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Interview with Dr. William Ballard (WB)

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by

Varoujan Bedros (VB)

VB: Dr. Ballard, can you tell us a little bit about yourself, and in particular, when and where you received your degrees?

WB: Well, I had my undergraduate work at Whitman College in Walla Walla, Washington which wasn't very far from where I grew up. My family had an orchard growing various fruits in the Yakima Valley in Central Washington. I got my degree in, bachelor's degree, in 1946. Went to the University of Chicago, and got a Master's degree there in the fall of 1947. And then after that academic year I spent two years teaching at a state college in Washington, then returned to Chicago. Various things intervened, and I eventually got my Ph.D. at Chicago in 1957. Does that answer the question?

VB: Do you recall what was the dissertation topic?

WB: The dissertation topic was *Cohomology of Fields*. So, this was homological algebra, cohomology to groups to find for a certain field extensions.

VB: Okay. Why did you choose to become a faculty member at The University of Montana?

WB: Well, by the time I was choosing that, I certainly wanted to be a faculty member somewhere, and I had traveled through Montana several times, and it looked to me as though Missoula would be a nice place to live. For two or three reasons, one was simply that, one of the nice features, one of the best features of a place I came from in Central Washington was the nearby forests and mountains in the Cascades; that's in Washington. And the mountains and forests around Missoula were rather similar, but there were more of them. So, I thought Missoula might be even better as just a place to live. And of course I wanted to teach mathematics somewhere. I wanted to get away from where I was, just at that time. I had been teaching at the Air Force Institute of Technology, which is an engineering school which is at Wright Patterson Air Force Base in Ohio. That was a good job. I was, I had an Air Force commission, and was at that time being discharged from the Air Force, but I'd had a good job there, and I could've continued, but actually every summer I got hay fever rather badly there. It was, I found it very difficult to breathe, naturally from about middle of August to about middle of October, and I thought it would be a good idea to get away from Ohio. And the Rocky Mountains appealed to me, so I choose to come to the Rocky Mountains. I actually applied for positions at three universities in the Rocky Mountains, and got offers from three and chose Missoula.

VB: Good.

WB: And that was it.

VB: Who was the most influential person in helping you choose mathematics as a career? How did that person influence you?

WB: Well, to answer that is rather difficult. I don't know that there's any one person that I would say did that. I had a very good mathematics teacher in high school. A right, remarkable woman. I had some good undergraduate teachers in mathematics, and, but I also had good teachers in some other things. And I really decided that a couple of things separately, I think. I think I decided separately that an academic career was attractive to me, and then that I preferred mathematics just because it's intellectually appealing to me. Intellectually satisfying. In mathematics, you don't have to just take some body's word for very much. You do theorems which means you really logically understand things and that's, that's satisfying. And I've, I'm still convinced that it's the most intellectually satisfying discipline possible. Or that exists anyway.

VB: Ok. What were your goals when you started, and have these been accomplished? Have they been altered? And, if so, how and why?

WB: Well, my goals were always flexible. I would of liked to accomplish more along some lines. I've never done much publishing or much research or published a great deal, and I could be, I'm not completely satisfied about that. But, in general I think that I have done

an honest job of being a faculty member, a teacher at The University of Montana. I'm not dissatisfied particularly; I'm not completely satisfied.

VB: What changes has the department gone through since you have been here? Were you involved directly in these changes?

WB: Well...

VB: What did you think of that?

WB: What do I think of that? Well, of course in the, those, what is it now 42 years there have to have been a lot of changes. And there certainly have been. Some major things that come to mind, I'll try to mention. When I first came here I was pretty ambitious about having a strong undergraduate program, a strong program in mathematics available for our undergraduate students. We did have some very good undergraduate students, Dr. Yale who's on the faculty now, Dr. Manis who just recently retired, Dr. McRae. For example, and some others who aren't here, but those three happened to be starting at about that time. And I had had what I thought was a good background, and had an idea that we ought to have a strong program for our majors. And in the first few years I was here we made a lot of changes in what we offered for our majors. We strengthened the basic offerings in algebra and analysis. And we built up our curriculum in some other respects too, for the teacher training. And I had quite a large part in that, and I felt that I had accomplished some good things. That's a change. There were changes going on in mathematics everywhere at that time. It was the time when the Russians launched their first little satellite, so called Sputnik, and that seemed to give impetus to a movement to improve mathematics, and in all levels. And we were working to help teachers in the grade schools and the high schools, which we did in various ways. We had some NSF sponsored institutes, for example, and our own curricula in the beginning mathematics; we worked with and modified quite a lot those first few years. So, those are some things that I took part in. I mentioned those institutes with NSF support, those, we had those for high school teachers, and for 14 years. Every summer for 14 years I taught in our summer institute. That was 1961-1974. And that was a considerable effort that I and a number of other people in the department worked in. It was about 1970 or 71 when we undertook a Ph.D. program in the department. We had had a master's program, master's degree that we offered, and we decided to try to have a Ph.D. program, and we got fund... some funding to help with that from the National Science Foundation. And we're able with that to hire some new faculty who would be helpful and make it possible to have a Ph.D. program. We'd had trouble for a long time before that in getting and keeping adequate faculty. Just, well let's see, I came in 1957 and by, and at that time there were 10 Ph.D.'s in the faculty. I think by 1962 we were down to 5. People had left. We had an administration which was not being as cooperative as it should have been in hiring new mathematicians. I think it simply wasn't interested in mathematics, didn't believe it was important. That's maybe a controversial statement, but that's my opinion, and we were down to a very low ebb. And I recall at that time, it was one time when I was teaching all, this wasn't normal but I was teaching all upper division or graduate courses because it

was something that, well because I was able to do this kind of thing. I had rather broad training in mathematics, and was able to and willing to teach anything the department offered except statistics. I never taught that, but I taught at the, I taught through the master's level any of the algebra or analysis courses. Or any of the courses we offered in geometry. And so I, once for example I was teaching simultaneously the complex variables course and the topology sequence. The, but that was the result of our being short of staff. And we had improved that situation somewhat by about 1970. I think by about, it was about by that time that people I mentioned, Yale and Manis and McRae came back after having gone elsewhere and gotten their degrees and done some teaching at other places. In most cases any way, I think, maybe Manis came directly here, but McRae had been at Illinois for a while, and Yale was at Morehouse for a while. But, then we got some new faculty around that time, and started the Ph.D. program, and that was, that was a big change in what went on in the department. And the, that was about the time when the department became more organized so that there were algebraists and analysts and statisticians. Before that time, I really didn't think of myself as anything, but mathematician, and I taught algebra and analysis. I taught both of these things without thinking I needed/wanted to specialize, but after that time more specialization was apparent. And, after that time, I, when I taught I taught, whatever I taught was algebra, in upper division and the graduate courses. And I think had more specialization than the kind of thing we've got now where there's a group in, they're all small groups, but there's a group in statistics, a group in algebra, a group in analysis, a group in operations research, and some people emphasizing applied mathematics as apposed to pure mathematics. That organization has developed beginning at about that time, in the early 70's. So, those are broad changes. There have been some more changes, not of our doing. There'll be more than I remember, more than I think of in this interview, but one thing that is a big change just recently imposed from the outside, and that's our change to a semester calendar from a quarter calendar. And that, well, I'd always said that probably didn't matter very much which kind of a calendar you had, you could teach mathematics either way.

VB: I think it was from quarter to semester.

WB: Quarter to semester, did I say the other way? Oh, I'm sorry. No, of course from quarters to semesters. I always thought it didn't matter much, I had gone to school under both systems, I had taught under both systems, but when it was imposed on us, it was the semester system that with the fall semester starting first of September or even earlier, and I don't think it's a very satisfactory calendar. And it has resulted in some changes in what we offer students, and I think we're really offering students less than we were able to do before. So, I regret that that happened, I opposed it at the time, and I think virtually all of our department did, but the Board of Regents wanted that, and they decided we would have that, and they forced it on us. You know, that was a fairly long answer, but.

VB: That's all right. Can you tell us more about how the mathematics courses changed, and do you expect them to change?

WB: Well, yeah. I can tell you a little about it. We've. at the lower division level there have been changes in both the courses for majors, and in the courses that are given as service courses. In the courses for majors, when I first came we were still giving an analytic geometry course, and the whole mathematics community all over the country did pretty much as we did and stopped giving an analytic geometry course and combined it into, combined some of the content into calculus. The reason for doing this was to speed up the curriculum a bit so that students would get, get through some kind of a calculus course in one, in their first year. And the idea there was partly at least, what I was mentioning earlier, to try to give a strong undergraduate program. To get the students off to a start where they could take a lot of mathematics. And then also in lower division, we've had a number of changes because of the demands of some of the customers. When I first came, all that we gave that was special for the business students was a little bit about compound interest. That's approximately true, but they have wanted for a long time now; they have wanted some introduction to linear programming and playing around with so-called linear algebra, playing around with matrixes, linear algebra. I don't know exactly what we're giving now in that, I haven't taught it for quite a few years, but we still do that, and we give more combinatorial mathematics and statistics for business students and some others than we used to. Well, there've been changes of that kind. In our own mathematics courses, as I said, we strengthened our offerings when I was first here. There was for undergraduates available I think one 5 hour, one quarter course in modern algebra when I was first here. We substituted a full year of a three hour course and in fact we made it a more demanding kind of course rather quickly by choosing certain textbooks and that kind of thing. Same kind of thing was true in analysis. So we just strengthened some things. Various things have been added. Numerical analysis was added. Charlie Bryan taught that. I don't think; I don't know that we've really replaced that course. Charlie's course, Charlie's retired. He retired about a dozen years ago, and I don't, I'm not aware that we have the same kind of offering there that we did. Another change that has come had to deal with computer science. We offer, well, there was no such thing as computer science when I came. It was one of the professors who came at the same time I did. His name was Fred Young who had been working with the development of computers. I think he worked for North American which was an airplane defense contracting company. Made some airplanes, did some other contracting with it then, but he had been working on computer development, and he gave lectures on the very fundamentals of how computers worked in the first year or two that I was here. It wasn't too long before the university was buying a computer, and we were hiring into the mathematics department a person to teach computer science, and be in charge of the university's academic computer. And, the first fellow we had was here only about a year, and then another chap Banaugh was hired. He was in the mathematics department at first, but then he wanted his own department he decided, and arranged with the dean and got his own department. So, computer science was set up separately, but the mathematics department has always given some courses that computer scientists are required to take. And that's another kind of course that we otherwise didn't have. What do you, what do we call that? Oh, discrete mathematics. Yeah. We teach that. I even taught that a few times, so you see, I've... my claim that I've taught almost every thing is justified. But

then the other big change in courses has been, I think the institution of the courses in so-called, you know, I mentioned it before, what's the name for it.. .what's the name for what Jenny McNulty and Mark Kayll do?

VB: Optimization?

WB: Well, it's.

VB: Operations research?

WB: Operations research! Oh yes! Well, operations research is something that I first learned about when I was in the Air Force. It, they called it operations research or operations analysis, and it was invented, the term was invented by people working on government contracts, people in the Army research projects outfit or the Rand Corporation; they started doing that kind of work, and it involves optimization of almost any kind. I guess you would say and it seems to involve a lot of graph theory. And, just what it involves at any given time depends on the interests of the person who is doing it I guess? But at any rate, that has developed. We have a group in our faculty who does that, and when I started, we certainly didn't. It's a big, quite a big change. Well, those are the things that come to mind. There are probably other things. I'm not good at lists, so...

VB: Okay.

WB: Having a list of everything.

VB: Okay. If you can identify the best asset of the Department of Mathematical Sciences and The University of Montana, what would it be?

WB: The best asset? Well, I don't know. You know, I think, well people say your best asset is your students, and people say your best asset is the faculty, and those are kind of meaningless things to say. I think we have a good department, and I think we have had a good department because we've always had people who worked together. We've always gotten along pretty well, and we have people who are generally interested in the students, and with a real, who really are obligated to or really devoted to the welfare of the students and the university. So, I think we've had a... Well, we've been quite fortunate in getting people who came and have done a good job, and who stuck to it, really dependable people. Yeah, I don't think this is peculiar to one department in these university, I think they're, in many places in the universe do you find the same kind of devotion. And there are a few places where sometimes you don't. But.. .more than that, I don't know. I'm not good at answering... (Side of tape ends)

VB: What area of mathematics are you interested in?

WB: Well, I'm interested in many parts of mathematics. Not, I've mentioned that I've taught in various areas, and that I didn't think of myself as being restricted to one area, and my

interests are still not restricted to one. I have been concentrating more on algebra and number theory recently than other things, but I still pick up and read some other things with interest. And, I don't know, I have the, my outlook is that good mathematics is good mathematics and I like it. I don't...

VB: Where can we find samples of your work?

WB: Well, as I say, I haven't published very much. In fact I can think of only a couple of examples. One is a book I wrote. That was a book of geometry. I don't, you know what I don't think I have a copy of it here, I have a copy of it at home, but the book is called *Geometry*, and it's in the library, so you can see that. There was an article in the monthly, once upon a time, and I can't tell you when, I think it was, well I'm sure it was in the early 60's at any rate on which I'm a co-author. That was an article about a topic in analysis. It had to do with infinite series, even power series, but the other two authors were analysts, and three of us worked on this article. But that question has a short answer. That's all there is.

VB: Ok, what question would you suggest for the year 2000 Hilbert list of problems to direct the thinking of mathematicians and mathematics educators?

WB: Well, I don't know. I don't have. I don't have a nominee for that. As to my work, there's another answer of course. My thesis exists and it's available at the University of Chicago library. But, no I don't have a question to pose for the new Hilbert list.

VB: Well, do you have any favorite anecdote or memory that reminds you of why you enjoy being here?

WB: No, I don't think so. I've enjoyed being here in so many ways and for so many reasons, that I don't think there's anything. I don't think of anything that stands out.

VB: All right, thank you very much. We appreciate your time and your input on this project. Thanks a lot.

WB: Well, you're welcome. I hope it helps out. I hope that it, you know, adds to the total.

VB: Sure.