had known when I was a student, Russell Hertzog and George Plitnick. But it was—there was such commonality of experience that when you walked up to anyone, and asked when they graduated, what they'd been doing. It was all very, very casual and delightful. There was a panel discussion done as conversation between Mike Day and Jake Rhodes. Jake, must be 90, close to 90. Mike would read a question to him, and Jake would sit back and talk for five or 10 minutes on his recollections about the question, or what he had heard. He spoke about the very early years, which he was not part of, but he's done a great deal of research, and—

A: You mean the first 50 years or so?

E: Well, Jake was a student starting in '38, so the period from 1914 to 1913 to '38, it was all done by research. But he and the department secretary Barbara West had been going back into the archives.

A: Well, he covers a large part of that, a hundred years.

E: He does, yes.

A: Yeah, and what kind of things do you remember from what he said?

E: Well, he talked about what the students had been doing. He was quite proud; deservedly so. And interestingly, a lot of people think that a Ph.D. in physics will lead to an academic career, but the smallest percentage of Lebanon Valley physics majors are in teaching, and the bulk of those are in high school.

A: Really?

E: Yeah, the majors from Lebanon Valley. Then, there was a more sizable contingent working in government labs and National Science Foundation, or military labs, or NASA, as I was. But the largest contingent worked in industry. We were talking to some of the current students after and they're starting to look in that direction. When I entered, the assumption was that we would become teachers. And a couple of people thought about working in industry, or in research labs. I kind of learned that at Lebanon Valley, of the other opportunities that were available. Although, I still thought I would teach, and did it for a short time, until circumstances changed.

A: How many physics majors were there when you were there? Approximately?

E: Our class was 10, which was the largest class.

A: You say your class—was that the sophomore class, or all four years?

E: We graduated 10.

A: Ten—10 physics majors, is that right?

E: Yeah.

A: That's pretty good.

E: And, the classes behind were a little smaller, but there were probably close to 40—between 30 and 40 physics majors when we were there. It was a very active Physics Club.

A: Does it seem to be that way today? You said you were talking to some of the students—

E: It's actually getting bigger. They will graduate 11 this year, and, I'm pleased to say that the—I think the independent study and the opportunities to work with the professors is keeping the students there. There was one student I had met last year who was part of the engineering curriculum, the 3+2 program, and he decided to stay as a physics major and is graduating this year.

A: Will he go on to engineering in graduate school then?

E: He's interested in robotics and space work, so I'm going to get him in touch with some of the people at Johnson Space Center—some of whom are working with J.P.L., and I think that might be the sort of place that he would like to go. Although, Johnson actually has an interesting amount of work in robotics, so he might wind up there, but, if he winds up at J.P.L., he is indeed going need an advance degree, whereas Johnson he could probably get in and pursue his degree while working.

A: OK, I think we'll begin to wrap this up. OK? But I always ask people one of the last questions at least. You think back over your four years there and then your life occurred since then—what has Lebanon Valley College meant to you?



E: It was an excellent grounding in the physics. When I went to work for the Navy, I was rather surprised because I was working with a woman from Bucknell, which had a much better reputation than Lebanon Valley. I was better prepared than she was. And when I went to graduate school, I was at least as well prepared as most, and better than some. And that's been part of what I've been trying to pay back is the excellent start that I had.

A: Did you have any kind of scholarship when you went there?

E: Yes I did, I had a—I think it was a quarter tuition scholarship, which was part of the decision in coming also, I don't think my parents could have afforded it if they had to pay the full tuition.

A: Yeah. Well, anything else that—any other way or reasons why Lebanon Valley means something to you today?

E: Well, the friendships— and I've gotten to know the current physics faculty and have enjoyed seeing the way they're working with students, which is very similar to the way Jake and Bob worked with students over the years.

A: So you're pretty optimistic about the future for physics at Lebanon Valley?

E: I am. I am very optimistic, and given the increasing enrollment and the work that I see the students doing—so I think that the tradition is continued, and they're also turning out well prepared students. Hopefully we'll bring more to Lebanon Valley.

A: OK, well finally, any final thoughts that I haven't touched on or questions I haven't asked that you would like to cover? You see, these—this recording might be read 200 years from now, or even listened to with whatever technically they have then (laughs). What would you like them to know about Lebanon Valley College, your years at Lebanon Valley College, then? You are talking to the future now (laughs).

E: One thing that I haven't talked about much is the value I have seen for the liberal arts side of the education. I did talk about enjoying some of the courses, but—the abilities that that part of the education gave me—the writing skill, particularly the writing skill, has served me very well and been an advantage as I moved through my career. I've emphasized the physics part and it, of course, has been extremely important. As I see people talking about the practical side of education—I hope that Lebanon Valley doesn't lose that liberal arts tradition that—turns out people that are prepared in a number of ways, rather than just a narrow technical field. You can't know what type of work you're going to do throughout your career, especially today. It's maybe even more important in the future, and the broader the preparation the better.

A: Well, you're a good example of that.

E: Thank you.

A: Coming through that kind of program and then adapting to some of the things, especially... (unintelligible)... that you adapted to. And maybe a stricter, more scientific education might have made it a little more difficult for you to do that.

E: I think it would have.

A: If that's what you're saying. OK, well I think we'll end it at that point. Many thanks.

E: Thank you.

A: Very interesting.

E: I enjoyed it.

A: OK.