2006

History of The Department of Mathematical Sciences at The University of Montana: A Collection of Interviews

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of
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Edited by
Johnny W. Lott

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Introduction

In 1999, the Math 606 Topics in the History of Mathematics class was presented a challenge by the instructor of record, Dr. Johnny W. Lott, Professor, in the Department of Mathematical Sciences at The University of Montana. He offered a variety of projects to accompany the readings, problems and presentations that the class was required to do for the semester. Because the university had celebrated its centennial celebration and the department had a faculty member since the beginning of the institution, one project was to assemble a history of the department including a set of audio tapes of current and recently retired faculty members discussing different questions that the class would develop. After some discussion, the four students agreed that this was a joint project that they would like to do for the semester.

With the help of Mansfield Library archivist, Jodi Allison-Bunnell, the class received some instruction in what it takes to do an oral history, a set of blank audio tapes from the Library, and the work began. The students who are listed as the authors of this work were graduate students in the class and those students conducted all of the interviews in 1999. One tape, that of Dr. Gloria Conyers Hewitt, was accidentally erased in the transcription process. Dr. Hewitt was re-interviewed by Lott in 2006.

When the interviews were completed, all the tapes and the permissions for publishing the transcriptions were returned to Lott and the transcription work began. As a novice person working on an oral history, the amount of time involved in the transcriptions was vastly underestimated, and work stopped for a period of time. Professor Lott applied for a grant to help with the transcription but that grant was not funded.

In order to spur the completion of the work, department chair, James Hirstein, paid for Tamara Scholz to transcribe the tapes. The initial transcripts were completed with the exception of that of Dr. Hewitt. The initial transcripts were distributed to the interviewees to check for name accuracy. To complete the project now seven years later, Professor Lott made a check of the accuracy of the transcriptions, correcting spellings as much as possible, and re-typing those transcriptions that had not been made electronically.

As the professor of record Math 606, I naively thought that this project could be done at least within an academic year. That did not happen and I take full responsibility for the very long delay in getting the work done. I also take full responsibility for any typographical errors in the transcriptions at this stage.

One note to my fellow professors is that I also naively thought that corrections in grammar and other small corrections to make the record factually accurate could be made in a final product. I have since learned that future historians want an

accurate transcription of the audio tape, not necessarily a corrected one. Because of that, I have made the transcriptions as true to the record as I could make them. There are places in the transcriptions where (?) is used when the tape simply could not be heard clearly enough to transcribe the sounds. Users will see that this is true especially in some tapes where there were distracting sounds, like bells, phones, and people interruptions and in other places where the microphone was not near enough to the speaker. Little could be done about those problems.

I personally want to thank both the interviewers and the interviewees for helping with this project. The oral history is an important view of the Department of Mathematical Sciences in 1999. Updates to include faculty members in the written record, not the interviews, were added in a final section. Thanks to the department for allowing me to copy pictures for the file. All files (written, electronic, and tape, where available, have been presented to the Maureen and Mike Mansfield Library Archives for cataloguing.

Johnny W. Lott, Professor Emeritus
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December 13, 2006

Set of Possible Interview Questions Submitted by Class Members

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

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

3. What were your goals when you started and have these been accomplished?

4. What changes has the department gone through since you have been here?
   a. Were you involved directly in those changes?
   b. What did you think of them?
   c. What changes to the physical plant can you recall?
   d. Has the department grown since your arrival?

5. If you can identify the best asset of the Department of Mathematical Sciences at The University of Montana, what is it?

6. In what area of research are you especially interested?
   a. Have you done research in other areas?
   b. Could you please tell me where I can find examples of your work?
   c. On what are you currently working?
   d. Has technology affected your area of research?

7. What question would you suggest for a year 2000 "Hilbert" list of problems to direct the thinking of mathematicians or mathematics educators?

8. How has content changed in mathematics courses over your career? How do you expect it to continue to change?

9. Do you have a favorite anecdote or memory that reminds you of why you enjoy being here?

Interview with Dr. William Ballard (WB)

Department of Mathematical Sciences
The University of Montana
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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.

Interview with Dr. Richard (Rick) Billstein (RB)

Department of Mathematical Sciences
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Missoula, MT 59812

by

Charles Myers (CM)

CM: Okay, this is Dr. Billstein, 11/10/99, interview for the History of Mathematics class.

CM: Dr. Billstein, why did you choose to become a faculty member at the University of Montana?

RB: I think it was just fate. When I was an undergraduate at Montana State University in Billings, that I found out that I became a math major because I had more credits in mathematics than anything else. And, Oliver Peterson, who was on staff there, has some connections and Bill Myers had just done a trip down there and said well why don't you apply for graduate school at the University of Montana? And as I didn't have anything else going so I decided to apply for graduate school up here. Got accepted as a TA, found out that I liked college teaching quite a bit, and so came up here, completed a master's degree. And then they wanted me to take over the remedial program here—the one that Mary, the program that Mary Jean Brod's got right now. So I took over that and installed a brand new program in there on using audio cassettes and remodeled that whole program. Same time I was doing that, I finished a doctorate in math education. In the meantime, I had some many things going that they

decided well why don't you just stay here? So I just stayed on as a faculty member. The idea was that you typically don't hire your own graduates. But the fact that I went across campus and finished a degree in mathematics education meant that I wasn't really from this department. So they kind of generalized, rationalized, I guess, and said that you're not really from inside the department. You're from across campus, so … anyway I got… I was very luck and got to stay here. Howard Reinhardt and Bill Myers and Bill Ballard and those guys were very sympathetic towards mathematics education in those days. And that was rear. When I first got into mathematics education, most mathematics departments were not sympathetic towards mathematics education. Math educators were second class citizens. But here they were well respected so I decided just to stay here.

CM: Okay. Who then would you say is the most influential person in helping you choose mathematics as a career? Why do you think that person was?

RB: Well, at the undergraduate level, it had to be Oliver Peterson. He was a professor at Montana State University in Billings and he was the chairman of the department. And I had him for probably three or four courses. He's the one that said I ought to be a mathematics major and that I ought to be going to graduate school. And he really didn't ask me; he told me that I should be doing it, so… And so he was the most influential as an undergraduate. Then when I got up here, I think the person that influenced me more than anyone else as a teacher was Howard Reinhardt, because I envisioned him as anything that a professor should be. He was professional. He knew the mathematics. He had a sense of humor. He enjoyed teaching and soon I thought that if I could be like him, and do what Howard did, then that would be a great life. And then the other one is Bill Myers, because Bill Myers took me on as an advisee for my MA, and worked with me in real analysis to get me through the MA program. And I guess the other person in mathematics education that influenced me was Alan Hoffer. Because Alan Hoffer was here and then he took over as my dissertation advisor for my doctorate degree. If I had to go back, I suppose Alan Hoffer was my mathematical father. Going back, he was fantastic. Then he left here and went to the University of Oregon and on to Boston and NSF and California, and so on. He was one of the most influential math educators in the United States.

CM: What were your goals when you started? And have they been accomplished or altered, and how or why?

RB: Goals, as at the University of Montana?

CM: Uh-huh.

RB: Probably the biggest thing I wanted to do was take the teacher training program, which was…Historically, if you look back the University of Montana, historically was one of the first people ever to get interested in mathematics education and write books in mathematics education. The first *Mathematics for Elementary Teachers* written in the United States was written by John Peterson and Joe Hashisaki. And they were at the University of Montana when they wrote it. That was the very first book ever written—it was called *Theory of Arithmetic*. And they went through several editions, and so on. We were using that book when I first started teaching those courses. And then Peterson—Hashisaki left. Peterson moved over to the computer science department. And so, we said well we can probably, you know… It did a lot of things, but we thought we could do some things better. And so we started revising that math for elementary teachers, because the history of that was at the University of Montana. And so, we revised it to see if we could make it the best possible book around, because what happened in the traditional book they didn't do enough problem solving. It was more drill-and-kill computation, algorithmic-type thing. We wanted to get the thinking process, the problem solving in. So that was the biggest change we made into it. And then put in a little more communication-connections things in it. So we took Peterson and Hashisaki's book as a starting point and our goal was always to remodel the teacher-education program. I particularly zoomed in on the, elementary and then Shlomo Libeskind and Johnny then zoomed in on the secondary more. And we tried to put technology courses in and courses especially for secondary teachers. And that was accomplished. So we achieved a lot of goals in, in refining our programs. And that was accomplished. So we achieved a lot of goals in, in refining our programs. And our program, I think, is nationally known now. We've had influence all over the United States, because the *Math for Elementary Teachers* [*A Problem Solving Approach to Mathematics for Elementary Teachers* by Billstein, Libeskind and Lott] is the most widely used book in the United States right now and has been since 1980. We can't go anywhere without people recognizing the names and so on. We're much more well-known off campus than we are on campus, mainly as a result of the books. One thing that has not been accomplished that I would still like to do here—the certification---is the K-8 certification. And we don't provide enough mathematics content and background for middle school teachers. And if those teachers are going to go out and teach a program like the STEM program or any of the NSF standard, new standards projects, they don't know enough mathematics to teach it. And so what we need is a middle school certification in the state of Montana, and even nationally, where these people really know some mathematics. And if we could get that in place, and then we'd have to convince the middle schools around the state to actually hire these people. Because right now they're hiring elementary certified people, so they've got reading teachers and English teachers and social studies teachers teaching the mathematics courses. And those

mathematics courses aren't like they used to be, because before we didn't have algebra in eighth grade. We didn't have pre-algebra in seventh grade. People didn't have to teach quantitative literacy. They didn't have to know about stem-and-leaf plots and box-and-whisker plots, and son on. These teachers right now don't know about these things. Yet, they're in the new reform materials. And the only way they're going to learn that is if we really get some kind of certification, I guess, specialists in the middle school. And right now I' haven't been able to even crack—I don't even know how to go about that.

CM: You promote specialists in the middle school. Aren't there some disciplines where they certify to like fifth grade, fifth to twelve?

RB: Yeah, in Montana what happens, the elementary certification is K through 8 and then the secondary certification is 5 through 12. And so what happens typically in Montana is that they will not hire somebody that is certified in 5 to 12, say in mathematics, because then they can't shift them around and have them teach social studies and so on, because it's a scheduling think. So they need the elementary certification so they can have them teacher math once, one year, and music and social studies and that kind of stuff. And you have to understand the principal, you know. It's very easy for the principals then to switch these people, and the scheduling problem. But if you've got a math specialist, only certified in mathematics, then they can't switch them. So until that mentality is somehow eradicated, we can't do it. And in Montana we've got the small schools, you know, with 50 or 100 students where that math teacher then has to teach a whole bunch of other subject matter areas. And then, so they'd need that elementary certification. And what we need to do is the same thing they've done in China, like we looked at that article the other day. The difference in China, and the reason those Chinese teachers and Japanese teachers are so much better than and the results are so much better, is those teachers are specialized. They're mathematics teachers.

CM: Uh-huh.

RB: And our teachers here are generalists. And so, my goal, if I live long enough, is to really get middle school teaches prepared to teach the mathematics in the middle school. And if, in particular, we can get the state of Montana turned around, so we can get certified and qualified teachers in the middle school…

CM: I would say that this university is probably where it has to come from, if you're right.

RB: Yeah. This is, this and Montana State. There are some good people at Montana State. But what's going to happen, I don't…I don't know at what

point we're going to be able to force anything because of all the small schools in Montana. But the teachers need to know much more. If you look at the TIMMS study, you know, our fourth graders did well in the United States but our eighth graders did terribly. And then it got worse in the high school. And what happened is that those people that we trained, that teach up K through 4, they have a good background in mathematics because that's the mathematics for elementary teachers. And that's sufficient for those people. But once they get 5, 6, 7 eighth grade, they don't know enough mathematics to teach those. As a result, the students get turned off, the teachers get turned off. There's a lot of bad feeling about mathematics. They don't know the material. And if you look at the study that was done out of Chicago, in a traditional mathematics program, only 30% of the material that was taught (end of Side A tape)

(Begin Side B tape.)

Take every middle school mathematics teacher in Missoula. There is one, and only one, that is, has a mathematics degree. And that's Stan Hassman. Everyone else is elementary certified. And when Stan retires, there will not be a single person teaching middle school in Missoula, Montana, that has a degree in mathematics.

CM: Now is there, in the new certification standards, or the new majors for elementary, they can, where they can have an emphasis? Would that be some way to go, possibly? Is that to be able to teacher in the fifth through eighth grade, that you'd be elementary certified with an emphasis in mathematics?

RB: Yeah. What's happened, you know we had that put in about 10 or 15 years ago when I was fighting this battle. And you could… You could get essentially what called an emphasis in… Well, you could get an elementary, elementary degree with an emphasis in mathematics, and so on. But the state did not recognize it. You could get it stamped on the University of Montana as an emphasis in mathematics. And then the teachers could go out and sell themselves, and make them more… And again, they were very marketable, and so on. But again that faded out of the catalog and it's no longer there. But just in the last year or so, now they've introduced a new idea, and I guess this is the first year it takes effect, that you have to, in an elementary program, you have to declare an emphasis. And you have to take an extra—I don't know what it is—15 credits, or whatever it is, in that emphasis. What's going to happen is that very few people are going to actually choose the mathematics. And so, we're not going to solve the problem with the emphasis. We may get a few more than we had before with a few more courses. But it's not like having a minor at the elementary level. The other thing I'd like to do, and we haven't done yet, is get a masters degree for middle school teachers.

We have the only MAT in the state for secondary teachers, although Montana State offers a masters for teachers. But it's not an MAT> But what's really needed is a masters degree for middle school teachers. Because those teachers can't come in and compete with the secondary teachers, because those people are all secondary certified. So we're starting with a middle school teacher that maybe has had the equivalent to a precalculus course and a math for elementary teacher course, and trying to throw those in with a real analysis course of the high school teachers. And it doesn't work.

CM: Sure.

RB: So we've got to design a whole new MAT program for middle school teachers. And again, those are goals that I have, but certainly haven't reached.

CM: Well, that's great. I thin we've covered 3 pretty thoroughly. Thank you. What changes has the department here gone through since you've been her?

RB: Oh, attitude wise, I think that they've gone from when I first came here that mathematics education was a second class citizen. Then it became very well respected. And, as a matter of fact, then if you looked at it mathematics educators have even been involved in administering the department now. Even Jim Hirstein now, chair of the department, is a mathematic educator. And we've all had major roles in it. And so, that something you didn't see, you know, 20 or 30 years ago, is the mathematics educators taking a lead in the department. The other thing that we see in the building, you just see if you just look around now, is all the technology that's used in all the classrooms. Every classroom you see is equipped with computes and projection devices. And the department has classroom sets of calculators and graphing calculators. We have two computer labs right in the department. When I got here 30 years ago, we had black chalkboards and chalk. And that's all you needed. And, math education, we didn't have nay hands-on kits. We didn't have geoboards or Cuisenaire rods or anything to bring into the classroom. We had to make everything ourselves, and so on. There was no budget for those things. But now we've got a math ed room stocked with ands-on materials we can sue for those classes. We've got tables that we can put together for group projects. So the whole philosophy—the hands-on materials, the technology, the renovation of the classrooms, the attitude, and so on—I've seen those changes come about. The other changes I've seen in just the last five or six years or so—the students seem to be weaker and less willing to work. In may they come in with a weaker background and less willing to do something about it. And that particularly became evident when I was on the grant for six years and not teaching at all. I've just been

back now two years teaching half time. And if I tried to use the same tests and the same standards, which I trying to do, last semester I flunked 405 of my class. Btu yet those kids need that kind of background if they're going to teach the new materials.

CM: As a proponent of a lot of these changes, would you say you were pretty directly involve din them?

RB: Oh, yeah. I think everybody in eh department has been directly involved in them. And its' been nice to have. What happens is if you're a single person in any discipline in the department, whether it's real analysis or algebra or mathematics education or something, if you don't have anybody to talk to, you're in trouble. And so, the fact that I brought Johnny Lott out here for a one-years appointment 25 years ago, and we've had that continuity. Shlomo Libeskind was here at that time. And he stayed for about five or six years. But we've had, I've had Johnny her for 25 years. And so he talks me into half the stuff and I talk him into the other half the stuff. And when you've got that kind of continuity, then changes can happen. And that's nice to know. Right now we have a math education staff of four tenure –track faculty with Hirstein, Lott, Libby and myself. And with four people you can accomplish quite a bit. You've got somebody to talk to and somebody to share things, and so on. That didn't happen before. We were one or two people, but you need at least four to rally run the program. If you're going to go out and get grants and develop courses and stuff.

CM: Okay. If you could identify the best asset of the whole department, what would you think it is?

RB: I thin it's small enough that people get along with each other, and can, and share things. And it's small enough that everybody can go to the parties, and help each other move and that kind of stuff, and so on. That's the camaraderie in the department. So it's small enough to do that, yet it's large enough o be able to offer a variety of courses in analysis and algebra and math ed and the different areas—statistics—and represent the. So, you've got the best of both worlds. You got it small enough where you know everybody and know what everybody is doing, yet big enough to have a variety of areas and everybody to be able to have their own group to interact with. It's just a prefect sized place to be. The fact that we've got a doctoral program, a masters program and an undergraduate program is a luxu5ry that most schools don't have. Because we're not heavy-duty enough into the doctoral program to make this a real heavy research institution, which can get somewhat boring. But we've got a docto5ral program that we can get involved in research and in turn help our own mathematics background. And just make life a little more interesting. So it's just a great place to work, because of the people here and what we can

offer. It'd even be better if the university had the funds to make everything work a little smoother, but… it has the potential to be the perfect place to be.

CM: Now we talked about this before, but could you briefly summarize a little bit form me, for this interview, what area of mathematics you're especially interested in?

RB: Again, my area is mathematics education. And, in particular, teacher training. And then in the back, going back to my background, every time there seems to be a hot item, I end up in depth. The latest one has been curriculum development, and writing new middle school textbooks. But again, when the U. S. was changing over to the metric system, I was heavily involved in that with metric grants for three or four years. Then if you go back right after that, I directed the, co-directed the EMME project, which worked with elementary teachers all over the state of Montana, getting herm involved. And, after EMME was finished, directed the IMPACT Project, which was how do you introduce technology to secondary teachers. And if you look at the leadership in MCTM and so on, all the leadership essentially in the state came out of the people that participated in those two projects. And it was just an absolutely phenomenal thing that we've done, getting those people involved. We had the School of Education and the mathematics department at U of M involved and the same thing at Montana State. And those people went on to get doctorates and masters and leadership programs, and so on. It's just…that's been a fantastic drive. This curriculum development program right now I'm involved in. It's been really rewarding to see this think—the commercial version. It took us seven years to write it, with about up to anywhere from 25 to 40 writers working on it. And it's finally out. And it is really making a national impact right now. And when I can travel around to just about any state in the United States now and see people using the material you wrote, and that, both at the middle school and college level, that's very satisfying. That's all the committees now, the national committees you get on. You can have an impact then, on everything.

CM: Do you then do a lot of traveling to those?

RB: Oh, yeah. That's what… I sleep in hotel rooms probably 80 to 90 nights a year.

CM: Huh.

RB: I mean, just if you look after Thanksgiving, I'll go to Phoenix for four days, then come back for 12 hours and to go Las Vegas for three days, and so on. Last month I went to North Carolina for four days, Portland for

three days, Denver for three days, so my weekends are filled with meeting after meeting. This summer I'll be going to Japan for two weeks to work on the international conference over there. So the bad part is when you're traveling that much it takes you away from what you can do at the university. But you make a lot of national conventions.

CM: Now I did ask you about this question. Part of the reason for that is, is because one of the things that has driven this century's mathematicians has been trying to solve several of the problems that David Hilbert proposed at the beginning of the century. The century's about over now. So, the question is what's going to drive mathematicians in the future? Or, if not that question, possibly, where do you see mathematics headed in the next century?

RB: Yeah, I don't really know. I think that the … because of the technology, the mathematics we can do and the mathematics we're doing to be interested in is going to be a lot different that it was at the beginning of the century. We can look at and examine a lot more problems in… I mean, ten-fifteen years ago you didn't see people at any level looking at chaos theory and fractals and that kind of thing because we didn't have the technology to do that. And now those are commonplace things. Or the big operations research problems, or the big statistics problems that you can use technology to help you develop. Or just the whole field of operations research because of the computer. You know, Hien Nguyen's business of, you know, just designing the most efficient bus routes, and that kind of thing, or designing airport runways. I think technology is going to be the thing that leads to the problems that we're going to work on. And, again, those could not possibly have been thought about at the beginning of this century, because nobody could have predicted the computing power we've got, right now, just sitting on our desk. You know ten-fifteen years ago when I had an Apple IIe, and I got up to 64K. You know, I was thinking, what am I ever going to do with it? I went from 48 to 64 and I thought I was in heaven. And I thought what am I going to do with all this, and son on. And then we started Logo. We did a lot of things that we didn't' know existed even five years before that. And now the things I'm doing, right now, just with Sketchpad and different things. No. I don't know where it's going to go and I don't know what the emphasis is going to be. But technology's going to be right in the middle of it.

CM: Okay. Thank you. You mentioned briefly that students were somewhat different from what you had seen in some of the courses that you had taught previously. Has your content changed in those courses?

RB: No, because we're using the same material, the same book.

CM: Okay.

RB: Yeah, it's just been updated. And one of the things you update in… We still have problem solving, that kind of thing, but we've done more cooperative learning, little more hands-on, lot more connections, and so on. So we revised it and built it up. But the basic content is still the same—the core, the core big ideas and the core nuts and bolts stuff. The kids come in right now and their backgrounds are much weaker. And if they don't know something, they don't know how to develop it or learn it, because their whole structure was—you memorized it. They didn't know why anything worked. I think one of the things that we've got to teach nowadays is not only how but why. And that's the step that these kids are missing. They don't have no clue on why things work. And the other thing I see is they're having trouble just motivation wise. If they don't get behind or if they do get behind or things aren't going well, it becomes the teacher's fault, not their fault. And so, they have trouble taking responsibility for anything. If you look at the TIMMS study, and they asked the students in Japan and the United States, you know what it takes to be good in mathematics, and so on. And the students in Japan said a lot of hard work, and son on. And the students in the United States pointed out that it takes a good teacher, and so on. And again, the Japan students took the responsibility on themselves, whereas the U. S. students, in many cases, were trying to put the responsibility on somebody else. Then if they didn't learn, it wasn't their fault. It was the teacher's fault.

CM: Yeah.

RB: And so I've seen these students come in. And if they flunk an exam, they want to know that can I do to make it up or change their grade, because they're so used to that mentality. Yeah, their basic skills have suffered and their thinking ability has suffered. I don't know. You'd think if their basic skills are going to go, then they'd better pick up something, some other skills. But they don't. Attitude and just basic mathematics content, it just, it isn't there anymore. I will say this though. My better students are better than they wee six years ago. And the worst students are worse. What' happened is the middle's dropped out. When I used to be able to give exams, I would have a nice somewhat bell-shaped curve with most of the students grouped around the middle. You could teach to that group in the middle. But, right now I've got my good students and I've got the poor student and they're spread. And then the middle's gone. And that makes it very hard to teach, because you've got this real far-reaching group on both ends.

CM: Do you see fewer students in the classes? Or fewer of the people who are really interested in mathematics?

RB: Yeah. I…regretfully, I'm seeing a lot of these kids that are in mathematics education right now because they probably couldn't survive in another subject matter area. You've got the good ones that really want to be in there because they want to be teachers. And they're going to be good teachers. But many of them are looking at teaching because they couldn't do something else. And, you know, that causes some problems. But my good ones are really good. But it's just that I have more of the bottom end and not many in the middle anymore. You know you used to try to teach to them. And a lot of the, you'd give them something for the good ones to do and something for the little weaker ones to do. But now it's very hard to teach this group. I don't know if we need homogenous classing or mandatory prerequisites or what. But something has to change. I guess mandatory prerequisites might an idea.

CM: Does the university require at least three years of high school math?

RB: Yeah, to get in the university you have to…

CM: An algebra II level class, or something?

RB: You have to have the equivalent of an Algebra I, Geometry, Algebra II. You can get that in the form of an integrated mathematics program. But it has to be at least that equivalent. Then if you're teaching an integrated program, you have to show that you really have that background. But, all it…if you're a non-traditional student, you can get around it and you don't have to have that. And so by… if you sit out a quarter, or you take less than, I think it's 12 credits or something, then you're a nontraditional student. And you get around those requirements.

CM: I did not realize that even existed—that possibility. I thought it was pretty straight forward.

RB: No, on the books it's there. And so I think Mary Jean Brod has the statistics on the people that come in and take the placement exam. No matter how much mathematics they've had, probably if we enforced the prerequisites, and so one, we'd have 60 or 70%, around 70%, in courses that are equivalent to high school course. And these are university students. And about 705 of them would have to take a high school mathematics course all over again. And, as we've seen, they're not going to go to the college of technologies or vo-techs or community colleges. They want to come to a four-year program. Then they come here and they end up taking remedial course.

CM: So that would be the student that in high school took only two years of mathematics since that's all the district required of them and then waited a year before they came to college?

RB: Yah, or they took three years of mathematics and didn't take any their senior year.

CM: Right.

RB: Or took three or four years and memorized things to get through and nothing stayed with the. And so, I've had people in these courses that, you know, that had four years of mathematics, and got As and Bs in it, and can't add two fractions. Or they've had a statistics course and you ask them about some basic concepts and they'll tell you what buttons to push on the calculator. But they have no idea of what they're doing. If you change the calculator with different buttons, they're in trouble. So technology's a blessing, but it's also brought some bad points, too.

CM: Sure.

RB: Kids get too dependent on it and use it for the wrong reasons.

CM: Basically, that's the standard questions. I have one further question that is just if… if you had a favorite anecdote or memory that might remind you why you enjoy being here that you'd like to relate to us.

RB: Nothing in particular comes to mind—just the people I enjoy working with and the experiences I've had here. But, nothing in particular comes to mind.

CM: Okay. All right thank you very much.

[**Editor's Note:** When Professor Billstein talked about the creation of a new textbook for the mathematics course for prospective elementary teachers, the text being used at the time was authored by Ruric Wheeler, Alabama. A goal was to create a text that better met the needs of the students at the time and not to revise the text by Peterson and Hashisaki as may be implied in the transcription.]

Richard W. Billstein

B.A. Montana State University—Billings (Eastern Montana College) 1966
M.A. University of Montana, 1969
Ed. D. University of Montana, 1972

University of Montana, 1966
Graduate Assistant (1966-1969)
Instructor (1969-1972)
Assistant Professor (1972-1976)
Associate Professor (1976-1982)
Professor (1982-current)

Director of the STEM Project (1990-current)
Other works: too numerous to mention, but notably
Thinking Metric
A Problem Solving Approach to Mathematics for Elementary Teachers
Using Computers and BASIC Programming to Solve Problems
Logo: MIT Logo for the Apple
IMPACT's Window on Graphing

Interview with Ms. Mary Jean Brod (MB)

Department of Mathematical Sciences
The University of Montana
Missoula, MT 59812

by

Merrie Rampy (MR)

MR: This interview for the math department will be with Mary Jean Brod. And the first question we're addressing is why did you choose to become a faculty member at the U of M?

MB: Well, we moved to Missoula in 1975, and I had young children then so I was content to spend a year home with them. Then I had the opportunity to teach Indian careers in Health Program in the Summer of 1976 I believe. Really did enjoy that and I knew I wanted to get back into teaching because I had previously taught at the University of Wisconsin-Oshkosh campus. So, when I had the opportunity to teach part-time in the Department of Mathematical Sciences, I believe the chair of the department was Bill Ballard, and he asked if I was interested in teaching a course or two, and I said 'yes.' So I started teaching here I believe in this department, I believe it was 1977, maybe '76, one of those two years. And it was really what I always wanted to do, and that was to teach lower level college mathematics courses to both young adults and non-traditional students. I found that I especially enjoyed teaching algebra, intermediate algebra to the non-traditional students who were anxious to get back into academics and pursue a college degree. And if they didn't have the skills in mathematics, they, the gate was closed. So I found that very, very rewarding to be able to help them get prepared for a college curriculum. And every year I was fortunate to be asked to teach again and again, on a temporary basis. And finally, I can't remember the exact year; I remember Charles Bryan was chair. The developmental program became more

stable. There was permanent funding. It was through President Bucklew. I think it was called the Enhancement Program, and this department applied to make my position permanent, and it was granted, and I've been here ever since.

MR: That must be nice. I have a younger sister I need to have talk with you. She's been procrastinating about 107 and 117. I think 117 she needs for our Anthropology.

MB: So, I guess, along with what we were talking about, there was, when I first came here, there were maybe a couple of hundred, 300 students in developmental mathematics annually, and it just really, really took off right around the 1980's on this campus as well as nationwide. So, for the past few years we've been serving all between 1200 and 1300 students enrolled in developmental courses annually. So, it really skyrocketed there in the late '70's early '80's.

MR: And by developmental, you?

MB: Okay, by developmental I mean, basically high school algebra-type material, material that's a prerequisite for any college mathematics course that satisfies the general education requirement. And we've offered three different courses over the years in the developmental program. The biggest enrollment is in the intermediate algebra which is the prerequisite for freshman, college-level freshman level courses. And we also offer a beginning algebra course, and some of the years we've offered pre-algebra. Years ago, we offered arithmetic, pre-algebra course. Then when we consolidated quarters to semesters, that course was dropped, and we managed to get by, but there were obviously some students admitted to the university that needed that course. So, when the College of Technology took over the introductory algebra and the arithmetic, well actually the introductory algebra is all we had then, at that level. Then the College of Technology… (bell rings)…well, we know we're on campus don't we. When the College of Technology took over introductory algebra, we were at that point able to offer once again a pre-algebra course through the College of Technology.

MR: So, if a student wanted to take pre-Algebra or introductory algebra, they do it at the College of Technology.

MB: Right and it's pretty much of a paper trail. The sections, most of the sections are still offered on this campus for the COT Math courses that are part of our developmental program. And the students use our lab down the hall here in the mathematics building.

MR: And professors here teach those classes, or?

MB: Well, that’s a little bit of a gray area. Nenette Loftsgaarden coordinates the introductory algebra course, and her office is here. And the College of Technology has a little more responsibility for the pre-algebra course, the MAT 002T Course, and they are involved in the selection of who teaches those courses. But we try to work together.

MR: To give them what they need…

MB: Right.

MR: The next question on our list was who was the most influential person in helping you choose mathematics as a career? And how did they influence you?

MB: Well, I guess we go back to childhood. Both of my parents encouraged just having fun with puzzles and games, and that sort of thing. And I don’t ever recall there being a gender bias. Because I was a girl, I mean, I was allowed to play with Tinker Toys, puzzles, that sort of thing. And I had fun with it. And it…and I didn’t particularly like arithmetic in school, so I guess I can’t credit my grade school teachers with presenting arithmetic or mathematics in a positive light. It was just okay, but I didn’t see myself doing that for my, rest of my life, so I guess I would primarily give my parents credit for having fun with puzzles and games, and having confidence in that area. And then, when I got to high school, though I did have some good high school math teachers that encouraged me to pursue my interests, and I think the first algebra course I ever took was when I realized ‘hey, this is what makes sense, I like it.’ So, I guess I would credit both my parents in my childhood and my high school teachers. And they, I was the one that was always called to tutor other students, and that sort of thing. So, that’s how I got interested in the teaching part.

MR: And you didn’t find any, you said your parents were not gender biased, you didn’t run into any problems in high school or beyond?

MB: Not too much, perhaps the peer pressure thing a little bit, that was, you know, part of the culture, but not from teachers, and I think I had enough friends that didn’t see it as a gender bias area, that math was just for boys type of thing.

MR: It sounds like you wanted to be, almost wanted to be a teacher from very early on. The next question asks about your goals, and have you accomplished them? Did you have other goals besides going into teaching?

MB: Teaching was the main thing. I briefly considered a medical career, but always came back to the idea of teaching a subject that I enjoy. I'm basically a pretty shy person and I think teaching mathematics allows me to interact with other people in a meaningful way. I don't know if that makes any sense, but…

MR: It does, but I'm thinking if you're very shy it must hard sometimes.

MB: Yeah, it's strange that I enjoy teaching, and that I chose that as a profession because I don't like public speaking, but teaching seems a little different. It's like you have a goal, and you can have fun with it.

MR: Well, the next question asks if you've, if your goals have changed at all, and if they have why? And it sounds like they haven't, you know.

MB: Well, I guess, yeah, my basic goal was, is just to assist students improve their math skills to give them an opportunity to succeed in college. That's the overall goal of the developmental program. By the way, I don't know if I mentioned that I'm the director of that program. And another goal, early on when the demand for developmental mathematics became very evident, a goal was to stabilize the program. Because it was, you know, you didn't know from one semester to the next, or one quarter to the next at that time, whether there'd be funding for this or that, and I used to worry about having enough money to pay tutors, and that sort of thing. And one thing I've been very, very proud of is the math lab. The math lab is a crucial instructional component to the developmental mathematics because we find that students learn one on one, they can learn the material, develop their confidence in the subject. On the other hand, we don't want it to be all self-paced, go to the lab when you feel like it, because that's a total disaster as far as completion rates, and that sort of thing. So what we've developed over the years is a combination of the two. Students that sign up for developmental courses attend lectures three days a week. They have a real instructor. Many of the instructors are TA's or part-time instructors. Then the rest of the week, they fit in hours in their schedule and study in the math lab.

MR: Do they have a certain number of hours?

MB: Well, we recommend two to six hours a week, but we don't you know, insist that they have exactly a certain number of hours. Some students camp out down there, our regulars waiting at 8:00 in the morning to get into the lab. And others will just come in the last minute before a test or the homework says it's due. So, we've put that responsibility on the student to decide how much they utilize the math lab, but it's been pretty successful, not only for the students in the developmental mathematics, but it's also been a successful way for the tutors to improve their

communication skills, their algebra skills, and appreciation for mathematics. I've even had straight A math majors who've been tutors there who've admitted to me that after tutoring there for a year, they know their algebra and mathematics a heck of a lot better than they ever, ever did before.

MR: I can certainly vouch for that.

MB: Yes, it's a wonderful opportunity for employment for undergraduates. Many of them are, of the tutors are math majors, and many are from other departments as well.

MR: Well, I'm curious; it sounds like you knew when you were in high school that you probably wanted to go into teaching. You got into college, you started doing your thing, and when did you decide or know that you were going to be a college teacher as opposed to say a high school math teacher?

MB: Well, I've actually done that as well. In college I majored in mathematics, and my minor was secondary teaching. So I did the student teaching and the education requirements to be certified in the state of Colorado. And then, after I was married, lived in California in the Palo Alto area, had an opportunity the first year we were there. I got a job teaching at a middle school in San Mateo, and I actually enjoyed the subject matter; I enjoyed the students. It was an extremely demanding job. I had six different preparations every day because they had a tracking system slow, medium, fast. And I had one of each for 7th and one of each for 8th grade. So, while I enjoyed the teaching aspect; plus I had an hour commute each way, in the California traffic. So, one day when I was commuting home, I thought, well, my husband had been encouraging me to apply to graduate school at Stanford, and coming home one day. I thought nothing could be more difficult than this; I think I'll apply. So, I did and I was admitted to the Master's program and that's what I did the following year.

MR: You didn't stay in teaching, you just were.

MB: No, right, so I finished up the year, and then I went to Stanford the following year. This was in the late 60's.

MR: With the idea that you might move on to college teaching?

MB: Either high school or college, and I had the opportunity when we moved to Oshkosh, Wisconsin. I got a phone call one day from the department chair of a math department there, and they were saying we need somebody to teach a couple of courses, are you interested? And that's, boy times, have changed. I used to get calls.

MR: How did they know that you were open?

MB: I had written a letter, right before we moved there asking if there were any opportunities at the lab school there, and that would've been either junior high or high school, a university lab school. Well, they closed that school that day, but for some reason the department chair got a hold of that letter and got my name and phone number and called me. So, I did teach at the University of Wisconsin-Oshkosh for two years.

MR: It is different now.

MB: Right. Times have changed.

MR: For sure. Well, speaking of which, the next question says what changes has the department gone through since you've been here? And you mentioned one in terms of the developmental ed being fully funded. And were you involved directly in these changes, and what do you think of them? So, I'd say, beyond what we've talked about already with developmental ed.

MB: Well, I guess I could just reiterate what we were talking about there. There was just this huge, huge growth and demand for developmental mathematics. And greater numbers of non-traditional students coming back to school. You know, been away from formal education for a long time. And as I mentioned before too, I worked with Charles Bryan to get that enhancement funding to get permanent funding to the developmental program. And I guess, so that, has been a good change, although let me add to that. In developmental mathematics, this is one of the few programs where growth is not good. In the sense of numbers of students needing developmental mathematics. So, actually I would be happy if fewer students needed the program, and would, and I would happy if the only people we saw in our classes were older students who had been out of school for a long time who would understandably have a need for it, and see fewer 19 and 20 year olds who just recently graduated from high school needing the developmental math.

MR: And why do you think that's changed? Any ideas?

MB: I don't know. I don't know if I want to get into that. I think it's a complex issue, I don't think it's fair to point fingers at any one place.

MB: But it needs to be addressed.

MB: Right.

MR: If you could identify the best asset, oh, if you can, identify the best asset of the Department of Mathematical Sciences, what's the strength of this program, the whole thing?

MB: The whole math department. I think the attitude of the faculty toward the students. Faculty know students, both graduate students and undergraduate students. The students here are not nameless faces in classes. The faculty interact with them. I think students usually feel comfortable speaking with faculty in the department, both, you know, on an informal basis. Not only that, I like the collegiality among the students. And I don't think this is true at every university, but graduate students here stick together. They support one another. They cheer each other on, instead of being in kind of a cut-throat competition kind of attitude. They really work well together. And I notice that among the graduate students, and also the undergraduate students. You often see them working together up in the study lounge. Helping each other out. I see that among my tutors, who study mathematics. They develop friendships and give encouragement to one another, and I think that's, that makes it a healthy learning environment. I guess that's what I like about this department. Both all the way from the faculty down to the students.

MR: The undergrad…Would that extend then, I know that you have undergraduate math students, people who are math majors, and then you have a whole bunch of people who are serviced here, like you said, the non-traditionals, and the developmental program. Do you think that extends to them as well then?

MB: Yes, I do. And that's another thing, feature I like about the math lab at the developmental level. You see students sitting around a table working together, helping each other out, venting when need be, complaining about a difficult assignment or something, but it's better than just feeling detached.

MR: And it doesn't also make you feel that the math department is isolated from… the rest of…

MB: No, no, it's not an ivory tower environment.

MR: You'd mentioned algebra as an area you're interested in. Would that, you…the next question says what area are you most, especially interested in? Are you currently working on something in that, and have you done research? And then, if you have, can I find examples of your work?

MB: Well, I've always loved algebra. I love teaching algebra. So, enough said about that. Another interest I have is American Indian Mathematics. I've worked with a Watkins Scholar who did a wonderful paper on Northern

Cheyenne mathematics. I worked an independent study with another student on Crow mathematics. And, I was just real excited about the findings and working with them on those papers. I've also taught in summer programs, one, the SMILE Summer Camp. Science and Mathematics Interactive Learning Experience is what SMILE stands for.

MR: And is that for college?

MB: It's for 6th, 7th, and 8th grade American Indian students to get them interested in mathematics and science. I did that for I believe three summers. And more recently, I've been working with the Health Careers Opportunity Program, known as HCOP, and that's to attract minority students to pharmacy, and those are high school and college students in those summer programs. And I've done that for four summers, maybe five.

MR: Is that another summer's program?

MB: Yes, summer programs. And so I have an interest in that, and in these programs I try to utilize my interest in American Indian mathematics, and do little workshops on Mayan mathematics, for example, and dice games. There's hundreds and hundreds of American Indian dice games. So, I do, we make the implements and play some of the games and the scoring. And I find that pretty exciting and interesting.

MR: I've worked with the Upward Bound program here on campus so I know they have amazing games.

MB: So, I guess that's an area of interest. Another, is I've been an advisor to the Math Club for the past 5 years…I'm not sure about these numbers of years. I should have done my homework on that.

MR: We'll look…

MB: And the Math Club is, has a Pi Mu Epsilon chapter, it's an honorary math society with members of that. And a chapter, a student chapter of the MAA, Mathematical Association of America. And we have a seminar, actually we developed into a one credit seminar, again this is another thing that has just grown in recent years. We started out just meeting, oh, just two or three times in the semester, and now we meet weekly and offer one credit to those who are interested, it's called a Math Club Seminar or Pi Mu Epsilon/MAA Seminar, is what it's been called over the years/semesters.

MR: And is that primarily then for the math majors?

MB: Yes, they're mostly math majors, although we do have some math minors, and students in other areas closely related to math, computer science, economics…

MR: Education?

MB: Education. Yes, we have had a fair number of secondary math ed students in the Math Club.

MR: Well, the next one we threw in kind of for fun, because we spent our first month of class going over, month and a half, going over the Hilbert questions. And the next question asks you, if you have any suggestions for a year 2000, to start another list of 20 or 25 Hilbert questions?

MB: Well, I don't have any profound, cutting edge mathematics questions to propose, but I notice math educators. I do have a question for math educators. Exactly how do students learn mathematics? How do they learn it, and even more importantly, how do they retain the knowledge and apply it in other situations? I think that's just a huge, huge area in math education that needs to be further addressed because you hear faculty complain all the time, and students complain all the time; well I did know that, but I forgot it. You know, that sort, you know all of the things that we hear. Or, another classic; it makes sense when you do it, but when I get home I can't do it. So, you know what is the actual, what happens, you know, when the student actually learns the material, incorporates it, and retains it, and can't apply it, transfer of learning to apply it in other situations.

MR: Now, if we could answer that one…

MB: That's a big question.

MR: How have you seen the content in the mathematics courses that you've dealt with change over the career and do you expect it to change some more?

MB: Well, one obvious thing of course is the technology. I can remember slide rules, and extracting square roots, and that sort of thing, and looking up things in tables. So, that, there's been a big huge change there, and I think, you know, of course the technology is here to stay, and will increase. So, I think integrating technology, especially at the level that I teach, graphing calculators into the curriculum is a necessity. And again, that's not a simple issue. When do you have the student whip out the calculator? When do you make them think through the process, the algorithm, or whatever? And so I think those are some really important issues that we're all struggling with and need to continue to work with. So, there of

course is less emphasis on just rote algorithms when you have, you know a $20 calculator in your hand that can do the same thing quicker. But I am concerned that the technology is totally useless without the understanding of the concepts. I see that with students who'll have a high-powered calculator in their hands, but they don't know how to model a problem, or interpret the results, or know when they get a goofy answer. So, you know the appropriate use of technology as a tool with understanding the process I think are things that are important.

MR: Sounds like some of the things we address at the high school level. Well, on a lighter topic, do you have a favorite anecdote or memory that reminds you of why you enjoy being here at the U?

MB: You know I just can't think of any. This is embarrassing. I guess I just enjoy the variety of personalities in the department. The humor.

Interview with Dr. Charles Bryan (CB)

Department of Mathematical Sciences
The University of Montana
Missoula, MT 59812

by

Charles Myers (CM)

CM: Would you please look at that [That is a very brief vita that is at the end of the interview.]? And, if you could fill in the missing pieces there that I was unaware of and then check the other dates and such. Let me know.

CB: Okay.

CM: MSC, is that, uh…?

CB: Montana State College.

CM: Ah, yes.

CB: You see, when I graduated, this was MSU.

CM: Oh, that's correct. Okay. So, you got your bachelors…

CB: In Bozeman.

CM: In Bozeman at Montana State College.

CB: And I…

CM: In engineering physics?

CB: Yeah. I picked up my masters in mathematics at the same time I got my Ph. D. I'd already fulfilled all of the requirements and I just never paid the fees to get it. So, I paid the fees to get it, because somebody'll want to know if I got my masters at the same time I got my Ph. D.

CM: Oh, well, that's different. Is this correct? About the time you came to the University of Montana in '66?

CB: That's right. Do you want to know where I was before that?

CM: Well, I definitely would. If you want to tell me now, or later on in the interview would be fine.

CB: After I got out of graduate school from the University of Arizona I taught at Arizona State. For, let's see…, I started in 1963. December of '63—the winter semester of 1963. And, I taught there for… until I came to the University of Montana.

CM: So, '63 to '66?

CB: '66.

CM: And that's Arizona State?

CB: Yeah.

CM: Now which one is where?

CB: Arizona State's in Tempe, just a suburb of Phoenix and the University of Arizona is in Tucson.

CM: Okay. Well, that's a decided difference in climate; isn't it?

CB: Yes, it is.

CM: Go from Bozeman to Tucson and Tucson, or Phoenix, back up to Missoula.

CB: Actually the climate here isn't all that much different than it is in Tucson, except for the rare times we get a bunch of snow. And we do get a bunch of snow. Tucson has a relatively mild climate most of the time. Phoenix has got a hot climate. It's in a desert.

CM: Now, I can probably do a better job on these, if on some things I'm not sure—like those probably didn't mean much to you.

CB: Well, those chairman dates—I was chairman twice.

CM: Oh. I will try…

CB: I can't remember the dates myself. The other date was earlier, I believe.

CM: Okay.

CB: Uh, and then,

CM: I wasn't sure about the emeritus status.

CB: I wasn't aware of the fact that they ever removed the emeritus…

CM: I wasn't either.

CB: I don't think they do, do they?

CM: Uh, other than, if you're carried in the directory or not. And, I don't know exactly what they would do with that.

CB: I don't know. I have no idea about that kind of stuff.

CM: Okay. I looked up your dissertation title.

CB: Okay.

CM: I found out what you had done your dissertation on.

CB: Okay and I published two or three other papers. And I don't even remember their titles now. But, they had to do with the same kind of things.

CM: Do you recall what journals were associated, they were in?

CB: One of them was in an Italian journal. I don't even remember the name. It's been a long time.

CM: Sure.

CB: I've been out of mathematics for ten years.

CM: Sure.

CB: And, it was in Italian journal. I can't remember the name of it now. And the other article I published was in a SIAM journal, which is not a foreign journal. It's the Society for Industrial and Applied Mathematics. And it had to do with integral equations.

CM: Well, Dr. Lott's pretty good at finding a lot of these things and finding out information. Plus he has access to like presidential papers, and things that the department might have. He can ask specific questions. And he can get some information that we don't actually have. And this is probably information that would be on record.

CB: I'm sure it's on record somewhere. I mean, if they had to have it. Somewhere when I was throwing things out.

CM: Do people still call you professor? Is it…? Your close friends, of course, call you by your first name.

CB: I, hardly any, sure. Most of the people I run into don't even know I ever taught at the university.

CM: Oh, is that right?

CB: Well, see my wife and I own a real estate office here in town. And, I don't really work at the real estate office, but I hang around down there and act important. And, most of the people there find out I was at the university maybe in an off-handed way. They just think of me as my wife's helper. My wife was in the real estate business for a long time before we bought it.

CM: Well, I have a set of questions I'd like to ask…

CB: Okay.

CM: …to get to some information we would like to deal with in this. If everything comes to fruition, you should be able to see a kind of a timeline situation—how the people who came to and/or taught at the University of Montana in the mathematics department progressed through the ages. And the span of time they were there and such. Besides that, we hope to include a short biographical information. And, then oh, some other information—anecdotal things and such, and how the department itself has progressed. So the first question is, "Why did you choose to become a faculty member at the University of Montana?"

CB: All right. That's relatively easy to answer. As I told you, I was on the faculty at Arizona State and my parents still lived in Livingston. My wife's parents lived in Helena. And we had three children. And they never got to see their grandparents when we were living in Arizona. So we decided we should come back to Montana. And I didn't want to go back to Montana State because that was too close to my folks who lived in Livingston and it was too close to Helena, too, almost. So, I applied for a job at the University of Montana. And they hired me. Besides that, Phoenix was too hot for my wife and for me it turned out.

CM: Who was the most influential person in helping you choose mathematics as a career?

CB: I guess it must have been somebody at Montana State, because I was… At I told you, I got my degree in engineering physics at Montana State and after I got my degree, I started out working on a bachelor's or master's degree in physics And about half way through I decided, Hey, I'd rather be a mathematician. I liked the math courses more than the physics courses. So I started applying for graduate assistantships at various math departments around the country. I got one at the University of Arizona through the National Defense Education Act, which was a three-year fellowship, which allowed me to go to school for three years. And I'm not sure who I could say was actually responsible for it. I guess it was the professors at Montana State. I just like mathematics better than physics.

CM: Okay. What were your goals when you started here? And do you think they've been accomplished or changed?

CB: I guess my goals when I started teaching here were to spread the word—the word being mathematics. When I was younger I was, perhaps, more successful in spreading the word. As I got older, and had been here longer, I all of a sudden became more of an administrator than a teacher. And then, after serving a year, or one term, as chairman, I became heavily involved in the teachers' union, simply because I didn't want anybody else telling me what happened. I grew up being anti-union. And all of a sudden, there was a union at the University of Montana. I decided that if there was going to be a union, I wanted to have some input into what they were doing. So, I ended up…I negotiated two contracts, and I was

president of the union for one year. And I learned all kinds of things about the university that I wish I'd never known. And, in the process of doing that, I got burned out. I finally just said to heck with it and went into the real estate business with my wife. So, yeah, I guess, I, in summary, I enjoyed teaching mathematics. I didn't enjoy all the other things I had to do at the university.

CM: But you are not the first person who has been…who I've interviewed here that's retired from the university that, that didn't have that sentiment about teaching, was the favorite part of what they did at the university, for sure.

CB: Right.

CM: Which changes has the department gone through since you had been here…since you came? That you saw while you were here?

CB: Well, probably the biggest change and the one that I liked the most was the institution of the Ph. D. program. And the change in the Ph. D. program through Bob McKelvey's grant. I'm sure you've heard about Bob McKelvey's grant. We supported about ten teaching assistants for about, oh, probably six years, through the auspices of his grant. It turned out that got our Ph. D. program off the ground, really. I believe; my memory is terrible. I think we already had a Ph. D. program, but it was very ineffectual. And Bob came in with his grant and it allows us to support some graduate students. If you don't have any graduate students, you can't have a program.

CM: Do you recall a time frame on that?

CB: It seems like it was in the 70s—the early 70s. You can check and see when he came and the next year we had it.

CM: Oh, right away.

CB: Yeah, he actually came with the idea.

CM: Were you pretty directly involved in that?

CB: I turned out three Ph. D. students. Actually, I should have put that down on the other things. That's probably one of my accomplishments.

CM: Sure. Well, I don't know what order any of this is going to go in.

CB: No, I understand that.

CM: I understand.

CB: People always…When I was on the faculty, everybody wanted to know why I didn't publish more—especially people in other departments. One of the reasons I didn't publish more is, here's an excuse, is the publication of mathematical papers is the publication of ideas. And, it's hard to come up with ideas, original ideas. I'm sure that's true in other disciplines, but, it's more so, I believe, in mathematics. Essentially, I had a good idea every two or three, every year or two, and I'd give it over to a student.

And I would help him do it. And, to me, that seemed like a reasonable thing to do.

CM: Yes.

CB: And sometimes people weren't too impressed with the fact that a professor would turn out a graduate student. But that didn't seem right. It seemed like a very good idea to me. It seemed like that was what my job was. But, what do you know!

CM: If you could identify the best asset of the department of math sciences at the University of Montana, what would it be?

CB: Well…the best asset. Well when I first came, I think it would be the way we got along with each other. And we didn't fight with one another, except for the fights we had to have. And after, we were more like a family. We survived. If we had a fight, we'd settle the issue one way or the other. And then we'd proceed along and continue to get along with one another. I'm not sure it's still that way anymore. I'm not there anymore.

CM: Sure.

CB: I could detect…I could detect it was changing as we hired more and more and more…as we began to hire people. And we were starting to do that before I left. You have to realize that most of the people who were there when I retired had been there for twenty years.

CM: Was there quite a change in the numbers of people from the mid-60s…?

CB: No. I think, probably Johnny Lott and Rudy Gideon were probably the only permanent people we hired—until about '85 or '86. I'm not sure what year it was. I can't remember too many people coming in. But, on the other hand, I don't think about that a great deal either.

CM: No. So, in the mid-80s, then we began expanding some.

CB: We didn't expand. We just started to have turnover.

CM: Okay. I see what you're saying.

CB: I'm not sure it's expanded much still. I have no idea what the faculty size is, but I suspect it hasn't expanded a whole lot in size. One of the things that we always dealt with---and, again, it's because I was more of an administrator than I was a teacher—is…W always dealt with the fact that the administration would not allow us to expand. They always told us there was absolutely no money to hire staff. And, we'd say, we're going to have to hire staff. We're going to have students. No, there's no money to hire staff. There's no money to hire TA's. There's no money for anything. And then we would have registration winter quarter, or fall quarter or fall semester it would be now. That was another thing. I didn't like the semester system. But, we were still on the quarter system. Fall quarter we would start registration and guess what? We'd have sections we couldn't cover. And, all of a sudden, they'd give us money to go hire people. And it

isn't easy to hire people. What do you get? You get high school teachers that are retired. Or you get whatever you can find. That got to be very frustrating. I suspect it's still happening. Somehow or other they'd come up with money when they had to have it for classes.

CM: Okay. And you personally, sir, what area of mathematics were you most interested in?

CB: I was a numerical analyst.

CM: Has that occupied any of your time since you've been retired?

CB: Very little. Occasionally I end up doing something that essentially is non-linear and I go use some of the techniques I learned. Essentially I like mathematics. But I figured if I was going to leave the university at the age I was, I'd better leave mathematics, too. Because there was no way, there was no way I could become a practicing mathematician without being around mathematics.

CM: Yeah, I understand.

CB: So I gave away all my books. In fact, I gave them to the math department when I retired.

CM: Had you done research in other areas besides analysis?

CB: Not really. Numerical analysis was the only thing I'd ever wrote papers in. When I was a graduate student I did work which was in numerical analysis before I even knew I was in numerical analysis. I did some work consulting for a civil engineer at the University of Arizona.

CM: Something in the course, now, dealing back with our project and our class. We were trying to think about things that maybe people who had some background in mathematics might suggest either like a new problem—like Hilbert's problems.

CB: I don't think there are too many of us around like Hilbert.

CM: Or maybe just where do you think mathematics is headed in the next century?

CB: I think the nice thing about mathematics is nobody knows. And one of the things that people, when you talk to people, when I was at the university and told them I was in the math department, they would always tell me about mathematics. The standard comment was they always liked it but they never did well in it. Or, they never did well in it, but they always liked it. Which were contradictory statements, I think. But, one of the nice things about mathematics is nobody knows where it's going, which is where I started, because problems come up. People try to solve real world problems. And when they're trying to solve real world problems, they open up new branches of mathematics. I mean, they…most of mathematics was generated to solve real world problems, although most mathematicians won't admit it. Now my history and background is

coming through. But, even the most abstract mathematics, the ideas that generated that abstract mathematics, were really generated to solve real world problems, which may have been number theory, which is another branch of mathematics. But it was real world. They were dealing with the integers. And my feeling is most of the areas of mathematics had their genesis in applied, in applications. You can hardly tell anymore. But that's where mathematics grows from. People are interested…people are interested in an idea to solve a problem. In order to solve the problem, they generate some new kind of mathematics. And it's happened since I was in mathematics. There are things like chaos theory, which I'm sure you've heard of and I don't know very much about. But, it's essentially the idea that everything is not predictable. And most of mathematics is built on the idea—most of physics is built on the idea that everything should be predictable. And my understanding of chaos theory is that, hey, everything isn't predictable. And things are not nearly as stable as everybody would like them to be. So you get things like chaos theory being developed.

CM: So your feelings would be that will continue to change courses in mathematics as things develop like that.

CB: Yes, that's right. And, I would hope it would.

CM: Well, that basically covers most of the mathematical type questions, historical types of things. Can you recall if there was any change in the actual mathematics department? Was it always just the mathematics department? Was it always…?

CB: I'm not sure what the actual structure was. But physics used to share the building with us.

CM: Okay. So it was in the same building.

CB: And, I think at one time they were put together. But, you'd have to go back prior to my time. When I came here, the physics department was in the building, but they were on a different floor. It's hard to believe there could be two departments on different floors in that building given the size of the building. When they built the new science building, which is not a new science building, but the one that's over there in the parking lot, physics moved over into that new science building. Mathematics took over the whole building, which is an old dorm.

CM: Would you have any favorite anecdote or memory that might remind you why you enjoyed working or living here?

CB: No.

CM: Would you have some other anecdote or memory you would like to share with us?

CB: Actually I have to work hard at not sharing most of my memories. That sounds kind of bad, but, when I left the math department, I was not a

happy camper. And it had nothing to do with the people in the math department. But, now I live next door to the guy that was dean of the graduate school when I was there. He lives right next door to me and he and I are very good friends.

CM: Is this a fairly new development?

CB: Yeah. Most of the houses…The house I'm in was built in 1996 or 7, I can't remember.

CB: That's not appropriate. That's an aside that I told you. I get along a lot better with dean…

CB: Okay. When Keith Yale was chairman, we had one of our—I'm not sure what word I should use to describe it—almost our biennial, or every two-year study to decide what we should do to prevent duplication within the university system.

CM: Okay.

CB: We were supposed to tell the administration so they could tell the Board of Regents why they shouldn't abolish the Ph. D. program in mathematics at the University of Montana because they had one in Bozeman too. So we had gone, I mean, we…that was the third time we had gone through it. And the principal reason was, this mathematics department is a large service department, and we teach a lot of classes to a lot of people. And they can't afford to have enough fulltime faculty to teach all those people. So you're going to use graduate students to do it. And our graduate program was designed to develop graduate teachers for universities and colleges. So, teaching was a big part of what we were trying to teach our students how to do. So we would tell the administration, the reagents, whoever asked, that it's going to cost you money to abolish our department. So Keith went over and told Koch, who was president at the time, that it's going to cost you money to abolish our department. He says, "Don't give me that. I'm an economist. I know better than that. You can't give an argument like that." Keith came back and said, "What are we going to do? He won't let us use that argument. We've used it twice and it's worked and he says you can't use it." And I finally convinced him to use it anyway, even though he [Koch] told him not to use it. Because as soon as he looked at the argument, if he would, he'd find out that it was right. And he'd claim it was his own. And guess what? He did use it and did claim it as his own. It was that kind of…That's the kind of thing I was talking about.

Charles A Bryan

B.A. Montana State College, Engineering Physics, Bozeman, 1958

M.A. University of Arizona, Tucson, 1963

Ph. D. University of Arizona, Tucson, 1963

Employment:

Arizona State University, 1963-1966

University of Montana, 1966

Assistant professor (1966-1968)

Associate professor (1968-1973)

Professor (1973-1987)

Chairman (1983-1987)

Emeritus (1987-)

Dissertation Title: *An iterative method for solving nonlinear systems of equations*

Other works:

An article on "Integral Equations" in *Society of Industrial and Applied Mathematics* journal; two works in an Italian journal

Interview with Dr. Rudy Gideon (RG)

Department of Mathematical Sciences
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Missoula, MT 59812

by

Charles Myers (CM)

CM: The tape is rolling.

CM: My first question is "Why did you choose to become a faculty member at the University of Montana?"

RG: Well, when I was nearing graduation from the University of Wisconsin, I applied for jobs in industry and in education. At that time there was a little downturn in industry. I wasn't really planning on being a teacher, but I had 3 children. And I needed a job. And this is one of the jobs that came up. So, her I am, maybe 30 years later.

CM: Okay. Who would you say was or were the most influential people in helping you choose math as a career?

RG: Probably a high school teacher. I liked my…there were a couple of high school teachers in Centralia, Washington, that I …Well, at least hey didn't destroy my interest. Couple of females, one female teacher… and that's the type you remember. Miss Thomas was her name.

CM: Wow! You do remember.

RG: Yeah.

CM: I remember Mr. Polk, my geometry teacher. How did that person influence you? Was it just by being a good teacher and sparking interest?

RG: I don't know if she was a good teacher. It's just, we had a good class. I had a really bright class of people, my high school class. And they were all in this geometry, calc, algebra together. And we just sort of had a competition among us. We all tried to get ahead of one another and see, to see who could do the homework first, and things like that. So it was more than just the teacher. She kind of provided the atmosphere and, I guess, that enabled us to learn to like mathematics. She wasn't a controlling person at all—just kind of laid back and gave us assignments and let us work.

CM: What were your goals when you started…?

RG: Started what?

CM: Started teaching here?

RG: Oh, my goals were to raise a family. I guess my real interest in statistics started at the University of Washington. I think I was about a senior there before I took my first statistics course. And once I took a probability and statistics course, I found out that was the area I really liked, although I did a little bit of work in numerical analysis, computers. But to answer your question, I always had this tremendous interest in statistics and how it works. So, in addition to raising my family, I always had a research area in which I could spend all my free time thinking about things that no one else knows how to do.

CM: Do you think you've accomplished those goals pretty well?

RG: Yeah, I've accomplished the research goals. I haven't accomplished the publishing of it and getting it out to other people. That's a strange world that I don't understand yet.

CM: Uh-huh.

RG: I've got some of it out there, but not enough.

CM: Have those goals changed, beside the fact that you really went into statistics heavily? In the math part, have they changed?

RG: Oh, yeah, they've changed. Because when I, in the early 80s when I got an idea I just was going to do something in nonparametrics, and decided to invent this correlation coefficient. I had no idea how to do it. Thereafter I

said well, why don't people use nonparametric correlation coefficients? For nearly 15 years now, I've just been working in this area of using correlation, and in particular nonparametric correlation or rank correlation, in all areas of statistics. And I found that every time I solved one problem it leads to about 5 more problems. So I'm further behind now than when I started.

CM: Well, you've been here since 1970. So you've got a 20 years record on—no, 30 years record on what the department has done. What kind of changes have you seen the department go through?

RG: Well, in the 70s this department was trying to build itself up. They hired 3 or 4 people and we developed our sort of mathematical Ph. D. degree in not quite as…supposedly not as theoretical but tried to develop people. And I think that was successful through the 80s. And in the 90s we seem to be having trouble getting people here involved in the program. And a lot of the people that developed the program retired. And the younger people coming out of larger universities being research oriented. I really don't think they understand what it means to be at a smaller university like the University of Montana yet. And so I think we're having trouble with the direction of what our program really is right now. There's no one direction. We're kind of without a goal. So in some sense we had a goal in the 70s. We kind of accomplished it in the 80s. And I think it's with the change of a bunch of people retiring and new people coming in, and they're just bringing individual goals without any departmental goal. And through all that, what really hurt was in the 80s when we had this tremendous, even worse budget crunch that we have now. The whole university was…professor were fired and all that. And that destroyed the morale of the university and lots of faculty. Of course, that's kind of a biennial event now—trying to destroy the morale of the faculty. Most of us survive some way, because we like to work in mathematics or probability or something.

CM: Were you pretty directly involved in these changes, besides teaching in this department?

RG: Oh, I just participated as a department member. I don't, was never a major proponent in the direction of the department. I tried to get them to think about the things I'm telling you right now, but I've been rather unsuccessful at it.

CM: If you could identify the best asset of the Department of Mathematical Sciences at the University of Montana now, what would you think it is?

RG: Well I think that everybody here seems to be a …quite a bright bunch of people with ambition—at least in their research, and this direction.

CM: So, my next question you basically have answered, the first part of it—the area of mathematics you're especially interested in. Right now it's statistics, and beyond that more nonparametric statistics.

RG: Yeah. Well, I did a lot of work in applied work for people. As a statistician here, throughout your career, you generally have helped a lot of people do applied problems. For example, from 1978 to 1982 I worked with a big group that did a big air pollution study and measured the health effects of the high particulate matter in the Missoula valley and other cities, what the effect of the breathing ability of people with chronic obstructive pulmonary disease and children in third, fourth, and fifth grade were. And based on that study, actually, is some of the health standards that are still enforced today in the Missoula County.

CM: Sure we see that in the particulate readings in the county. Uh-huh. Are you currently working on something of that nature, or anything like that?

RG: No, I'm not. I was going to work…. What would happen is a lot of times people would ask you to work on something. So recently a person, medical doctor in Hamilton that is going to work on some research in autism and a drug's effect. But he didn't get funding, didn't get it funded. So that doesn't look like it carried out. So, lost of times it depends on whether somebody else is trying to do an applied project gets funding; whether or not you get to do something like that.

CM: Have you done research in other areas recently? Other areas of mathematics?

RG: Nope. My one area is big enough. It's bigger than I am actually.

CM: Okay, yeah. Could you, off the top of your head, give me an example where I might find some of your work?

RG: On my desk generally.

CM: (Laughs)

RG: Oh, I have a few journal articles in the *Journal of American Statistical Association*, a couple.

CM: The *Journal of American Statistical Association*?

RG: Yeah. A couple articles in *Communications and Statistics*, that journal.

CM: *Communications and Statistics*?

RG: But my goal now I've been working on, I hoe to get funded for a workshop that I can present my…a 4-hour workshop at the national meeting—a workshop on all my various methods. And a lot of it hasn't been published. That's what I've been working on. And working on that, of course, there's always some minor things that get you side-tracked into proving something else.

CM: Now, Dr. Gideon, I talked to you before about the possibility of trying to come up with something that you might foresee for the next century. Since this project is basing it upon kind of what's happened at the University of Montana for the last century. Specifically now that we're at that kind of end spot, where do you see mathematics headed in the next century?

RG: Well, I think it's a real problem with no funding higher education enough to have qualified faculty working on research and examining ideas. I think the advent of computers and low budgets for states may destroy the ability of our society to take on new research projects, except by a very few elite types. Your question reminds me of the way it used to be—that people could ask these things. I'm worried about there's not enough people in our society we'll be able to find to work on things. We seem to be a society interested in entertainment and sports and not enough money is going into development of really crunch-type science.

CM: I hear you there.

RG: And I think the direction of it really depends on, generally depends on, individual personalities that get great ideas that comes along once a generation. So you can't foresee that. You got to have somebody that's very bright. He does something very miraculous. Or sometimes people have done stuff very bright but they don't get it developed and then the next generation develops it. So, which of those will happen? It's hard to say. Some of the things already done may be very important but just haven't fit in yet.

CM: Now you've taught several different kinds of mathematics courses. How would you say that the content in these courses has changed over your career?

RG: Well. I'll tell you what I told you the other day, Chuck, that…nonparametrics. When I taught you in 1983, I had 15 people in the class with probably 9,000 students at the University of Montana. I'm teaching a nonparametrics, same type of class this year, with 12,000 students in the University of Montana and there's only 8 people in the class. So, I'm very concerned about either the students aren't interested in the mathematics or statistical events. Or else, they don't have the time or

the money or there's a general flaw in our society that doesn't think that's important.

CM: In some of the other classes…Do you teach classes much at the lower level?

RG: Yeah, I teach lower level. I taught…

CM: Have they, have their courses, has the course content kind of changed?

RG: Well in general, most of our students don't seem to be able to have the ability to solve what you might want to call word problems. They don't know how to start what we'd call a word problem. If you give them a formula and let them plug in a number in the formula, they're all right. They seem to think that's mathematics or statistics. But that isn't mathematics and statistics. The whole long line of logical thought is what it's all about. And a lot of them either don't have the time or don't want to or they can't. They just don't know how to start a problem. That's very worrisome. So the content of the course, to me, has kind of gone down, because you get to kind of start at a level now that you didn't have to start at years ago. You can assume less about the student. And then they seem to do less homework. I just took a survey in my one class—what they did over a weekend. And it seemed like, I didn't compute the average, but instead of studying two to three hours, most of them were studying maybe 30 minutes. And that's hard to teach students that don't go over their notes every day.

CM: Would you expect that to continue to change in that manner? I know you don't have a crystal ball, but…

RG: Well, I thin part of the problem is maybe there's some students trying to get through college that don't really belong there. If that's the case, I always have a number of very bright students in a class that I feel kind of bad about because they can be taught at a faster rate than these other students that don't seem to be doing much of anything. So, in some sense, the lower level students in the class kind of destroy it for those that are really amenable to being able to pick up things rather quickly.

CM: Do you want to speculate as to a why on that? Do you want to, besides what you've already…

RG: Speculation's what everybody says—to many TV and too much emphasis on sports and too much emphasis on having a good time. And students don't seem to think that sitting and solving a problem has any merits. It doesn't; somehow they don't get the…many of them don't get any

satisfaction abut sitting and thinking and solving a problem. And why that is I don't know. I think it's related to our fun society.

CM: Okay. Well I'm about through here. I have one question that's kind of real open-ended. And if it is something that you would like to talk about, do you have a favorite anecdote or memory that reminds you of why you enjoy being here?

RG: Yeah, my favorite thing about students in statistics, it's a year-long course. Sometimes we teach it, we get students that say "I can't get his. I can't get this. I don't understand it." They don't understand the delay in learning. So one of the big satisfactions in teaching is for a student that believes you when you tell them "Just keep at it. Keep at it and maybe it'll come." And sort of, maybe three-quarters through the year, once in awhile, one of them will say "Eureka, it's all fitting together. I see it now." It doesn't happen very often, but it does happen. And it only happens for very responsible students. And that's a big reward. The greatest thing a professor can have is a student that's interested in what he's doing in class and a student that understands that the professors are really trying to get them to understand these things that the professor enjoys, he thinks worthwhile. So that's one of the main things that just involves the ordinary student.

CM: Is there any particular student you can recall that you want to mention?

RG: Well I remember this one particular student but I can't remember his name. I know he went into education but I can't think of his name. I saw him recently so…But that's happened to several student sin the past.

CM: Okay. Is there anything else?

RG: One other thing I learned in my years. When I first came, I think I had an opinion of people, that if you didn't catch on right away you, maybe I didn't think so much of these people. And I learned from a guy that used to work from, when I worked on a big environmental thing in the late 70s, early 80s, there was a fellow over in Helena, working for the government. He didn't ever seem to understand anything. But the more I worked with him; he just kept at it and kept at it. And I realized that perseverance and what he had. He had something more than almost no one else had---perseverance to follow through a problem. Even if he didn't catch on quite so fast at the beginning. So I think it has influenced my teaching in that I don't really think just the people that are on top of it all the time are the most important. Those people that want to learn and have perseverance are probably going to be the more valuable people in our society. So, I've learned a lot from students and people that I've met over the years. This person ended up doing something I thought quite remarkable related to statistics and pollution in the Helena valley. So I rally learned to admire

him when I really had the wrong opinion in the beginning. So I look back at that as one of the neat things I’ve had happen to me or whatever.

CM: Sure. Well, that’s it.

RG: That’s it, huh? Okay, thanks, Chuck.

CM: Pretty painless?

RG: Yeah.

CM: All right.

Interview with Dr. Jon Graham (JG)

Department of Mathematical Sciences
The University of Montana
Missoula, MT 59812

by

Daniel Finch (DF)

DF: Why did you choose to become a faculty member here?

JG: They offered me a job…probably a better question for me would be why did I choose to apply here...I grew up on the East Coast and uh really had no exposure to the West whatsoever...and I guess um summer of '93 I had a practicum at the Idaho National Laboratory in summertime, and I never even considered coming out West, but just thought I'd do it for fun. Came out here and really enjoyed it, and that was the only reason I even applied to Montana, because I thought maybe there was a chance I could live out West, and then I ended up getting two academic job offers and just waited 'til I ended up coming here, and, probably just chose here because the people were friendlier here when I came. People at the other schools all worked at the University, and they frankly didn't seem to care, what I was doing or care that they were even hiring anybody.

DF: Second of all then, was there a most influential person that helped you choose math, and if so how did he or she influence you? Or was it more of a group of people?

JG: Well, a lot of people certainly have influenced where I am now mathematically and probably the two main ones would be my dad. He was a high school math teacher, so I grew up with dad bringing me math problems and giving me puzzles and games, and bringing home a computer to play on. You know, the old powerful 48K's and things like that. So, certainly my dad, and my high school calculus teacher, because Calculus was really the first place in math I really hit a stumbling block, and she's the one who basically lit a fire under my butt, and got me to start working a little harder on mathematics, and she's just arguably the best teacher I've ever had in a mathematics course, so…those two primarily would be my main influential people.

DF: Some people are goal oriented, some people aren't, but when you came did you have a list of goals or a goal, maybe? You know off in the distance that you would like to get to, or maybe not even as tangible as that?

JG: Yeah, not really, I'm not a goal oriented person. I don't know; to me the main thing I should be doing at this job is teaching, and so as a general goal, I try to make my teaching as high quality as I possibly can. And I take that as my primary responsibility here, and then I've got, you know, you've got research and service and so forth, are responsibilities as well. But no, I mean, for me, I like mathematics, I like to teach. My general goal in life is to enjoy my family and be a good person. But I don't, I'm not the kind of person who writes down specific goals.

DF: So, since you've been here have you seen some changes to the math department?

JG: Of what nature?

DF: Any sort? Maybe changes as a focus, a direction of the department? Or maybe chemistry wise? Obviously there has been some physical changes or upgrades, things like that, but, maybe an overall attitude of the department?

JG: Well, here I'll get myself in trouble, given the age of the department, it is probably getting more and more cynical in many ways about things. Especially with regard to University administration, just issues related to the university affecting the math department. There is a very cynical view toward how administration views us. In terms of tangible changes, one of the things that was done the second year I was here was they streamlined the undergraduate program, and did away with a number of 400 level courses to try to force students to take courses in a broader, to get a broader background in mathematics. Take courses from more than one area, so it was a major philosophy shift and the whole thing driving that

was too many students were focusing so much in one area, that they weren't getting any algebra or any analysis or anything like that. So, certainly efforts in this department have been made towards getting students to get a broader background in mathematics. The other major tangible change I can think of is we have a Math/CS joint degree that just got approved in the last couple of months by the Board of Regents. And that was kind of a big deal and it took a lot of work to get that done. And beyond that certainly the major losses of the department are retirees. Gloria and Don in particular.

DF: You had mentioned earlier in one of your reasons that you decided to come here was how friendly the department is, and kind of a close knit group, and maybe this will be the same answer but, the department as a whole can you pick just one defining asset of it. Certainly it has many, but…

JG: Well, an easy answer to that is no, I can't. No, I would generally like to think that the faculty of this department are encourage able, for whatever purpose. We don't all agree on everything, we shouldn't all agree on everything. But, people aren't hostile to one another and people listen to each other. And, you know I've been in other departments where I haven't gotten that question, or that attitude. And I think that is something that I've found here that is, is maybe purge ability.

DF: In addition to the content of the undergraduate degrees getting more broad-based, yourself, have you see the way that mathematicians are trying to, you know, incorporate ideas in their teaching or just the courses themselves. Content wise, is there a difference between what was done say at the beginning of your undergraduate degree until now. A lot of people will point to, well, certainly we're using much more technology, but is there anything else that you can think of along those lines?

JG: I tend to think that even in the time from when I first became an undergraduate to what I see now, that, the topics that are covered have gotten watered down, and I don't know if this is just the pendulum swinging but I think it's in the direction now of less mathematical rigor in classes. I think you're just; it's a lot more of a sampling of ideas than a real hard-core study of those ideas. I just, just seems like more survey-type information than serious mathematics in a lot of cases. And I see it, I try to avoid it when I teach, but a lot of times you are forced into that because the students simply aren't as prepared. That's the bottom line, they just, they come into a 300-level math course, and they can't integrate a simple function. And I don't know what has caused it or what's behind it, but it seems like a result of that has been too simply to make the material easier. So, if there were a change, I would say somewhat of a negative change, and I don't know if all this started because of technology,

but maybe bringing technology in the classroom had to replace something, and maybe its replaced mathematical rigor. You know.

DF: The example that you gave there was at sort of an undergraduate level, and the base of the students' knowledge itself, and so when it comes to teaching, not as prepared, to go in more detail, do you think part of that might come from mathematics itself being much more broad. Now, we're, I'm thinking of a longer time period than say 20-30 years ago, but I'm not saying that you were aware of what was going on then.

JG: I don't think that's a major part of it. I just think that math is being taught differently. It goes to the high schools; it goes to the middle schools; on back. It just seems like there is this whole movement away from rigorous mathematics, toward, let's appreciate mathematics. Well, that's fine, you know, but it seems like you're not going to appreciate math unless you knew how to do it. And all these same students, they may be getting broader backgrounds, but they're all taking calculus. And, I don't know; they just don't seem to know it quite as well. Maybe I'm just becoming the old cynic.

DF: So, the last question I have for you, it doesn't have to be mathematical at all, but is there something that comes to mind when you think of why you enjoy being here? Montana, or Missoula, or the department itself? I see what you wrote down here in your notes, but, you know….

JG: Yeah, that was a bit different question, yeah on an annual basis; I certainly enjoy the destroying students in sophomore year.

DF: It was a tie last year, but…

JG: Yeah, it was a tie last year. We had a bad year. No, I mean I, for me, I love teaching and that's really what got me into this in the first place. And now that I've been here a few years and I kind of know the level of students, what they're looking for, and what content is to be taught, and the courses I teach it's a lot of fun. You play around a lot more your first couple of years, you really struggle to figure all that out. As a statistician, the thing that's been great is I have has a very full training in statistics, where you design experiments, you lay them out, very neatly and very nicely, and it's more loosely an agricultural background lead to that, because that's was where the school I went to, that was what they did. I came out here and found that, they don't do any of that out here, everything is, let's go out to a forest and observe some data. There's nothing planned or experimented. You don't set things up, so I had to completely change the way that I think about statistics a lot of times when students or whoever come to ask about a problem. So one thing I've really enjoyed is that shift, having to learn about sort of this other type of

data collection people do because it's not something I was ever exposed to until I came here. So that's been, and I still see it just every day, and so that's one thing I really enjoy. And that's partly a product of being in Montana, you know, they had some forests back…, the forests back there are in somebody's back yard.

DF: Well, thank you Jon. That's all.

Interview with Dr. Gloria Conyers Hewitt (GH)

Department of Mathematical Sciences
The University of Montana
Missoula, MT 59812

by

Johnny W. Lott (JL)

JL: Recording Gloria Hewitt and it is May 12, 2006.

JL: Gloria, I think that we are all set for this to go. Why did you choose to become a faculty member at the University of Montana?

GH: They offered me a job. No actually, Art Livingston was chair of the math department here at the time and he had been a faculty member at the University of Washington where I was a graduate student. He offered me a job before I finished my degree, but I didn't want to leave there. I wanted to get further along with my dissertation. And the next year, he offered me the job again. And my thesis advisor was going on sabbatical to Berkeley and I figured that there wasn't any point in my hanging around the University of Washington. So I came here but not after saying no. It was Edward Hewitt on the faculty there, on this 300 SL, and this was a cute little red thing that opened up at the top and he took me for a ride in it one night around Seattle and he said I hear that you turned Art down again, and I said "Yep" and I don't want to go there, I don't know a thing about Montana. By the time he got through telling me how beautiful it was and how if you wanted to commune with nature someplace to be. He had taught here one summer that I changed my mind so I sent a telegram to Art and said I changed my mind. And that is how I ended up coming to the University of Montana.

JL: Well that is great. I’m glad that you sent that telegram.

JL: So who was the most influential person in helping you choose math as a career? And how did that person influence you?

GH: Well, there are two things. I got married when I was in college and I had Ronnie [her son] and I needed to…I wanted to graduate with my class I did think, so actually I went back to school. I was trying to double up so I could get out and I had to choose a major and I had the most credits in math. So that was number 1. Obviously I was taking it because I liked it. But the reason I was taking it was because of Lee Lorch.

JL: Lee Lorch, okay.

GH: Right, He had encouraged me after I had gotten through that one year of general math that every body had to take. He had encouraged me to take calculus that he was teaching that year. And then you know that he got fired by Fisk because of his activities in civil rights. And after that, I really wasn’t going to do anything with the math whatever, but I had chosen it because I had the most credits and he was gone at that point.

JL: So when did he get fired?

GH: This was in 54.

JL: Okay.

GH: But I graduated with this degree in math to teach secondary school, and I took all the education courses required, but I just couldn’t take any more education courses. I just couldn’t do it. So I never got around to doing my practice teaching. And so I never got certified.

JL: But you practice taught a lot later in your career, just not at secondary

GH: Yes, I did. I wasn’t thinking of graduate school. I wasn’t thinking anything. I just didn’t know what I was going to do. I had just gotten divorced that year and I wasn’t sure what I was going to do with anything. Instead I did what most women do, I went home to momma. But then, Lee Lorch it turned out came to the graduation when I graduated. And he’s the one who came out here to the math meeting during the math meeting that summer. And he went on to the University of Oregon, the University of Washington and talked to them and he ended up writing me, offering me what they called a teaching assistantship in a graduate school. I had no idea what graduate school was about. I had no idea what a teaching assistantship was either.

JL: So this was at the University of Washington?

GH: Well, I got offered one at both Oregon and Washington.

JL: Okay.

GH: Carl Allendoerfer was Chair at Washington at that time and Morrison was Chair at Oregon. And I, I just put both of them in a drawer and my momma found it. When my brothers came home that summer and of course she showed it to them and they encouraged me to accept it. So I accepted the one at the University of Washington. Got on a plane and came to Seattle.

JL: I love it.

GH: And that's how it happened because I just didn't know what I was going to do. I knew that I had this little boy that I needed to support and something. My dad wasn't working at that time. He had had a stroke and so he was at home at the time. He agreed to take care of Ronnie. He did so they came out to Seattle so that I could go on to school. So that's what I did. I came out to Seattle.

JL: That's great.

GH: Five years later I was at The University of Montana.

JL: So, I don't remember you were the third?

GH: Well, heck, I'm not sure because I had people tell me they see on the Web that fourth, and somebody else told me that I'm the third African American one that there was another one that got a degree at the University of Nevada.

JL: Okay.

GH: So I don't know. Johnny, I really don't know. In most of the publications I've seen in support, they say that I'm the third. African American.

JL: That's fantastic.

GH: Well the other two… The thing I find fantastic about it. I didn't know it at the time of course was that the first two had gotten their degrees way back in 1947. In the same year. One from Michigan and one from Yale.

JL: Oh wow!

GH: In the same year.

JL: Okay.

GH: In the same year and there weren't any more. I got my degree in 1962.

JL: And you got it in algebra, right?

GH: Yeah.

JL: That's what I thought, okay.

GH: That's a long, long time.

JL: That's a long time in there.

GH: Yeah…

JL: So we could do like the Olympics and say that you're the first in the modern era. Maybe that would be fairer way to say it, I don't know.

GH: I don't know.

JL: You said a little about your goals when you started. One was supporting your son. Have these been accomplished and have they been altered?

GH: Oh yeah, he's such a great kid. I'm thinking very nicely of him right now. You know. [Gloria had an accident recently before the conversation and had a shoulder injury. Ronnie had come to Missoula to care for her after surgery and had just left before the interview.]

JL: That's great. What were your goals in math? Were you able to do what you wanted to do in math?

GH: Yes and no.

JL: Why don't you explain?

GH: Well, when I came her to the University of Montana, I had hopes of really doing research in mathematics.

JL: Okay.

GH: But nobody was doing any research and so I wasn't encouraged to do that. And so I had to finish up that first year, to finish up my dissertation and so

forth. And so I did that. That's why it turned out to be 62 when I came here in the fall of 61.

JL: Sure.

GH: That I got my degree. Because I went back over to Seattle in the summer of 62 to take my final orals and get the dissertation accepted and all that summer. But I had been here one year at that point. So it was very difficult for me anyway. A lot of people, I guess, can be very independent about this, but I guess that I'm not one of them. I wasn't quite disciplined enough, I suppose. To just do research in isolation.

JL: But you did research with the students here. Maybe not to the same level. You did do that I know.

GH: I published papers, three of them in pure math.

JL: I know that I just saw one of your former students, Rick Kitchen,

GH: Oh yeah.

JL: In St. Louis, and he said tell you hello. So, and he still is appreciative of all the work and all your help. You should know that.

GH: I enjoyed working with the students, you know. They were a pleasure.

JL: Yeah. I can believe it. The next set of questions is about kind of changes the department has gone through. And the first one is just a big question, "What changes did you see the department go through while you were there?" And then after that, "Were you directly involved in any of them?" And then we'll go from there.

GH: Oh, Johnny. I've been here so long that the department doesn't even resemble what it was when I came?

JL: How many faculty members were there when you came?

GH: There were six of us.

JL: Six?

GH: Yeah.

JL: And now there are 21 or 2 or something like that.

GH: And we didn't have all these divisions, separate areas, on and on. Just all the faculty.

JL: You were in the math department.

GH: Yeah. And we didn't offer a Ph. D. at all, but we did offer a masters. And uh, the big thing then was summer institutes for high school teachers where they could so many summers and most of them would come out with a master's degree.

JL: Those were the National Science Foundation supporting?

GH: That was supported by the National Science Foundation.

JL: Okay.

GH: And then we also had academic year institutes we got after that because that was when the student came and stayed a full year. And then out with a master's degree. And a lot of students out of that went on to get their Ph. D. You know the only Ph. D. student I ever had which was Frank came out of that academic year institute.

JL: And just for the record, that was Frank Hannick, right?

GH: Frank Hannick, right. It wasn't until McKelvey came here to kick off the Ph. D. in math.

JL: And that was in the early 70s, maybe?

GH: Yes.

JL: Okay. I knew it was in place when I got here, and I didn't get here until '74, but the program was already in place.

GH: Yeah, right. They got a big grant from NSF. And the emphasis of course was to create college teachers. That was the emphasis of it and that's why they got all things to (?) of it. The requirements.

JL: One of the things that I know changed even while you were chair, we didn't have very much money for scholarships. And you changed some of that–directly.

GH: Well you know Johnny. One of the things that I felt very strongly about when I was chair was the invisibility of the math department. I just thought that it was a crime that here we were, the largest department in the College of Arts and Sciences. We were even bigger than some schools,

say like the School of Journalism and. And we were invisible. Nobody listened to us. Nobody cared what happened to us and it just made me angry.

JL: That's probably a good thing.

GH: Dean Flightner used to all the time say, "Don't make her mad. Don't make her mad." And so one of my goals was to do something about the visibility of the Math Department. Well, in doing that, and another one of the complaints was that you didn't have any money for students to help in the area and on and on and on. And in the Undergraduate Committee, everybody was talking about maybe having some kind of tutorial program for the students. And Jack Eidswick was here, visiting professor at the time. And he talked about a tutorial kind of program that they had at Santa Barbara where he was. Well somehow, it didn't quite appeal to me, but yet, it started the seeds of what we could have, of getting a more intimate relationship between the student and a faculty member, having them do something they would appreciate and be really good at math. Because we need to increase their maturity and (?) and so forth. So I went to Flightner, tried to get money to fund that program. So, I said, "Well, what will you give me?" Well, he just didn't have any money. So I said, "Okay, would you match what I give?" Well no he wasn't sure about that. So finally, I said to him, "I'll make you a deal. I said if I raise $30,000 for it, and this is how it all started, would you give us the money?" And he said, "Yeah, if you raise $30,000, I'll give you five." So I'm sure that he didn't think that I would do it. So I said, "Okay." So I went over to the Foundation and I set as a goal getting $50,000, a small goal to start with. $50,000 to do this program. And I was going to endow it with $50,000. It wasn't much but it was a start. Now, Jack Eidswick donated some stock to it. By the time of course he did all of this, I don't quite understand the details on this, but it turned out to be worth less than $4,000. And I thought originally that it was going to be worth $10,000. So I then took $5,000 of my money and put into it and the dean gave me $5,000. Then I went to the Mack Johnsons and they gave me $30,000. So here it was up to …, and then I went to the President and said that I want $200,000. I got bold. He said no. So, I said well, okay, I'll tell you what if I give 5, would you give 5? And he said, "Yes." So I gave another $5,000 and in turn, he gave me 5. And that brought us, I was thinking, within $6,000. Now I've got the $50,000 and that are two endowments for that thing now.

JL: Sure.

GH: I wish that they would have consolidated those two but they haven't. So I endowed that program with $50,000, but I still needed $200,000. So that's when I went out looking for help. I talked to the Foundation and talked to the Foundation until I got Charles Bryan and his brother. And I had

written up this proposal. Of what I thought it was and I took it by the Policy Committee and they okayed it. So I took this wider proposal and they okayed it and I sent it to Charles Bryan's brother. He liked it. He thought that it was just this great idea. So he asked me what I would do with it if he gave me $500,000. I said I don't want $500,000; no. He said, now what did he say? Never $500,000. That is just the most ridiculous thing; what about $500,000. I want $200,000. Not picky. All that became clear to me was that he would give me $500,000. And then I started to think of all these things I expand it to for adjuncts and on and on and on. And so I went to the Policy Committee and we drew up a list of what we would do with $500,000. I took that back to him and he then got his attorney to draw up the contract and that is how I got $500,000 from him plus $25,000 to run it the first year.

JL: And that had a tremendous effect on the department of course, Gloria.

GH: Then we got the $50,000 from the other also for the undergraduate fellowship program in a separate thing. So they aren't linked up yet together but I do wish that they would consolidate that undergraduate math scholar's fund. It is a pain in the neck to me.

JL: You'll just have to come out of retirement to work that one through.

GH: I tried to get Jim Hirstein to when he was chair to deal with that. He never got around to it to the very end.

JL: Well, I can tell you from a student's standpoint I think that they have been most appreciative. Always. Let's return to the building itself. What did it look like when you got there and how did it change or did it change?

GH: Oh my God, it was going to fall down.

JL: How did it change?

GH: Well, I'll tell you I've got a higher power I'm sure looking at it. Because we had so year after year, you know, the proposals under the Building Fund.

JL: Right.

GH: Well things that needed to be done. All the things that got denied year after year after year. One of them was the doors for the Math Building, the front doors. And so nobody would ever do anything, just wouldn't do anything. So finally I had the President. I made that an agenda item on the President's yearly visit. He just started. Well I said what we really want is a wing. And he was not receptive to it. After the whole meeting I asked

him. I said, "You know. You put out this call for (?). I said, "We don't have any call for (?) over here. We are in this rattrap and look at the paint on the walls. I said, "Do you see it?" "Yes, I saw it." It needs painting; I said the doors are separating faculty and offices. I said there's all this stuff. I said and, and I mention some things like that. I said, are you going to fix up this building; are you going to put a wing on it? What do you intend to do? Well, he said, I haven't thought about anything right now. I said, well what are you going to do, let it fall down? Then he said, hm. Then he walked out. That's all he said. And by a miracle, he then sent all these people from Physical Plant over to assess the Math Building and report directly back to him. The first thing I managed to get was those doors. Because Ed Willet came over to check the doors. I said that they are fire hazards. I said this one has to stay locked so it won't fall down. And I didn't know I was telling the truth. I said, you know that's against fire regulations? Yes it is. We have to open the door. He opened the door and darn if the door didn't fall off the hinges.

JL: Good timing.

GH: I said, right on. Told me that was a message to the president.

JL: (?)

GH: Yeah.

JL: (?)

GH: Right on. Got the doors and while we were at it, the back door needs it also, and I said right on. Then we got the computer thing, and we started getting all our grants funded after that after at the end of the year. And kept getting them. I know that you have discretionary funds. I said we need this and that and the undergraduate room as well as the faculty lounge got big grants from Flightner's excess money. And half of it had to do with you because you challenged me. About the faculty lounge, I told you. I tell you what you give me $500, and I'll do it. I got you. If you give me this, I'll deliver.

JL: You got the money, didn't you?

GH: Yes. We got it and the Physical Plant got interested. They started donating the time. They donated all the time and the paint, they donated the coffee table where the coffee is and on and on. And Flightner and your grant [gift] is the one who bought the furnishings. Well when things start to roll, then things begin to happen. The more they gave me, the more I asked for. We got the building cleaned up; we got it painted. And there

were excellent deals the Physical Plant did on the doors between offices and…

JL: You were the chair I think when finally the wall made out of bookcases…

GH: That is what I mean.

JL: Between George McRae and Keith Yale?

GH: Well, more than that. It was between all the offices, between Derrick's and Stroethoff's offices. See Stroethoff really wanted it because he had a door between his office and Derrick's..

JL: Got you.

GH: There was a door between…

JL: Between his office and Yale's.

GH: Between his office and Keith's. And there were bookcases between Keith's and George's.

JL: George's.

GH: So all…

JL: All..

GH: All the internal walls had to be done and it was the same way downstairs.

JL: Yes.

GH: On the second floor. I said we might as well do the whole thing. So I called Physical Plant and they made a bid on it. Thank goodness that I had people who got big grants and Dean Flightner was nice enough to kick in a lot of kickback from the SPABA funds, and those were the funds I used to do that. (?)

JL: Those indirect funds did come in handy, but without your planning, I'm sure that they would not have been used that way.

GH: Well, actually that was too good to turn down. I thought we'll take that.

JL: Hey, as a faculty member, I thought that it was great what you did.

GH: We made the building more livable. (?) The President even got smarter. He sent his architects over and they drew the plans for a wing. You know, we've got plans for a wing.

JL: I think that the building they've put behind the Math Building kind of stopped that wing.

GH: No, the wing goes out the other way.

JL: Okay. I had it wrong.

GH: It could be really quite nice. Chaudry and oh, someone or other submitted the plan. The plan was submitted to the President. And if I had remained chair, that was the next thing that I wanted to do, raise funds for the wing.

JL: For the building.

GH: But I never got that far. That can be somebody else's dream.

JL: The next question has to do…if you could identify the best asset of the Department of Mathematical Sciences, when you were there. What would it be?

GH: The nurturing of students. I think that was a success. The faculty really cared what happened to students. And the other asset is the willingness to set aside differences and try to get along with each other.

JL: I agree.

GH: They made a concerted effort to not have the department split over too much over tenure and that type of thing. They really tried to get along.

JL: That was a huge asset for sure. I agree with you totally. As a former faculty member over there too, and uh. That was a very good thing.

GH: That doesn't mean that we didn't get mad at each other as you well know.

JL: I can't imagine two faculty members every getting mad at each other. Gloria taught me how to slam a door after I slammed one once. Now we have this on tape so that it is public record. But all for good reasons, let me tell you. We did get along with each other. I think.

GH: I think so too. I think that we liked each other.

JL: Yes. Very different opinions, but people liked each other.

GH: Yes.

JL: So. It is something that not every department has, that's for sure.

GH: Especially when you've got so many different division.

JL: Yes. Yes, I don't think …

GH: Too many divisions.

JL: Right.

GH: We could almost have a Department of Applied Math, Department of Analysis, Department of Pure, Algebra, Department of …

JL: Right. Stat, Math Education, Operations Research…

GH: All of those operating under one umbrella. That's hard. That is hard because everybody wants a big share of the pie.

JL: That's right. The next question had to do with research. And you already mentioned a little bit about research and other areas. I know that you've done quite a bit over the years with women in mathematics in different ways. And while that is not pure math research, you've certainly done enough for to count and you've been active in a number of organizations. Do you want to say something about some of that?

GH: Oh, yeah, I was kind of on the ground floor of all that stuff. It … At the very beginning of AWM [Association of Women in Mathematics] for example, it really came to the public eye…

JL: That is the Association for Women in Mathematics?

GH: Right.

JL: Okay.

GH: And it got kicked off at a Penn State meeting with (?)Mary Gray and myself, and Mary Ellen Rudin, and Christine Ayoub. We set up a panel there at Penn State. It was held in an auditorium and that whole auditorium was packed. We showed that women had a lot of interest in those matters. Because women just weren't really recognized. They weren't advancing in the ranks. They weren't in any significant numbers in the departments, or anything. Salaries weren't as good. It was just the very beginning of trying to get some kind of equality for women mathematicians. And I can remember talking about how applications you

could read. There were pages of the same things, of how the chairman would go about how he wrote letters of recommendation. And you know, they would come right out and say, “For a woman, she is the best student that I’ve ever had.” That kind of thing. Nothing (?) rather than. I don’t think that it was intentional. They just didn’t know any better.

JL: Right.

GH: So a lot of education had to be done, but that’s I think with some deliberate effort we brought it to the attention that there were people out there getting ready to form AWM. So it was Mary Gray as its first President. And they had other panels of women scientists. I wrote a long status report for mathematics that appears in the New York Academy of Science journal. In which New York had I think that it must have been in the auditorium. Between 2500 and 4000 women scientists gathered there. I remember Yalow was one of the speakers there. You know and she was the Nobel Prize winner. She worked on the (?) research. And I remember Jill Cobb was President of Cal State Fullerton. So they had these great women scientists. And Horowitz, I met her at that particular conference. Who later turned out to be President of AMS, you know. And there were lots and lots of very famous women scientists at that conference. I can remember seeking the status of women in mathematics. And one of the things about that is right after a period where I had been totally demoralized by this department. So I was very emotional. And I probably shouldn’t have mentioned those kinds of things, but I blew it. I got to talking about and was going to cry. And that was exactly what happened. And it made them feel so sorry for me that they got up and gave me a standing ovation.

JL: I’ll bet that is not the only reason.

GH: But I’m talking about the kinds of little things that just wear away at you and just totally demoralize you and just sap away all of your energy. And they don’t seem to realize the difference and respect and love. And you know, they say they do. But you wouldn’t expect people to say to you that let you know what they think of you in some ways, you know. I don’t feel competent. I don’t think competence in women at that time entered people’s minds very much. You know, and it got to where anything, it wasn’t because of competence. Got another reason and there are all these insidious things, and I talked about those kinds of things in that talk. That’s how I ended it up after all the statistics of how many were in this, their salaries, and all of that. I just had to say something about that because that was the thing that mattered in my life and just destroys more and more women mathematicians and why a lot of them don’t go on. Somewhere down the line, they got disturbed by this kind of thing.

JL: About what year was that? Or just relatively?

GH: I could look it up, but I forget.

JL: That's okay.

GH: But for letters of evaluation. I just felt very strongly about those kinds of things. And it never left me. I can never figure it out personally. And Flightner said to me one time, you spend too much time writing these faculty evaluations. I said, I beg your pardon. I said you wanted an evaluation, don't you? And he said, well, do they have to be this long? I said, Yes to say all the things I need to say. He said well you know, it sounds as though when you write things up long, people think that you are probably padding the file. I said, Read it and if you see any padding, then forget it. So I told him, You know Jim, one of the things I really don't want to happen. We're getting more and more women in the department and I don't want them to ever have to go through what I went through. And he just looked at me and that was the end picking at me about my letters, because I didn't just write list of work, I wrote a paper.

JL: I remember you wrote for everyone and where I thought you were very honest in them too.

GH: I always was very conscious in them. I didn't want them to be turned into something else because of the way I was writing them.

JL: Right.

JL: One of the things in this whole project that we've been doing is looking at chairs of the department, and if I have done my scans right and math history right, you may be the second woman who was ever chair of the department, and I'm assuming that the first faculty member was the chair, although she might not have been. Because I don't think that there was another woman in there who was chair before you.

GH: Oh.

JL: And I suspect that Professor Reilly who was the first math department faculty member wasn't a chair, because I'm not sure that they had them then. So you may very well be the first and the only woman chair of the Department of Mathematical Sciences at the University of Montana.

GH: Now I well looking up the early math departments, and I don't remember a woman faculty member.

JL: Well, the very first one was a woman.

GH: Really?

JL: Right.

GH: I didn't find her.

JL: The very very first one. She was a former high school teacher was the first math faculty member. But there aren't a whole lot in between.

GH: That's right.

JL: And there were people, there were women who were may be called instructors or maybe called by other titles who may have taught or helped with classes, but I'm virtually positive you were the first professor of mathematics and I think you very well may have been the first chair.

GH: I'm pretty sure of that.

JL: I don't think that this first woman was considered to be chair of the department because that was when the faculty had only about five or six faculty members total in the whole university.

GH: Well, one of the things that was called to my attention that I did not know or had not thought about was that they were saying that it was very unusual for a woman to be chair of a mathematics department of a major public institution. And that was while I was chair. I said is that right and they sat there and named them off. I said, Oh. But I didn't know that but at private institutions, yes, but at major public institutions, that was really a rare thing.

JL: I know that it was a shock to me when we started this whole math history project to find out that the first math faculty member was a woman. After that woman in a normal tenure track line, I'm not sure that there were any until you got there. And we've gone through it pretty carefully.

GH: There were no women when I came here.

JL: Right.

GH: And for years and years and years. There were no women until we hired I think Elizabeth Papousek.

JL: And see that was before my time, so… But…

GH: Of course Emma Lommasson taught math.

JL: Right.

GH: In the department under Lennes.

JL: N. J. Lennes.

GH: Yeah. But I don't remember.

JL: If we weren't doing the history project, I would never found the other name, ever.

GH: well, I can …

JL: But I'm pretty sure that you're the first chair, almost positive. I do not believe that there were chairs when she was a faculty member.

GH: Well nationally, that's not a huge mark on Montana in the sense that the is not difference from what is the norm.

JL: Sure.

GH: So I think that redeems a little. They didn't know any better.

JL: Okay.

JL: Gloria, I know that when you were chair you used technology some, but did you use technology much in your teaching at all?

GH: No.

JL: Okay.

GH: I …

JL: I know, it's not normally been considered a tool of algebra.

GH: well I used a calculator a lot in 107.

JL: Right.

GH: When I taught it, but I you know, technology was used in all the classes, but I never taught those classes.

JL: 107 is Contemporary Mathematics.

GH: Yeah, right. I used calculators a lot especially dealing with data and tangents. They used their calculators. They usually couldn't do without them. Without them they couldn't do decimals and on and on.

JL: But I know when you were chair, you used technology. I mean you used word processing, a spreadsheet. You name it.

GH: I had to. I had to.

JL: It may not have affected your research, but it affected your work.

GH: Oh yes. Oh yes. Without Excel, I don't know how I could have done the schedule and kept track of all of that stuff.

JL: One of the questions that we had down here, which is a little bit outdated now, but it was asking for a Hilbert list of problems. And did you have any kind of problem that you might suggest that would help move us in the future. I don't know if that problem is appropriate right now, but if you do, I would like to include it.

GH: Oh well. That's a pretty hefty opinion. For he gave that to close his session to keep mathematicians busy to this day. You know, it seem that more and more and of mathematics research is moving together, more applied areas and modeling and things of that sort. And I still don't' think anybody has the math education part right. I don't.

JL: That's fair.

GH: They keep changing that. It's just amazing. Like (?) came out with the top 100 high schools in the United States you know. I looked over that and I thought now what made them tops over the schools in Montana. Now most of them are magnet schools or schools for the gifted, or schools that required everybody to take courses in math and sciences and I thought somehow or another, you got these little private school called academies of science that are doing their own thing. And you got some public schools that made of course this list and you've got the majority of them and everybody seems to be doing their own thing and nobody at all seems to tell them what to do. Your thing for example was on the threshold of something really innovative and you called it integrated mathematics and on and on. But that's hard you see, but I think that it is more than a lot of things. And I somehow don't think that people quite know yet what to do.

JL: I think you're probably right.

GH: I think that there's still lot of open area out there. What is going to excite students? Hang on to any assortment of students that excel. Have more

exciting things to do. They got interested. Tell me to give students a whole backpack of homework to do isn't the right kind of homework you want them to do. You know that's busy work. And it's not turning them on. They're grumbling about not every being able to go out and play or anything else. They've got to spend so much time to do this homework that it may not do any good any way. So… That's what I think.

JL: That's fine. But we did want to know what you think. And it is interesting when I read some of those rankings. Well about like the collegiate rankings in Newsweek and other magazines ranking colleges. You know, what makes one college better than another? And the same issue or types of issues may arise. The one thing about thigh school is that it does affect all kids or virtually all kids in the United States. And it is a big issue. On a different level but a Hilbert type problem.

GH: Oh yes. Maybe that will by your last push when you retire. Early retirement.

Phone rings and interview ends.

Interview with Dr. James Hirstein (JH)

Department of Mathematical Sciences
The University of Montana
Missoula, MT 59812

by

Varoujan Bedros (VB)

VB: Dr. Hirstein, could you tell us when and where you received your degrees and what was your dissertation topic?

JH: I received a Bachelor's of Science in Mathematics from Illinois State University in 1967. That was a teacher education program, so I was a certified high school teacher of mathematics. I stayed for an extra year and got a Master's of Science in Mathematics at Illinois State University in 1968. And then after teaching for four years, I decided to go on for a Doctor's degree, and I went to the University of Georgia and actually finished my degree in 1978. And at the University of Georgia, my degree is in Mathematics Education. They have a Department of Mathematics Education, and so I got my degree there. At the time, the University offered only a Doctor of Education in Mathematics Education, so that's what my degree is. And my dissertation was on the counting strategies of children in first and second grade in their development of number concepts, in addition and subtraction, and numeration.

VB: What area of mathematics are you especially interested in? What are you currently working on? Have you done research in other areas? Where can I find examples of your work?

JH: All the research that I've done would be considered in mathematics education. And as I said, although my dissertation was with elementary school children, my preparation was actually as a secondary teacher. And at the University of Georgia, the, we, they considered mathematics education everything from early childhood through graduate school education. So, my secondary training and degree in mathematics was very helpful for that. The kind of work that I've done has been primarily curriculum work and assessment work. My first job out of, after my dissertation was at the University of Illinois when they were doing the Second International Math Study. And I was the curriculum specialist in, on that project, analyzing curriculum from countries all over the world, talking about what kind of math gets taught, what kind of math do students learn. And then when I got out to the University of Montana I have done work in, with the SIMMS [Systemic Initiative for Montana Mathematics and Science] Projects, which was a secondary school curriculum development project. I was co-director of the assessment part of the SIMMS Project. So, most of my research there has been in curriculum development and assessment. Where you would find my work is in the work of the Second International Math Study and the SIMMS Project. Internal and published documents about the curriculum and the evaluation of the curriculum. I've also done quite a bit of writing and research with college students on mathematical modeling. And so you would find articles of mine in the *Mathematics Teacher,* you would find presentations in some international symposia that I have participated in, and then where the papers were published as the proceedings of the symposium.

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

JH: Well, I, I guess I would say to that, I have always wanted to live in the West. I grew up in Illinois, you know, flat lands, no ocean. I always liked the mountains and the ocean in fact. Really became, loved the hills and so forth around Georgia. And then I had moved back to Illinois and actually was working in Pennsylvania for about five years when a job opening came up at the University of Montana, and I thought I would always like to live in the west, so I applied for the job, and got it out here. And came out of course and looked at the University of Montana when they interviewed me and just really liked the environment, and liked the University, I liked the size of the University; I liked the fact that I would be in a mathematics department. I guess I should say, I have been both a math educator in an education department and I've been a math educator in a math department, and I much prefer being in the Math department, and interacting with colleagues who are mathematicians, rather than in an education department, where my colleagues were teachers of English, and teachers of social science. I have a lot more in common with mathematicians, and so I prefer being in a department of mathematics.

And so, I liked the University of Montana, and they offered me a job, and that was, I've been here ever since.

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

JH: This is a really difficult question for me to put on one person, to name one person. There were so many people who influenced my choice to become a mathematics teacher. And I guess I'd like to you know, give more than just one name here. I would say the first person that helped me recognize that I could do mathematics and was good at mathematics was probably my high school geometry teacher. And from high school geometry on, is when I really realized that I was, that I wanted to do mathematics, that I wanted to teach mathematics and that was, his name was Mr. Bond, and he was quite an influence because from then on, I knew that I wanted to teach mathematics and I thought I wanted to teach it the way he did because he so impressed me with his knowledge of mathematics, and he impressed me that I could do mathematics. And so I went off the university to be a math teacher, and I guess I would probably suggest two people at the university who really made me feel that I could do well as a teacher of mathematics. The first was my department chairman, whose name was Dr. McCormick. And he hired me when I was a sophomore to be his paper grader in analytic geometry. And that was the first time that anybody had indicated to me that they really thought I was good at something. And the other person there was Dr. Hicks, who was my analysis teacher. And I think I learned probably more mathematics from Dr. Hicks than anybody else in my life. He was a demanding teacher, but he was so good at explaining things, and I have, a year or so ago he won one of the MAA awards as teacher of the year for Missouri, and I wasn't at all surprised. He just was an excellent teacher, and as I teach now I always think back to Dr. Hicks' class and think if I could explain things to my students as well as he does, I would be a good teacher. I probably don't reach his standard very often, but I guess I would credit him probably the most with encouraging me to go on in mathematics and you know, get a doctorate, and teach at the university level. He's the person who really convinced me that I could do that. So, at these various levels I think people encouraged me along, and I would set my goal a little higher each time, and then, and when I got to a higher goal, somebody else would be there saying you can even do more than this. And that's what I think helped me ultimately to choose to be a mathematics teacher at the university as a career.

VB: Okay. You probably have answered this question as well, but let me go ahead and ask it to you. What were your goals when you started and have these been accomplished? Have they been altered? If so, how and why?

JH: Yeah, I think that's very related to what I said in question two. You know, as I said, when I first began at the university my intention was to be a high school teacher of mathematics, and I got to the point where I was qualified to do that, and then people convinced me that I could do more than that. And so I went on to do more. And so while, you know, only for brief periods of time was I ever a high school teacher of mathematics. I'm now in position where I work with people who are going to be high school teachers. And so, they, you know, I still feel my connection to that original goal, but it's just that I never dreamed when I started that I would be one of the people who was training teachers rather than, I just expected I would be a teacher in some high school somewhere for the rest of my life. Probably would have been happy doing that, but, so my goals have changed.

VB: Okay, what changes has the department gone through since you have been here? Were you involved directly in these changes? What did you think of them?

JH: I would say certainly the, probably the biggest change, since I've been here, was the conversion from the quarter system to the semester system. And I think that was a fairly, I would say it was a fairly painful experience for the department. I think this department was happy with what it offered on the quarter system. I was happy with what we were doing on the quarter system. And we were, you know, sort of imposed from the outside that we would change over to semesters. I don't think it's all bad that we had to change to semesters because I think it forced us to make some decisions about what was important and how things should be offered, but I think it was very difficult, for us to do that, and I don't, you know, I'm not convinced, I guess, that what we ended up with is better than what we had in the first place. My characterization of it was always, I worked in both semesters and quarter systems, and I think that each of them has their advantages and disadvantages, but it's so painful to change from one to the other that I don't know why anybody would do that. And I think we would not have done that if it hadn't been imposed on us. I do think there was some positive things; I mean I think it forced us to confront some common ground that we had within the department. I like the offerings here at the University of Montana. I mean I like the fact that we have mathematicians who are in pure mathematics, and applied mathematics, and statistics, and math education… All together as a unit, and when we changed to semesters we had to think about some courses that were common for all of these students, and how could we deliver it in way that meets the needs of students in all these different areas. And I think it was a useful exercise for us to do that. But I think we're still fine tuning what we did after we changed. And, you know, was I involved? Yes. We were all directly involved in it. What do I think of the changes that the department has gone through? Well, I think we've grown from it, I think

that's probably helpful, but I'm, like I said earlier I'm not really convinced that what we do now is better than what we did before. But it's just, it's reality, and there are minor changes that we've gone through, but by and large the faculty, I think, have retained, for a department of twenty tenure-track faculty, I think we've all maintained our interests and represented our interests very well in a fairly small department. So, I think it's a good, I think the change has been good for us, but it's not always pleasant.

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

JH: From my point of view, and I alluded to this earlier, from my point of view, the idea of being math education myself, having the math education component within the math department, and respected by mathematicians, I think is the greatest asset that I have, to, you know, to what I do here at the university. I believe first and foremost that math teachers ought to be mathematicians and then they ought to be teachers, you know, who are sensitive to children's learning, so I think that's very important. But, I guess I really appreciate the asset of the department that says mathematicians and math educators work cooperatively within the Department of Mathematical Sciences. I think the same thing could probably be said of the other areas as well. I mean, I think it's probably good that statisticians and analysts are in the same department, and have a chance to cooperate with each other. I know many places those would be separate departments, and there wouldn't be a lot of interaction between those separate departments. And so one of the advantages of being small is that all of us are here together and we work together. And I think for as varied as our department is in their interests, I think we work together extremely well, so, I think that's a strong, very strong point for the department.

VB: What question would you suggest for the year 2000 "Hilbert" list of problems to direct the thinking of mathematicians or mathematics educators?

JH: I'm not quite sure what to say about the, about Hilbert's list. You know, as I said with respect to the last question, having mathematicians and math educators working together I think is helpful. In most other places, math education probably wouldn't be much interested in Hilbert's list of problems. But the fact that we're in a math department and, you know, you can look back upon the last century and what's happened in mathematics in the last century, I think is important for math education as well. And so the fact that math education would even consider Hilbert's problems, I think is a huge step forward for math education. And, you know, in terms of the math department, I suppose most math departments would consider it, you know, Hilbert's problem, Hilbert's list, and the

progress that's been made on his individual problems as worthy of study by a math department. And I'm just thrilled that math educators are interested in what's been going on in the last century. And, you know, it's not one of Hilbert's problems, but to me one of the great problems is which of these things that have been done in the last century are accessible even to education? Are these only problems for graduate study in mathematics, or do they have something to say to math education? And here, I would say most people, when you look at math education, over the last half of a, half of this century, we're still teaching things that were, that are essentially 400 years old in terms of when they were invented. And math education in the teaching of high school is really not at the level of the solution of Hilbert's problems. But, still, I do think it's important, like I said, I think math teachers ought to be mathematicians, they ought to be aware of those problems and aware of the progress that's being made on them. And so I guess from the standpoint of math educators, I would say the awareness of what those problems are and what progress is being done. The fact that there are still many that are unsolved, just the whole attitude that, you know, that math is a growing dynamic field, and it's not something that 400 years old is an important connection between mathematics and math education.

VB: How has the content in mathematics courses changed over your career? Do you expect it to change? And if so, how?

JH: I believe it's changed dramatically, and I think it will continue to change. I mean it's a living, dynamic thing, this mathematics curriculum, and it's, we know it's going to change. How has it changed in my career? There, when I first started, geometry was a much more important aspect of the mathematics curriculum. I believe the requirements for my teaching credentials were that I had to have one course in algebra and one course in geometry, and the rest I was free to choose. In that, I would, well that was beyond calculus. Prior to calculus, we learned analytic geometry, and so geometry was there before calculus, geometry was there in many flavors after calculus, transformational geometry, projective geometry, non-Euclidean geometry, all of those kind of course I had in geometry. Today's students, I think know very little geometry. They haven't had non-Euclidean geometry, I've said this before on many occasions, has been essentially wiped out of the curriculum. Because we expect the students have had some geometry in high school and so we don't do anything with them when they get to the university. And the problem is, the students have had such varied experiences that nobody has the same experience, and so you can't assume that they know any specific approaches to geometry. And so I think that's been one of the big, one of the big changes. Another big change has been level of abstraction. What students learn in terms of abstract mathematics and abstract algebra, and abstract analysis, there's just a lot more expectations now than there were

for a beginning teacher 30 years ago. But you know; how's it going to change in the future? That's a hard thing to predict, I guess one of the things I see in terms of curriculum and the training of teachers is that people think if teachers don't have to teach something when they get into school, then they shouldn't have to take it in their careers. And I think this is; this really speeds up the evolutionary progress of the curriculum. What happens is people say, well, if these teachers aren't going to have to teach geometry when they get to high school, when they go to teach high school, then they don't have to learn geometry. They only have to learn what they are going to have to teach. And I think that's a disaster for what people ultimately have to know. I think it's very important that, you know, teachers, math teachers need to know calculus, whether they're going to teach calculus or not, because they have know where the students are going. And I guess one of the things that concerns me is that this sort of pragmatism is prevalent in what the students choose to learn. And what we require them to learn. And I don't think that's always a good thing for their mathematical knowledge. If they're going to be teachers, I think they need to have a lot more depth, in a lot more areas than just those things that they're going to be expected to teach. And so, one of my fears is that things are going to just deteriorate further. And we're going to do less and less, and do only the things that are practical for students to learn. And I don't think that's a good. I don't think that's good for math education.

VB: Do you have a favorite anecdote or memory that reminds you of why you enjoy being here?

JH: Hmm, anecdote. I should have thought more about this I guess. I guess one of the things that makes me enjoy doing this is when teachers come back to me years from now, after they've been teaching school, and tell me that what they learned, what I taught them was very helpful in what they do. I guess it's an old story, but many years ago when I was teaching in Pennsylvania, I had a student who had been in my class, and she came back to me about, it was a relatively short period of time, I would say, it was about maybe 6 months or so after she'd been in my class, and told me that she felt that she owed me an apology. I asked her why she felt she needed to apologize and she said, well, she'd been in my class last semester and she said, that she thought everything that we were doing was trivial. That we were sort of playing with blocks, and representing base ten using blocks that included, you know, tens and hundreds and thousands and things like that, and she had just regarded that as playing with blocks and she didn't think it was useful at all. And now as, in her program she was required to go into some schools, and she was teaching fourth graders about the numeration system. And, she found that they didn't understand it when she explained it. And so she finally realized that if she had these blocks, she could show them what was going on. And so she came back to apologize and ask me if she could borrow the blocks to go explain to

these fourth grade kids what base 10 numeration was all about. And I think that story probably says, said a lot to me about, about the problem of training teachers. They don't know what their questions are going to be when they're taking these classes. And I think what we have to do is give them a broad enough background so that when they get out there, and they find out what the problems really are, they can then come back and solve it. And I guess I look on that story as a success story. I mean, I thought this student, probably learned something from class about something that she can do, and even though she didn't appreciate it at the time, it turned out to be a very good experience for her because she knew where she could go to find the answer. And I think that says a lot about what I enjoy in teaching. I know students complain about what we do when we're asking them to do it, but as I told this student. It doesn't really matter to me when you come around to feeling that this is a good idea, as long as you do. And that's the important aspect of teaching. I think it's an awareness of the kinds of things you can do, and that's what keeps us coming back.

VB: Thank you very much for your time and we appreciate your input on this project. Thank you again.

JH: Good.

Interview with Dr. Leonid Kalachev (LK)

Department of Mathematical Sciences
The University of Montana
Missoula, MT 59812

by

Varoujan Bedros (VB)

VB: Dr. Kalachev, can you please tell us a little bit about yourself, and in particular, when and where you received your degrees and what was your dissertation topic?

LK: Yeah sure. Okay, I got my B.S. and my Ph.D. all of them at Physics Department of Moscow State University in Russia. And the last degree, Ph.D. I got in 1987. The topic of dissertation was as I recall *Hemi-Perturbed Radical Equations in the Critical Keys in the Problems of Heat Transfer Combustion and Semi-Conductor Physics*. And, what I will do next, I will simply go through your questions and read the question and answer it.

So, why did you choose to become a faculty member at the University of Montana? Well, it's easy; you see when I came here to the interview it turns out to be a friendly is department of mathematics, so I think the atmosphere is very good. So, this was simply my choice.

Who was the most influential person who helped you choose mathematics as a career? How did that person influence you? Well, it was my Ph. D. advisor, Professor Butuzov [Valentin Fedorovich Butuzov] from Moscow State University. How did he influence me? Well, it's easy, when the

professor and mathematicians is a professional and certainly he has influence on everybody, me included.

What were your goals when you started and have these been accomplished? Have they been altered, if so, how and why? Well, it's kind of interesting; why don't we discuss it a little bit? What are the goals in science; how do you think?

VB: Well… (Deleted material; defective tape.)

LK: Okay, coming back to number three about the goals. Actually I do not quite remember what the goals were when I started doing mathematics. For example, as a student and once again when you talk about goals in science, it's a philosophical question. You know, are they personal goals? Or I mean did you can get a position or solve a problem? It sounds kind of funny, but I can tell you now; I mean the goal is certain to be professional and a teacher professional scientist, that sort. So, how and why? Well, work hard.

Number four. What changes has the department gone through since you have been here? Were you directly involved in those changes, what did you think of them? Well, the changes I, a lot of new faculty came, and they are both very strong in science. They are very good teachers, and was I involved, yes. I participated in some of the searches.

If you can identify the best, what is this?

VB: Asset.

LK: Asset, I see, misprint. Of the department of mathematical sciences and The University of Montana, what is it? As for every university, the best asset is people. You know, certainly you need the buildings and the computers, but as long as we have stronger faculty, we'll be strong department.

In what area of mathematics are you especially interested? What are you currently working on? Have you done research in other areas? Where can I find examples of your work? The thing is that areas is a bit, I mean everything in mathematics is overlapping, and currently for example I work with applications of a syntactic analysis and modeling problems in chemical kinetics, atmospheric chemistry, some bubble dynamics, semi-conductor device modeling, etc., etc. And is it one area, or those many areas? To me, it is one area. You can find examples of my work in mainly journals, for example, *Chemical Engineering Science, Nonlinear Science, Rocky Mountain Journal of Mathematics, Journal of Mathematical Analysis and Applications*, etc., etc., etc.

What question would you suggest for year 2000 Hilbert list of problems to direct the thinking of mathematicians or mathematics educators? Actually, not all their problems in Hilbert's list for 1900 have been solved. I mean the one that comes to mind, return to it, certainly correlative analysis of large systems. Systems with really many degrees of freedom.

How has the content in mathematics courses changed over your career? Do you expect it to change? And, if so, how? Yes, it is changing, but I think a lot here depends on particular person who teaches the course. So, overall, I think courses, more and more involve technology, and kind of less and less basic mathematical stuff is included. I hope it will still change, but it in the opposite direction. I don't know.

Do you have a favorite anecdote or memory that reminds you of why you enjoy being here? No. Thanks a lot.

VB: Thank you very much for your time. And we appreciate your input in this project. Thanks again.

Interview with Dr. Don Loftsgaarden (DL)

Department of Mathematical Sciences
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by

Daniel Finch (DF)

DF: My first question to you is where and when did you get your degrees? Let's start out with that.

DL: I got my undergraduate degrees, undergraduate degree, and Masters, and Ph.D. from Montana State University.

DF: Okay.

DL: I was trained as a statistician, and I consider myself a statistician.

DF: Okay. Then, since you decided to go into statistics, was there someone that helped you that influenced you? You know, what started your interest in that? And maybe it wasn't a person.

DL: Well, when I was in high school, I liked mathematics a great deal. The school I was in did not have two of the second, third, and fourth years of

mathematics. My dad was the superintendent; he helped me get some correspondence courses for my last two years so that I could get the mathematics. Those two years of courses were taken by correspondence from the University of Montana, and the textbooks that I was using were written by Lennes and Merrill. So, that kind of gives a long time connection to this department. However, when I left high school in order to become an engineer, and that went fine when I was a freshman except that I did not like the technical drawing courses. You can go ahead, that's like high school, I did not like that end. Decided it was the mathematics that I really liked. I also found out at that time you couldn't major in mathematics from here, which I had no idea whatsoever. And then as I took courses and got a couple of statistics courses, then I decided that's what I really liked to do.

DF: Well, you just retired last fall, still on part time.

DL: Yeah, July 1, 1999.

DF: Okay, But what originally brought you to be a faculty member here at U of M?

DL: When I got out of school with my Ph.D., I first went to Western Michigan University, in Kalamazoo, Michigan. A position that I enjoyed a great deal. However, being a native Montanan, there was always that desire to see if I could get back in the state. And, had this, there was a position open here, and I applied for the position, interviewed, and got the job and, so I took it. That was going on 33 years ago. Full-time I taught 32 years here. Three years elsewhere.

DF: So, since you've been around the department, have you seen quite a few changes, that are fairly identifiable?

DL: Oh, when I came we didn't have a Ph.D. program here.

DF: Oh, Really?

DL: So that was a substantial change. When I came on campus there were two computers on campus, two mainframe computers. An IBM 360, I believe it was, the administration computer with an IBM 650 which the faculty and students could use, but just two mainframe computers. So, one of the first things I did here was to work on that, so we could get some modern computing in here, and networking several people using the same computer at a time, was just beginning at that time, and shortly sometime, I'm not sure, after I'd been here for two or three years, and we didn't begin to get into modern computing, and of course technology has had a

huge impact on things over the years…teaching, research, and in all areas. (What was the rest of the question?)

DF: That's alright, just the changes that the department has gone through.

DL: Of course, the department has been involved in a technology shift as well. And we now have two labs of our own. Those, I'm very happy about those labs, we had to put those in during my last term as chair of the department.

DF: Well, along the same lines…

DL: We've also… excuse me…

DF: Go ahead.

DL: Another thing that has happened over the years is many, many more fields require more mathematics and statistics, so that means that the teaching load in the department has increased dramatically, to the point where we are now where we probably have 50 or more people teaching each semester.

DF: Right.

DL: And that has had good and bad effects, but the idea that, of other people making use of mathematics and statistics is very beneficial. And I think that the department has always tried to do a good job of meeting those needs.

DF: So as we're talking about changes, and as you just mentioned, one of them is that so many other areas need math and statistics, but especially in your field of statistics, have you seen how, is there any change in the content of the courses, or do you see it going in some direction, also from here.

DL: I think over the years, particularly in the elementary courses, there has come to be more emphasis on applied statistics. There's been more use of technology in courses, considerably more. There's a lot of statistical techniques and procedures that have been developed in recent years have depended heavily on the availability of high speed computers. And of course as these new techniques have developed, then they've also pushed their way into the curriculum of statistics courses at all levels as well, so. And that probably is the biggest change that has been influenced by computers.

DF: Sure. Well, you mentioned that you were chair of the department, so maybe you'll be biased, but maybe not, we're all pretty proud of the

department that we have here. And why do you think that is? That as a whole the department communicates well, and, is there something about the department that people can kind of hang their hat on, kind of say, yeah, that's….

DL: As you know, the department has a sort of a diverse set of groups in the department. In particular we have statistics, we have mathematics education, we have operations research. All of which on some campuses have separate departments. Now I personally like those areas which are closely related to mathematics together in one department. But sometimes, in other schools, I've seen a lot of this, there's, the people cannot get along together in the department. In fact at times there's almost all out war. Yet, historically we've never had that problem here. There's always minor disagreements between areas, but we've always been able to respect each others' areas and get along together, develop curriculum, et cetera. Taking into account everybody's point of view. And I don't know exactly how that, why that's so. I think a lot of it has to come back to the type of faculty members that we've had at the department. Individuals have been good. And I think that the individuals we've had affect that as much as anything. And of course when we've gone out to hire people, we've gone out to hire strong people, we're going to hire people who are interested in all aspects of a professor's life. We're interested in good teaching, interested in research, interested in (excuse me!). So having hired faculty members that are interested in all aspects of their career, research, teaching, service, and people that would fit in well with the other people. It's just evolved that way; I don't; I have no real explanation. But, having contact with a lot of people over the years, in many departments around the country, I've noticed that we are one of the best in that way.

DF: As far as what you have been interested in statistics Don, is there things that you've been involved with or are currently working on? Everyone has their own interests.

DL: My interest has always been in applies statistics, which is very broad. The specific areas that I've had some work in logistic progression, non-parametric density estimation, these two areas. But I've done consulting, on and off campus for state agencies, federal agencies, and various faculty members, graduate students on campus. And then, beginning in about 1978, I got involved in gathering data for the profession, and since that time I've been involved in two ways. One, the Conference Board of Mathematical Sciences, which is an organization made up of professional organizations in the mathematical sciences, and they do things that are beneficial to the mathematics community. And one of the things they do is have a survey committee. They've done some major study of undergraduate mathematics in departments around the country at the four-

year level, at the university, and two-year level every five years. And I went through four of those cycles, three of them I co-authored the final report, and either did myself or supervised the statistical work on those. And then in about 1988, I also became involved in a committee called, which for short is called the Data Committee. And it's sponsored by AMS, American Mathematical Society, Mathematics Association of America, the Institute for Mathematical Statistics (IMS), and the American Statistical Association, ASA, and they gather data on mathematics departments annually. And as well as, considerable data on new Ph.D.'s, and the job market, and what fields they're in, et cetera. And they publish two reports a year in the *Notices of the American Mathematical Society*. And I served four terms on that ending in 2000, then had my arm twisted to stay another 3 years as chair of the committee, which I agreed to do, so that's what I'm doing right now. But, I think that this area or groups is very important, so that people around the country know what's going on, and decision makers of course in Washington D.C. can make decisions, they know when there is a shortage of people, when there is a surplus of people. They know what the job market is, and in doing that I've had the chance to work with a lot of very well-known people who have made their name in various ways but have also been, realized how important it is to do this kind of thing. So I've had a chance to write reports, co-author reports with the associate director of MAA, Mathematical Association of America, the president of the MAA, the president-elect of MAA, I've done four different things with her, well-known statisticians, and all people in general who are willing to go out in their states and do some hard work because they felt this was beneficial. That I guess is where my major concentrate, in addition to the consulting things. That's where my major effort has gone in recent years. It was kind of a service area as…

DF: Sure; well, I think that's about it. Not too bad.

Interview with Dr. Johnny W. Lott (JL)

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by

Daniel Finch (DF)

DF: My first question to you, before we even get into the particular is let's do specifics, not even particulars. Where and when did you get your degrees?

JL: I got my first degree at Union University in 1965, Jackson, Tennessee, and the second one, it was a Bachelor of Science degree, and the second one was a bachelor, excuse me, was a Master of Arts in Teaching degree from Emory in 1969 in Mathematics Education. And then the last one was a Ph.D. in math ed from Georgia State University in 1973.

DF: Ok, you knew those right off the top of your head. Most people have to think about it for a while.

JL: Not exactly off the top of my head, but…

DF: All right, as you think back, was there a most influential person who helped you go into the mathematics field?

JL: Yes.

DF: If so, you know, how did he or she do that?

JL: I had a great high school math teacher, Mildred Majors. And she was without a doubt a super influence on me. When I went to college, I

always knew that I would major in math. I didn't know what I would do with it. But I always knew that I would major in math. She was a fantastic teacher, and I appreciated her immensely. And I went back and told her that about 25 years later.

DF: Really?

JL: She didn't know who I was, but I went back and told her anyway.

DF: Still nice to hear; still nice to hear. Well, after that, after your degrees, obviously you wound up here at The University of Montana. What led you to decide that? Some sort of strange factors or not too many?

JL: I like to claim it was just fate. I went to a National Council of Teachers of Mathematics meeting in Atlantic City, New Jersey, and met Rick Billstein and Shlomo Libeskind. They had a 3x5 card up on a board advertising a job in math ed for one year, when Shlomo was going to go on leave and go to Israel to the Technion for a year. I talked with them in their hotel room for about 20 minutes, and they were busy and about to go somewhere else. I was about to meet some people for dinner, and that was kind of the end of the conversation. I went back to Atlanta where I was living, and Carolyn and I laughed about it. One, we almost didn't know where Montana was. Two, we knew we'd never heard of Mazola, not Missoula, and finally though, when the job got offered, we said sure, we can live anywhere for 9 months. It was a visiting appointment. So, I stayed for 9 months. Had a great year. They offered the job for a second nine months visiting because Shlomo wanted to stay two years in Israel at this point. At that stage, we had decided we pretty much liked Missoula, but I was still applying for other jobs. But we liked the people here. We liked the community in the math department, and during that second year, I got offered a tenure track job by the department. So, I came for 9 months and stayed nearly 26 years.

DF: Not what you expected…

JL: Not at all, what I expected. But it worked out well.

DF: That's good. But it worked out well…That's great. Well, then since you've been in the department for that amount of time, obviously you've seen it change. Can you see, can you identify some of those changes?

JL: Sure.

DF: Like, you know what, and what do you think of them maybe? If you're willing to go that far.

JL: For many, many years, there was only one faculty member who had been here less time than I had. Hien Nguyen, he came the second year I was here. Okay. And for about 12 years, we were the two faculty members on this staff with the least amount of time on campus.

DF: Oh, on campus.

JL: No, excuse me, just in the department. I'm talking about in the department.

DF: Ok.

JL: But one of the things that has been a definite change over the 26 years is the turnover of staff. It is in the process of completely changing since the time I got here. Several of the people have retired in the past 5 to 6 years, and there are many more of them coming up. Because there are a good many people now in the department who can retire. So, one of the major changes is to watch new faculty members with new ideas come in here. I think it's very positive. We needed that to happen, and it's about time for me to take off too. So, it needs to happen again. But I do think that, that it's been positive. It's been positive for the department, it's been positive to see ideas come in here, it's been positive to have new mathematics come in here. We didn't have operations research when I first got here. I think the first operations research, and I know that's your area, but I think the first operations research courses officially kind of got here the second year I was here. When, Hien Nguyen. So, that's something that's been pretty positive. We've lost some things over the years too. Sometimes when faculty members have left, we haven't been able to replace them necessarily with the types of people that we wanted. An example might be Frank Wang who was here early on when I got here. He was a probabilist and a statistician, but more of a probabilist, and he kind of mixed the two areas. And it's, we've never truly had another probabilist-type person here. We've had more statisticians, but where they haven't had quite the interest that Frank had. But Frank was able to kind of bridge the two areas of mathematics. That's not to put any of the faculty members down that are here now, but… This has been kind of a unique place in that it, for a small department, it's had a pretty good mix of people who aren't local people necessarily. I mean, it's had, it's been almost common international community. It has not until more recent times had enough women, probably, in the department. But, it's changed in that regard, and we've made an active effort in the last few searches at least to try to find women to fill the positions. And I think as time goes on, that'll change and help the department too.

DF: So, do you think there's a reason why faculty tend to stay here? I'm not sure every department around…does that happen, and do you think the

new faculty will have the same sort of tenure if you will, in the department?

JL: It's hard to say, there have been a few people who have left, you know, over the years, have come and stayed not too many years. I'm not, I don't know. The reason I think people have stayed in the past certainly is not because of salaries, because the salaries are fairly pathetic. But, of all the places that I've ever been in math departments, even though we may not always get along with one another, this has been a pretty friendly, easy-going department where people have pretty much respected other people's ideas. That hasn't happened where I've been at other places. Emory when I was there, shortly after I left, the department had a battle basically and split up. The same thing, same type of thing under different circumstances happened at Georgia State. I haven't seen that happen here, and I don't mean that everybody has always been bosom buddies with everybody else, but there's been kind of a sense of community in the math department that's been here over the years that I think is kind of unique. At least it doesn't happen in every place anyway.

DF: True.

JL: And I think that's important, I think that's kept people here. The other thing, and this has to do with, somewhat with respecting other faculty members, but faculty members have been given a lot of freedom here to do what they want to do. And, I know I have always been allowed to do pretty much what I want to do in this department. And being in mathematics education in a department of mathematics, that had potential for real problems, and it could've had real problems at other places, but here, the department members have I think, have respected me and let me do what I wanted to do. So, I've appreciated that, and I hope the new faculty members are receiving that kind of treatment, because I think that's one of the things, the collegiality of the department and the respect of your colleagues goes a long way toward keeping people around here.

DF: Yeah, but the reason I asked that because this may or may not be the same answer to the next question that I have, which would be, you know if there is one thing that you think about one good asset, one, something to have the department to hang their hat on. Do we have a singular best asset, or is it an accumulation of them?

JL: I can answer that in two or three different ways. One of the ways that I would answer that question is for me, personally, finding someone with whom I could work in mathematics education over a long period of time was super important. And Rick Billstein and I have been able to do that for many, many years. We haven't always agreed on everything, but we have been writing articles in books together for over 20 years now. We've

given talks together, we've taught classes together, more so in some of the earlier years than we're doing right now because our interests have diverged some, but just having a colleague like that with whom I could work has been a tremendous asset for me. For the department as a whole, probably the best asset that it's had over all these years is, generally speaking, the ability of having the students and the faculty be able to talk to each other. The department's small enough that basically everybody knows everybody else. I think that's important too. So, if I had to pick out a single kind of asset, for the whole department as a whole, it almost has to be that one. Because people do know each other, and they generally know what each other's doing.

DF: Right.

JL: That's not always the case in terms of research and things like that, but generally speaking, we know what each other's doing. I think that's pretty helpful. Probably one of the best assets this department's got. It's had a graduate program that is not huge, it had some good undergraduates, and I think having faculty that know many of the students has helped. Kind of wandered on that, but… that's the way I feel about it anyway.

DF: That's what happens. Well, since you've mentioned your obvious interest in math education. Some people are goal oriented; some people aren't. You mentioned it was important for you to have a colleague to work with, but as you've gone through your years, has there been a goal that you have always wanted to achieve, or a series of them, you know, have you done it, or do they change to much to say, ok, check that one off my list let's go to the next one?

JL: It's pretty interesting…Years and years ago, a colleague from Helena and I were sitting around having a beer and talking one day, and saying we'd like to have some major kind of National Science Foundation curriculum project to be the swan's song. Well, I got to do that with SIMMS [Systemic Initiative for Montana Mathematics and Science]. It just came a few years to early, but that truly was a goal, forever. Rick and I had a goal of working on an elementary school curriculum to see if we could make some changes in it. Together we wrote the grant that eventually became the STEM [Six through Eight Mathematics] Project, and because I was also involved with writing the SIMMS Project grant at the same time, when they were both funded the same year, a decision had to get made. And I wound up with the SIMMS Project and he wound up with the STEM Project, so we kind of got our goals in some respect, although not exactly where we had expected them to be. It was a real shock to get two major grants at the same time, and it's kind of like having the best of all worlds and the worst of all worlds. Yes, you got what you wanted, but you got too much of it.

DF: That's right, how am I ever going get it done.

JL: But I mean, that was a goal. I mean, and it was for me, at least, a stated goal at one point in my career to kind of do that kind of thing. There have been some other things that I have wanted to do. I tried very hard to write a geometry book, and had a contract to write it, wrote enough of it that I could teach out of it about three times, and decided it was a disaster. So, it's sitting over in the filing cabinet. So, there have been a few goals that obviously have not been met, and never will be, because I'll never finish it. I figured if I couldn't teach out of it, nobody could. And…

DF: You are your own worst critic.

JL: So, there have been some things like that. And for what's coming up, I mean, there's still a few that I want to get done. I'm working on a National Council of Teachers of Math Project right now called the Figure This! Campaign, and it's got another couple of years to go. I am about to start working this coming week as the editor of the secondary mathematics portion of the Addenda series that will go with the new standards of NCTM that will be published next April. And it'll be a series of books, probably six of them. [Telephone rings.] One of the other good goals that came out of the SIMMS Project is working with people like Maurice Burke at Montana State. I found my colleague there to be super knowledgeable and easy to communicate with. So, one of the assets, particularly for the math ed community that this place has had for me, is the ability to work with other math educators across this state. Glenn Allinger and Maurice Burke, Lyle Anderson, three in particular are outstanding people, and I'd rank them with anybody anywhere in the country. So, that's been pretty wonderful.

DF: Tell me, I don't know why, what is Figure Disk Campaign?

JL: Figure This!.

DF: Figure This! Thank you.

JL: Right. The National Council of Teachers of Mathematics got a grant from the National Science Foundation and the Department of Education to write materials that could be used with middle school kids and their families at home. And it's coming out in a print version and also a web version. And this is something, it's one of the first times that those two government agencies have really tried to work together to do something. And I mean really work together with their hands in it, not just give the money and say 'bring us a product when you're done.' And I'm the project manager for the National Council of Teachers of Math side of it, and we will produce

about 80 problems that can be used with kids and their families. The first 15 are done, and we'll continue over the next couple of years to try to do the other, whatever it is, 65. So…

DF: Sure, over a variety of topics?

JL: It's, pretty vague directions from the Department of Ed. and National Science Foundation because their supposed to cover all of mathematics that kids might see in middle school, and, but they're a series of distinct, individual problems.

DF: Ok.

JL: So, it's kind of challenge. There are about 15 writers from across the country. There's a chair of the writing committee from Boston University. My immediate boss on the project is from the National Research Council. And the three of us manage the writing of the product and then hand it off to a public relations firm who are doing the design and printing of it. And it's all done in coordination with the National Action Council for Minorities in Engineering in New York. So, the three groups, the public relations firm, the National Council of Teachers of Math, and NACME, the National Action Council for Minorities in Engineering are working to produce this stuff, and we have a web site where it's available by web, or people can call and get it for free, so…

DF: That's great.

JL: It's, takes up a considerable amount of time, so. I've got another year or so, to work on it.

DF: Just the traveling alone, I'm sure. Well, then as we've discussed the changes in you work itself, as we've broadened the scope, and say, so how has math, or how have the courses in math been changed? Or how do you expect it to continue to change? I don't think many people think nothing has changed, but…

JL: Personally, in math ed over the time that I've been here, lots of things have changed. I will talk only about mathematics education courses, but we have been instrumental since I've been here in putting calculators and technology in for the perspective elementary teacher math courses. Those were not there when I first came here. In fact, I worked with a graduate student many years ago now, on one of the very first calculator studies in elementary schools. And it was financed in a very small way by the Montana Council of Teachers of Mathematics. It was one of the very first studies that was done using grades 2, 4, and 6 I think. That was a long time ago, but based on what we learned in that study, we put calculators

into those classes. One of the next things that came along, Rick, Shlomo, and I received a grant from the National Science Foundation where we learned how to use Logo when it was in its infancy. And we incorporated Logo into those classes, okay. And got some of the very first computers that were on this campus. They were Apple II's. Eventually we got Apple II+'s and Apple 2 E's, and all sorts of other things. But those were some of the very first ones that we had around here for general use with kids. And we had a lab where they could get to them and use the Logo in that lab. One of the next things that has happened that grew out of the SIMMS Project was we put, kind of the first multiple use computer labs in the department, specifically for mathematics teacher education use, but then more generally we got money from the University to put them in for all math people's use. And one of the things that's grown out of that is our Math 401 class for secondary teachers, Math Modeling with Technology, which is about to be revised and renumbered as Math 301. The intent was always to let students learn how to use the technology to the point the point that they might be able to use it in their other classes. So, it's going from a 400-level course to next year, I guess it'll be a 300-level course. And, so, I mean, those are some technological changes that I think I've helped and with other people to be instrumental in getting that done, and I did not do it alone by any stretch of the imagination. But, that's a big change in a math department.

DF: Yeah.

JL: I bought my first calculator for that calculator study in about 1976, and now every department, I mean every department member has a computer sitting on their desk, and we've come a long way. I think it's changed the way we write mathematics. I think it's changed the way many of us think about mathematics. I think it is slowly changing the way we teach it. That's been an unbelievable change in a fairly short period of time, 26 years. But where we went from having almost no technology. Charles Bryan had one of the early pieces of technology, and it was the, the equivalent now would probably be a $1.95 Calculator that you could buy at K-Mart, but I think that initial calculator cost about $1500 for this department, and that was early on when I got here. I think that's changed. I think the use of the computer and computer lessons even to do traditional type mathematics and the way it's delivered and the way students turn in homework, I think all that's changed math a lot. There are things you can do in mathematics now that you could not do without that technology. I mean, that's not taking anything away from the theory; that's just plain thinking about big numbers or small numbers, or numbers or operations that you simply couldn't deal with by hand, they took too long. You couldn't even approximate it then. One of the big changes in the mathematics itself that I think is coming is going to be the use of recursive formulas more and more and more, because lots of spreadsheets use that

kind of formula. And I think that's going to change certainly some of the lower division type math courses. It's almost the same kind of revolution you got when you're talking about a slide rule. You know, many, many years ago, which is, they were popular when I was an undergraduate. You know, now you would never catch anybody with a slide rule, but most everybody has some kind of calculator, graphics calculator of some kind, and a computer, or computer accessibility. We didn't have that before, and it's going to, I think it's changing the mathematics we teach and how we teach it, both. Probably at some point, we'll do away with it, more of the drill, and that's going to be I think one of the bigger challenges for university math departments…

DF: Sure.

JL: …is to decide what is it you can throw away and not lose anything, or not lose much. And there'll be more and new stuff that comes along. Pretty exciting time actually. In the past it took roughly a hundred years to get anything incorporated into mathematics. I mean, here we are the computer is what, 60 years old, and…

DF: And look how prevalent it is.

JL: But in 60 years it's gone from being an instrument of the government in war departments and things like that, to being accessible to nearly everybody. It's a lot faster than some of those hundred year changes. So…

DF: Yeah. Two questions, with absolutely no relation to each other, but as we're still thinking of maybe the future here, and we're in a new century, would you have an idea as to what might be included on a new list for the new century if Hilbert were to come back from the grave and know all that was to happen, but something for a new list of Hilbert problems?

JL: I have a hard time with that. I'm not enough into research mathematics probably to answer that question. So, I don't have a good one.

DF: Alright, fair enough. That's great. So, my last question, which is a good summary because in one question you can incorporate a lot of things, but you wouldn't of stayed doing what you're doing unless you enjoyed it. I don't think. Whether that be as a teacher or doing your research or a combination of the two, but do you have a favorite memory or anecdote that you, when people say why do you do what you do, and in the back of your mind something clicks and you think, jeez, you know?

JL: It's an interesting question. My wife and I had this conversation not long ago, and the question that we were thinking about is, 'What would we change if could go back and redo any of it?' And the truth of the matter is

'very little.' Very, very little. When I think about my time here at the university, not all the memories are good. I mean, I can distinctly remember the first talk I gave after I was a faculty member here, and I gave it at Washington State. I got invited to come over and give a colloquium. Unfortunately, they wound up being on a holiday, not having any students. There were about 8 faculty members that showed up in an amphitheater type room, and the talk was a disaster, and included in that was the fact that we had a blizzard that night as well.

DF: To make matters worse.

JL: If I hadn't had another talk scheduled for the very next day at Eastern Washington, where it turned out to be a really good experience, all except driving in the snow storm to get there following a snow plow, I'm not sure I would have remained in mathematics education another year. One of the good things that happened out of that was I came back and talked to Howard Reinhardt who was one of the faculty members here, and he gave me some good words of encouragement, and said, 'okay, chalk one up as being a very bad experience, see if you can get beyond it,' you know, and helped a little in trying to do that. It's one of those experiences that without a doubt kept me in it, and at this university, and I tried to tell Howard that in later years, but I don't know that I ever got that totally across, but it's something I'll never forget. Wasn't a great experience, but it was one that certainly lasted with me. And there have been many other with Rick and Shlomo in traveling, going to math ed meetings and being on the road. Watching Shlomo with his interesting diets that he had over the years, and Rick's reaction to him, and Shlomo's reaction to the world. Watching other faculty members in their interactions with people here, some of them visiting some of them permanent are pretty incredible stories, some of which aren't worth repeating, but watching a visiting faculty member occupy a tenure-track faculty member's office for a year and going in one day and finding a rotten apple stuck between two books. There are little snippets that you can sort of pick out that are interesting. The people in the math office have made, over the years, this place be alive. Vera Hanner when I got here, Valerie Crepeau who came, I describe her as a child. She and I got here about….? (Tape ends).

Interview with Dr. Merle Manis (MM)

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by

Merrie Rampy (MR)

MR: Interview Dr. Manis, the day is February 24, and the first question we're asking is why did you choose to become a faculty member at the U of M?

MM: Well, I had a bachelor's degree from the University of Montana, and I'm from Montana, so I'm very familiar with the school, and I also, at the time I finished my Ph. D. had a wife and four children, and looked around at other universities I could go to and the cities that they were situated in, and decided, of all of them, places that I wanted to raise my children, Missoula was probably right at the top of the list. They wanted me here so I came.

MR: Where did you get your Ph. D. then?

MM: University of Oregon.

MR: Well, the second question isn't directly related to that, but it says, 'Who was the most influential person in helping you choose mathematics as a career, and how did they influence you'?

MM: Well, I can't actually say that I chose mathematics as a career. I drifted into mathematics. When I started out as an undergraduate, I didn't know what I wanted to major in. It was out of a small high school in Montana, and, but I felt that whatever it was I was interested in, it was going to require some mathematics. And so, I also didn't know whether or not I could make it through college. And so, I decided one way to find out is to get mathematics out of the way first, and I just never quite got it out of the way.

MR: What, you said small school in Montana, where?

MM: Charlo, just 50 miles north of here, in the Mission Valley.

MR: I'm familiar with the town; I have in-laws there, in-laws or something…

MM: And you know, ordinary people off the farm in Charlo didn't go to college. But I had the G.I. Bill; I'd been in the service, had the Korean G. I. Bill. And figured what the hell…?

MR: Couldn't hurt.

MM: …couldn't hurt. Probably beat working for a living, and it did.

MR: So, you didn't really expect to graduate, when did you finally realize that math was what you were doing?

MM: Well, by the time I started my junior year, I already had enough credits in mathematics for a degree so I decided, that might as well get the degree in mathematics, even though physics was more interesting.

MR: Was that what you were?

MM: Mathematics was easier.

MR: You were pursuing physics then too as an option.

MM: Yes, I came up three credits short of a physics degree because I hadn't finished German, and it conflicted with the courses I needed for a math degree.

MR: You have my sympathy on that one.

MM: Yeah, back in those days, serious math majors were also physics majors, and conversely.

MR: It was. They pretty much went hand in hand.

MM: Yep, so.

MR: So you didn't have any…?

MM: Like I said I just drifted into it.

MR: And you didn't have anybody, any professor or anybody who said, 'you should do math; you're good in math'?

MM: Well, yeah. I mean, this was a small school, you know. Yeah, I attracted attention; it was practically assumed that as a freshman. I mean, by the time I finished my first quarter, some of the faulty members were basically embarrassing me by talking to me on the sidewalks. You know, I tried to hide, but yeah, I did well enough my first quarter here that the faculty knew who I was and they all talked to me. Probably Hashisaki was, Joe Hashisaki was one of the more aggressive of talking to me about mathematics. I mean, I didn't, I mean, I thought that was just part of their job I guess. Because I never really felt like I'd probably finish college; I mean every spring I left college permanently, and worked for the summer, and at the end of the summer, I decided that going to school beat working, so I'd go back to school. And, by the end of my junior year, I , well it was obvious that I'd get a degree, but I wasn't at all sure when I'd do it, but…

MR: Well, in math especially.

MM: Right.

MR: Well, that kind of leads into question number three which says, 'what were your goals when you started, and have these been accomplished; have they been altered? If so, how and why'? And I guess when we wrote that question we weren't specific to when you started here at the U, or when you started your…

MM: Right, I was going to say it's not terribly specific to when I started what.

MR: So, you get to pick when you started your…family, I don't know.

MM: Oh, I though you wrote that. My goal when I started school at the university was just to satisfy my mother who had wanted me to go to college. I figured I'd go back into the service as soon as I flunked out. So certainly my goal wasn't to get a degree when I started at the university. I

didn’t think that I’d get one. And, I don’t know to my junior, I was taking courses with graduate students, and decided, that well, you know I thought it was sort of unfair that they were getting master’s degrees for what I was getting a bachelor’s degree, and so I decided that I’d get a master’s degree, and applied to NSF for money. Sputnik had went up so there was money available, and they paid for my master’s degree. And I felt that, I don’t know, probably end up teaching or something. My senior year I went into the, you know to take tests so that, tell you what you should do, and it was the first time I was ever told there was anything I couldn’t do. And they told me that I couldn’t teach secondary school.

MR: Were you thinking, oh, high school?

MM: That’s right, they said, ‘Don’t bother! You’d never be able to do it.’

MR: Huh?

MM: And, so then I wasn’t at all sure. I applied for a few jobs, a couple jobs when I was going to graduate with a master’s degree. A couple jobs teaching, and didn’t get any offers. But I did; I applied to a couple schools for graduate schools and got more offers than I applied for that; faculty in other words took the opportunity to apply for me. But I wasn’t, at that point, still didn’t have any means and since I didn’t have anything else to do, to work on, I took an assistantship at the University of Oregon, and went to, went there. And, then I got, got married just before we went there, and the woman I married had a couple of children, actually three. And so after I got there, it was a little bit tight on money, so I decided to try to get a job. And I went out to Boeing who was hiring people with master’s degrees. I figured it would be, should be a shoo-in. I had a pretty good record, academically. And what happened is I had too good enough record academically. And I went in, and thy started out the interviews, and their reaction is, you know, well, we don’t anything to keep you interested, why don’t you go talk to this next level up. And I spent all day being pushed one level up after another because they didn’t have anything that would keep me interested. I finally got to the top level; and they said yeah, there were interested in me, but I had to finish my Ph. D. Anyway…

MR: Caught in one of those loops.

MM: Right, so I went home and figured well, I’d reinstate my teachers’ union membership, but my wife had sent out Christmas cards, and she had told the people here that I was going to drop out, and they had called and offered a position. They had one starting in the spring. Actually I guess it became winter quarter that they’d hired me. So, I came back here, and I’d done a little bit of teaching at the University of Washington as a graduate assistant, and started teaching here, and I decided that was, I think that’s

probably when it first sort of developed some aims because you might say I really got out of standing in front a bunch of people, bullshitting about mathematics. And I like that; I've always liked mathematics. Anyway, so I came back here with a two-quarter contract to teach, and they offered to renew it for the following year under condition that I would apply for another NSF fellowship. And so I applied for another fellowship, got it, didn't, paid well enough that, I didn't have any excuse just for not going on. It was renewed again the next two years.

MR: Did you actually finish your Ph. D. here?

MM: No, I went to the University of Oregon. I went there because I really felt that I could pass the German exam there, and I knew if it wasn't dumb, I'd probably pass it. And there was a person there that I did feel that I could probably, would be good to work with. And so, NSF paid well enough that one of the job offers I had after finishing my degree then, it was less than I was making. This NSF fellow, and so I didn't have any excuses not to go. So, I drifted into graduate school. I finished my Ph. D. out there in '65, something like that. And it was just before the…NSF had really kicked in a lot of money about then…

MR: For teachers especially.

MM: Pardon?

MR: For people who were in education, to try to bring us up to speed in the sciences, right?

MM: But they pulled a lot of it in, the year I graduated. The year I graduated, every school in the country was looking for mathematicians. They pulled in money off a lot of people that were in faculties that were on NSF money, research and teaching, while I was going to school, and a year after, they all had to go back to teaching. The year after I finished my Ph. D., nobody wanted any mathematicians. So, I also finished just at the right time.

MR: Sounds like it.

MM: I could of, when I finished I could have went to any school in the country. The job market was that good. People that I went to school with, and finished the second year, were four or five years trying to find a tenure-track position.

MR: Nothing open.

MM: I finished just at the perfect time. And my, I gave you reason for coming back here… Montana's, it's a good school. Much better than the state deserves. And it's a good math department. They instituted offering a Ph. D. while I was at Oregon; they weren't offering a Ph. D. degree here when I went to school here and was teaching here at first. I've always felt that was a mistake. It's not a big enough school for, to offer it.

MR: No, we shouldn't have a Ph. D?

MM: It's not a big enough department to offer a Ph. D. in it. You have too few students, spread out of, over too many disciplines at too many basic levels of where they're at. I mean, you know there, have six or eight disciplines, three or four levels of how many years you're into it, and what you're up into the 20s as far as the number of people ready for any one particular class that might be offered. You can't offer classes that are big enough that, where there's really any competition, and you need a modest amount, you don't need a lot of competition between students; you need a modest amount for people to, you know, to get students to work just a little bit harder. And, you need bigger classes in order to go very deep in the subject. And it wasn't…

MR: Okay.

MM: It wasn't there while I was teaching…

MR: Do you think that's true in the master's program, or just the Ph. D. program?

MM: Ph. D. program. The master's program's real shallow and they're not going into any specialization very strongly. I mean, the math, when I got a master's degree here, it was a very, very good master's degree program, and I think it continues to be a fantastic program. You just, it's always surprised me how good some, a lot of the students have turned out, were. But they also didn't have the background that they should've had, as far as depth goes.

MR: And that kind of leads to the next question. It says what changes has the department gone through since you've been here, were you directly involved and what did you think of them? It sounds like you weren't here right away, but right away there was a Ph. D. program added. What other things have happened? You've been here; you were here for quite awhile.

MM: Well, quite a few things happened about the time I came back. Of course there was, I came back in the mid-60s , and of course the Vietnam War protests were in the later 60s, and it spread onto the basic (?) movement. The 70s, and in the 70s, the students decided that they knew what they

needed to be taught, and the universities and a lot of the faculty members, not necessarily in mathematics, indulged them. I will always feel that education at the college level took a nose dive in the mid-70s.

MR: And you don't think…

MM: And I don't know that it's ever flattened out as far as going downhill, as far as what the (?) was being offered and the expectations of the faculty to what the students…

MR: Do you think in the math department, that's been the case?

MM: Definitely, certainly. I mean, what happens when you water down the freshman course? Sophomores come along, they're not ready for sophomore level courses, so you water those down, and over the years, junior level courses are watered down, and after five or six years, you have to start watering down the graduate level courses also. Because the students just flat at any given point really learned at the level there were 10 and 15 and 20 years earlier. They're not! They are not as well prepared. They're every bit as smart, but they're not as well prepared, and they have, you also, because they've been babied all these years have a totally different attitude than students had when I was going through school, and when I first started teaching.

MR: Some of the privilege versus responsibility type of thing?

MM: Right.

MR: I taught high school for a long time, so…

MM: You know, you always had students that, you know just sort of wanted to get validated. They've always been around, but not as high a percentage. There's still some awfully good students up there; there are, I mean they're every bit as smart, and a lot of them are just every bit as motivated, but I don't know, maybe a part of it is the population of the state of Montana really hasn't grown much in the 30 years since I got out of high school. The, when I came here in the mid-50s, I think the student population was around 4500. What is it now, around 11 or 12? The population has stayed about the same; the number of students has tripled. Two-thirds of those students probably, well a lot of them are out-of-state, but they're not the best students from out-of state, probably two-thirds of those students shouldn't bother. And the third of the students that would have represented the third that's been going when I was going, they're so good, but you've got…

MR: So what would you recommend?

MM: …so you've got these other two-thirds…I don't know how you turn it around. I have no recommendations on how you turn it around. I wish junior colleges were trade colleges, I mean, really do need trades. They don't need laborers, but they do need trades. Well, the students are, they're not going to, they're not getting anything out of it. All they're doing is getting four years older. Maybe that's…

MR: Necessary.

MM: Maybe that's all; maybe that's enough. I mean I've always felt that…that's the main thing anybody every got out of high school. That's certainly all I got out of high school, is four years older, but it was an important four years older.

MR: Right.

MM: And the four years older after high school is probably, well it was obviously very important. I was not ready for college when I got out of high school. I kicked around for a couple years out of high school, I was ready to go to college. I really wasn't any more than most of these people out here now are. I needed those four years; I'm just not sure college is where they should be while they're gaining those four years.

MR: Right. I'm reflecting on my students, as I say I teach high school and have for awhile. There are a lot of them who could use…

MM: They need four years…

MR: Something between…

MM: I think I'd probably flunked out of school if I went right out of college, college right out of high school. I needed four more years to grow up. I mean I didn't. I was too damn dumb to know that, but … I did; I needed it. And, I think this is a lot, you know a lot of the kids I knew when I was going to college had also been out of school four years. A lot of my friends were ex-service people.

MR: Yeah. That's what I was thinking.

MM: They were, but, they were four years older than the ones who were just coming. And it showed then, and it, how mature they were, the function of college. I think those four years are real important. But, we've got too many of them spending those four years in college, and they're not ready, they're not interested. They're not anywhere close to mature enough to get what , what they're paying for.

MR: And what they could get.

MM: Yeah. I don't know. My feeling is, my time I spent in the service is very valuable. I, but when young men ask me what they should do, I often suggest that they go in the service for two or three years, take advantage of the programs that are, sort of, like the G. I. Bill and the service still has, grow-up a little, attitude gone…

MR: Get away from mom and dad.

MM: …come back in four year and with the wherewithal, the maturity to gain something and go to school. I think universal military training is really great for the boys. It didn't do much for the girls; all it left for the girls was getting married. I mean, in fact,…

MR: Well, that's changed.

MM: I mean when I was…

MR: Right, even when I was a young person it wasn't really an option, and now it's much more so.

MM: So, I don't know. That…

MR: It'd be interesting if they could implement something. That you didn't jump right out.

MM: There's nothing wrong with the kids, other than they're not grown up.

MR: Well, yeah. I guess that's been my experience as a high school teacher is, they think they're leaving for college in three months, and they don't have a clue what they're leaving for; they're just getting out of Dodge.

MM: Yep.

MR: That's all they want to do.

MM: And they need to, they need to get out.

MR: But maybe not, while their moms and dads are paying $15,000 a year to go somewhere.

MM: Or when the state is paying that much for the…

MR: Right.

MM: Yeah. I don't know. It's not the kids' fault. It's the system. In, you know, when I was an undergraduate that system wasn't here yet. You know they didn't have easy loans and whatnot, and guys on the G. I. Bill have worked to go to college; everybody else had to have six separate sources of money.

MR: Right. Student, in fact even it's been in the last 20 years that the loans have become so prevalent, and you're getting. Because even when I came through and, I'm a generation after; I started school in the early, early, early 70s. You paid your own way pretty much, unless you were G. I. stuff, or even scholarships.

MM: You were going early 70s, that's when I was just starting to teach right?

MR: We may have shared a class.

MM: Great, right.

MR: Although I have to confess, I'm not a math major; I was a…I have a biology degree. And I teach high school, so I went through and got sciences and then eventually added on the math, and I'm back in the master's and Ph. D. program, while I'm still teaching. Well, the next question kind of follows what you've been talking about, some of the difficulties with teaching students these days, and that is if you can think of one thing that's really positive about the math department specifically, some real strength it has? For faculty, students, or all?

MM: Relative to when I was a student here and actually, when I was a student teaching here, it's lost its strength.

MR: It's lost…

MM: A lot of its strength was the fact that there were small class sizes, and that the faculty, and the students could interact from the time the students were freshmen on up. The faculty and the students just don't interact anywhere near as much as they used to. And that was when I was going to school here, the main strength. When I was first started teaching here, that was the main strength of the department. The faculty, I don't think has, well, don't have anywhere close to as much time for undergraduates, and they definitely don't have as much time for graduate students either.

MR: Why don't, why has that changed, I guess? Is it a personal choice that you see the faculty making, or is it something the administration has put on them?

MM: A little of both. I mean, there's a lot more emphasis on the faculty since they are doing, having a PH. D. program here. Faculty research definitely cuts into faculty interaction with students. It puts it on a different plane when they do interact. And, the others, just the number of students changes both the attitude of the students to the faculty, and vice versa. Students get lost while they're here. And of course, that's a strength of a small school. It's changed from a small school to a medium-sized school. The strengths would still be, however if it's closer to a small school than a really large school.

MR: You still see as the same proportion of students coming into math?

MM: No, I don't …As near as I can tell, there isn't any undergraduate math courses at this moment, the moment when I've finished teaching, that was populated by, I'd say 90% of the students in the class was there because they wanted get what was in the class, they were there not because it was required but because…

Tape ends—only side A was used.

Tape 2 Side A only.

MM: …it's a complete diversion if 90% of the students are there because it's required by their discipline; with possibly 10% there because they want to be there. And that's total reversal of what it was 30 years ago. Where 90% were there because they knew they needed mathematics, or whatever it was they were studying, and maybe 10% were there because their discipline took the trouble to tell them that they had to do it. My feeling is that the quickest way to degrade a class is to require it.

MR: Is to require it? So…

MM: And all our math classes until you get into the upper division classes, and even basically they also are required.

MR: And in your time there weren't?

MM: There's no freshman course where you've got more than four or five people in there that was like I was.

MR: Who were just taking it for the fun of taking it?

MR: Right.

MR: And when you came through there weren't as many requirements; you just pretty much figured out what you wanted to study?

MM: No, in fact there was, you know, there was one section, at most two sections of anything. My calculus class, there was, I guess there were two sections for the first two quarters, and one section the third quarter. In each of the two sections I had maybe, 14 or 15 people in it, and in the third quarter calculus there was about the same in the third quarter, maybe 15 people.

MR: I know from talking to my folks things have changed pretty dramatically from when they came through.

MM: And that makes a huge difference. These were people that weren't there because they were required. They were going to be math majors, or physics majors, or they knew that they were interested in a discipline or not, that they choose to take calculus because they were smart enough to know that they needed to take it. Not because they had to have it on their transcript.

MR: We face that even in, to some extent, at the high school. If you require two years of math, those first two years, can be pretty crazy, but when you get up to the upper levels where kids are selecting to take it because they need it…

MM: All the difference.

MR: Yep. Well, you've talked a lot about the school, but the next question asks if there's an area of mathematics that you're especially interested in, if you're working in a certain area, or if you've done research or are interested in research, and if there's any place that you have published work? And I imagine you have bits and pieces around.

MM: Yeah. There are bits and pieces around. Abstract Algebra.

MR: That's your forte?

MM: Right. Oh, I'm a firm believer in basically, at least up through the master's level, being what I'd call strictly classical algebra, no specialties, until you start at the Ph. D. level. Which is a change in this school out here that I really, don't think has improved things much. I mean there's what, a half a dozen different, or more specialties at the master's lever. And that, as far as I'm concerned—B. S. There should be no master's, no specialty required to getting a master's degree. People, they're getting master's degrees, should know…

MR: It should be a general…

MM: General… body; they should have some… fairly strong connection with abstract algebra, classical and complex analysis, and perhaps a course or so, not a specialty as something that's not strictly classic. In that algebra and analysis.

MR: So, they know what they're doing first.

MM: I feel real strongly about 6that, I mean. I think kids that finish with master's degree, your… well, the last 30 years, very few of them have anything approximating a good background.

MR: Too specialized.

MM: I can't think of anything. Because I probably can't use myself as a thermometer, but there's many of them that don't know as much mathematics, when I finished my bachelor's degree, when they finish their master's degree.

MR: And yet there are more requirements.

MM: More, many more requirements.

MR: Interesting contrast that the school is obviously trying to make these people more well-rounded, better educated, but it's not working.

MM: No. That, only a student can make themselves well-rounded and better educated. I don't know just what, how it happens when we require a lot of things. They take more courses, and as many credits, but somehow it seems like they're too damn busy to learn. I mean, I learned much, much more outside of classes than I ever learned in classes, and seems to me like what we've done to some extent is with a lot of requirements, and whatnot, is made it so a student doesn't have any time to learn anything outside of class. I think we've made, we've made the courses worse by trying to cram more stuff into them.

MR: And the programs that have so many requirements that the students can't elect to take an extra math class for fun.

MM: And this hasn't improved the education; it's degraded it. The student doesn't have time enough to investigate on their own thing. I mean; I didn't learn mathematics in the classroom…

MR: It was all those days over the coffee and the…

MM: And reading on my own. I actually read math books as an undergraduate. And I had time, you know. We didn't cover as much. Calculus was then,

and still should be, was a sophomore level subject. It is not a high school level subject.

MR: And with the advent of some of the technology that…

MM: And, the students, even the students that had what you might say good calculus classes in high school, actually come…It's a detriment to actually learning mathematical calculus. You know, calculus, you think about, rather than what you do. I guess, one of the things that I think of as far calculus was the same as when I came and took chemistry. Lots of kids took chemistry and whatnot in high school, and most students, they didn't have chemistry in Charlo. And walked into chemistry class, and the guy who was teaching said, 'well, you know, a lot of you people who haven't had any chemistry in high school, probably feeling like you're starting out a little bit behind,' he said, 'but believe me, you're starting out ahead. You don't have near as much to unlearn as the kids that have had chemistry in high school have.' And he was right. I mean the kids that have had chemistry in high school thought they knew something, and they didn't because it taught a little bit of cooking.

MR: They hadn't learned.

MM: They hadn't learned anything about what chemistry is really about. The combinations and the thinking. Their chemistry didn't very much grow, and whatnot. And the same thing is, I think, goes to quite a large extent… high school for the average person. I mean, the good students, it doesn't matter…

MR: What you think…

MM: At all, but I'm not talking about the good students. I'm talking about the average student. The average students would have been much better off if they'd have spent their time doing Euclidean geometry and varied equations, more algebra and geometry.

MR: Get the basics.

MM: More basics. Calculus in high school wouldn't be high, because they took calculus at the expense of not having geometry and…

MR: …and not understanding it. You realize, you're right in the middle now of all that big, one of the things Johnny's talking to us about, the math wars, and…

MM: Well, I was towards the end, rally in a hurry, I wanted to get the hell out and retire before anybody asked me to teach reformed calculus.

MR: I understand. Well, you've actually, again…

MM: You know where I'm coming from. I was educated in, before calculators or computers existed, in a different world than what I'm teaching in, and it's an interesting dichotomy.

MM: Computers are wonderful things, and…

MR: They're nice tools.

MM: And if you know some mathematics, they are wonderful tools to use the mathematics that you know. But, until you know some mathematics, they have no place in a mathematics curriculum. That's my attitude.

MR: Well, you've kind of talked about it already, one of the other question says 'how has the content changed,' and you've talked, at least I think some about that. Was there any other area that you've seen, other than the idea of the reformed calculus, and some?

MM: Well, we've reformed everything. When you started college, I mean they had calculus and analytical geometry, but it was brand new. Before that they had, analytical geometry was a separate subject in the 50s. I guess that I'm enjoying my age, because that was in the 50s, the late 50s. They had separate courses in analytical geometry, college algebra, trigonometry. Calculus was a freshman-level university course. And in the early 60s, it began actually while I was in graduate school in Oregon; they decided that the way to go was calculus and analytical geometry. Analytical geometry was never taught again at the university level.

MR: As a separate?

MR: It was supposedly in the calculus, but it wasn't there. And it still isn't' there. And analytical geometry is a very important part of calculus. I mean, a good student eventually will sort of pick up analytical geometry on their own, but it makes it a lot harder.

MR: And it's just got dropped out of the calculus program as far as you know?

MM: Yep. They even stopped putting it on, I think on the covers of the books. I don't think that calculus books are called calculus and analytical geometry, where they were for 10 to 15 yeas.

MR: I'm trying to remember, and I remember seeing it on any of our texts. We have several copies in our school, different calc books.

MM: You do. Late 60s and 70s was calculus and analytical geometry, but that…books.

MR: Any other content changes? Particularly maybe related to the changes with technology, anything you've seen added, or dropped?

MM: Oh, certainly. I mean, a lot of the…there's been a lot of pressure to institute, in courses that are, computer-oriented that are set-up to use the mathematics that you do, can do with a computer.

MR: So, kind of a computer-based math?

MM: No, it's, I wouldn't say based, oriented. The... with baby linear algebra type things, and a little bit of combinatorics and whatnot. But they're your general, as far as I'm concerned, worthless courses that sort of can satisfy the requirements of different disciplines. I don't know, linear algebra has been pushed down into sophomore, junior level, and a level of mathematics that isn't worthwhile during that.

MR: So, the linear algebra classes, for instance that's being presented now, you feel has been watered down or reduced significantly.

MM: And the content didn't do anything. Linear algebra is part of, so-called advanced calculus, second-year, not just being taught matrices and stuff for, I don't see it to be, for the sake of teaching it. I don't know. They don't do anything with it. Or at least from what I've seen. They've got a course, 117 or something like this, out there for example, and I taught in the summer a few of time, and it's…; they do some linear algebra for half of it, and probability that other half, and…

MR: Right.

MM: It's impossible, you can't do anything with either of them in half of a semester. And there's other, you know there's been various and sundry times, lots of things stuck in like this. There's out there, I've never taught the…, I don' think they would of ever let me even teach it, but there's a so-called transitional course between undergraduate lower division and upper division, so called Introduction to Abstract Thinking or something like that.

MR: Oh, I know the course, I don't know…

MM: I sort of made an effort not to find out too much about it because I know I wouldn't like it.

MR: Well, you might give just the twist they need.

MM: No.

MR: Well, do you expect any additional changes, or do you just see this as a progression of watering down? Do you think it’s going to…

MM: Well, it’s not necessarily watering done; it’s smushing out. I mean, it's where you can now spend five years at the freshman level in mathematics, and after five years not know anything any deeper than freshman level. And it’s not necessarily watering down, I mean there’s a lot of mathematics at any level. It’s just, they keep getting wider and not… no depth; it’s just a matter of directing it.

MR: Spreading it. So do you think that’s going to continue? Can it continue?

MM: Yeah. And I think one of the reasons that it’s probably going to continue until they do something about what all these people are doing in college. Because that’s the easiest thing for the faculty to do. Stoop too hard to drag people up that don’t want to be drug up, and that there isn’t enough of them that want to be. I think we bore them enough at the freshman level that the good people, and I’ve seen this through the last 15 years, don’t stay in mathematics. They go into chemistry, biology, geology, et cetera, et cetera. I think we drive them out of mathematics.

MR: Because the good ones are bored, and the other people don’t ever get any depth.

MM: Well, how many people in these courses is even at all interested? The ones that are interested in mathematics are even more interested in something very (?). Good math, good students I’ve had in the last 15 years, and especially the last 10 years, in my math courses, weren’t math majors. I mean they could have been easily enough, but that wasn’t the direction they wanted.

MR: They enjoyed the math, but they were looking at other things.

MM: Yeah. And it’s not surprising, I mean they’re.. They’ll probably end up in mathematics anyway, because it wasn’t the classes, there were just inherently interested in it. But, you know there are great, wonderful things going on in all areas. It’s …

MR: It’s fun.

MM: Pretty strong competition out there. Especially from the biological sciences.

MR: It’s amazing, isn’t it?

MM: As far as interest groups…

MR: And what they like to call, cutting edge, new things happening.

MM: Yeah, and back in the olden days, we didn’t have that competition. There was some competition from physics, but not the…You had to have so much mathematics anyway that physics wasn’t that much competition. We need mathematics, but not in the same way in modern sciences.

MR: Well, when you figure we’ve made some major breakthroughs scientifically in the last 50 years, that’s going to turn things around.

MM: Well, how about the last 50, last 10. No, I think mathematics has a lot more of competition for the good students than we did 30 years ago. The competition for the good students wasn’t there.

MR: Well, there’s a fun question.

MM: There just wasn’t that much going on 30 years ago outside of mathematics and physics. Some in chemistry, but not near like it was a few years later, even in chemistry.

MR: Right.

MM: Mathematics, physics, and chemistry… There’s been some other areas that were interesting, but not near as interesting then as they are now. A lot of my friends are geologists which was pretty interesting, but there wasn’t as much going on now even there.

MR: Well, again, if you look to technology and what it’s opened up for us in terms of analysis of any data that we have. Pretty phenomenal.

MM: But I think that’s one of the things that’s happened, that has degraded the subject. But, you know, as a discipline as an undergraduate discipline, it has changed radically in 30 years. And not for the better as far as somebody that really loves mathematics. And it’s not the student’s fault, it’s the faculty and the administration’s fault.

MR: And you said the system?

MM: And I might add, I mean, how many times out there, how long have you been out there, just at the university at the graduate level?

MR: Oh, a couple of years.

MM: Have you heard anything from the administration about quality?

MR: No, the big difference for me is that I'm, in fact, the school that I teach at doesn't even acknowledge master's degree as a pay change, so I'm not in it for a salary or any of that. I'm going back because I've got a bunch of kids who are all growing up or grown, and I wanted to recharge a little bit. So, it's a, I'm coming to it bringing my own incentive, but in terms of anything from the university, no, they're not. It's not an issue that they're addressing. Not in that context, they're concerned with whether or not there's equity, and…

MM: Quantity is the word.

MR: All those.

MM: Retention, not quality. And that brings us totally all the way around because there's a lot of people up there that they're trying to retain that shouldn't be there in the first place.

MR: Somebody should acknowledge that this isn't going to meet needs. Unfortunately. But we started very early, that whole idea of 'this is for everyone'. Well, there's two fun questions for you to answer. One is do you have a favorite anecdote or memory that reminds you of why you enjoy being at the U of M? You can have more than one, but…

MM: I really don't. I enjoyed it, but I can't …

MR: No stories?

MM: None that should be told.

MR: I can relate to that too.

MM: I enjoyed it. I really did. I'm very glad to be out of it, but it's not… the reason I'm glad to be out of it has nothing to do with the students or the faculty. It has to do with just what's happened, the education, or what I perceive has happened in the last 30 years. Just, I mean, what you get out of teaching is reaction and interaction with students, and it is very depressing to go into a classroom with 30 students and at most two people who are at all interested in me or…

MR: Well, welcome to the world of high school.

MM: Yes, very much like they told me, 'I couldn't do that'.

MR: That, yeah.

MM: And the problem is, that eventually it's worked its way up. Universities are just almost as bad.

MR: Especially I would assume at the first couple of years before you get up into the…

MM: And this is what you spend most of your time doing. You know, you go ahead and teach calculus which is a neat, neat subject. There are lots of… I mean…It's built up that students are required to be there. They're not prepared; they're not interested.

MR: They don't really want calculus.

MM: They don't want to be there. And it's harder and harder to find anyone that you can get any feedback as far as enjoying the experience of teaching, because you're not teaching. You're talking to an empty room that's full of people, kids, bodies. That's why, it's good; I'm really happy to be out of there. It's just gotten to be too depressing.

MR: The last question, you get to think about; you may not have answer for, but one of the things that we did on our history class was to look at Hilbert questions because they…

MM: I look at that one, and I have no comment.

MR: That's okay, but that was for us, kind of a pivotal thing to look at to begin the class, and we spent our first couple of weeks of class doing Hilbert questions as part of our time, simply because it was so much a…; it gave focus to much of the rest of the century, and you were mentioning things, quantum physics, grew out of, to some extent.

MM: Amazing construct, in an amazing short period of time, but … brilliant people have practically no data then to work with .

MR: But what fun…

MM: Yeah. That was absolutely amazing period of physics, the 19s and 20s.

MR: It would have been interesting to be a fly on the wall at some those conversations I think.

MM: Yeah.

MR: Any final words of wisdom to share with us all?

MM: No, none at all. I know a lot less now than I did when I started.

MR: I know I know a lot less as I go along; I think that's the key.

MM: But, I've enjoyed it, I really have.

MR: You wouldn't go do something, go back and change it, be a physicist now?

MM: No, not really. No, I don't; I love mathematics. And…(tape ends)

Written notes continue to say:
Trend will continue until college again becomes a privilege instead of a right.

Interview with Dr. Robert McKelvey (RM)

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by

Daniel Finch (DF)

RM: I came here in 1970, and at that time I was 40 years old, so unlike most people who come kind OF come in as first job, I was already a full professor at Colorado. I had been the chairman of the Department one time. And, I had two objectives when I came here. These were things that, well, first, in my own professional career I was in the process of making a very sharp change in what I had done. Up to that time, I had been involved in pure mathematics, differential equations, and functional analysis. But, while I was there I was active in the local environmental causes. And I wanted to; I decided to find a way to make my professional life and my interests in those things run in parallel tracks.

DF: Sure.

RM: And so I decided I would get involved in applications of mathematics to natural resource issues.

DF: Yeah.

RM: And I thought I could do that better by coming to a small school than by staying at a large one. In retrospect I probably was not right about that. The larger schools have more possibility of setting up special interdisciplinary institutes. Whereas the smaller schools are surprisingly rigid, as this place has always been, about people who cross departmental boundaries.

DF: Right.

RM: So anyhow, I, but nevertheless, that was my first goal, and I thought I could do it in a smaller place. And the second goal was, I was trying to promote the idea of a different kind of doctoral degree from the usual one that research-oriented universities have been following since they took up the Germanic model in the early part of the 20th century. And I, it seemed to me that this wasn't the most perfect thing for people who were going to teach in small colleges, primarily teaching undergraduates. And, it seemed to me more appropriate for them, for those people in their graduate careers to have much broader training, to become more competent across the broad field of mathematics and its applications, and not be focused narrowly into some particular research topic. And I tried to persuade my colleagues at Colorado to do that, and they wouldn't touch it. So I had to find a place that might. At that time, this is 1969 or '68 when I was thinking about it, most of the small colleges were having a hard time getting faculty members who had advanced training. There was a shortage of qualified people. It was definitely a seller's market, those days; now it's a buyer's market of course. And, so even very good four year colleges had a lot of trouble getting anybody with more than a master's degree. And so, there was really a market for people of this kind, it seemed to me then. And this school seemed like a good place for it because most of the faculty who were here at the time were people who'd come here when this had been almost exclusively a teaching institution. And they were people who were very much dedicated to teaching themselves. And the school had only a master's degree program in mathematics. And so, I came here with the proposal to create a doctoral program of this somewhat different sort. It's a bit like the thing that was called a Doctor of Arts, but I thought it was in a somewhat higher intellectual level than most of those are. But that was idea. And initially, it was pretty successful. I was able to wangle a pretty large grant from the National Science Foundation to bring this about. The grant involved for example, paying the salary of four new faculty members for a period of, I think, three or four years. At which point, that was to be taken over by the university. It provided for sabbaticals for several of the people who were here. They didn't have a regular sabbatical program at that point, so that the, I think it was Bill Ballard, Bill Myers, and Howard Reinhardt all were able to go on sabbaticals for maybe the first time in many years through this. And, it provided to bring in and pay people who were currently teaching in small colleges who had master's degrees and who wanted to try this new kind of Ph. D.

DF: Oh, is that right?

RM: Yeah. And we got some really able people as teachers in that way. But then, that went on pretty successfully for about 10 years, but then it really dried up. And it dried up for two reasons. The first was that the university here didn't come through with its share of funding, so the NSF didn't

renew the grant. And the second reason was that, at, by the end of the 70's, the thing had switched over from a buyer's market, from a seller's market to a buyer's market, and there were lots of Ph.D.'s out there. All of them trained in the traditional way, which was more acceptable because it was the traditional way. And, so any small schools could then get people with this kind of a training background and it was the safest thing. And so our program gradually withered away. That period also marked the time when the faculty here changed its character from being largely people who thought of themselves mainly as teachers, to people who felt they would be researchers, at least part of their activity would be researchers and training people to get doctorate's degrees. And so that transition was occurring too, so there was less interest here in such a program as well. So, that's gone, but I still think it was a good idea, and maybe someday somebody will revive it somewhere, but it's gone from here. Anyhow those were the reasons I came. And I did follow up working in environmental areas and I've been doing that ever since. For example, currently, I retired in 1993 from teaching, but I still actively carrying on a research program and I'm, you know, I have two grants going now. And, I'm being funded through the, not the mathematics branch, but the biology branch of the National Science Foundation. And I'm no longer in the Mathematics Department here; I'm in the Economics Department. And I go to meetings where there are people who are biologists, engineers, economists, all kinds of people, applied mathematicians too, but it's very, very interdisciplinary what I've been doing. And so, in a way, that has been quite successful, although. And it's really the people I collaborate with are all over the world. And that's another thing. You don't have to have them locally, collaborators, because travel is so easy; contact through the Internet is so easy.

DF: Sure.

RM: For example right now I'm collaborating with a couple of people in Norway, and somebody from well, from Russia, who's visiting.

DF: Who's now here?

RM: Giving a talk this afternoon. And I've been talking to people in Australia, New Zealand, and South Africa, Canada, and all over the place, so it's possible to do that now, even from a small place where the library's not to good, it's all you can do.

DF: Sure.

RM: So that's my personal background and career. So then let's see what your other questions are here. How did I get into mathematics? I started out--originally I was in physical sciences and I have a bachelor's degree in

physics, and switched to mathematics in the graduate program. I don't know who in particular made me move over.

DF: Might have swayed you over.

RM: But, as an undergraduate I became more interested in the logical structure of the subjects. And people in physics and chemistry are sort of sloppy about that. And really, I was uncomfortable doing things that way. And that's probably what moved me over into mathematics. But I maintain an interest in application always. And even before I made this environmental switch, I was involved in applications to physics, to quantum mechanics, to things like that. And then I switched over completely when I made this switch. It's totally different kind of math. Mathematics used to be linear mathematics and infinite dimensional spaces, and now it's very non-linear kinds of things, lots of statistics, and probability that I learned. Most everything that I know about mathematics I learned since graduate school. It's been a constant evolution of learning new things. And I think that's something that most people expect to do these days. It's not good to stay put, stuck in whatever your dissertation was for the rest of your life.

DF: Certainly.

RM: It's much better to move, even though it's sort of hard to do that sometimes. Particularly for young people because for young people they need to get papers out if they are going to be recognized. And later on, you get more and more freedom and independence to what you want to do. So, I've already told you what changes have occurred in the department and some of my goals.

The best asset of the department and the university: Well, I think there are advantages in being a relatively small and tentative kind of place. I think this place has a better faculty overall that would ordinarily have because of its location in the mountains. So that is sort of an important asset of the university. Otherwise, I think it's typical of many universities that are our size, and particularly, a state university in small or less affluent states. I don't see it as being particularly different, particularly better, particularly worse than those others.

What areas are you interested in? Well, I sort of told you.

DF: Kind of covered that.

RM: The applications of, involve a lot of differential equations, a lot of stochastic processes, like Markov processes, and therefore a lot of probability and statistics. Also, one of the things that I have found particularly rewarding is that I have to always delve into new fields in

order to deal with these problems. And they're not always in mathematics. So, I've learned a lot about population biology, and a lot about resource economics. Things that I wouldn't get to do otherwise. And I don't think you can do good applications unless you understand the applications as well as you understand the mathematical techniques because if you pick the wrong thing to model, if you misunderstand what the problem is out in nature, you make beautiful mathematics that's got nothing to do with reality.

DF: Certainly, that doesn't make any sense, that's right.

RM: And if I have any criticism of people who do applications for mathematics department, it is that. That they often do not understand the application, and the applications they don't really apply. And I could go on about that. Where can you find examples of my work? Well, I can give you lots of papers.

DF: Sure. We know.

RM: They're, most of what I've published since I've been here, have been published in interdisciplinary journals in one field or another. And in fact I actually had started a journal; it's called *Natural Resource Modeling.* Which I started back around 1965 before I came here, and which I've edited most of the time since. Except there was a hiatus of four or five years that I turned it over to somebody else, an economist from Berkeley. But, the journal got into trouble so I took over again. And I'm just now retiring from that, and turning it over to somebody else. And that publishes the kind of thing that I'm interested in which is applications to these natural resource environmental fields which involve fairly sophisticated mathematics. So that, often the journals that are just in those application fields don't like to include that much math. And I've got copies of that journal; in fact the library has it too.

DF: You know, and, how do you go about starting a journal? I mean obviously it's got to be, well, I would think it would be an arduous task. Maybe.

RM: Well, in fact that's the second one I started. When I was chairman in Boulder, I looked around for things that I could do from that position. I wasn't there very long, but I mean as current chairman, it was a rather short time, but I did two things. First, I thought at that time the whole Rocky Mountain region was rather isolated mathematically. And so, I organized a consortium, we called it, of universities in the Rocky Mountain west called the Rocky Mountain Mathematics Consortium which still exists. This school's a member, and there are twenty members now. I did that by talking to the chairmen of other departments, and they agreed it was a good idea. And I was originally the executive director of

that. And one of our goals was to start a journal, and that's the *Rocky Mountain Journal of Mathematics*. And so, I started that journal, and the way I started it was I went to the National Science Foundation and asked them for some money to underwrite the publication for the first several years until we could get on our feet. The, now it's supported by subscriptions.

DF: Right.

RM: And, then I remained the director of that for a few years and even something like 3 or 4 years after I came here when I dropped that job and somebody else took that over. And so, I had the contacts with that organization, and when I wanted to start this one, I went to them and said the board of directors were from all these universities, including one from here. I guess George McRae is probably still the representative from here. Said, 'here's what I want to do; will you take it on?' And since by that time they had something like four other journals, in addition to the *Rocky Mountain Journal*, they were willing to underwrite that too, and they're doing it. But then, that's financial support and they, you have to put together a board of editors, you have to advertise it so people will know that it's a place they can publish, you have to define what's in it. If you look at the inside back cover, it gives a description of what we think the goal of that particular journal is. And, I had some papers in that journal, and I have papers in one of the journals. One of the journals I have a paper in is called *Ecological Modeling*; it's a biology journal. And I have a couple in a journal called *Journal of Environmental and Resource Economics*. That's an economics journal. And a bunch of others.

DF: Sure.

RM: So, that's sort of that question.

DF: Yeah, and I got you off track there.

RM: I don't have a list of Hilbert-type problems.

DF: That's okay.

RM: But it seems to me that the, the mathematics departments have changed very much their character, since when I started out as a student in the 50s, and a young faculty member in the 60s and 70s. I guess the 50s and 60s; by the 70s I was not young anymore. I was 40; I thought that was not so young anymore. Looks younger now. But, departments have become less focused on pure mathematics research and have realized that they have to play a role within the scientific community, and the university more broadly. And of course, that service role is quite important to the

university and it's bread and butter for mathematics departments. So, maybe it's out of sheer necessity, but it's a realization that most of their students are not going to go on to be college professors. Most of them will be in industry somewhere, or in government service. And a different kind of training is needed for these people. Several times over the years I've run summer workshops on mathematical modeling in these environmental areas. The most recent one was summer of '98 and '99. And at that one, the people who came in as our students, or participants, were something like, I think we had 26 or so people who were young, college math teachers, new math teachers maybe within their first five years or so for most of them. All of them with Ph.D.'s and all of them teaching in small colleges. So, once again we are still working at this particular audience, but now they are more sophisticated because they all have Ph.D.'s. They all have very good training, but none of them knew much of anything about modeling. And, so what, the role, the purpose of this was to add this to their, the kinds of things they felt comfortable with, and could incorporate into their undergraduate teaching. And that's clearly ended, focused on people whose own students are mostly not going to be mathematicians. But they are going to be people who will increasingly use mathematics, so they have to make them sophisticated about how mathematics enters into science and into more than just science, into the whole community. So, I think the focus in mathematics departments is much more toward that kind of thing than it used to be. And it was more recognition that this is one of the principal goals for, even graduate education in mathematics. So, right down the list…

DF: I think we're… just the last one.

RM: How has the content of… changed? Which I sort of answered.

DF: Exactly.

RM: An anecdote or favorite anecdote. You know; I honestly don't. I mean there are lots of good things that have happened in my life since I've come here. My kids grew up here. And my son still lives here along with some of my grandchildren. And that's certainly important. I like a small community. I think this department has been, always a rather, a very congenial group of people and quite tolerant of people who do odd things like I did. But also, it incorporates math education, and it incorporates statistics, applied statistics which many mathematics departments would stick up their noses at, in the old days, you know if it wasn't pure enough.

DF: That's right.

RM: And one of the reasons I left Colorado was because the department there was and remained a very contentious one. With factions, people fighting

over who got the largest salary increases. A lot of things that were kind of nasty. And this sort of nastiness I've never seen around here. And I think that's one of the good things… about this place.

DF: Definitely.

RM: Another good thing is that so many of the faculty members are genuinely interested in their students.

DF: That's right.

RM: At a large university, they're lucky to see the faculty members. My son got his Master's degree here, but then he went to University of Florida for a Ph.D. and he said he would never send his son to that place because, well, you never get to see, certainly as an undergraduate, you'll never see a faculty member, maybe in a classroom with 500 or 600 other people.

DF: That's right.

RM: And that's one of the great virtues of a place like this which has always had a good faculty for teaching undergraduates, but also, had an active interest in what's going on in the larger mathematical world, and which realizes itself through a graduate program. And even there, showing a lot of interest to students at the graduate level. I know that that happens in places that are purely undergraduate. I've been, sometimes I get invited to give talks at such places, and I notice that in those places, the faculty members will be very much interested in the careers of the juniors and seniors, and majors, the undergraduate majors. And there are some people here who do that still. Somebody like George McRae.

DF: That's very true.

RM: And Keith Yale has always had a reputation for being a marvelous teacher, even at the beginning level for people who are not going to take more than one math course. And so, that's still here, and at the same time we had people who are interested in the graduate program and graduate students. And because of the program is small, a very personal interest in that.

DF: Right.

RM: So, I think those things are good. I can't single out an occasion.

DF: That's all right.

RM: So, anything else you want to know…that occurs to you?

DF: No. I guess I should get when and where you received your degrees? I know you mentioned your undergraduate was in physics.

RM: Yeah, that was at Carnegie, used to be Carnegie Institute of Technology, Carnegie Mellon. And I was lucky to be able to go to school there, it was only because I had a full scholarship, or I couldn't afford to do it. Then I went to graduate school at the University of Wisconsin, and I was there for 3 ½ years and I got my master's degree at the end of the second, and my Ph.D. in the middle of the fourth. And from there I went to teach; I taught at, since I finished school in January, I taught spring term at Purdue University. And then I had a post-doc to the University of Maryland for two years. And then I went to Colorado. I went to Colorado 1956; I think it was, and stayed there until 1970, came here.

DF: Are you from the west originally?

RM: No, I'm from Pennsylvania. I gradually moved west. See, Pittsburgh was only 50 miles west…

DF: Where Carnegie is…

RM: … of where I live and then, well one of my professors there knew somebody he thought I could work with in Wisconsin so that's what got me there. A hitch-hiking trip west to climb in the Tetons brought me westerly. Sounds like in stages.

DF: Sounds like Keith a little bit.

RM: See, Keith went out to Berkeley, and then he bounced back into Montana where he came from.

DF: Yeah. But hiking in the Tetons reminds me of him.

RM: Yeah, that's true. Yeah, well a lot of people, Bill Myers came from Ohio, and he loves to climb. I don't think he was ever a technical climber to the same extent, but Keith probably was. But yeah, I did technical climbing in Boulder. And then I joined an Alpine club in Canada and climbed in the Rockies. I haven't done that for a number of years now. Back country hiking, you know, I used to do that, and I don't like to carry a heavy pack anymore. But I still cross country ski and take day trips. Now days, it's easy to go to distant places like Europe. I spent three months in Norway visiting the Norwegian school of economics, which is in Bergen. Before that I was a couple months in Australia. I spent the summer in Italy working for the United Nations.

DF: Is that right?

RM: All of this in the last, really the last 10-15 years. Before that I didn't do very much traveling at all. Just in this country. So, and I know that my grandchildren were traveling when they were two years old, so, my first trip was a recruiting trip when I, after I got my Ph.D. It was the first time I was ever in an airplane. But of course, that was a bigger deal then.

DF: That's true; that's true. All right.

RM: Okay.

Interview with Dr. George McRae (GM)

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by

Daniel Finch (DF)

GM: So, a lot of the faculty members around the country, people with Ph.D.'s, computer science in general. Computer science didn't exist at that time. They all worked for government or industry in the space race. And, that's what happened here.

DF: Right.

GM: So, a number of Ph.D.'s in math had been also, I don't know the numbers, but also physics, chemistry and so forth, and math here. It seemed like nice, as an undergraduate 10 or 12 Ph.D.'s in the math department, and by the time I graduated three years later it was something like 4 or 5. And the rest had gone to work in Sylvania and all kinds of places, had really good opportunities in other schools. And it was really a huge, big push across the nation for space, science, really math and all that stuff started, and the National Science Foundation started pouring lots of money into graduate programs. So, that's partly it. So, I had a real nice fellowship while getting my master's degree. I was a TA. I had a National Science Foundation--they called a cooperative fellowship. Take (?) and I could take 15 credits.

DF: Yeah. I wondered you said you'd mentioned.

GM: Or a year, so I finished in three quarters. I was one or two credits shy of finishing at the end of spring. Starting in fall, finishing in the spring quarter the master's, but then I stayed on to teach here. And this, and I taught calculus and differential equations and also statistics. Howard Reinhardt was just new here, but he left to do post-doc work at the Army Research Center at the University of Wisconsin. He'd come here with a new Ph.D. from University of Michigan in Ann Arbor. He was gone for a year when I was teaching here. I had the course the previous year too, I took the courses from him, graduate and masters. Anyway, so one of my jobs is sort of fill-in. It didn't start out that way, I was actually going to you know, do something else when another person was hired with a Master's degree to fill in for him. That other person had left after the end of December.

DF: I thought you said first quarter?

GM: Yeah. Boeing or something, and he was in charge of teaching the year-long statistics courses. And so, I had to take over something I guess, and he also was the official (?) for the university. Craighead for example. …Frank to all their studies. When Ray Tether (?), you know wildlife biologist and others, they were doing (?). . . Then Don Sward went to work for, I think he…I've forgotten what was… it has been back a while, but (?) I think he went to work for IBM. Other people went to work for Bell Labs. I mean all kinds of jobs, Sylvania, all kinds of jobs. Books (?), hardly any of them left here then, to go to other teaching jobs, although there was quite a bit of there too. So, some of us, so, Joe Hashisaki saw me; he was my master's thesis advisor. He left at the end of that year to become chairman at Western Washington, Bellingham. And he too quit. And Paul Reid who was in graduate algebra. I guess Western Washington was trying to become a 4 year with graduate, with Master's graduate program to have at the university. They've been a teacher's fellowship that Eastern Washington, Western Washington, all Central Washington, they were all in this teacher's club. They wanted a four year liberal arts and college with a master's level graduate program then in the basic areas. Biology, math… (?) So, some of the people from places like here had really nice offers to go places like that. So, there was a lot of mobility. Summer time, you could just get a job anywhere in teaching summer school in math. You didn't have to stay at your own institution, so I, my advice for here, after graduate work, one year of graduate work at the University of Washington. I spent; I taught at Western Washington, I was at Bellingham for the summer. But there were like three other people there that summer that were teaching from California, from back east, from all over. People have wanted to spend the summer you know, on the Puget Sound Basin. And it was just another holiday teaching those.

DF: Interesting.

GM: And it all sort of becomes a structure. There's tremendous design. Developing that in math and science. Everything about math and science in the cost of the work. And it's also the case that there weren't very many new Ph.D.'s being produced. When I started the graduate program at the University of Washington, in the fall of '62. And that year…and I think there was like 600 Ph.D.'s in math in this country. By the time I graduated, it had gone to 1200. It doubled. And all the graduate programs were just double during that time. And, but by the time I graduated, then it was, 1200-1300 Ph. D.'s that year, and they aren't all likely to get jobs. Jobs were becoming a pretty tight market at that point. But prior to that, it was still moderate. You had lots of choices. And if you had a Ph.D., up there, say teaching, you could get summer jobs working for NSTA or you could get summer jobs teaching some place. I think you could pick your geographical area. But then it's, the shorter, ever since, I graduated, the numbers, I haven't really paid too much attention. But they pretty much have stayed right there. But the other thing, that if you don't, the thing about Ph.D.'s in math that you have to factor in is the fact that we now have Ph.D.'s in computer science and in statistics and in specialty areas of math, numerical analysis, that were just, didn't exist. Computer science graduate program didn't exist. Operations research graduate programs didn't exist when I started my graduate work, but they started developing those. I mean, there were departments, computer science departments that existed, operation research departments didn't exist on college campuses for the most part, but all in the last 20-30 years, those have now become separate departments. And they have separate departments of statistics, or separate departments of numerical analysis, they also have separate departments of computer science. And they could produce their own, their own graduate program where they could produce their own Ph.D.'s, and so if you want to compare the Ph.D.'s in math, thirty years ago with the Ph.D.'s in math today, you need to factor in for that. In fact, thirty years ago people were getting Ph.D.'s and they were called Ph.D.'s in math, but in fact they were people that end up majoring in computer science now a days. So there's that, you have to look carefully or compare the wrong numbers. But in a certain sense, Ph.D.'s in sort of the mathematical sciences, has sort of stayed, in this country has sort of stayed at the 1000, 1500.

DF: Right.

GM: In that ballpark. The cross section of how many of them are foreign born has changed. You know, ten years ago, I would guess now, one, probably of four or a third of all of them are Chinese born graduate students. Even here at the University of Montana we have the same cross section of Chinese students as they have in the nation. And with changing of things

in China, the Tiananmen Square-type things, that's changed as far as they come to this country.

DF: Right. So, you know you mentioned that when you came out, it was much harder to get a job, but you chose to take a position here?

GM: No, I went to the University of Illinois Champaign-Urbana from the University of Washington I went. But I had to; it was really my only job offer. Although I could have, I was recruited by the University of Montana, Montana State University, UVC, and for that matter Bellingham, but I had chosen not even to apply at those places, and they called me about jobs, and that's because I knew people at these places, but I deliberately wanted to try if I could get a job someplace else northwest because that was the only place that I had been. And then, of the places that I tried elsewhere, there were no jobs in the state of California. Virtually identical, my advisor wanted me to go to, he had wrote to various places, and places, Berkeley, and Yale, and so-forth. But Berkeley, they wrote back and said mine was two positions.

DF: Oh wow.

GM: Available in the math department. And that was, and they blamed it on the governor at the time. The newly appointed governor Ronald Reagan.

DF: Ronald Reagan, yeah.

GM: That he was cutting back on graduate cutting back on research and graduate science and stuff like that.

DF: And how long did you stay in Illinois?

GM: Three years.

DF: Okay.

GM: And then I came back here.

DF: And you, you know when you were at Illinois, had, were you looking to get back at some point, or you know, then why did you choose the, being the faculty here?

GM: Oh, mostly because I, at the time I was coming back in the summers because my roots and my family and my wife's family were all Montana-types. And so I would come back for two weeks vacation in the summer to spend most of it on horseback in Bob Marshalls in Montana, fishing. But it took a day, you know, over a day to drive, so really a long ride to

Montana. And we just went away. So, when you get this sort of reason like that we decided to come back to Montana. And I only considered coming back here, and there was a job available at that time. You know I liked Illinois very much and I've got some, lots of really good friends from that. It's a good place. Our kids were born there, but where that it's green as Seattle…Champaign-Urbana and Champaign-Urbana is a very nice place to live, to be at that point. But the disadvantage is, if you sort of like the outdoors, recreation, that sort, then there isn't much there. All the people there that were into skiing or anything like that, always, were transferred, gone, would go to Colorado. But there's some people that Champaign-Urbana that thought it was the west, of wide open spaces, the west. And they were the ones who grew up in Brooklyn. And so here, in the Champaign-Urbana I have the house where you see farm fields and cows.

DF: Right.

GM: It's a small place.

DF: That's true.

GM: So, it was very rural, rural-type town. So, anyhow I had no regrets coming back here. I enjoyed it. I like the size of The University of Montana. It, when I started as an undergraduate, there was like 3,000 students. Over half of them were Korean War veterans. So, most of them lived in married student housing. They were like strip houses at that time you didn't have fancy, it was, you know. But that had a big effect on just the student body to have the majority of the students being married, Korean War Veterans. My younger brother was going to Dartmouth at the very same time, and it was the same size school, they had 3,000 students, you know there were 2,700 students at Dartmouth. But they were all 18-22 years old, and they would have food riots in the mess hall, you know food service…

DF: Cafeterias. Sure.

GM: Cafeterias, but like those kinds of things in other context, but you'd never see a riot here. Just the mature, sort of the mature attitude of the average student was very much enhanced by these veterans. They were very serious students, they may not very good students in some cases because of their backgrounds, only they worked hard at it, were very serious about it. They didn't have a lot of this sort of panty raids or food riots that you read about on other campuses. They didn't, didn't have it, state universities in general, and certainly not here. But then it grew so that when I came back you know in '70, the enrollment was right at 10,000. I don't know, 8-9,000, something like that. See there was a decade there

where it really grew because every university, University of Washington grew; the University of Illinois grew; all grew too. See, we were then, in Montana, and Montana was then like…I came back of course when there were riots on campuses. It was the campus of hate, screaming and when I came back in the fall after the spring of Martin Luther King being killed, Robert Kennedy being killed, Penn State riots, the Vietnam War, there was a real problem for people in this country. And so there were sit-ins on this campus where the students were sitting-in on the ROTC headquarters. Sit-in on the President's office, wanting the president to do something of this or that. And that was, in Illinois in Champaign-Urbana; we had riots, where all the members (?) were broke down, and they returned a building on the quad, a huge big pretty square quad with these ancient old, colonial style buildings there, three and four story buildings. They had landscaped all their flower beds and the sort on campus, with washed rock about that size. So, when you have a few thousand students marching, protesting things, it was just natural…

DF: Like that's the one.

GM: They picked up those rocks and break every darn window in the quad.

DF: Wow.

GM: So, then they had to put sheets of plywood on all the windows, it was a temporary solution, but… And of course, what the physical plant did there was before they put glass back in those windows they went and picked up every one of those rocks and replaced them with beauty back the same size. But it was, you see we had 30,000-40,000 students in one square mile, and you had extra things that you had to deal with.

DF: Certainly.

GM: Just because of that many people. Whereas, and so I thought coming back here to 10,000 is not that many students, that it's the right size for a university. Big enough to have resources, libraries, computers, and whatever, but yet small enough you would actually know people when you see them. At the math department at the University of Illinois we had 154 in math faculty, 200 supported graduate students in math, and another 200 unsupported graduate students in math. They worked at Motorola, places like that, while they took courses. So, it was a big operation, just the math department was a big operation.

DF: Sure.

GM: So, the joke was that the head of the math department didn't even know the names of the people in his department, 150-some to know. And he

was challenged with that. And, but it turns out he actually knew the names of everybody, and their wives, and so forth, even though we couldn't have, see we never had faculty, department meetings, and never had department parties. Because if you have a department party where each person can bring somebody else, that's, there would have had to be room for 300. And in the years I was there, twice did we have such a party, and it was the state-rented the ballroom, the Illini Ballroom. Like I say, we never had department meetings, because they didn't have a big enough meeting room on campus to have 150 people sit down at a table and discuss motions.

DF: Right. Right.

GM: So, it was a different. And then the University of Washington was big also. There, and the student body was the same size, right at 40,000 as at Illinois, but the faculty of the math department, the faculty at Washington was one half the size of Illinois. We had 75 full-time faculty, and the student, the graduate student was about half, at about 100 supported graduate students. But the main difference between the two, and there was one way of accounting for that difference in size in teaching faculty, and that was the fact that the University of Illinois never had a single math class with more than 25 students. Whereas at the University of Washington, it wasn't until you got to be a junior, in junior-level math courses that you had class with less than 80 students. Most of our classes were taught to 500, at least hundreds at a time, freshman and sophomore classes. Whereas Illinois, they were able to get away with it. See, their, and one explanation was this was before the days of one man one vote. And in Illinois, in that the legislature was sort of run by the down-staters, you know down-staters were the farmers. And it wasn't run by Mayor Daily, of Chicago.

DF: He was in Chicago.

GM: And they liked what the University of Illinois, the other thing is the state of Illinois didn't have a Michigan, Michigan State, Illinois, you know where they had the A&M, agricultural, mechanical, engineering… at one campus, professional school at the other campus, they just had one university for the state of Illinois. At the University of Illinois they had the agricultural, and the engineering, and the law school, and the business school, and the pharmacy school, and everything in one university. And the Ag. School was really good at developing new hybrid corn, soy beans, and fertilizers. So that the, Illinois was very rich agricultural state, very productive rich agricultural state, and much to credit and opportunity of the University of Illinois Ag. School for making it that way. And so the down-state farmers in the legislature rewarded and supported the University of Illinois by funding them well, so they could afford. Math

departments had a tradition saying that they couldn't teach math to more than 25 at a time, and so they made sure they had the faculty so well to do that. Whereas at the big state universities on the west coast or the big 10 in general, the Ohio State's, the Michigan's, the other states that didn't get to do that at the same time. So, at the same time we at Illinois had 20-25 at a time in our honors calculus there, and they stopped us there, and we only had to have 10 or a dozen, 15, but in my regular calculus, or differential equations whatever. I taught… I never had more than 25. But when I taught math at the University of Washington, I had hundreds. And at night school, we had a night school at the University of Washington, you could get a bachelor's degree in math, but just at night, then most cooperative, Boeing-types, and there I taught advanced calculus; that would be medium size classes. Anyway, I liked the size, and it was sort of family roots that brought me back as well as I like the size so I could know people in science departments or music departments. I could get to know other faculty instead of just like the ones that worked in the department.

DF: And, on, like a few, not even all of them would have been.

GM: Sure.

DF: Ok. Getting a little further behind that George, was there someone, or how did you, you know, how did you choose mathematics as a field? A lot of people have a, you know, an early teacher or something like that that, who influenced them, and how about yourself, you know, how did you come to choose mathematics?

GM: Well, I had a good experience with math in school. In grade school and in high school, and had older brothers that were going to college in the sciences, math and sciences. So, it's because of that, it was pretty natural for me to choose math as well as a major in college. But I had, so I had an (?) since I was a math and physics major; but I also had friends who went languages and did other language. And so forth, a scholarship and had to be a major. You know I had taken languages in high school, but at the price of other family members and others. And then, why did go immediately onto a graduate program, that's probably because of the times, and stuff like that times, posted up in times. It provided opportunities…

DF: Right.

GM: …that I took advantage of. And I had had interest quite in the past, coupled with the Cuban Missile Crisis, Urban Mall type times. And if you see, I, there was a draft at that time, and they would give you deferment from the draft, being a foot soldier by being a math teacher, so I was very distracted for the time I was teaching for a year going in. I only intended

to teach that one year and then go on to graduate school, but in the middle of that year I had to have the Dean of the Arts and Sciences go down to my local draft in fact. I told them I shouldn't be drafted right in the middle of this quarter because of my college teaching position. Whereas they would give you deferment if you were a graduate student, they had student deferment, but being a teacher wasn't a good enough reason at my level of work.

DF: That's interesting.

GM: So, that was an incentive for me, if I didn't want to become a foot soldier, and you see, I didn't intend to be a foot soldier. My older brothers who had gone to college, they went into the military department. (Tape flips over). And so we still had the draft at the time, and my, in my own case my older brothers had been one of the ones in ROTC Program here. And the other was an officer in the Navy, but he had gone here and got a degree in pharmacy, and he could then. People in the medical field could get officer appointments with various branches, and my brother did so. Pharmacists didn't want to see, these were brothers that weren't married with families, but if you were married with families you got deference…

DF: Right.

GM: Regardless of what your occupation was, but the, so I knew that just because I didn't want to be an enlisted person, drafted, so I. If I were going to serve in the military, I much rather have served where I could use my scientific background and be more valuable to the nation that way, rather than just being another one the grunts. So, my, at that time my idea was to get a graduate, go on to a Ph.D. And so, that's what I went and did, and there I picked the schools mostly by the ones who saying they would give me a letter deferring me. So I could turn that over to the draft board and start this process of getting deferment for the next year. See, by getting people to go back for me, they said that I wouldn't have to put my uniform on until school was out, that I could finish the year teaching, and they shouldn't draft me. So, I crossed the table saying that I would have to put my uniform on the 15^{th} of June when school was out. But, and then I did all the induction physical like going down and then get the deferment to go to graduate school the next year, by getting into graduate school, and I only applied to three of them, I got eventually got accepted and support from all of them, but I choose the University of Washington first. To give me everything I wanted. And then… [Knock at the door] Come in…

Guest: Hi, I was just going to turn in my dissertation (?).

GM: Thank you now.

Guest: Thank you.

GM: Yeah. So, I chose the University of Washington, I suppose, the main reason would probably be because of Merle Manis and Gloria Hewitt. Gloria, my first year of teaching here was her first teaching here, and she just came from the University of Washington. And Merle had gone to the University of Washington for one part of the year, the year that I, let's see, no, he and I got, he and I both got our master degree together here, and I stayed here. We both had NSF Fellowships, and so he went, he was a Korean War Veteran, so he didn't; he already put his time in. He had gone to school on the G.I. Bill, and, but he'd been after getting his Master's degree here, with me, we finished up together, he then went to the University of Washington…

DF: Sure.

GM: For his Ph.D. work. And I stayed here to teach. But he didn't finish the year out there. He got married and came back and taught the last half of the year here, and that was because like I say we had people here that started the year out, and they left for bigger and better jobs in industry too. And so there was openings in the middle of the year. He came back and he stayed on to teach for a couple more years, before he went back, and then he went to Oregon to get his Ph.D. So, that's sort of why I choose. Now at the same time I considered Wisconsin, and Berkeley. And Berkeley because that's where a whole bunch of my undergraduate classmates from here went. Keith Yale, Max Solberg, Brian Adams, and so they all went to Berkeley. And so, I'd been down there to visit them. And so I was interested in going there. And then Wisconsin was another natural because I had older brothers who had gone there in the sciences. Maybe not at that time, but I did have older brothers that got their degrees there, but I can't remember now. But probably the main reason, one of the main reasons that I considered Wisconsin was because R.H. Bing was a famous topologist there. I had an interest in topology. So, and he'd been here for a visiting lecture, and I visited with him and liked, and he intrigued me to go there. Like I say, I ended up mostly choosing the University of Washington over the others because they could give me a letter that would get me, keep me from going in as a foot soldier (?).

DF: Sounds like a good reason to me.

GM: So, and then after I was there I got married, of course. I never really had that problem. So, when I got my Ph.D. and went to work at the University of Illinois, at that time I had Lorene. She was 6 months or so old, so, and I was older then too. Being foot soldiers (?). So, that, because of my particular age, all of us at that particular age didn't have to serve. The war I would have served in would have been the Vietnam War. I was just a

little old to not be really considered as a part of the draft. And then of course they changed all the draft went through a lot of revisions.

DF: You know, so since you started here, even as your undergraduate, you have a lot more exposure than most people do to the department, and obviously it's gone through many changes, but are there some kind of key transitions to the department, since you've been involved with it, George, you know that kind of stick out in your mind? And they can be any kind of thing, they can be maybe a direction of the department, physical changes, or you know, like you'd mentioned before the computer science broke off and became its own, but you know.

GM: That happened, they actually, the computer science department was created almost 10 years between the time I left here and the time I came back. How? My guess is 8 years, 8 to 9 years. And so, but I actually kept in touch with the department because I knew most of the people that were in the department who are even not only in the department on the faculty, who at that time. Because I knew a lot of the people on the faculty because when I was, as an undergraduate I worked in the Registrar's office, I was assigned veterans advisor. That was my departmental job. And, as a consequence I knew lots and lots of the Korean War Veterans. And lots and lots of the faculty that I knew I had never even had courses with at the time, you know because I worked in the university's office and being around, and I was involved in some student-type things like that. The, and then I get, I myself was not in the student government, but classmates in the math department, you know most was, you know the president and vice-president people like that on the various student body officers were friends of mine. Like I say, two or three of them were math majors. So, because of those kinds of connections, you know, I really kept in touch with lots of them here. And so, that was fairly natural to kind of develop a computer science program, but in the math department to start with, that's how most of them started, and then when it got to be big enough that they formed their own department, with their own degrees, undergraduate and graduate degrees. And the other, but another feature that you know, physical feature about the math department here would be the fact that when I was an undergraduate, and including after when I first came back here in the early 70s, this was the Math/Physics Department. The lower half was physics and the upper half was math. And then, at some point in the early 70s, they built the science complex, that building and the math people moved out of this building over there, and then the, I mean the physics people moved out of this building and moved into the science complex along with geology and some of chemistry and some of forestry. And then the math department took over the rest of this building. And that's the way it's been. Now, of course it's outgrown this building, so now we have to, there's never enough office space, where we even had let our classrooms in this building. Now we have to have neighboring

office space for all of math teaching faculty as well as math classes. Back when I was undergraduate when I first came back here, the astronomy courses were taught by math faculty and we've taught next door in the planetarium. But that's changed; they've made that into a sort of office-type building, even though it's still got the stars painted on the ceiling, fashioned that way for astronomy courses. But then the physics department has added astronomy as part of their curriculum. So they have faculty persons that teach astronomy courses.

DF: Right.

GM: The math department or mathematics curriculum courses keeps changing as it should. Changes in technology as well as changes in the application for more and more disciplines require more and more mathematics for their programs. And the math department does that service in part to teach more department math, so that's happened. So we teach freshman level courses for different uses business math, math of the biological sciences, math of the social sciences. Different kinds of courses they've all developed over the years. When I came back to be, the math department had a grant to improve the graduate program in math here, by you know, improving the library facilities, improving the, adding more faculty lines. And changing, adding new courses, graduate type courses. And so, I came back at a time where new people were hired [interruption], and so that was a sort of big event in the history of the department. And that sort of coincided with the building of the science complex. I came back, and it was probably two years, I still only spent two years, I was in here, I don't remember what year the Physics department moved out of this building but it would be early 70s. I came back in 1974, and then about a few years, three years maybe the physics department moved out, but at the same time, and the same time we had tried to build up the math graduate offerings and so forth. And one of the new features was a sort of second option for a Ph.D. in math, we had option 1, option 2. One of the options was the traditional research oriented, and the other option was sort of a mathematical practitioner, teacher of mathematics college-level mathematics, interdisciplinary type of mathematics, a practitioner of mathematics, a general analogy with medical science, medical field have specialist, and then they have practitioners. And most graduate programs in math had evolved into producing new Ph.D.'s in these super specialized areas. And that really meant that the best kind of job for them would be another super specialized graduate program, whether you wanted to teach in a mostly undergraduate, 4-year degree program, you had to be, have a broader experience in college and graduate math. So you could work on interdisciplinary math things going to a small school, there would only be a handful of people in the math department, but they probably shared that department with other science people, so it's really a math and science type department, and so that was the idea. To design a program, Bob

McKelvey, was the one that got the big grant to have that in that program. So, that influenced a lot of the courses we taught, we developed [bell rings] to meet the market. Those first Ph.D.'s that came out of here, then came out really at a time where it was really hard to get jobs. When I left, and I wanted to come back here in the next few years, there was a lot of people at the University of Illinois, really good research type Ph.D. weren't able to get tenure track jobs, teaching jobs, and whereas the people getting their doctorate degree from here that had this mathematical practitioner type background where they could step in and do undergraduate teaching with computing math, you know, interdisciplinary type things, they were all getting jobs, and that's not so for some of the others were in different programs. So that then, was a big problem in mathematical professions to, you know, shortage of jobs, a tight job market there for a few years. And, anyway that concludes that. In the history of the program as I've known it that would probably be an important part, that part of the, and it's still a part of the graduate Ph.D. program here, several recent people that's been their goal and taught over. Came here because of that with the idea of going back into the teaching at small liberal arts college as a math faculty there. So, that's been a fairly successful part of the overall history of the department I guess.

DF: You know when you think of the department itself, do you, was there some way by what we as a department, our assets have to offer. You know, not necessarily compared to anyone else, but what do you think distinguishes this department?

GM: Well… [Long pause]…I would say, well about the undergraduate program here has I think always been a good undergraduate program in math for both pure as well as the applied areas. And one way of measuring that is by the success of our students. They go here to get their undergraduate degrees and then they go on to graduate school, in the mathematical type sciences and do well there. As well as the ones that go on to, go to other industry with their mathematical, or a quantitative science, or at least background that they get in our program. So that I think has been a strength of the department and the credit for a lot of that probably has to go back to N.J. Lennes. He built a strong program here in pure math emphasis, you know then, but that's what math was, in the first half of the century anywhere in the country. Then for the graduate program, and then let's see I guess for the undergraduate program to me one of the things that's been distinctly ours, is the proper size. Small enough so they would be personable I suppose, yet big enough to have some resources, some quality resources. And I tend to think that that's sort of one of the important features of it. So, it's maintained that sort of smallness, even while we've grown, doubled, quadrupled our size, as an undergraduate from 3,000 to 12,000 total enrollment. It's still maintained some of those features, so students can get a very good, if they want, at least they can get

a very good experience in math here. It had a faculty that is very giving and willing to help a student that needs a special reading course of (?). We have a faculty that is interested in working with the undergraduate students and mentoring them. So that, that's one of the (?) and of course, some of the bigger institutions, there's nothing real personal about them, the operation. An undergraduate student probably would really find it hard to do individualized undergraduate independent research projects. And we've had a lot of our students do that you see, so, a senior thesis, do undergraduate research projects and do well at it, and use that as a spring board to you know their professional future. (?) And that, some of that kind of stuff is harder to find, hard for the student, the undergraduate student to find those kinds of niches. At the bigger schools where the undergraduates, I mean they would never get to know some of the faculty, as undergraduates. So I think for the size of the school, the smallness of the school, but yet on having a tradition of quality education and wanting to you know, provide specialized experiences for undergraduates, that's, you know an important part of this. And I don't know that we're much better at that than other schools, but I do know that some schools, I just, various times I've gotten calls from, you know, people wanting to know about this or that aspect of our program. They are pretty impressed with watching. You know our undergraduate students have done for example with I think these REU, these Research Experience for Undergraduates, and we've had more than our share I think of good students over the years in the undergraduate program. Now, in the graduate program though I won't, many of the same things about it, so we've been able to. One of the roles that our undergraduate master's program has always served here, I can say the same thing for the undergraduate master's program out at say Bellingham is that it provides a place where the student can attend from a smaller, typically a smaller program with their undergraduate degree being in math, but it's not a good enough background to allow them to go directly into a major master's degree program around the country. They would just fall through the cracks, but here, we're small enough that we can tailor make the program to provide what they, a successful experience, they start in with a weak background, say in math and take courses here and do a good job on their thesis project, and then go out and get a good job you know, job experience at least, you know and competitive, getting competitive jobs that… (Tape ends).

[This tape was quieter and hard to understand; (?)'s indicate lack of clarity in speaking.]

Interview with Dr. William (Bill) M. Myers, Jr. (WM)

Department of Mathematical Sciences
The University of Montana
Missoula, MT 59812

by

Charles Myers (CM)

WM: This is a class you're taking?

CM: Yes.

WM: This is a history. You want to get it finished by the end of the semester?

CM: Oh, I probably won't do that.

WM: Uh-huh.

CM: I imagine we'll still be transcribing and stuff. It'll take us a long time.

WM: Uh-huh.

CM: This is what we have, you know, factual documentation on yourself, sir.

WM: Uh-huh.

CM: If you would just look that [That is a brief vita that is included at the end of the transcript.] over please and let me know if it's right or wrong.

WM: Yup, okay.

CM: We nailed you, huh?

WM: Yeah.

CM: Okay. This is the interview with William M. Myers, Jr., past faculty member from the University of Montana mathematics faculty. First question: Why did you choose to become a faculty member at the University of Montana?

WM: Well, it's a long story. Do you want to tell the whole story?

CM: We got a lot of tape.

WM: Okay. Well I was a graduate student finishing, almost finishing a Ph. D. at Ohio State University in the summer of 1949. And on the spur of the moment, I was invited to attend, mathematics meetings in Boulder, Colorado, was in August of '49. And, as I say, on the spur of the moment I decided to accept the offer to go with some friends to attend the meeting. I'd never been west of the Mississippi River, and I thought it'd be an interesting travel venture. I attended that meetings and found that the mountains were very interesting. And a year later my wife and I bought a car—our first car—and we traveled, took a trip to the West, decided that if the opportunity came to live in the West, we'd accept that offer. We'd do that. And fortunately, Dr. Harold Chatland, who had been a visiting professor at Ohio State while I was there, knew me. And he was seeking new staff members. He gave me an offer to come to Montana, which I was happy to accept. I've been here ever since.

CM: All right. It was then just a kind of spur of the moment thing.

WM: Yeah, it was right at the end of summer quarter at Ohio State, and one of my colleagues, a fellow graduate student lived in Colorado. And he wanted to go to staff meetings and also to visit his folks in Denver. I had planned to do something else during the break between them getting out at the end of summer quarter and the beginning of fall quarter. But, when they asked me if I wanted to go, it was a spur of the moment decision. I made the decision and I haven't regretted it, so…

CM: Now, you say that Dr. Chatland influenced you. Did he—was he able to hire you, kind of, in the situation? Or offer you a position himself?

WM: Yeah. He was chairman of the mathematics department here at the time.

CM: Oh, okay.

WM: Yeah.

CM: As you think back, who was the most influential person in helping you choose mathematics as a career?

WM: Well, I can think back. Well, I became interested in mathematics when I was a kid. I was ten years old. My parents had, who went to the University of Cincinnati, had a couple of mathematics books, algebra books. And there were problems like John and Mary's, sum of the ages of John and Mary is 36, and John is four years older than Mary. How old are Mary and John? And puzzles of that sort interested me in mathematics. At first I just solved a problem like that by trail and error. And then I got to doing the way the book did it. Let x be John's age; Mary's age is $x - 4$, and so on. So that was my really first interest in mathematics. When I was in high school I had a very good geometry teacher. Was very enthusiastic, lively and a very intelligent and excellent teacher. Her name was Evelyn Ladle [or Lydell]. She made mathematics interesting, too. And I had the opinion, I had the feeling that I had some ability in mathematics and so that's what decided me to go into mathematics.

CM: What were your goals when you first started?

WM: At what level?

CM: Well, let's see. That's a good question. How about, what were your goals when you first started teaching at the university?

WM: Well, I guess my goals were to do the very best job I could do at teaching mathematics. Also, to learn more mathematics. If a person doesn't learn more mathematics, or in any field of endeavor…If you're going to teach you have to keep learning. And so I wanted to teach mathematics as well as I could and learn as much more mathematics as I could.

CM: I believe you. Do you think you've accomplished the goals or have they been altered some, or…?

WM: Well, my interests in mathematics have changed. Matter of fact, they've changed since I've retired. I'm more interested now in a different branch of mathematics. Interested now in numerical analysis. In my retirement I enjoy writing numerical analysis, writing programs in numerical analysis on the computer. For such things as approximating solutions of partial differential equations and finding latent roots or so-called eigenvalues of matrices, and so on. It's very interesting and I enjoy it.

CM: Well, good. Then you're still pretty active in, in mathematics as far as what you do. Mathematics still occupies a lot of your time or at least your thoughts?

WM: Yeah, you can say that. I've, there are, I've other interests too.

CM: Sure.

WM: But I still enjoy using the computer to do mathematics in the same way as kids enjoy using the computer with video games. That's, I think, maybe an apt comparison.

CM: Now I'm sure that you would have a lot of this knowledge. My fourth question is what changes has the department gone through since you have been here? And, kind of a sub-thing, were you involved directly in those changes? And what did you think of them? But if you could, maybe enumerate some of the things that have been the radical changes that the department has gone through.

WM: Well, in 1952 when I came here, there were four of us on the staff. The three teaching assistants, we called them graduate assistants then. And, I'm not sure exactly how many mathematics students we had during the year. We'd have one calculus class with maybe twenty students, starting in the fall. I think maybe we'd have another calculus class with twenty students starting in winter quarter. So, very few students taking calculus and beyond. So the number of faculty members has increased tremendously and the number of graduate students likewise. The number of students taking mathematics has increased a great deal. Another change that's taken place is, in recent years, we've had mathematicians coming from other countries. If I'm correct, at the moment, there mathematicians from Russia, Bulgaria, Germany and the Netherlands on the staff, which gives the mathematics department a more international flavor. In past years, we've had faculty members who grew up in Montana, who, and went through the University of Montana and Montana State University, and who later came back to join the staff. So, that's one difference. Another difference is the change in curriculum. Some of the courses that were taught back in the 50s are out of, not in vogue any more. Whereas new disciplines of mathematics developed.

CM: Yeah, I know that. I got my undergraduate degree in early 70s. And the difference in that 25 or 30 years has changed an awful lot of curriculum anyway. Now, was the mathematics department always the same department? Wasn't there a period of time in which it was, there were other departments in with it or it was in with other departments?

WM: For a while computer science was with the mathematics department. But that was just for a short while—in the 60s for just, perhaps, three or four years. When the computer science department was small. And there weren't very many students taking computer science. Pretty soon people realized that computer science was a coming thing and with many students

taking computer science there was a need for more staff members and a separate department which was a good thing.

CM: If you could identify what you think was the best asset of the department of math sciences at the University of Montana, what would it be?

WM: Best asset, hmmm. Well, I think I would say that members of the mathematics department worked hard to provide a good education in mathematics for students at the undergraduate and master's degree level. And I think that the mathematics department here, at that level, at those levels, was, perhaps, better than what one would find at a larger university where the undergraduate student could take all of his mathematics courses and never see a professor, but rather receive instruction from graduate students.

CM: Was the math department always housed in the same building?

WM: Yes.

CM: It's the same place. Has the building changed much? Can you recall?

WM: Oh, some of the rooms have been remodeled for various purposes.

CM: Well, yeah. Yeah, I know that they have computers in a lot of them now so they had to do a lot of, probably, electrical remodeling and such.

WM: Regards to that last question, I've just remembered now. Back when I first came here, and for, oh, probably up until some time in the middle 60s, the physics department was located in the same building. On the first floor of the math, the current math/physics building.

CM: Was that a sub-department? Were they under the…?

WM: No, it was a separate department.

CM: Oh.

WM: The mathematics department was on the second floor and third floor. They physics department was on the first floor and in the basement. And the room that is the commons room now, where the coffee room is, that used to be the physics laboratory.

CM: Huh, okay. So where was the coffee room?

WM: The coffee room? Well, if you enter the back entrance…

CM: Oh, okay, yeah.

WM: And go up the short flight of steps and it's the first door on the right.

CM: Oh, yes.

WM: What the room number would be—112 maybe. I'm not sure. No, its' 103; I guess—101, 102, whatever, something like that.

CM: Well, 6 you've partially said something about and basically covers the areas of mathematics that you're especially interested in. Are you currently working on anything in research that you plan to publish?

WM: No.

CM: You have truly retired, then. You're doing it for your own sake and fun.

WM: Yeah.

CM: That's great; that's great. Have you done research in some areas that I could find some?

WM: No. I was more interested in teaching at the university.

CM: A man after my own heart. I really truly believe that teaching sometimes gets the short end of the stick at the university. Good. Since we had been working on problems that Hilbert posed at the beginning of the century, one of these questions is to ask you what questions you might suggest for a year-2000 Hilbert list of problems to kind of direct the thinking of mathematicians or mathematics educators.

WM: Well, I don't have a good answer for that.

CM: Well, I actually probably should have contacted you earlier with that question, because that's something that would be very hard to come off the top of your head with.

WM: Yeah, exactly.

CM: …something of that nature. Well where do you think maybe that mathematics is going in the next century? You've seen some of the changes in the last forty years here, uh, fifty years. What do you think is going to happen maybe at the college level? Or, if you care to venture to guess, at the high school level?

WM: Well, I think that computers are going to have a big effect on teaching of mathematics. Computers can be used to find approximate solutions of problems very quickly. And, in past times, theoretical methods existed, but they were extremely difficult to carry out with pencil and paper because it should take a lifetime to do what a computer could do in two or three minutes. And I think that's going to influence the teaching of mathematics. I can see that the teaching of calculus that it'll be, teaching of calculus will be much more computer-oriented than it was in the past. Maybe much more than it is right now. I'd guess.

CM: Yes, I just did a presentation on working with large primes and cryptography. And, of course with the computer now, they have been finding Mersenne primes that are two million digits long. It's amazing.

WM: Yeah.

CM: But, of course to some people who don't truly deal with mathematics but rather just with numbers, that's the same think, because the computer will do just that for you. And, you don't really have to know an awful lot of mathematics. You have to know some, of course, to know what you're doing and what you're trying to find—computer does all the work.

WM: Year. And then with the computer, too, you have to be careful because they say computers don't lie. But, nevertheless, there's a lot of rounding off and truncation errors. Simply the fact that the computer goes from the decimal system to the binary system and back, a problem, problems there. If you consider the harmonic series 1 + 1/2 + 1/3 + 1/4 + 1/5…(you get the idea) + 1/6 + 1/7, every computer in the world will tell you that that series converges. But, of course it diverges. So, computers can only give you very accurate approximations, but sometimes they can lead you astray. So you have to be careful using them.

CM: So, you said that the content in the mathematics courses has changed over the course of your career and part of it is based on technology available. Are there any other reasons that you could say that the content has changed?

WM: Well. When I was in college, courses such as Theory of Equations was taught. It's out of the curriculum now at most universities. Spherical Trigonometry is another course that was taught. NO one ever teaches it any more.

CM: We've lost some of the courses., Have they been incorporated into others?

WM: I don't think so. I don't think so. Well, spherical trigonometry is still taught to people who are interested primarily in navigation. People, naval

officers would have to study spherical trigonometry, for example. But, in the main, mathematics students, in general, don't study that. Theory of Equations—I don't know where one would find that. It's available in the literature. But it's not commonly taught as a course. Other branches of mathematics—functional analysis. When I was at college, it really didn't exist in the curriculum. Now it's very important. So, another example.

CM: As you were teaching here at the U of M, did you see some of that happening with courses that you maybe taught when you first came and they changed over the time?

WM: Another course that was taught here was Mathematics of Investment, where students would learn about compound interest and annuities and so forth. That hasn't been taught for thirty years. Probably is taught in the business school now. But that would be the only place.

CM: Well, I think that we've covered those types of questions. I have a final question that I thought that if you had nay favorite anecdote or memory that you're reminded of, or maybe reminds you why you enjoy being here, you might relate that.

WM: Still having to do with mathematics?

CM: Well, not necessarily. But…

WM: Well, one thing that I can say about Missoula is that it's a good environment—maybe not as good now as it was at one time. But it was a great place to live and a great place to raise a family. And I've enjoyed the opportunity of living in Montana. And, I've enjoyed the opportunity of being part of the mathematics department. And, many of the….well…I've enjoyed having the opportunity to teach mathematics and to learn mathematics for the last forty years.

CM: You had mentioned maybe a couple of people that we should pay particular attention to in looking to find out information of mathematicians of Montana in this century. You again mentioned Harold Chatland and was it Archie Merrill?

WM: Archie Merrill, yeah.

CM: These were people who were probably here when you first came?

WM: Yes, that's right.

CM: Is there anybody else that you knew personally that you think (end of tape)…

William M. Myers, Jr.

B. A. Denison University, 1946
M. A. Ohio State University, 1948
Ph. D. Ohio State University, 1952

Employment:

University of Montana, 1952
Assistant Professor (1952-1956)
Associate Professor (1956-1963)
Professor (1963-1087)
Chairman (1962-1969)
Emeritus (1987-)

Dissertation Title: *A functional associated with a continuous transformation*
Other works: articles in *Pacific Journal of Mathematics*

Interview with Dr. David Patterson (DP)

Department of Mathematical Sciences
The University of Montana
Missoula, MT 59812

by

Charles Myers (CM)

CM: Professor Paterson, would you please tell me why you chose the U of M?

DP: When I was looking for a job, I was looking to be out west. I had lived in Oregon for a couple of years earlier, and just liked the west. I've always liked it. Some of my family was out here. And, so I applied for jobs both in industry and in academic jobs all in the west. Missoula had a kind of a special appeal to me because when I was a kid—5 or 6 years old—back in '59 or '60, somewhere in that era, my uncle had been a forest ranger up in north west Montana. And we had gone for a couple of extended visits during the summers. We really liked it up there. It's now under Lake Koocanusa where he was.

CM: Oh.

DP: He'd gone to the University of Montana. So my aunt and uncle had fond memories of Missoula. So, I actually got offered jobs both at Bozeman, at Montana State, and at UM. But, I just liked the people here better—the feeling, the collegiality. I like the people at Bozeman, too, the faculty. But I didn't like the kind of hierarchy—the autocratic chairman. Here at Missoula, things seemed a little more democratic, and so on. And, so I liked it better and I liked the orientation of this university, being a kind of

a liberal arts university with strong music and dance and things like that. That was the kind of university I was interested in.

CM: Great. Was there somebody special who at the time was a mentor or got you interested in mathematics?

DP: I'd always liked math and been good at math in high school. When I got to college, I actually kind of got burned out on it. I'd taken calculus in high school. I took some more calculus in college. And, I found myself not being very enthusiastic about mathematics. I considered becoming a history major for a while. I liked the analytical, critical approach to looking at historical documents and history and so on. I ended up kind of coming back to a math major mostly because it was easier than a history major. Writing papers was always a big chore for me. I actually was, you know, a fairly good writer. But it took so much work that it was easier to become a math major. When I finished my bachelor's degree I really had no interest in pursuing a graduate degree in mathematics. So I was kind of wondering what to do. I went to work in Oregon for a couple of years. But the summer after I graduated it suddenly dawned on me. The one thing I had really enjoyed as an under graduate was the course in statistics. Then I did an independent study in statistical decision theory and statistical game theory, and read, gone through, part of a book by Blackwell and Girshick—David Blackwell, a very famous statistician at Berkeley. And I just loved that book. I kind of think of Blackwell as the one who got me interested in going into statistics, although I had no idea who he was. And, and it dawned on me that that was one area of mathematics that I really enjoyed. And then, couple of years later I didn't really have a mentor. My advisor I kind of chose by default because he was willing to work with me on a project that I had found when I worked a couple summers at Los Alamos National Laboratory while I was a graduate student. Then a project came out of that and he was swilling to work with me on it. It wasn't really his area, so that's how he came t6o be my advisor. But we never worked together on projects after that.

CM: So after that point, statistics then has been the area that you've concentrated on.

DP: Right. And I loved it from my first day in graduate school. It was just… I don't know what I liked about it so much as compared to pure mathematics. But it, maybe it was the…even the theoretical courses I enjoyed in statistics. Maybe it was, I liked it so much because always at the basis there was all this theory had been derived because there were real problems to be solved. And, I don't know. I like modeling and so on, which is fundamental to statistics—models. And so I just really enjoyed that.

CM: What are you currently working on?

DP: A lot of what I do comes out of collaborations with people in other areas. One that's kind of been ongoing for along time has been with an economist, John Duffield, who was on the faculty here and then started his own consulting business on an environmental economics, natural resource, damage assessment, and economic impacts of decisions on… environmental decisions, you know, like reintroducing the wolf. Economic impacts and so on—economic impacts of building dams and so on. And particularly at getting at the … putting a dollar value on things where it's not easy to put a dollar value on them. For instance, you can easily measure the revenue from producing the power from a hydroelectric dam,. But, what's the cost? Well, its' more than just building the dam. It's also, you've dest4royed a fishery. And what's the value of that? So any kind of environmental impact thing, he's been in this area. Putting dollar amounts on damages like that, which is pretty common now. But he actually was doing it at a time when it was kind of one of the first people to start doing that kind of assessment. So, anyway, there are statistical problems that arise in trying to actually put those values on. And, part of what, how they try to put dollar values on things like that is… several different ways. By observing people's behavior and also by asking people. That's a difficult problem to figure out how to ask people in a way to really get at the true value to put on something—their willingness to ay for something. I've been mostly involved in kind of the how to, what kind of data do you want to collect? How do you want to collect it? And analyzing the data with statistical models to get a value.

CM: Are… is this, then, an example of some of the things that you have done recently also?

DP: Yeah, this is ongoing. So, for instance, there's a problem I'm working on right now with, a statistical problem of building a model that's appropriate for a certain type of data collection procedure. So. Other things that I work on… I'm associate chair of the department. So sometimes I don't have much time to do other things I'd like to do. I also…one area of interest since my doctoral dissertation has been discriminate analysis or classification of objects. The situation is that you're trying to come up with a rule for classifying, deciding which group an object belongs to. And you have a training set of objects. For instance, if you're trying to sex bald eagles, which are…bald eagles or birds in general are hard to sex if they're not dead. And so, are there measurements you can make on them? You know, measuring their beak length and talon length and feather lengths—all sorts. Can you distinguish between males and females? So you have a sample, a training set which is animals, which were killed or something. And you were able to sex them. And you were able to get all these measurements. And now you are trying to develop a rule for deciding

whether an eagle that isn't dead, based on these measurements, whether they're male or female. It's really a decision problem that has applications in just, you know, all sorts of areas. Medicine, you know, classifying, deciding which disease a person has based on whatever information you can get.

CM: So, that was something that you had originally worked on with your dissertation. And it is something that you are continuing to be interested in?

DP: Yes, yes.

CM: What changes have you seen at the U of M since you've been here?

DP: Let's see. When I came here in the fall of 1985, I was the first new faculty member in mathematics in, I'm not sure, perhaps 10 years. So I was really the young kid at that time. And, a couple of years later, excuse me, somebody else came. We got a new person every couple of years after that. But, in the last five years it's really accelerated, where a lot of the group that were the senior members when I came in are retiring. The turnover's amazing. I mean we really have a very different department than when I first came. There's been a lot of good come out of that. I think we're really, got a lot of rally good people come in. Strong teachers, strong researchers, People who've generated a lot of activity in the department in terms of conferences and speakers and so on, and working with students. I think there's, there seems to be a little more friction maybe sometimes in the department than there w was when I fist came here. Maybe I'm misreading that because when I first come here I was the young faculty member and didn't know too much what was going on. And I think that friction may be partly just due to that there are a lot of good people who have different interests, trying to promote their own interests. What they think is important for faculty to do. And there are differences of opinion there. As far as the university goes, there are a lot more students. There were, I can't remember, 8000 or so when I came. Now there's 11,000. I liked it more with the 8000. I just like it a little less crowded. There aren't more students in most of our upper-level classes. That's stayed pretty steady, fluctuates a lot. We've gone to at the lower level; there are a lot more sections of courses. I teach our introductory statistics course, which when I first came here we just taught a few sections—small sections each quarter. Now it's a large lecture class. And I liked it better when we taught it in small sections. That's not feasible without staffing any more.

CM: Are there different people involved? Not mathematicians as much, or statistics majors, as people from other departments, now?

DP: Involved in what?

CM: In your lower level class.

DP: Not faculty from other departments, But, I guess students. I guess we're getting… I guess when I first came here; perhaps, I think there were some departments had their own courses. Like business may have had their own course and now they use our introductory course as their first course.

CM: Now, where do you see mathematics headed in the next century?

DP: You know, I don't think too much about mathematics in general. I think more about statistics.

CM: Okay.

DP: Interesting question. I guess just keeping up on where it is going is, takes enough time. I don't think too much about where it is, where it's going to go. Certainly in statistics the big issue—probably the biggest issue today—is dealing with massive data sets. I mean, you know, massive, massive, billions and billions of data points, and how to, how to develop software and algorithms for looking for patterns, and so on, in massive data sets like that. You know where statisticians traditionally are sued to looking at small data sets, ones you could draw pictures of by hand or with a computer. And now we're looking at these stupendously large data sets. So much information's being generated without really much idea of what to do with it. You know there are all sorts of problems with massive data sets. I mean there are errors, you know. And that can be a huge problem. So, a lot of statistics is going, looking at massive data sets. Also, a lot more common than when I fist started out are computationally intensive procedures. We, in classical statistics, made certain assumptions and then mathematically you could work out what, what the distribution of something was or what procedure you should use. And now people are trying to get away from that and using the often computationally intensive procedures that don't make assumptions about, as many assumptions about where the data, type of distribution the data came from, and so on.

CM: Okay.

DP: Which I think is really good. It takes a while to get out into the users.

CM: One last question. Could you think of an anecdote or do you have a fondest memory that king of, about the u of M or about your department, or anything like that, that you'd like to share?

DP: Huh, I uh. I wasn't prepared for that one. I have to… I'd have to think about hat one.

CM: Maybe something that lets you know why you like living here or working here or something.

DP: Well I can't think of a specific anecdote off the top of my head. But, one thing I've just really enjoyed about being here is it's …you know, when I came here I became a cross-country skier. I'd never really; I'd hardly ever cross-country skied before. I just fell in love with it, and back country skiing. You know, I'd always like hiking and so on. And just the opportunity to do it here, it's just been wonderful. And just…I'm just always stunned, the… Being able to ride up the Rattlesnake or go hiking on Mt. Jumbo, or drive a few miles from town and be in wilderness, it just continues to just stun me. Since I grew up in and around "Boston and then lived in Iowa for a long time, which … I loved Iowa, but it just, it still just amazes me.

CM: That's a pretty good reason. I imagine it's the reason an awful lot of people live here.

DP: Yeah, yeah.

CM: Well, okay. That's it. Thank you.

Interview with Dr. Howard Reinhardt (HR)

Department of Mathematical Sciences
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by

Varoujan Bedros (VB)

VB: Dr. Reinhardt, could you tell a little about your self and in particular when and where you received your degrees and what was your dissertation topic?

HR: I have a Bachelor of Science in Mathematics from the University of Idaho. That's Moscow in 1949, an M. A. from the State College of Washington which is now called Washington State University. That was 1951 and my Ph. D. is from the University of Michigan Ann Arbor in 1959. My dissertation is a topic in mathematical statistics dealing with hypothesis testing. The specific title is *Using Least Favorable Distributions in Testing Composite Hypotheses*.

VB: All right. How did you become a faculty member at the University of Montana?

HR: Well, I back up on that and tell how I became a mathematician in the first place. I personally don't feel that one has epiphanies that one's long term goals are met, that there are a lot of chance events in one's life that turn out to be very important in the way one's life goes. That's particularly true in the families we have I think. I think those are very much a matter of chance. But it's also true in--I think in my education--how I happened

to come to be a mathematician is a result of a number of different such circumstances. The first one is the fact that I was born in the depression. My father was a farmer, he lost the farm and then was determined that all of his sons (there were four sons) would have college educations. So it starts really way back there. One of my first memories with my father is of holding me and I asked him for a problem, and he giving me a problem. He would say how much is 1 and 4 and I would say 5 and he would say how much is 2 and 3 and I would say 5. And he would say the same for both problems? I would say "Yes" and we would both laugh. So, already then I was getting pleasure out of problems, getting some rewards for solving problems. They weren't rewards that I found trying to do work with my hands. I'm left handed very awkward. And I'm still incompetent with my hands. My wife says next time she's going to marry an electric husband. In my high school, again I was good at mathematics. I had two excellent geometry teachers the study of Euclidean geometry in the old fashioned way. I don't suppose it is done any more now starting with the postulates and the axioms, proving theorems and proving the theorems with steps and reasons, and that kind of structure appealed to me. The problems that you can do. I suppose the Pythagorean Theorem shows up pretty early on in such a course of mathematics. It is a beautiful piece of mathematics and it ought to catch the imagination of everyone who encounters it.

So those two teachers gave me pleasure in doing mathematics. I went off to the University of Idaho in 1944 and studied a kind of general freshman curriculum. We were not allowed to declare majors as freshmen. I think that is a very wise way to treat undergraduates. That most of the 17-year olds know how they are going to spend their lives is erroneous I think. I did take some college algebra; I took a year of chemistry; I took some journalism. And I thought maybe I would major in one of those. That was one of the things I was thinking about. I was drafted in July of 1945 just as the war was ending. I spent a year and a half in the army and came then back to the University of Idaho in January of 1947. I guess that works out. And the fact that I got out of the army in time for the second semester rather than in time for the first semester was one of those accidental things that I was mentioning that leads one to make an important decision. I saw that if I majored in mathematics, I could graduate in two and a half years. I had finished one year. I could graduate in two and a half years and if I majored in chemistry, it would be three and a half years. I had already found out though that I while I was very good at doing the qualitative analysis in chemistry; I was no good because of my left-handedness and my clumsy hands at the quantitative things. I would always end up with negative amounts of potassium iodide and so forth. So that's how I came to be a math major, that fact that I could get done in two and a half rather than three and a half.

None of my family except now my older brothers had been to college. I supposed that I would end up being a high school teacher. I admired my

high school teachers. I supposed I would be a high school teacher. After I got my bachelor's degree though, I still had some time left on the GI Bill. I enjoyed studying, so I transferred across the ten miles to the west to Washington State College and started a master's degree there. And that was just because…that was because it was close and because I had a year of GI Bill.
I had supposed…

At Washington State after I had my bachelor's degree, I started to school at Washington State, I still had no idea really what mathematicians did and how mathematics as a discipline was really structured. The calculus was all algorithms; differential equations was all algorithms. The advanced calculus course was a one-semester course which was designed to get us with a little bit of rigor to the Fundamental Theorem of Calculus. There was not--not a lot of mathematical content to my undergraduate degree. At Washington State, there were some remarkable faculty members and a half dozen or so graduate students, and a remarkable faculty who worked hard at showing us what mathematics is and how you do mathematics.

One of the…there are a number of people there, but one of the notable one of my teachers there was Bill Ballard, who was a faculty member here, known as Professor Ballard. He is a year older than I, but had managed to get a master's degree from the University of Chicago at quite a young age and was on the faculty at Washington State as an instructor. He taught the course in modern algebra—a year-long course-- using the book by Birkhoff and McLane. In that course, the connection and the difference between the problems and the theory became very apparent. It happened in some of the other courses too, but one of the problems, I don't even remember now the problem. I think it was to find all of the groups of order 4. It may have been to find all of the subgroups of the so-called alternating group on four elements—a group of 12 elements. One problem or the other and the fact that you could sit down with what you know and with the kind of problem solving ability which seemed to be divorced from the theory to see those work together to solve that problem was a great revelation to me really. It came pretty late in a beginning of a mathematical career, but that's how that happened, and I finished a master's degree at Washington State. I went to work in industry—though I didn't really like that very well. In the fall… the fall of '52, I was called one day by the Chairman of the Mathematics Department and he said "You better come back and teach for me this year." I was very happy to do that. I went back then and taught as an instructor at Washington State for a year and then there was no question to any of those faculty members that I was going to spend a year there and then I was going to go and get a Ph. D. I enjoyed the teaching enough that I thought that was a reasonable thing to do.

Then I started applying to graduate school. I think I applied only to the University of Washington and the University of Michigan. I was offered teaching assistantships at both and this is one of those branches in the road where one has to make a decision, and I had no way of deciding between Washington and Michigan. Somehow, I ended up at Michigan and clearly my life has been very different because of that particular choice where I met my wife and that's really how I got the job at the University of Montana. On the faculty at the University of Michigan as a visiting faculty was a young professor named Don Higman who was on leave from the University of Montana. The Chairman here Ted Ostrom, about whom I will probably say more later in this interview, asked Higman to find him a statistician, and he knew I was from the west and knew something of my reputation from talking with statisticians. I had never had Don as a professor, but he asked me did I want to go to the University of Montana. And since I had grown up in Idaho, I thought coming back west was something that I really very much wanted to do. And so, I applied to the University of Montana and was offered the job. Without an interview on campus, I came. And probably without even a telephone conversation. Certainly no email or faxes.

So I came here and so that is a very long answer to your question about how I happened to come to the department at the University of Montana. As I say, it is the result of some planning, of course, of my intellectual life but also the result of a number of accidental happenings. I guess I understand that chaos theory is based on that, that very small changes at some point in the initial conditions change the solutions remarkably, and I think lives are that way as well.

VB: At the time that you started there, you didn't have too much of goals at the time, or did you?

HR: Well, in fact, I didn't. It was a time when there were lots of jobs for mathematicians. I had some short term goals—like finding an apartment for my wife and baby, and finishing my dissertation. I was hired before I had finished my dissertation. So I had those kind of short term goals.

VB: But as…In terms of academic terms, what were your goals and have they been changed?

HR: Oh, well.

VB: Academically?

HR: Yes, I suppose. I suppose that when I got out of graduate school I expected to do more research than I have ended up doing. I certainly had no notion that I would end up being a chair of a department or dean of a

college. And those things weren't really thrust upon me; they became goals, intellectual goals. I had been here for four or five years and was offered a year at the Math Research Center at the University of Wisconsin. I took that really expecting that I would find a more stimulating environment, well not a more stimulating environment, but an environment that would allow you more time to do research. I found with that year at Wisconsin I could do some more mathematics besides my thesis. But that I really missed the whole environment at Montana so my wife and I together decided to come back to Montana. So then at that point really made a commitment to a long term goal to be a good faculty member at the University of Montana with the… fulfilling the kinds of expectations that were had of people here, and that involved more teaching and less research than big universities had.

VB: What changes have the department gone through since you've been here? Were you directly involved in those changes and what did you think of them?

HR: Well, there have been amazing changes. There were about 8 faculty members maybe when I came here, five graduate students, more undergraduate majors in mathematics than there are now, I think. The university had about 3000 students then. An undergraduate degree is much like the undergraduate at the University of Idaho that I described. It was a matter of a student doing typically starting with a year of algebra and analytic geometry and then a year of algorithmic calculus and then some upper division courses which meant the three dimensional geometry. In order to get a bachelor's degree in mathematics, one had to take at least some advanced calculus or some modern algebra—a pretty thin undergraduate degree. We have certainly beefed up the requirements for the mathematics degree since then, and the department always in those days functioned as a committee of the whole so we were all involved in all of the curricular changes. Besides that change in the undergraduate major, or those changes in the undergraduate major, another very large change in the department was embarking on a Ph. D. program. We were, the university, sometime in the 60s I guess, was starting Ph. D. programs in the sciences—I think geology was the first, chemistry and the biological sciences came along shortly behind, physics and mathematics were under a lot of pressure from Main Hall to start Ph. D programs, and we debated the advisability of that for a long time. We knew that it would take the commitment of a lot of resources. We worried about what that would do with the undergraduate program. We did decide to go ahead with the Ph. D. program in mathematics and I was instrumental in that as a part of that committee as a whole. Also, about the time we started the Ph. D. program, I became the Chairman of the department and I was at least partially instrumental in hiring Bob McKelvey from the University of Colorado to come here. And he was very interested in re-making the Ph.

D. program, giving an alternative Ph. D. program to the straight mathematics research Ph. D. that we all had had at our institutions and that he had been guiding students through at the University of Colorado. We, the department then, with Bob McKelvey taking the lead, obtained a substantial NSF grant which allowed us to hire some additional faculty members to give some stipends to graduate students and to institute a Ph. D. program which has as its goal the training of college teachers of mathematics not of training research mathematicians. So we did have the two tracks. I think the two tracks might now have kind of coalesced together. You can't tell whether somebody is training to be a college teacher or doing a standard Ph. D. program. They're pretty much the same. Some of the good things about that Ph. D. program we still have. I think all of the graduate students participated in a seminar in college teaching. You're participating in a seminar in the history of mathematics. Those come directly out of that program. I think they're good things for every graduate student. So, yes, I was very much involved in those changes. They've been really, really very, great changes in the department and not just because the student body has gone from 3000 to 12.

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

HR: Oh, I think looking back in my time and the thing that drew me…brought me back here from the year in Wisconsin is the fact that the department has served, and I've been away from the department for nearly ten years, but the department really was a very pleasant community to live in. It was a real community, everybody working together supportive of each other. The students felt they were part of that community, and the faculty were together as a part of that community. I think people were encouraged to develop new courses. People were encouraged to do research if they had research to do. They were not required to do research so one could get tenure in the math department at the University of Montana without doing any publishing other than his dissertation. I think everybody in the department does, every faculty member, does research of some kind or other and does it at some level all right. Maybe it's just solving problems at the back of some book. Still that's research. And you know, mathematicians, probably anybody, cannot be a good teacher if they don't remain mentally alert. There is a joke that a lecture is a process whereby the notes of a professor are transferred from his notebook to the notebook of the student without passing through the brain of either one. Well, I think that is a joke, but lectures of that form are certainly not worthwhile lectures. And the faculty member has to make sure that what he is saying goes through his mind on the way and maybe through the mind of the student. So I said…so that feeling of community, that valuing of mathematics are the really remarkable things about that department. I think still an emphasis on quality of whatever people do and I say quality

rather than excellence because if one were here and wanted to really do cutting edge research, he would probably be very unhappy here. But one can solve good problems, solve them in a good way with good quality. The students can have a good quality education at this institution and I think making that possible has been an important part of what I like about being here.

VB: In what area of mathematics are you especially interested and is there any current research you are involved in? Have you done any research in other areas and where can I find examples of your work?

HR: Well, I came here as a statistician. One of the things that I had to do, as a statistician, was to help people around campus with statistical problems. And so, some of my work you can find in other people's dissertations. That might be a little hard to do. My own dissertation was published in the *Annals of Mathematical Statistics* about 1960. I did some other work at the Math Research Institute at the University of Wisconsin. Those things were published as technical reports at the Math Center, and they are probably in the archives someplace. Don Loftsgaarden and I wrote together an undergraduate textbook which, I think, was a worthwhile endeavor. You'll find that in our library. You can't find it in many other places. It didn't sell very many copies. It was a book that was ahead of its time, we like to say. Well, I have done some writing about some statistical matters about some pedagogical matters, a number of papers in the *Two Year* journal, one or two in the *Math Monthly*. I don't have a big bibliography.

VB: Okay. That's fine. How has the content in mathematics courses changed over the years? Do you expect them to change and if so, how?

HR: Well, we don't yet know how technology is going to impact mathematics. It already has clearly had a tremendous impact on the way we think about mathematical problems. Probably not much difference in what problems are important. Maybe that isn't true; maybe there is a class of problems that were just impossible to do without the help of computers. And in my area of statistics, there are some such examples. The statistics I learned in graduate school goes back to R. A. Fisher, and a lot of the statistics he did was designed so one could take data and make computations in a reasonable length of time with paper and pencil computations. When I first came here, we had some little Monroe calculators that were hand operated. They were not electrical calculators—hand-operated calculators. There was in one of the classrooms a huge slide rule and the physics majors all carried slide rules around with them. I wish I had one of those nice wooden slide rules now and I wish I had one of those old Monroe calculators just for historical value. But… So a lot of the statistics was aimed at simplifying computations so that the fact that you could

compute a sample variance, the formula for the sample variance as the sum of the squares minus whatever it is, *n* times the square root of the mean or whatever, rather than subtracting the mean from each observation and squaring those things and adding those up. You know, it saves a lot of time that computing formula. But then the computing formula also says something important about statistics because the fact that you can do that computation, the decomposition of the sum of squares, gives rise to the student-t distribution, and if one hadn't worried hard about that computation, one might not have seen that relationship. I don't know; Fisher was a very clever student, was very clever. But a lot of those things, that statistics, was designed to make computation possible. I spent a whole semester in a course where we started out with one problem in linear regression and we went through that problem. That regression problem one can now do with approximately one touch of a button on a keyboard. And besides getting everything that we got out of that one course, you would get a whole lot of other statistics as well. And another course I had, we spent about half of the time learning how to invert matrices. Again, if you are doing multivariate analysis, all of those things are done for you. You don't have to know any algorithms. But and it is one thing that I worry about, think about, is where the future of mathematics will go. We all, my generation, learned mathematics by first of all learning algorithms. You don't have to learn algorithms any more to do mathematical problems. You can ask your computer and it can solve all of the differential equations, you can ever solve, and it can integrate everything you can possibly integrate. It can invert any matrix you can invert. But nevertheless, we started by learning algorithms and then working from learning about the algorithms to seeing the structure that makes those algorithms work. And so, the question of whether one can see the structure without understanding the algorithms is one that I don't, I don't know the answer to that. Because I can't erase from my memory what I learned although I'm forgetting a whole lot of it. I said nevertheless, can't erase what I learned and start over. You see what would happen to me if I didn't learn the algorithms; I just depended on the software to do the algorithms for me. So the technology allows one to think about problems one couldn't think about before; exploratory data analysis in statistics is an example—where you take a set of data and manipulate it a million different ways, do a million computations on seven data points and it turns out to be a good thing to do. If you don't have a machine to do that computation for you, you are not going to do the million computations on the seven data points. So exploratory data analysis really requires the high speed computation. Exploratory data analysis is an important part of applied statistics. I don't know if it is an important part of theoretical statistics. I don't know if it will become an important part of theoretical statistics. I think that mathematics is still developing in the directions set out for it by the nineteenth and early twentieth century European mathematicians, Hilbert in particular. Setting

out the program for the future. I think we are still proceeding along those lines. How much we are going back and looking at the paths not taken because we couldn't take them because of the computation. I don't know.

VB: I think it is a fair thing to say. Do you have a favorite anecdote or memory that reminds you, that reminds you of why you enjoy being here?

HR: Oh, many many of them, but let me give you one that is a very high point in my life here, but it is indicative of the things about this department. At the end of my second year here, I was asked to teach summer school and I needed the money and so I was happy to teach. The chairman of the department was a remarkable man, Ted Ostrom, who left here and had a distinguished career at Washington State University. Really a remarkable man took the young faculty under his wing, made us feel a part of that community almost immediately. Asked me, he said, "Would you like to teach number theory?" And I said I never studied number theory. He said, "Well, it's time you learned, isn't it?" So he assigned me a course in number theory. There was a book by Niven and Zuckerman on elementary number theory that I chose as a text. I don't know how I happened to choose it as a text. But we, the students and I learned number theory together that summer. And among the students in that number theory class—there were I don't know, there were maybe ten or so—six of them eventually got Ph. D.s in mathematics. Included in those are Keith Yale, George McRae, and Merle Manis. There were some others who've gone on to careers just as good as theirs. That was a really remarkable heady experience as mathematics I didn't know anything about, mathematics they didn't know anything about and we didn't know which problems were hard, so we did the problems. And those young people continued to be very clever. It was a delight and it started with the chairman saying, "Well, HR, it's time you learned some number theory."

VB: Okay. Any final thoughts?

HR: Oh, well, one thing I think that probably comes through in what I've been saying is the importance of problems in mathematics. There is the beautiful theory of mathematics, but there are also the glorious problems. I think one isn't a good mathematician unless he recognizes both of those things. Good mathematics starts at, I think because my career started that way, with pleasure in doing problems—going back to when my father saying 2 + 3 and 1 + 4 are the same thing.

VB: Thank you very much for your time and we appreciate your input in this project. Thanks a lot.

HR: You are very welcome.

Interview with Dr. Gregory St. George (GS)

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by

Daniel Finch (DF)

[The beginning of the tape is quiet. The transcription starts with the first sounds on the tape.]

GS: …tendency of not planning at all. My, my wife is local in the sense that her dad grew up in Eastern Montana. They have property down the Bitterroot, and so the reason I choose to stay here was basically because I was able to. Which I thought was a pretty good trick to be able to do that. I'm not sure if I'd make the same choice again. I probably wouldn't because I did have some interesting offers back east. It was, at that time, the bottom was falling out of the Ph.D. market, but I probably could have just gotten in under the wire. It didn't get seriously bad probably until '92, or '91. It was terrible. The jobs weren't available at all, but probably could of gotten a job then, but they needed… I didn't know anything about how you get jobs. And I wasn't real good at asking questions, so when I got my degree in '89, or maybe it was '90, I don't know, yeah, it was '89. I sent out about 150 letters. I got my job, my degree in the spring. I hadn't wanted to worry about getting jobs before then. So I sent out about 150 letters in the summer. Nobody hires anybody in the summer. You apply, and you know, there's a regular season for these things; you know you do it probably in November, and the serious decisions are made in January and February, so I didn't get much interest. I went to the summer meetings in Boulder, and couldn't pick up anything there, and I decided to

apply to next year. So, I needed the job for that next year, and they…It's fairly usual that when people get a Ph.D.; they hire them a full year. So, I had a job that next year here running 150. And they were anxious to have somebody continue to do that, so, and they had created this special position which was this teaching position which is the position I ended up applying for. Because normally you wouldn't be able to stay. I don't know. Billstein managed to do it too, but when you get a Ph.D. from a place, you generally don't stay there. It's kind of viewed as a kind of inbreeding. Although eventually you outlast most of the people that taught you, so maybe it's good for continuity in the long run, but, so…Normally you wouldn't get a normal faculty position, or wouldn't be considered for one, but that, they created this special teaching position, and since I had a reputation of being a pretty good teacher, that I applied for that, and I was still applying for jobs back east, and I got an interview here and an interview there, and went to some of those interviews, but I, at that time I was pretty sure I was already going to take this one. So, I took the job here. Which is basically a job coordinating freshman classes. And the, you know the basic reason is to be able to stay in Montana. Because you know my wife had property, and the whole, her family's all here in Montana; mine are in Boston, Cape Cod, those areas so… That's how I ended up here and that's basically been my education. I don't know, I'm kind of a person that educates myself anyway, so I don't feel like it was a terrible blow only to… but you know, it's difficult now, and it would probably have been better to go somewhere else just for, to avoid all that. It's okay too. You know, I'm not mad about anything…and…so…So, there's question number one anyway.

DF: So, as we move on…

GS: …the most influential person?

DF: If there was one.

GS: Yeah, that would have been Keith Farver, he, but you wouldn't know him; he was my high school teacher. His name F-a-r-v-e-r. I should get a hold of him one of these days. He was a very rigorous; I guess it's a good argument for having terribly hard math classes in high school. Probably most people hated him. He made the, my high school classes were much rigorous than, probably most the classes we teach around here. I mean, we did, and so, even when I went, I went to a very good high school which is Randolph, New Jersey, and I… Even when I went to the University of Vermont, most of my classes the first year were just. They weren't you know… I took, I started in Calc 2, and that was probably, that was probably a good a split, a good place to start. But my, that first part of my education was seriously disrupted by the fact that they were having a war at the time. So, they did things like take over ROTC buildings and do

intelligent things like not taking any finals, because of bombing in Cambodia, stuff like that. Stuff that's you know, ancient history, you know. So, I had a spate of that. Anyway, but that would who that was; it wasn't anybody here. I guess the main thing that, how the person influence me was just, part of the thing is just gave me such a good education that it was always easy. You know, I never I any problems as a math major, at Rutgers-Newark because I had such a good background, and my background was such better than other people.

DF: Was your high school public? Or religion?

GS: Yeah, public. Yeah, I was going to public schools, never gone to… I guess Ithaca College, I taught at a private school for a year; that was kind of a funny experience for me, because I'd never been at a party school before. They had classes, at that point, I mean, if you had a Monday, Wednesday, Friday class in the afternoon, it would meet Monday, Wednesday, Thursday, because nobody would come to class on Friday.

DF: Is that right?

GS: It's changed since; I guess it's a serious school now. But at that point it was a little less serious. I'm not, on number three. I haven't really been a goal sort of person, you know, so I'm never, I've never lived my life that way. I always try to, you know, much more unconscious sort of kind of ways of making decisions, and sometimes just drifting into things. I think, so I didn't have a real set of goals. If I had to state goals, it would be more kind of personal goals of, you know, I'd like to be a kind person, you know. One of the basic problems I see with being a professor is a lot of professors end up being assholes at a certain point in their career. I always wanted to avoid that. No offense…it's just that…

DF: Hope that you would be able to recognize that at least.

GS: Right, I hope so. Well, it's just because they have a little bit of power, and a little bit of power in a limited area is very dangerous. A lot of power, you probably realize that you have a lot of power and you're not so prone to become, I don't know. If I had goals, they'd be goals like that, which are kind of not the kind of thing that really are easy to put into a department mission statement… So, the best asset of the department of mathematical sciences I would say is the faculty… and Montana itself. I mean, the fact that we get some wonderful students here just because they like to come to Montana. You know, probably better students than we deserve. The core of the faculty, which I view as being, you know, people like Don and Gloria and Keith and Bill Derrick, those people. So, they're in the process of retiring and going out the other end, and we're getting some wonderful people in the other end. So, it's… but you know, so those

two things. I think we, especially in our programs, like the Wildlife Biology Program brings in really, sometimes some better students that I ever have a right to see. And so that's been a real…, so the location and the faculty is number 5.

DF: They're in number 4, Greg. Do you see some things that you know, that have changed? Whether, you know I mean…

GS: Well, yeah, a lot of things have changed.

DF: Well obviously, there are going to be some, rather some maybe that you can point to and say these have made a pretty big impact on maybe, you know?

GS: Well, a lot of them have been external changes, just in mathematics that have been forced by the technology. I mean the technology is the major, the major fact of not only mathematics, but of the world. It's larger than mathematics, and so, the process of adapting to technology and deciding what's appropriate uses of technology, you know, and what aren't. So, you know, little things like the black boards have turned into white boards, but you know, the computers hanging from all the ceilings, and on all the desks, and the way, the fact that you know, all the computational part of mathematics is basically programmed. So, that's not something that is…so, that's major area of change. I don't know if that's what you're actually looking for there, but that's what I think is… What change has the department gone through? While I've been here, the department went through two of these things where they tried to abolish the Ph.D. program. And in two of those, and I was directly involved in one of them, in that I ended up going over to Helena to testify, and also Keith was chairman at the time, so it took a lot of his time. Sort of, those were very debilitating. It took pretty much all the faculties' energies for a couple of years at a time, and ended up being, you know, they did get rid of a number of departments in those, and we ended up surviving, but not by much. So, those are, a couple, they didn't end up changing things, but they did end up maybe weakening things in certain ways. So, changes that the department gone through…I mean physically it's much the same except that everything is now wired. I mean we still don't have a building of our own yet… Psychologically those were important, those, the last of that happened before I was a faculty member, but the other transition which is, you know, not completely immaterial was the semester, quarter to semester transition. Let's see, the major change, I think is a slow change, that people don't see it. I talked to Bill Myers the other night, at the retirement dinner, and he said that when he came here in 1952, there were 2100 students and about 200 faculty members. So that means that the faculty, the student-faculty ratio was 10 to 1. What's happened while I've been here even is that the faculty has become kind of a supervisory core

for a large group of part-time people that are doing most of the actual teaching. And, that's not a good change, you know. There should be twice as many permanent faculty for… and I don't know if that's just through, you know you can put some of the blame on the tenure system; you could put some of the blame on; I think you can put a lot of the blame on the administration. You know, I'm not sure if faculty are terribly overpaid; that's a certain amount too. I think they're probably fairly fair, and my brother-in-law that operates a D-6 Cat; he makes more money than I do, you know. About the same number of months a year. So, I don't think we're overpaid; I don't think we're terribly underpaid. I'm not one of these ones that is big to complain about the money or anything like that. The preparation level of the students has gone down because it's become more of a; there's just more people here. A lot of people that wouldn't have gone to school 20 years ago, are now going to college. That's not necessarily a bad change; it's just an adaptive sort of change. But you know, in terms of the psychology here, or that spirit of the department, the major change has been from that. The fact that there's the same number of faculty here essentially as was 20 years ago, or you can look up the numbers, but there's not a whole lot more for, you know, basically a tripling of the size of the university.

DF: That's true.

GS: And that's the kind of thing that happens year by year, so you don't notice the fact that you're spending extra time supervising things, instead of you know, thinking about things instead. So, I don't know if that's an adequate answer, but that's…

DF: Good enough.

GS: Well, that I can think of…So, a lot of the changes haven't been really terribly positive. Of course in the last couple of years, we've grown buildings everywhere. And you know, that's not… For a long time, they didn't do any building at all. I don't look at that as being a terribly substantial change. I don't know if I could contribute too much on that. On the other ones because. You know, what research work I'm doing right now, is just basically trying to figure out some things. And you've seen a lot of it because it's just, it's… My whole focus in mathematics is completely different, you know, in the sense that, I'm trying to understand things at a very deep level. I mean, I started like as a philosophy major, and maybe I'm still very much that way, and I'm, I'm interested in ideas and where they began, and how they exist today. Their evolution over time. So I'm not particularly interested in, although I may not… I think I have some pretty strange ideas, so I think some of them might actually be good ideas. I just haven't had time to follow up on a lot of kind of research ideas. So, recently at least, in the last couple of years it's been kind of

delving into various areas of history, although I have some ideas for some other things, I just haven't had time, to kind of look at them. I think of myself as kind of a, you know a lot of my, I have a hard time if I have a class you know doing, I don't find I have any time beyond you know what it takes to teach these classes, and run whatever committee I have. I tend to be running big committees at one time or another. You know, I sit computer committee, but before it was the undergraduate committee and stuff like that. Even a 121 class just takes me a lot of time. You know I don't do anything the same way I did it, or use old tests, or do anything like that so, it takes me a lot of time to do that. Maybe I've just slowed down too. I'm not sure. Number 9, I really have to think about for a long time, because anecdote or memory that reminds you of why you enjoy being here…I can't really think right off of… I like the place, you know. I like the place for its, kind of for its sparseness. And I like, I like a lot of the people, not necessarily, I respect the people and the diversity, but a lot of people that I like are kind of the old timers that are around. The ones that I knew mostly through my wife's family. And, so, there's a certain emptiness here, a certain toughness that I enjoy. And that's not something you really find at the universities so much. Overall, I like to be able to point to an anecdote; I have a hard time doing that right now.

DF: Do you find it more to be the attitude of the people living here, more so than, you would trying to get at a specific memory? I mean, you certainly don't have to say, gosh, there's one thing that sticks in your mind as to, why you remain a professor here at the University. And certainly that's not the only thing in your mind….

GS: Yeah, I still find. I mean it's gotten a bit more crowded since I've been here, and so I've moved to a little less crowded sort of area, but that's, but a lot of what I like is kind of the physical environment, you know, and I see that physical environment reflected in many of the long time people that, you know, grew up here, and you know I found the same thing in Vermont when I was there, and there was a lot of people that were from really small schools and so they were very individual and very interesting. And they had a certain resilience that I don't find in the people, when I, you know, my later life when I was in the suburbs, I think a lot of my life has been boring compared to most groups. Even though, I'm not always, find that was a very idyllic sort of situation. It wasn't a bad situation, but there was a cultural emptiness in the suburbs, and is not. I like towns, I like towns that function and have, you know interrelationships and different community, and suburbs don't have that. They don't exist as any sort of social entity.

DF: They don't have neighborhoods anymore.

GS: No neighborhoods that's right. And you know, in, Missoula's kind of losing its neighborhoods, and Corvallis maybe already has in some sense. It's not, but that's more of a functioning community there, Hamilton. It's been inundated by, maybe half the people in the last three years are, have moved in the last three years…

DF: Right.

GS: …so, it's half these new comers that a lot of the people don't know anything about, and a lot of old timers that, you know, know each other and kind of know how things have been, and so, the change has been a little bit too rapid, I would say, but you don't get to choose those things, you know. I'd kind of like to, you know, if I had a choice probably live…I did an interview for a job in Helena, and didn't get it, but I think it would be kind of interesting to be on the east side of the divide in maybe a smaller school. Not sure I'd want to go to Butte. Well, you know.

DF: That has neighborhoods.

GS: I'm half Finnish, and the other half is Irish, so I don't know, in some sense I should be in Butte…

DF: The last question Greg, number 7, although you certainly may not have an answer for it now, I mean certainly.

GS: Yeah…

DF: Take your time, all right, and if you do think of something just let me know, but you know one of the things that we're interested in looking at is, we saw when Hilbert posed his first problems, the amount of work that came out of that…

GS: Right.

DF: And of course mathematics anymore is so broad, but would it be possible to construct another set of problems that might help, you know, the direction of math in the next century?

GS: Yeah, and I don't think that I'm really on the forefront enough to have, to kind of have a real good feel for that. I have an idea actually, but I don't, I wouldn't know how to phrase it in terms of a single problem. There's been some kind of things that have kind of been ignored. But you really, I mean what Hilbert managed to do was to focus it in a bunch of specific questions. In terms of math education, I mean, the most, there there's certainly some big questions, and I don't think we have…The problem with those is you're never going to answer them and know that you've

actually answered them, but I mean as a profession, we have to figure out what role for technology, what's the proper role for technology in learning, and how much you can use it, and where you can't use it, and I mean, we've seen some atrocities committed by using too much, and it certainly, there's, certainly, certainly it opens up a lot of things that you can do that are quite wonderful too. So, it's just balancing that out is going to take, as a profession, is going to take another 20 years. But mathematically, you know that's, I mean the most open area I guess is probably functions of several complex variables. I'm not sure that we're going to get, I don't think we even have the right, a lot of the definitions right. I think the definitions are interconnected in a way, you know you have a, but see, I'm not working in that area, so it's not for me to say.

DF: Sure.

Interview with Dr. Brian Steele (BS)

Department of Mathematical Sciences
The University of Montana
Missoula, MT 59812

by

Daniel Finch (DF)

DF: See where it leads us…So, why did you choose to become a faculty member here at the U?

BS: Why? I don't know. Well, I wanted to for a long time, but that's not really a very good answer. Primarily because of an interest in pursuing research and also in teaching, but primarily because of researching. It's just the easiest way to pursue research.

DF: All right. Who was the most influential person in helping you choose math, then as a career? And you know; how did they do that? Obviously, you know you said your bachelor's was in natural resources, so at some point you kind of veered towards math. Or maybe earlier, I don't know.

BS: Yeah. I started taking math classes. I came here in '78 after I got my bachelor's, and I worked for the forest service. And sometimes in the winter, it was a seasonal type work, so I wasn't always working in the winter. And so I started taking math classes here mostly because I was encountering statistics in the work that I did for the forest service occasionally. But I took some math classes, and I took--I think it was Yale--I took a couple of courses from Yale in calculus. And so it has sort of been, it turned me away from biology and into math and into statistics.

DF: Okay. So, obviously you have just started here. So this question is--well, I'll only ask you the first part, but you know, what are your goals going into this as faculty member?

BS: What are the goals?

DF: Sure.

BS: My goals?

DF: The second half for everyone else was how have these been accomplished? You don't have to have an answer for that.

BS: I haven't accomplished anything really.

DF: I don't know.

BS: What was the question again?

DF: You know, just…

BS: What were my goals?

DF: …yeah, what would you like to be doing?

BS: Well, once I got here in place, I realized that teaching is also pretty important to me so I want be a good teacher. And still pursue research, and pursue research too. More specifically I want to develop a… sort of a research program. This isn't a particularly long-term objective, but it's a short-term objective in five years is to get a serious research program that's statistics in remote sensing and classification. So that involves having, you know, more than one person working on these projects.

DF: Okay, well let's… Since were talking about it. Let's do this question. And so, you know, what areas are you particularly interested in? Obviously you just answered a bit, and so, but let me just refine it. What are you working on now in your research? And is there somewhere, where, you know, myself or someone else can go and find examples of this? Publications or something along that line.

BS: Yeah. I'm working on classification rules. And so the idea is that in the context of remote sensing, we have a map which consists of a set of polygons. And these are unlabeled. And the objective is to label them with a vegetation type like Doug fir forest or sage brushes in contact. And so this information comes from two sources: somebody goes out on the ground and figures, observes what the vegetation is in some sample of

polygons. And then the rest of the information comes from a satellite which reads the spectral reflectance over big bands of the electromagnetic spectrum. So, you, and that's available for all the polygons, so the idea is to use the training data and mathematics that come up with a rule which will take the spectral reflectance data from any polygon and predict a land cover type for that unsampled polygon. And there are lots of examples of that. I can either give you, direct you to somewhere, or I can give you one or two.

DF: Sure. You know, at some point, maybe I'll just handle this.

BS: Well, yeah. I'll give you this, which is not exactly what I'm talking about, but it's closely enough related that you'll get the picture.

DF: Great, okay. Thanks, appreciate it. All right, so, you got your doctor in 1995 from here, and you know originally you said, kind of were in the Missoula area '78-'79. And if you took classes then and then came back, what do you see as changes in the department from, kind of when you were first here to now? And if you can identify them, you know, what do you think of those changes?

BS: Well, before I was a non-degree graduate student, and so I was only on periphery. You know I was only familiar with a few people. So what are the changes? I don't. I mean I can't pinpoint them. From all the way back then, I mean at the graduate level I don't have a very good idea. At the undergraduate level, I mean, I don't know. I mean, I've just never, I've never had a, I've never had a clear picture of what the department was really like.

DF: Sure. I know that feeling. Okay. Well, so, can you answer this? Do you think there's a, maybe a, best asset that this department has? Maybe it doesn't, maybe it's hard to define a direction of it, but does it have something going for it that…?

BS: Well, I don't know what the best asset is, but it does have a very strong asset, and that's that there are some very good teachers here, and as far as I know, that everyone is reasonably good. In that, that's fairly unusual actually in any faculty department for a state university or a more advanced university. If you go to a small college, then people have to be good. So, this place has got its, has a good mix of teaching and also a lot of things which can be done that you get with a larger university, so, it's a, I would say the asset is that it has small college attributes and also being size university attributes at the same time.

DF: Alright. This is a tricky question. Whether you have a defined answer or not, that's ok. You know in 1800, Hilbert proposed these problems,

twenty-three problems for people to answer. Now, some of them have been answered; some of them haven't. So we were kind of curious. Do you have any idea of something that, maybe not necessarily a question, but an area that will become particularly worthwhile to be worked on, maybe in the coming century?

BS: Oh, I'm not old enough to answer that kind of question. I'm not.

DF: Sure, it's a not. Just thinking about it, it's incredibly ominous, but some people do have definite ideas.

BS: You know you have to have reached a level of maturity to answer this, to answer a question like that. I mean, you know, even 10 years out it's, you know if you asked me what's going to be hot in the next 5 or 10 years, I might be able to say something, but…

DF: Okay. So, this on a lighter note, but do you kind of have a story or some kind of anecdote in mind when you think about, why are you doing what you're doing? Or why did you choose to be here?

BS: Oh, well, I mean the reason why I'm here doesn't have anything to do with The University of Montana.

DF: No, and well I think for most people, that's probably the case, at least most that I've spoken with.

BS: So why am I doing what I'm doing? I mean, I don't have an anecdote. I mean I like statistics a great deal. And I love having a problem which I can solve. You know, when I was taking these classes back around 1980, I took 241 from Merle Manis, which is really kind of a bizarre idea when you think about it. And there were only 30 students in his class. And he would state questions or conjectures to this class of freshman and sophomores. And they were really, really interesting, and it got me excited, and I can remember asking him questions after class. I mean, I realized then that there was a lot more to offer in mathematics than there was in biology. That the ideas were, could be very sophisticated. And to some extent that's why I'm here. That is to say mathematics and statistics.

DF: Okay. While Merle was teaching 241?

BS: Yeah. It's pretty strange.

Interview with Dr. Keith Yale (KY)

Department of Mathematical Sciences
The University of Montana
Missoula, MT 59812

by

Varoujan Bedros (VB)

VB: Dr. Yale, can you please tell us a little bit about yourself, and in particular when and where you received your degrees and what was your dissertation topic?

KY: Yes, and I can go back long before that. I was born in Billings, Montana. Family legend said my mother had a thousand aces in the game of Pinochle the night before my birth, so I'm perhaps improbable. During World War II, the family was moving to Seattle; the family car broke down in Livingston, I grew up there, graduated from high school and started at the University of Montana in Fall of 1957. I graduated here in mathematics in 1960, and went to Berkeley for my graduate education. I received my Ph.D. from Berkeley in 1966. My dissertation was written under the mentorship of Henry Helson on Generalized Commutation Relations which is an area function analysis inspired in part, by von Neumann's work in quantum mechanics. I benefited from having two other committee members: one, Michel Loeve, the other Hans Albert Einstein, who was the eldest son of the real Albert Einstein.

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

KY: At the time, I liked the size of the school. I had friends here. I had a few jobs elsewhere, but I kind of did not want to take them just because I would be too far from my friends. For example, I had a very nice offer at the University of Alaska, but I thought that would be saying goodbye to just about everybody I used to have good times with.

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

KY: Well, I don't know if I could say that there was a most influential person. There were several people who influenced me very strongly in different ways. I would certainly have to mention Harold Chatland. When I was in high school, Harold was a former chair of the department and dean of the faculty at the University. I met him while I was a junior in high school at a mathematics camp at the University. I had marvelous direction from professors Hashisaki, Ballard, Myers, and Reinhardt in the mathematics department. I had even stronger direction in, but in a different sense from my contacts with Professor Hayden in the physics department. The thing I appreciated most about my undergraduate education here was very deep commitments by the faculty to their students. And it meant a great deal for someone who was perhaps as insecure as I was.

VB: What were your goals when you started? And have these been accomplished? Have them been altered? If so, how and why?

KY: Well, the older I get, the less I think people are goal-oriented anyway. I think it's an illusion. I did have one kind of quest, and that was perhaps to understand everything. That was when, of course, I was young and naïve. Mathematics seemed to offer a security and a finality that many other areas did not. Although I, hence as an undergraduate I was very interested in philosophy and in particular the foundations of mathematics. That was one side of me. The other side of me was, and it still persists, is mathematical physics.

VB: What changes has the department gone through since you've been here? Were you directly involved in these changes? And, what did you think of them?

KY: Well, I've been here too long to remember all of the changes. I've probably been outspoken against a great number of them. I almost hesitate to say, because afraid a little bit too much bitterness might come out. I think the place has deteriorated quite a bit in the overall quality. We've become primarily a service-oriented department at a tremendous expense to maintaining standards in our courses. I have not been able in recent years to teach the quality of course that I had as a student when I was here. And that saddens me greatly.

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

KY: Well, for my own career and I think by extension it also affects students is there is a great variety of things that can be done, far more flexibility and opportunity than one has at say a bigger school or at a smaller school. For example, I've been able to teach a wide variety of course. These kinds of courses wouldn't be offered at smaller schools. At bigger schools, the faculty tends to get channeled more narrowly into their specialties. And so, my biggest benefit and thing I appreciate the most is this wide variety of things I've been able to do.

VB: Okay, In what area of mathematics are you especially interested? What are you currently working on? Have you done research in other areas? Where can I find examples of your work?

KY: Broadly speaking, I'm in analysis with interests in mathematical physics; more narrowly speaking I'm in abstract harmonic analysis or complex function theory, or function algebras. And, well, my published work has been in analysis, some of it has a pretty strong algebraic flavor. I think I, I really think some of the boundaries between areas are somewhat artificial things. But since you forced me to classify myself I have to say that I'm an analyst, but part of my spirit is definitely algebraic. On weekends, I like applied mathematics. On Tuesdays, I like Algebra.

VB: Can you name any of the journals that you have published in?

KY: Oh, *Pacific Journal of Math, Rocky Mountain Journal of Math, Michigan Math Journal, Proceedings of the Royal Irish Academy of Sciences.* Those are at the top of my head. There might be some others, *Proceedings in American Math Society,* a variety of places. In addition, during a large part of my career, I wrote a tremendous number of mathematics reviews.

VB: What question would you suggest for a year 2000 "Hilbert" list of problems to direct the thinking of mathematicians or mathematics educators?

KY: Well, first I don't think third rate mathematicians are entitled to give Hilbert-type problems. My own endeavors have been to give in some specialized areas; I, on a few papers have set, set some problems that gave direction to the field. No, it takes a Hilbert to give Hilbert-type problems. Given the breadth of mathematics these days, I don't know if there is a Hilbert who could give Hilbert-type problems at the turn of this century. I would ask perhaps; Atiyah [Sir Michael of Great Britain] might give some direction, but lesser mathematicians, no. I'm still working on one of Hilbert's problems, was just a call to mathematize physics. And of course,

there's a huge endeavor still going on in math, that thing, so I'm still working on his last century's problems.

VB: How has the content in mathematics courses changed over your career? Do you expect it to change? And if so, how?

KY: Well, I think some of the change is going to be random because I've never taught the same course twice. The content is always changing for me. I believe a course has to be an act in creation, an adventure. I have great difficulty presenting canned material to classes. But that's personality quirk of mine. I, for example, have taught advanced calculus courses with all sorts of different goals and flavors and spirits in mind. And each of them, in their own way has been successful. And I really hope that mathematicians in the future of this department will have that same adventurous attitude towards the subject that I've had. So, it has to change in that sense. That might just be called random or personal change. What other changes will happen, some are just driven by service demands. Technology has influenced certain aspects of what's done in courses, but I would hesitate to "predict" the future on this one.

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

KY: That's one thing, you know I've certainly have enjoyed being here, in spite of all the difficult times, but I've never encapsulated it in one particular story or anecdote.

VB: Nothing comes to mind right now?

KY: Nothing comes to my mind particularly. Mostly I've just enjoyed lots of good company. And good times as well as bad times.

VB: Okay. Thank you very much for your time and we appreciate your input in this project. Thanks a lot.

KY: Well, I enjoy it and I wish your project every success.

VB: Thanks.

Faculty Members in the Department of Mathematics/Mathematical Sciences at The University of Montana

Johnny W. Lott

The Department of Mathematics, later the Department of Mathematical Sciences, at The University of Montana has had a long and distinguished history with many famous and infamous faculty members. In order to simplify the presentation of faculty members across more than a century, they have been grouped here in decades. There will be overlap as expected, and there may be omissions. In some instances it is not clear whether faculty members were permanent tenure-track faculty members or whether they were part-time and transient. In many cases in the 1980s and 1990s, non-tenure track faculty members were on campus for very long periods of time. Some of those individuals are listed but in earlier eras, those are not. Perhaps in a different era, someone will do an even more thorough job on this task than is done here. Also perhaps, this will serve as a start to that research.

Mathematics at the Start of The University of Montana

Cynthia Elizabeth Reiley

From its inception the University has had a person working in the area of mathematics. The very first was Cynthia Elizabeth Reiley (listed in some sources as Reilly) who was here from 1895 until1910 when she retired as an assistant professor. Among the things that are known about her are that she received her Bachelor of Science degree from Glasgow College in Kentucky in 1889, that she matriculated at Moore's Hill College in Indiana, at the National Normal University in Ohio, and at Cornell University. Ms. Reiley was the principal of schools in Alexandria and Ft. Thomas Kentucky before coming to teach in the high school in Missoula. She left the high school position in Missoula to come to the university. While here she once lived at 120 South Fifth Street and moved to 808 East Cedar in 1907. As one of the original faculty members on campus she set the stage for the department. She was joined by an assistant Anna Carter from 1905 to 1907.

1907 also saw the arrival on campus of Louis Clark Plant. Mr. Plant came to campus as an associate professor with a Ph. B. (presumably a Bachelor's in Philosophy) from the University of Michigan in 1897 and having been a graduate student at the University of Chicago in 1897-1898, the summers of 1899, 1900, 1902, 1905, 1906, and 1907. Additionally, he received a Master of Science from Chicago in 1904. Mr. Plant's work experience included being a principal in

Olive, Michigan from 1889-1891, working in Overisel, Michigan from 1891-1893, being an assistant in mathematics at Bradley Polytechnic Institute from 1898-1900, an associate from 1900-1904, and an instructor from 1904 until 1907. In Missoula for a time, Mr. Plant lived at the corner of Gerald and University Avenues. In a 1914 copy of the *Sentinel* (The University of Montana annual), one finds a statement that Mr. Plant "Has a style of hairdressing all his own. Has been mistaken several times for an escaped criminal. Loves to direct—should have been superintendent of a section-gang. Considers his subject of mathematics beyond the grasp of ordinary mortals. He means well" (p. 181).

Classes were originally taught in University Hall (or Main Hall). The Mathematics Building was opened in 1903 as the Women's Dormitory (which became Craig Hall and later the Mathematics Building). Professor Reiley was a faculty member who lived in the dormitory for a period. It was only later that the building housed the mathematics and physics department and later the mathematics department alone. A photograph of the original structure (a donation to the Mansfield Library) was displayed in the building lounge as late as 2006. Only in 2007 was an elevator and additional offices added to the building. Porches were removed in an earlier era leaving the building as seen in the photograph below.

Mathematics Building, erected in 1903

1905-1909

1909 was the year that three people joined the mathematics faculty at the university. Those individuals were Eugene F. A. Carey, L. S. Hill, and A. S. Merrill. Carey and Merrill became longtime members of the department and the university while Hill left in 1914.

Reference of Hill is found in several places in the mathematics literature. Among them is notice that Hill received his doctorate from Yale in 1926 with his dissertation title being *Aggregate Functions and an Application in Analysis Situs*. Hill had come to Montana with his Bachelor of Arts degree from Columbia

University in 1911 and his Master of Arts degree from there in 1913. Additionally, Hill became a fellow in mathematics at Columbia during 1912-13, was a special student at Regia Universita di Bologna, Italy during the first quarter of 1913-14, a graduate student at the University of Chicago in 1914, and a member of Cricolo Mathematico di Palermo. Hill later published two articles on cryptography in the *American Mathematical Monthly* in 1929 and 1931. One reference listed him as a faculty member at Hunter College in his later career. In Missoula, Hill was an assistant professor and lived for a time at 324 South Sixth Street East.

As long-standing university community members, Carey and Merrill left their marks on the department of mathematics. Eugene Carey came to the university with a Bachelor of Science degree from the University of California in 1905 where he became a graduate student until 1909. A student of both physics and mathematics, Mr. Carey became an instructor at The University of Montana in 1909, was appointed to assistant professor in 1914 (after he received his Master of Science degree from the University of California) and to associate professor in 1921. Retiring in 1943, he was named an Associate Professor Emeritus.

Professor Archibald S. Merrill became associated with The University of Montana Department of Mathematics in 1909; he only received his Bachelor of Arts degree from Colgate in 1911, his Master of Arts degree from Colgate in 1914 and his Ph. D. from the University of Chicago in 1916. While on this campus, Dr. Merrill became an assistant professor in 1916, had a year's Naval Service leave in 1918, became a full professor in 1923, became Chair of the Division of Physical Sciences in 1935-1939, and later became Vice President as well as Chair, and even in later years became the Director of Institutional Research, the Director of Veterans Affairs, the Vice President and Dean of Faculty before retiring in 1957.

1910-1919

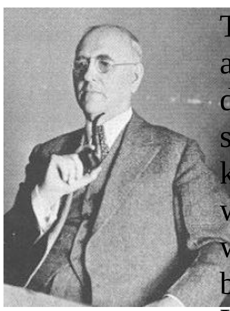
Another mathematical institution became a department member in 1913 when Nels J. Lennes came to town. Lennes, initially of 507 Blaine Street, received his Bachelor of Science in 1898, his Master of Science degree in 1903, and his Ph. D. in 1907 from the University of Chicago. Even at this stage, the ties between The University of Montana and the University of Chicago were becoming pronounced.

Lennes had been a teacher in the Chicago high schools from 1898-1907 when he received his doctorate. During a part of that period, he was also a fellow in mathematics at the University of Chicago during 1904-5, was an instructor there in the summers of 1906-7, was Head of the Department of Mathematics for the Chautauqua Summer Schools in New York starting in 1908, was an instructor at Columbia University from 1910-1913, and became Professor of Mathematics at the University of Montana on September 1, 1913. In 1917, Dr. Lennes assumed the additional title and duties as Director of the Public Service Division while

remaining a professor in mathematics. In 1914, we find in the *Twentieth Register* (p. 10) that Lennes was a

- Member of American Mathematical Society
- Author with H. E. Slaught of *Elementary Algebra*, *Advanced Algebra*, *First Principles of Algebra*, *Plane Geometry*, and *Solid Geometry*
- Author with Oswald Veblen of *Infinitesimal Analysis*
- Contributor to *Transactions of the American Mathematical Society*, *Bulletin of the American Mathematical Society*, *American Journal of Mathematics, Annals of Mathematics, School Science and Mathematics*, *The Chautauqua*, and *The Educational Review*

Additionally he had several books in preparation, *Elements of Projective Geometry*, *Aynoptic Course in Mathematics for College Freshmen* and *The Theory of Sets of Points*. A prolific author over his career, Dr. Lennes built the house at 1325 Gerald Avenue that became the home of The University of Montana presidents. According to some sources, Dr. Lennes had the home built with his book royalties. At the time and until 2006, the home was known as having excellent workmanship and being constructed of quality materials.


N. J. Lennes

There are many stories and legends about N. J. Lennes around the university community. Because he was in the department until 1944, there were many years for these stories to develop and morph. Among the people who knew him well on campus was Emma Lommasson who worked for him when she was a student, helped type [and write] many of his manuscripts, and who went on to become the Assistant Registrar for whom the Emma Lommasson Building is named on campus. One brief story about Lennes and written by Lommasson appeared in the *CAS* [College of Arts and Science] *Forum* in the 1970s. [That publication no longer is available.] Further information can be found about both Lennes and Lommasson in *The Newsletter of the Department of Mathematical Sciences* at the departmental Web site [http://www.umt.edu/math/Newsltr/winter05.pdf; http://www.umt.edu/math/Newsltr/spring04.pdf, both accessed in December 2006.

In different resources at the university, assistants are listed either as such or as lab assistants. It is noted that Mabel Lyden worked in the department as an early assistant beginning in 1914. Additionally Albert McSweeney became an instructor in the department in 1915. Few changes were made for the remainder of the decade. In fact in the 1918 yearbook for the university we find the statement, “Three men are in charge of work in mathematics.”

1920-1929

In 1921 when Dr. Lennes was on leave, Gertrude Clark, (B. A., University of Montana, 1921) and William K. Brown (B. A., University of Montana, 1915)

were listed as assistants. 1922 found Raymond Garver as an assistant. Few changes occurred until 1926 when Professor Merrill was on leave of absence, Robert E. Morris (B. S., Gonzaga University, 1924) became an instructor, and Elizabeth Flood (B. A., State University of Montana, 1926) became an assistant. 1923 brought Garvin D. Shallenberger and Edward Little as Professor and assistant professor, respectively, of physics, then combined with the mathematics department.


Emma Lommasson

1929 also brought Emma Bravo to campus as an undergraduate student. She later earned her bachelor's and master's degrees here became a teaching assistant and later a departmental secretary. Marrying Thomas Lommasson in 1939, Emma went on to teach mathematics during the war years and later moved into the Registrar's Office in 1946 as an assistant, becoming the Registrar in 1973. The Registrar's Office was located in a building known as the Lodge for many years. In 2001, the building was renamed the Emma B. Lommasson Center. Ms. Lommasson retired in 1977.

An article about Emma and the renaming of the building appeared in the Department of Mathematical Sciences Newsletter in 2001. [See http://www.umt.edu/math/Newsltr/spring01.pdf]

1930-1939

!930 found Elizabeth Flood as a research assistant but now with her Master of Arts degree from The University of Montana in1929. Joining her was Ruth Leib (B. A., University of Montana, 1930) as a graduate assistant. In 1934, Mabel Foster (B. A., University of Montana, 1924) also became a graduate assistant and continued in this role until 1937. In 1935, Dr. Merrill became Chair of the Division of Physical Sciences and remained in that role until 1939.


Harold Chatland

1937 brought Harold Chatland to the university as an instructor. With degrees from McMaster University (B. A. in 1934) and the University of Chicago (M. S. in 1935 and Ph. D. in 1937), Chatland was to become another longtime faculty member here. Chatland is remembered in the oral interview of Dr. Charles Myers and was the subject of an article in the *Department of Mathematical Sciences Newsletter* found at http://www.umt.edu/math/Newsltr/spring99.pdf, accessed in December 2006. In that article it is noted that Dr. Chatland left the university to work at Ohio State University from 1946 to 1950 when he returned to this campus where he served as department chair, Dean of the College of Arts and sciences, Dean of the Faculty and finally as Academic Vice President. He left the university in 1960.

1938 found John Houston (B. A., University of Montana, 1932, M. A., University of Montana, 1933) as a graduate assistant, and 1939 was the last year of N. J. Lennes' chairmanship.

1940-1949

The war years brought many changes to this campus like others around the country. The staff changed little but did include members teaching classes for the war effort. Dr. Chatland, for example taught Aerial Navigation and Advanced Aerial Navigation as well as Descriptive Astronomy with Dr. Merrill in 1941. Additionally Emma Lommasson taught navigation.

In 1941, Roy Dubisch joined the department as an instructor having earned two degrees at that point from the University of Chicago, the B. S. in 1938 and M. S. in 1940. Dubisch later completed his doctorate and completed his career working at the University of Washington in the Department of Mathematics.

By 1944, Professor Lennes was no longer teaching but was Professor Emeritus, having had a long and distinguished career in Missoula. Similarly, Professor Carey was retired and was Associate Professor Emeritus in 1943. Change was beginning. In 1945, Walter Hook (B.A., Montana State University, 1942) and Andrew R. Noble (B. A., Pacific University, 1929, M. A., University of California, 1934, and Ph. D., University of California, 1935) were hired as instructors. Mr. Hook went on to have a distinguished career as an artist in Montana and as Chair of the Art Department on campus. In her biography of him, *The Art of Walter Hook*, Lee Morrison described him as a painter and printmaker born in Montana who received over 90 awards from juried exhibitions and had over 80 one-man shows in his career. A prize of the Department of Mathematical Sciences is Hook's comments and pictures at a colloquium late in his career. He died in 1989.

By 1947, there were a number of new faces in the department. Edna Bennett, Helen Gillespie, and Evelyn Webb were instructors with Maryanne McBride, Lou Alta Merrill, C. R. McEwen, Thomas Joyce, Elizabeth M. Smith as assistants and John Gregory as a student assistant. Hook was still an instructor in 1947. Smith became an instructor in 1950.

Theodore G. (Ted) Ostrom (B. A., University of Minnesota, 1937, B. S., University of Minnesota, 1939; M. A., University of Minnesota, 1939. Ph. D., University of Minnesota, 1947) was added to the faculty as an assistant professor in 1948 with E. M. Smith as an instructor and Bruce Beatty as an assistant. Ostrom was a renowned mathematician in his career with work in different areas but finite geometries were specialties. His career led him to Washington State University where there is a lecture series established in his honor. He was The

University of Montana Department of Mathematics Chair in1955-1957. Also in 1948, O. I. Jackson became an instructor for the department.

1950-1959

In 1950 Dr. A. S. Merrill served as the Director of Institutional Research, Director of Veterans Education and as Chairman of Mathematics. Faculty included Ostrom and Chatland; instructors: Helen D. Gillespie (B. A., University of Minnesota, 1919) Elizabeth M. Smith (B. A., Ohio Wesleyan University, 1929; M. A., Ohio State University, 1937), and Robert L. Berggren (B. A., University of Minnesota, 1947; M. A., University of Minnesota, 1949); and assistants: Lou Alta Merrill (B. S. C. E., University of Colorado, 1920), Bruce L. Beatty (B. S., Montana State College, 1947), Edna K. Bennett (B. L., University of California, 1912; M. S., University of Chicago, 1917), John R. Gregory (B. S. Montana State University, 1947; M. A., Montana State University, 1948), Lester N. Hauge (B. C. E., University of Minnesota, 1939), Thomas F. Joyce (B. A., Montana State University, 1947), Maryanne McBride (B. A., Arizona State College, 1935), Kenneth G. Axvi (B. A., Intermountain Union College, 1941), Daniel E. Coffey (Ed. B., Illinois State Normal University, 1932; M. A., University of Wisconsin, 1934), John A. Peterson (B. A., Montana State University, 1949; M. A., Montana State University, 1951, who was appointed Instructor in 1955-56).

The 1951 yearbook, the *Sentinel*) also included a photograph of the Department of Mathematics that showed Chatland, Ostrom, Merrill with G. Masaglia, Assistant Professor, (B. S., Colorado State College, 1946; M. A., Ohio State University, 1948; Ph., D., Ohio State University, 1950), and instructors George A. Craft (B. S., Miami University of Ohio, 1939); M. A., Indiana University, 1950), A. L. Duquette (B. S., University of Massachusetts, 1948; M. A., Columbia University, 1950), and R. L. Berggren with assistant Paul T. Rygg.

1953 brought more additions to the staff with William M. Myers, Jr. (B. A., Denison University, 1946; M. A., Ohio State University, 1948; Ph. D., Ohio State University, 1952) and Joseph Hashisaki (B. A., Montana State University, 1940; M. A., University of Illinois, 1951; Ph. D., University of Illinois, 1953) as Assistant Professors, with Paul, V. Reichelderfer as Visiting Professor of Mathematics in the summer. Assistants were Thomas A. Bray (B. A., Montana State University, 1952)**,** Arthur E. Davis **(**B. A., Montana State University, 1952)**,** Larry C. Hunter (B. A., Montana State University, 1952), Vera T. Myers (B. A., Bryn Mawr College, 1948; M. A., Ohio State University, 1950 as a statistics assistant) and Robert S. DeZur (B. A., Montana State University, 1952).

Of this latest group, Joseph Hashisaki is honored by the department each year with an award given in his name to honor the “best” undergraduate mathematics major. He left Montana and spent much of the rest of his career at Western Washington University. While here Hashisaki and John Peterson (for whom the annual mathematics education department award is named) wrote one of the first

mathematics education books on content for the preparation of elementary teachers. As noted later, another successful book produced from this campus in the 1970s was by Billstein, Lott and Libeskind. They appeared to have had good role models with this earlier pair.


Bill and Vera Myers

William (Bill) Myers, who has an interview earlier in the book, and his wife, Vera, were active in the department for many years. Bill was chair and was the subject of an article in *The Department of Mathematics Newsletter* seen at http://www.umt.edu/math/Newsltr/fall00.pd, accessed December 2006. In that article, Professor Myers describes faculty dissention at the university in 1957 with President McFarland being told to fire faculty members by the Board of Regents, resigning instead and in the aftermath, several influential mathematics department members including Dr. Ostrom resigned. Dr. Myers was Chair of the department from 1962-1969.

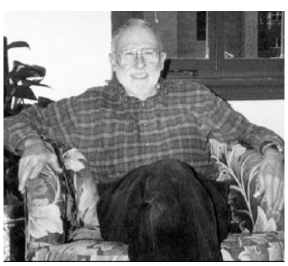
In the 1955-1957 period, Wayne R. Cowell (B. S., Kansas State College, 1948; M. S., Kansas State College, 1950; Ph. D., University of Wisconsin, 1954), John Frankino and Louis A. Schmittroth came to campus as Assistant Professors and Donald G. Higman (B. A., University of British Columbia, 1949; M. A., University of Illinois, 1951; Ph. D., University of Illinois, 1952) arrived as Associate Professor. Maynard R. Stevenson (B. A., Montana State University, 1953), John A. Peterson, listed earlier, and Richard Remington (B. A., Montana State University, 1952; M. A., Montana State University, 1954) became instructors with John Franklin (B. A., Montana State University, 1955) and John W. Marvin (B. A., Montana State University, 1954) as assistants. Additionally, Rimhak Ree (B. A., Kefjyo Imperial University, 1944; Ph. D., University of British Columbia, 1955) became a lecturer.

In the period 1957-8, both Donald G. Higman and Wolfgang Schmidt (Ph. D., University of Vienna), lecturer were on leave. William Ballard (B. A., Whitman College, 1946; M. S., University of Chicago, 1947; Ph. D., University of Chicago, 1957) and Howard Reinhardt (B. S., University of Idaho, 1949; M. A., Washington State University, 1951; Ph. D., University of Michigan, 1959) came to campus in 1957 as Assistant Professors and Frederick H. Young (B. A., Oregon State College, 1938; M. A., Oregon State College, 1948; Ph. D., University of Oregon, 1951) was hired as an Associate Professor.

Dr. Ballard discussed The University of Montana in his interview earlier and the book and from a lecture given in a seminar on campus in 1990. He worked at the Aberdeen Proving Ground during World War II. In 1946, he graduated from Whitman College in 1946, applied to and was accepted to Harvard, Princeton, and

the University of Chicago. He attended the University of Chicago and in the fourth quarter after studying 9-10 units and taking tests, he received a master's degree. In that first year, he received a service scholarship that paid part of the tuition. He lived in an 8' by 12' room at the Hyde Park YMCA and had three roommates. His advisor was A. Adrian Albert, algebraist who had hand written a 9-10 page dissertation in the area. Ballard took algebra, analysis, and topology. In algebra, he studied under Barnard (a student of E. H. Moore). He described Barnard as an undistinguished lecturer who talked to the board. In analysis, he studied real variables under Graves. There were 70 students and Graves used galley proofs of his book as the text. In topology, he studied under John Kelley. In the beginning Kelley used the Moore method which Ballard found difficult but he survived. Later Kelley lectured. Other students in the course were Massey, Rubin, Flanders and Gaffney. Chancellor Hudgins had brought Marshall Stone to Chicago and with him came many mathematicians. Ballard also studied under Saunders MacLane who had completed his Ph. D. at the University of Göttingen.

Ballard describes Irving Kaplansky as the best lecturer he had. Kaplansky taught only courses where he could write papers. Described as a single-minded individual, he came to the office at 7:00 AM, swam the 55th Street promontory and had perfect pitch. Halmos lectured on probability; Ziegmund was an analyst who lectured on Laplace transformations and was so short that he could write only on the bottom half of the board; Weil, the first and foremost mathematician in the Bourbaki group, lectured in differential geometry, algebraic geometry, and arithmetic on curves. In his last summer at Chicago fellow students were Smale, Thom, Riese, Calderone and Singer.

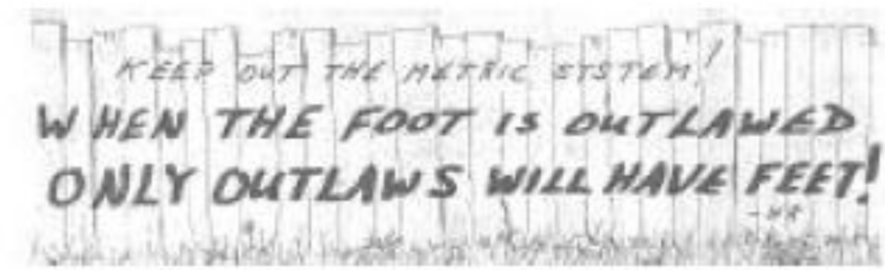

Bill Ballard

Dr. Ballard was the subject of an interview in *The Department of Mathematical Sciences Newsletter* in the Fall of 1998 which can be seen at http://www.umt.edu/math/Newsltr/fall98.pdf, accessed December 2006. Dr. Reinhardt had studied under Dr. Ballard at the State College of Washington, completed his masters degree there and went to the University of Michigan for his doctorate.

With encouragement from Dr. Higman and with no formal interview, Dr. Reinhardt accepted a position at The University of Montana, joining his former teacher as a faculty member. Though Dr. Reinhardt left for the University of Wisconsin for a short time, he returned to the university here, was chair for a time and retired as Dean of the College of Arts and Sciences. Dr. Reinhardt was the subject of an article in *The Department of Mathematical Sciences Newsletter* in the spring of 2000: http://www.umt.edu/math/Newsltr/spring00.pdf, accessed December 2006.


Howard Reinhardt

Among other things, Dr. Reinhardt was the co-author of an innovative statistics book with Dr. Don Loftsgaarden mentioned later. His keen sense of humor was displayed in the inspiration for a cartoon that once appeared in *The Missoulian* and seen below:



In 1959, Charles R. Simons became an Assistant Professor but was on campus for a very short time.

1960-1969

This decade starts with Theodore G. Ostrom as Chairman and Professor with Harold Chatland, Associate Professors Joseph Hashisaki, William Myers, and Frederick H. Young, Assistant Professors William R. Ballard, Howard E. Reinhardt, and Paul T. Rygg (B. A., Montana State University, 1949; M. S., Iowa State College, 1951; Ph. D., Iowa State University, 1959). Instructors were John A. Peterson and Emma B. Lommasson, with William Kirkpartick (B. A., Montana State University) as an assistant. Other graduate assistants and fellows included: Michael G. Billings, Robert D. Engle, Morgan A. Long, Anthony H. Provost, and Lee W. Shrock.

In 1960, Art Livingston was hired as a professor and served as chair for two years. Students who graduated with high honors in 1960 who later become faculty members are: Daniel George McRae, Jordan, Merle Eugene Manis, Charlo, and Irl Keith Yale, Livingston.


Gloria Hewitt

1961 was an important year for the department with its hiring of its first woman on a tenure track line in mathematics since the retirement of Cynthia E. Reiley in 1910. Dr. Gloria Conyers Hewitt (B. A., Fisk University; M. S. University of Washington, 1960; Ph. D., University of Washington, 1962). Dr. Hewitt completed her doctorate one year later becoming one of the first four black American women to receive that degree.1961 began a long tenure on this campus that ended with her retiring as department chair in 1999. It is noted that she was the first woman to chair the department in the "modern" era and was the person who was instrumental in putting the department scholarship program on a strong financial footing. Dr. Hewitt once described herself as driving into

the edge of Missoula as she moved here to begin teaching, pulling over on the side of the road and crying about what she was about to do. As a mother of a young child moving to a town that she had never even visited, she describes thinking that accepting the position was an insane thing to have done. Clearly, she became a part of the community and became an integral part of the mathematics program on campus. Dr. Hewitt participated in the interviews accompanying this book and her interview is printed earlier in the book. She (along with Dr. Don Loftsgaarden) was the subject of an article in *The Department of Mathematical Science Newsletter*) in the fall of 1999 that marked their earlier retirement in May of that year. [See http://www.umt.edu/math/Newsltr/fall99.pdf, accessed December 2006.]


George McRae

Also in 1961, George McRae (Ph. D., University of Washington, 1967) and Donald V. Sward were hired as instructors in the department. McRae served in this capacity only one year and then went to graduate school to return 10 years later as an assistant professor. In 1962, Ralph Bingham was hired as an instructor for the department, and Merle Manis (Ph. D., University of Oregon, 1965) was hired in the same capacity in 1963. Like McRae, Manis left for graduate school to return in 1967. Manis was the subject of an article in *The Department of Mathematical Sciences Newsletter* in the fall/spring issue of 2002: http://www.umt.edu/math/Newsltr/fall01spring02.pdf, accessed in December 2006. At the time of his retirement in 1996, Dr. Manis had more doctoral student advisees to graduate than anyone to date. Dr. Manis is mathematically known for "Manis rings".


Merle Manis


Keith Yale and George Votruba at their retirement

Two instructors hired in 1961 were Walter Phillips and Denny Culbertson. 1964 saw Keith Yale serving as an instructor for one year. 1965 found David Arterburn and Mason Henderson as Assistant Professors and Robert P. Banaugh (who went on to become the first chair of the Department of Computer Science when it split from the Department of Mathematics) as Professor in the department. George Trickey was an instructor that year.


Charles Bryan

1966 saw the hiring of two of Montana's Livingston natives, Charles A. Bryan (B. S., Montana State College Bozeman, 1958; M. A., University of Arizona; Ph., D., University of Arizona, 1963) and Keith Yale as Assistant Professors. Charles was the second Ph. D. student to graduate at The University of Arizona. Charles served two terms as chair of

the department from 1973-1975 and 1981-1984. Charles served as advisor to some of the early doctoral students in the department. He was the topic of *The Department of Mathematical Sciences Newsletter* in the fall of 1997: http://www.umt.edu/math/Newsltr/fall97.pdf, accessed in December 2006. Additionally he was interviewed in this publication with the interview presented earlier. Much of his last work on campus dealt with the University Teachers Union.

Yale (B. A., University of Montana; Ph. D., University of California, Berkeley, 1966) taught in the department for many years and was department chair in the period 1984-1987. Yale and Votruba (mentioned later) were the subjects of an article in *The Department of Mathematical Sciences Newsletter* in the spring issue, 2001: (http://www.umt.edu/math/Newsltr/spring01.pdf, accessed December 2006) as they were retiring.

Other faculty members hired during 1966 were James Dummel and Richard Johnson as Assistant Professors with Edward M. Wadsworth and Edmund P. Geyer as instructors.


Don Loftsgaarden

In 1967 another native Montanan Don O. Loftsgaarden, Power, Montana (B. S., Montana State University 1961; Ph. D., Montana State University 1964) hired as an Assistant Professor. Joining him as Assistant Professors were Robert Stevens (Ph. D., University of Arizona, 1965) and Elizabeth Papousek. 1968 brought George Votruba (B. A., University of Illinois; Ph. D., University of Michigan, 1964). Other instructors that year were Elmer Gall, Daniel Hansen, and Dennis C. Pilling.

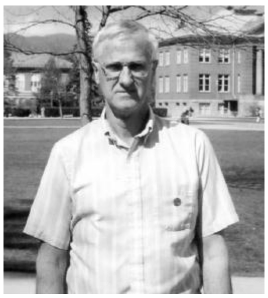
Loftsgaarden later served as chair of the department for a part of one three-year term when Johnny W. Lott resigned as chair to assume duties as the Director of the Systemic Initiative for Montana Mathematics (SIMM) Project and all of another term. Loftsgaarden appeared as the subject of an article in *The Department of Mathematical Sciences Newsletter* (http://www.umt.edu/math/Newsltr/fall99.pdf, accessed December 2006).

In 1968, Stephen Henry and Spencer Manlove as instructors. Henry went on to complete a masters degree in mathematics and become Director of the University Computer Center while Manlove became a faculty member in the Department of Computer Science. In 1969 Alan Hoffer was hired as an assistant professor and Rick Billstein of Billings, Montana (B. A., Eastern Montana College; M. A., University of Montana; Ed. D., University of Montana, 1972) was an instructor. Billstein became in later years the department's first associate chair a role that he


Rick Billstein

served in for many years. Billstein was the subject of several articles in *The Department of Mathematical Sciences Newsletter* over the years. One can be found in the Fall of 2002: http://www.umt.edu/math/Newsltr/fall02.pdf, accessed in December 2006. Billstein became the recipient of many grants, among them the Six Through Eight Mathematics (STEM) Project, funded by the National Science Foundation. Other instructors in that year included Leonard J. McPeek and Phillip Schultz.

1970-1979


Rudy Gideon


Robert McKelvey

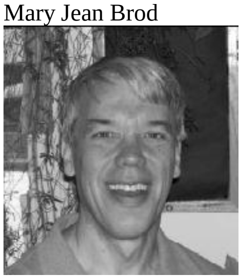

William Derrick


Johnny W. Lott

In 1970 Rudy Gideon (Ph. D., University of Wisconsin, 1970) and Michael Fisher were hired as assistant professors and Robert McKelvey (Ph. D., University of Wisconsin, 1954) was hired as an associate professor. When Gideon retired, he too had been the advisor of many doctoral students who have gone to teach statistics in many schools. McKelvey brought with him a National Science Foundation grant to enhance and enlarge a doctoral program at the university. With that grant came the opportunity to hire more new faculty members and another phase of the department was begun. With 1971 Fred Springsteel came to campus, and in 1972 William R. Derrick (Ph. D., Indiana University, 1966), Stanley I. Grossman (Ph. D., Brown University, 1969), and Shlomo Libeskind (Ph. D., University of Wisconsin, 1971) were here as new hires. The department expanded more in 1973 with the hire of Frank Wang (Ph. D., University of Wisconsin, 1973). In 1974, Johnny W. Lott (B. S., Union University, 1965; M.A.T., Emory University, 1969; Ph. D., Georgia State University, 1973) was hired as a Visiting Assistant Professor. He remained in this role for two years. During 1975-76, Dr. Springsteel resigned and Lott was hired on a tenure track line. Lott went on to become President of the National Council of Teachers of Mathematics and retired to become the Director of the Center for Teaching Excellence at the university. In 1975, Hien Nguyen (Ph. D., Massachusetts Institute of Technology, 1975) came to campus to stay five years before forming a local computer company and resigning. Stephen J. Agronsky (Ph. D., University of California, Santa Barbara) visited in 1976, and Mary Jean Brod (M. A., Stanford University, 1969) was hired as an instructor in 1979.

1980-1989


Mary Jean Brod


David Patterson


Karel Stroethoff

Nennette Loftsgaarden joined the department as a longtime adjunct instructor beginning in 1981; Billy Lee Foster (Ph. D., University of Washington, 1957) began a series of visiting appointments in 1984; and Chamont Wang (Ph. D., Michigan State University, 1983) was hired as an assistant professor. Dr. Wang was here only one year.

Dr. David Patterson (Ph. D, .University of Iowa, 1984) arrived in 1985 with Dr. Karel Stroethoff (Ph. D., Michigan State University, 1987) coming in 1987. 1988 found visitors James Trudnowski (M.A.T., University of Montana, 1969) from Carroll College, Helena, and Rick Ammons (Ph. D., California Institute of Technology, 1988). To round out this decade Dr. Richard Gallagher (Ph. D., University of Nebraska, 1988) joined the faculty in 1989.

1990-1999

Dr. James Hirstein (Ed. D., University of Georgia, 1976) joined the staff in 1990 followed by Dr. Krishnendu Ghosh (Ph. D., Temple University, 1990) in 1991 for four years and Drs. Ben Cox (Ph. D., University of San Diego, 1990) and Thomas Tonev (Ph. D., Moscow State University, 1973) in 1992. Dr. Cox was a faculty member for five years, and Dr. Tonev whose career started as a visiting associate became permanent member of the faculty. Dr. Hirstein later became a department chair for two three-year terms. 1993 found Dr. Lynn Churchill (Ph. D., University of Washington, 1985) beginning a series of visiting appointments in mathematics education. Dr. Gregory St. George (Ph. D., University of Montana, 1989) became an assistant professor in 1994; Dr. Christian Gunter (Ph. D., Free University of Berlin, 1976) began a series of visiting appointments and Drs. Leonid Kalachev (Ph. D., Moscow State University, 1987) and Jennifer McNulty (Ph. D., University of North Carolina, 1993) were on tenure track lines.


James Hirstein


Thomas Tonev


Gregory St. George


Leonid Kalachev


Jenny McNulty

Visitors that year included Dr. Jack Eidswick (Ph. D., Purdue University, 1964) and Dr. Margery Palmer (Ph. D., University of Maryland, College Park, 1986).

In 1995 Jonathan Graham (Ph. D., North Carolina State University, 1995) and P. Mark Kayll (Ph. D., Rutgers University, 1994) became tenure track faculty members with Eric Rowley (M. S., Utah State University, 1991) and Elena Toneva (Ph. D., University of Sophia, 1979) as visitors. 1996 brought Carolyn (Libby) Krussel (Ph. D., Oregon State University, 1994) [Libby Knott] and Nikolaus Vonessen (Ph. D., Massachusetts Institute of Technology, 1988) to campus.




Jon Graham P. Mark Kayll Libby Knott Nikolaus Vonessen

In 1997, visitors included Alexander Below (Ph. D., Moscow State University), Patricia Hale (Ph. D., Oregon State University, 1996), William Long (Ph. D., University of Montana, 1997), Steven Liedahl (Ph. D., University of California, Los Angeles, 1992), Regina Souza (Ph. D., Massachusetts Institute of Technology, 1990), Brian Steele (Ph. D., University of Montana, 1995), and Carol Ulsafer (Ph. D., University of Montana, 1984). Of those visitors, Dr. Steele was hired to become a tenure track faculty member. Drs. Regina Souza and Carol Ulsafer assumed roles as non-tenure track but long-term faculty members.



Brian Steele Regina Souza Carol Ulsafer

1999 brought Mark Wilson (Ph. D., University of Wisconsin-Madison, 1995) as a faculty member for two years and Dr. Terry Souhrada (Ed. D., University of Montana, 2001) as a visitor.

2000-2006

In 2000, Scott Stevens (Ph. D., University of Vermont, 1999) joined the department as a numerical analyst and assistant professor. Dr. Stevens was only in Montana one year. In 2002 Adam Nyman (Ph. D., University of Washington, 2001) and Bharath Sriraman (Ph. D., Northern Illinois University, 2002) joined the faculty in algebra and mathematics education respectively. In 2003, new faculty members included Jonathan Bardsley (Ph. D., Montana State University, 2002) and Matthew Roscoe (M. Ed., The University of Montana, 1999) and Lauren Fern (M.S., Northern Illinois University, 1994).


Adam Nyman


Bharath Sriraman


Jonathan Bardsley


Matt Roscoe


Lauren Fern

In 2005, new faculty members were Jennifer Halfpap (Ph. D., University of Wisconsin, 2005), Emily Stone (Ph. D., Cornell University, 1989) and Jakayla Robbins (Ph. D., University of Kentucky, 2003). In 2007, Solomon Harrar (Ph. D., Bowling Green State University, 2004) joined the faculty.


Jennifer Halfpap


Jakayla Robbins


Emily Stone


Solomon Harrar

Others Involved in the Department over the Years

In the initial version of this chapter, it was noted that the department has had many noted visiting faculty members who are not listed here. Some of these have been on campus as a result of exchanges; some have been here in regular visiting roles, but each had an impact on the department. Among those visitors are the following listed without year but with their affiliation in 2006 if it could be found:
Berhard Chen, unknown
Joseph A. Cima, University of North Carolina
Patrick Ewing, retired in Ohio
James Herod, retired in Alabama
Myron Hood, California Polytechnic Institute at San Luis Obispo

Barthel Huff, retired in Utah
Ketill Ingolfosson, College of Philadelphia
Ludvik Janos, currently in California
Roland H. Lamberson, Humboldt State University
Scott Lewis, Central Washington University
Mark Lutz, University of Montana
Arturo Magdin, University of Louisiana, Layafette
Walter Michaelis, University of New Orleans
Jed Mihalisin, University of Montana
Leah Murphy, unknown
Lyle Pagnucco, currently in Calgary, Canada
Swarna Reddy, University of Montana
Milton Rosenberg, currently in Florida
Hashim Saber, currently in Saudi Arabia
John Sallee, deceased
Joyce Schlieter, University of Montana
Jim Williamson, University of Montana
Machelle Wilson, unknown
It is with apologies that others are missed and that some whereabouts are unknown or incorrect.