CHEMED '91 TALK

8/6/91 OSHKOSH

Thank you. (Laughter)....I want to tell you how pleased I am to be with you this afternoon and how happy I am to see so many bright faces of individuals who are committed to quality chemistry education. I have seen a number of you in the past in a variety of settings, but I am especially pleased to see **all** of you this afternoon. I am especially pleased to have the opportunity to share with you some of the reasons and convictions about the importance of communicating science, and of communicating our value systems as teachers of science. I am happy to be back in Oshkosh. I think the first time I came to Oshkosh ~~(by the way who ever did believe there was a place called Oshkosh?)~~, the first time I came to ~~Oshkosh~~ was in 1979 when I was the founding chair of the University of Wisconsin System's undergraduate Teaching Improvement Council. I paid a visit to each of the campuses in the UW system. Sure enough, I discovered that there is a place called Oshkosh - a delightful place with a good faculty in chemistry and in the sciences and I am happy to see ChemEd '91 leaning on them. Now some of you came this afternoon expecting, and understandably so, that I would be doing some demonstrations. I feel embarrassed. Embarrassed because of the richness of the demonstrations that so many of you have been doing this week. And I feel proud to see so many people using demonstrations as an effective vehicle to truly communicate science. That is why I have decided not to do any demonstrations. ~~Sorry~~. But I do have a message, I hope a message for each one of you individually that places in context the activities and the missions that you are engaged in. So if you will bear with me as I try to use some overhead transparencies to talk about a couple of things that are important to

me. For the first focus I'm going to come to the demonstration..... they still do demonstrations. This, of course, is the flyer for Volume 3 of our Chemical Demonstrations Series. Volume 4 is coming out, I hope, at the end of this year. The publisher says it's coming out in February. If this interests you, you can pick up a flyer at the University of Wisconsin Press booth - pick up a flyer that tells you what the content of Volume 4 is, namely, clock reactions - a chapter on that and a chapter on electrochemistry. I'm sure it will go along with that one, but I don't have it ready yet so... I invite each one of you once again to participate and make contributions to our series. If you have demonstrations or experiments that you would like us to include, we would be more than happy to look at them and incorporate them and you will see in Vol. 4 once again we have taken advantage of the richness of offerings that many of you have given us to include in the chemical demonstrations series. I also would like to tell you this, when I came back from the NSF to continue my research and involvement in activities in science education not only by doing the chemical demonstrations book project, but last winter I made a series of videotapes called "Chemical Demonstrations" which Holt Rinehart is marketing, you may have heard about them at the NSTA Convention. If you want more information about that, I've a supply of orange flyers that list what the content of the 2 1/2 hours of the videotapes are and tells you how you can get them. This is a display of the demand for new hiring of classroom teachers in public elementary and secondary schools with three alternatives. This is a display which shows that the demand for new hires through the year 2000 is 1. As you can see wherever it says (cannot understand), the slope over the three projections, the high projection, the middle projection, and the low projection, the slopes were positively moving upward which means that we are going to need, as a nation, new teachers. This is new teachers in all subjects

not just chemistry or science. Where will these teachers come from? Will they come from Lebanon as I came in 1957? Will they come from Japan? Will they come from Mississippi? Will they come from Austin, Texas? Will they come from Madison, Wisconsin? Will they come from Little Rock, Arkansas? Will they come from Beavertown, Pennsylvania? Will they come from Brunswick, Maine? Will they come from Saledas, California? That's where we want them to come from. Because you, my fellow teachers, have the awesome responsibility of not only exciting students to grow in science but to improve the next generation of science teachers. And I know it can be done. But I want to talk about some of the conditions and activities that we are all contributing and we have a good timetable of Americans who pursue careers in science, who pursue careers in teaching science. Now, before I get into that (though), I want to say a few things about chemistry. Here is a headline from the Capital Times which is a Madison evening newspaper that says, "Do the Brewers Lack Proper Chemistry?" I was puzzled when I first saw this headline because how can you make beer if you don't know chemistry? And then I looked at it, of course this was under the sports page, and continued on another page with another headline, "Are Brewers Lacking Chemistry?". Not only do Brewers lack proper chemistry, but "Are Brewers Lacking Chemistry?" Tonight they hope that their Chemistry is about to get attention on the sports page! And so I went to the July 8th issue of Sports Illustrated and "The Point After" column, which is the very last column in the Sports Illustrated, the headline was "a chemical reaction...Do teams have bad chemistry and good chemistry?" A non-scientist explodes a myth. I just want to read a small section of this to you, I know some of you have read this same article. I read it with a great deal of concern. It starts, "I was never much good in Chemistry. My teacher in high school was an extraordinary disheveled codger whose white

lab coat wore the tell-tale stains of too many experiments gone haywire. But I can't really blame my own ignorance of the subject on this slipshod educator. No. The fact is I mistakenly regarded chemistry as more of a game: its beakers and burners merely toys than a serious, intellectual pursuit." That's what stopped me right there. That a learned person would think that chemistry is games and toys (wrongly) and not a serious intellectual pursuit. For those of you, let me just read one more sentence, "until a point recently, I never considered this vacumn in my education to be a handicap in my line of work. Now, I discover that chemistry is just about the most important thing there is in sports!" And then he goes on to talk about this issue of Sports Illustrated as having seen at the one that tell in the Brewers story something about our value systems and of society. A sports hero saying I lied and it's in the back of this July 8th issue that this column was published and I urge you to read it. And don't you tell me you are a chemistry teacher or a science teacher and you have no responsibility whatsoever to get people not to lie. I know all teachers have a lot of responsibilities towards the conduct. Not only do they teach their subject matter and go through five or six preps a day, but now Shakhashiri has the gall to admit you should be concerned about the moral and ethical behaviors. I submit to you that it is what we should be doing first and foremost, if we are indeed to be good teachers of chemistry, good teachers of science. For our behavior as teachers influences the behavior of the students that we come in contact with, the parents of those students and others in the community that we live in. Here is the July 29th cover story from Business Week, "A New Outcoming". Look what else do we, as chemistry teachers, want? We're getting all of this attention on the sports pages, we're getting in the business magazines. Why can't we get on with whatever this is? Why can't we get on with the task of effectively teaching chemistry and using

chemistry as a vehicle to influence the quality of lives of all the students that we are in contact with. We have to do this. Why do we have to do this? Here is from U.S. News and World Report. You can read this too well, but it's a story about, the headline to the story is, "Is the Water Safe?". That's the headline of the story. And then it goes on page after page showing .... the story goes on and shows the time-plate cracks, the chlorination laundry. It goes on and beautifully displays reason of information and talks about lead poisoning or as someone, a member on the plane Sunday coming back to Madison, reading the same article, he was sitting next to me. He was reading as lead (leed) poisoning. The next one is my formula of contaminants. The next one is chemical evidence. Why is it that near the end of this great chemical century, why is it that we have so many people through our population who are chemically illiterate? Boy, I remember George Patel (?), the late George Patel (?), the night before he received the national medal of science from President Reagan, when I took him out to dinner in Washington wanted, during the ceremony the following day, to walk up to Mrs. Reagan and shake her and tell her that chemical people are **good** people. You do remember Mrs. Reagan's unhappiness with the chemical people. We have a problem, we have a deep-rooted stack of complex problems related to communicating what it is that we do for a living. Why we do it. Most of us spend a lot of time trying to figure out how to do it. The demonstrations are part of the "how-to" part. Computers are part of the "how-to-do" part. Laboratories are part of the "how-to-do" part. What we need to spend some time on, all of us collectively is to figure out and announce succinctly **what** we do and **why** we do it. Go back to this... go back to this headline: "A New Outcoming". What it contends is that science and technology are based on chemistry, not only based on the procedures as we do the quantitative analysis but based on the

principles for which at some time chemical educators chose to use precipitation as an illustration for those principles. Basically what I'm saying, we need to go back and figure out where we are and where we want to be in the next century. This is a difficult task to do. This is a task that requires true leadership... not only from parents, faculty or scientists, but from all people who are influenced by science and influenced by phases in technology. Let me shift gears just a little bit and talk about this display which I know a lot of you have seen me use before. How many of you have seen this before? How many haven't seen it before? How many don't care? (Laughter!) Okay, there's at least one person who raised his hand. This is a display that shows the persistence of interest in the natural sciences and engineering among the population of high school sophomores which in 1977 numbered four billion. By the way, the number today is not the same; it is slightly smaller, about 100,000 people smaller. 100,000 or so smaller. But of those four billion of high school sophomores , 750,000 of them expressed an interest in the natural sciences, mathematics, that is including mathematics, and engineering. By the time they were seniors the number dropped down to 590,000 and one year later, when they entered college, the number went down to 340,000. A 40% drop in just one year. 61,000, I'm sorry, 406,000 received bachelor's degrees, 6,100 went on to graduate school, 46,000 received a master's degree and by next year fewer than 10,000 of those four billion individuals will get a PhD in science, in mathematics, or in engineering. This is the so-called pipeline for personnel in science, math, and engineering. And this blue area is the one that concerns most of us until recently. This is the area that produces scientists who are going to work on the new outcomings. This is the area that will produce scientists who will participate in learning the human deal. This is the area that will produce scientists who will help with the deployment of the space station. This is the area

that will produce people (scientists) who will deal with conquering AIDS. This is the area that will produce scientists who will deal with the strategic defense systems. I am not attaching any value judgements, yet, to any of these mega-buck projects. Just listing four or five of these **big** projects that are going to require **trained** scientists - trained in chemistry. I use the word trained carefully. The training takes place here. The attitude development takes place here. That is why for the past 15 or 20 years, and some of you can attest to this, I have said publicly that teaching high school chemistry is more important than teaching college chemistry. Because you get to enforce their attitudes, their life-long attitudes much more so before we enter when they get to be in college. It's not just in high school (let's hope), it's prior to the high school level. It is in elementary school and in the middle school as well where attitudes develop toward science and toward chemistry. Remember what the writer in Sports Illustrated said, "whose white lab coat wore the tell-tale stains of too many experiments gone haywire." The value attitude that he picked up that's what he remembers, he remembers an attitude that the teacher had. Now the main focus of institutions with higher education and federal agencies of society in general, until very recently, was on this pipeline of getting more people to read in the blue area of this display. Very recently, attention has begun to be paid to the people in the white area. Those are the people, the constant and obviously the majority of the population, the majority of the students that you have are in the white area of this display. The majority of the 330 freshmen that took chemistry with me last fall are in this white area. And so we have to be careful about how we convey our own attitudes toward chemistry, our own value systems on the importance of chemistry. One PhD, doing very very happily, is paying attention to the training of chemistry which comes here to the black line. What do we convey of our attitude about

chemistry? Take a 13 year old. You know within ten years she or he will become a parent. Now their attitudes toward chemistry or toward science will be transmitted to their kids. That attitude you understand will be transmitted to our (could not understand). That is the attitude that I'm talking about. That is the value system that I'm talking about. So, we have a problem in terms of making sure that the people who aren't quite (cannot understand) to us are literate in chemistry, are literate in science. But chemistry is but a pinnacle to accomplish literacy to science and science is but a pinnacle to accomplish literacy and making us all making us all fulfill our human potential. For today, what is the purpose of education? It is to enable individuals to fulfill their human potential. Not to guarantee it, but to enable them. I mean, do we believe we make a difference in the classroom? Don't we? That's why we go. We certainly don't go for the pay, that's another topic we want to talk about. Well, what I would like to do now is, very briefly, and I was asked to do this when I was invited to come to this important conference, to talk specifically about some of the national initiatives in science education and as time permits to talk about some of the personal experiences I have had at the National Science Foundation. Now, before I get to either one of those topics more deeply, I do want to thank those of you last summer, a year ago last June, who were very outspoken in terms of the support that was expressed for the various activities that I was engaged in at the National Science Foundation. As I told so many of you last summer at the Bi-annual Conference of Chemical Education, I'm neither down, nor am I out. I ask you, do I look like I'm down? Do I look like I'm out? What happened last June, that is June of 1990 at the National Science Foundation was a personal situation between the director of the Foundation and myself. Eric Bloch was in his last three months of service at the Foundation. His presidential leave limited term was six years and

he was leaving. And now I can tell you that for five and a half years of those six years that I spent in Washington that he was there we had a lot of .....discussions. (Laughter) You've only heard about the one that took place in the last three months. And I want you to know that it was a privilege for me to be in Washington on your behalf to see to it that science education activities are once again beginning to flourish in America. (Applause!! Applause!!) And so, quickly let me mention to you what is contemplated by way of change, because everybody says we've got to do things differently. What are the components of change that we have to go through? We need to be concerned about the content of what we teach. We need to be concerned about staff, the identity of staff, the science staff. Why is it in high schools there are many more administrators than actual faculty? Why? Yah, did you hear what she said? "That's where the money is." There is our value system again and of society. And you know what? We are the custodians of college chemistry and the principles, the value systems, that chemists have. And so we have to work on changing that value system. We're concerned for the conditions for learning. This is a euphemism that covers a whole set of territories, but one of them especially is laboratories. How can you be in a school or a college where a science course is offered without lab component? How? How can you tolerate that? We're concerned about government. Again, all of these points are related to each other. We're concerned about resources and human resources as well as financial resources. What we basically need is a national strategy. We need some goals and we need some standards.

END OF SIDE A

Do you want to be on the playing field or do you want to sit in the stands as spectators? Without being participants as far as the game is concerned. There are two areas of concern that we haven't taken up, one is assessment. How do you know that what you do in your class works? How do we know collectively that the school operates where you are at work? Hey, how do I know that what's going on at UW-Madison works for the students? We need some assessments and we need to work systematically. Through conferences such as this one, we do some assessing about our own individual progress. That's great! What I'm talking about is a massive national effort, so that we become aware of the true impact of the programs that we're engaged in. Bruce was very kind in the comments that he made about me when he introduced me about my work at the National Science Foundation. All the others were very kind in what they wrote about me. Yeah, I read quite a bit. That's not the important thing in the scorecard. The important thing is what we all do with that money. That's the important thing. Why is science education (cannot understand)? Do we need to be concerned about assessment and about research? I have suggested before and you will see it in a variety of places and people think about it and talk about it that is doing science and math is a game we all do. We need a major report card, a major revamping of sort of what's been going on. And for content purposes there are three main themes..... possible content themes. One is mathematics, one is health, and one is the environment. Here someone saying we're in chemistry. That's like a lot of people say, "Hey what is chemistry like in 2061?" When there isn't enough chemistry to go over in sequence. You know all of a sudden we've become very programmed about it. We need to be programmed. We need to fill up on the playing field of grades. I suggest to you that these three main characters receive some attention. Why mathematics? Mathematics serves across all disciplines in all

elements of education. How many people in the audience here have read the NCTM Standards? One, two, three.... How many of you know what the NCTM Standards are or have heard about them? Four, five, six.... How many of you know what NCTM stands for? The National Council of Teachers of Mathematics four years ago issued a set of standards that every member of your school board should know about. My friends, and I mean that genuinely, my friends and because you are my friends, I'm appalled that you haven't seen the standards of the NCTM. Please, as a favor to someone who developed a lot of gray hair in my beard while I was in Washington on your behalf, as a favor, for the hard work I did on your behalf, get a hold of a copy of the NCTM standards and look at them and even say if you want to say "hey, this is a bunch of something I don't want to deal with" but at least take a stand on it. They are worthy of your consideration. Everybody commented on the report that the National Resource Council on Mathematics and Science put together in the area of mathematics. It is embarrassing not to have a higher cadre of science teachers know what math teacher are doing. And, by the way, when I spoke with the math teachers, and I do speak with math teachers very frequently, so many of them, too, have not looked at the NCTM standards. How can you judge them if you haven't looked at them? The next area is health. Under health come three sub-content individuals: Human biology, nutrition, and drug education. Why human biology? Well, kids in the grade school level, all of us are interested in what's happening to their bodies. You are too. We should take on topics despite the fact that they may be controversial in our society. I mean, how can you deal with AIDS if you don't deal with human biology? How can you deal with sex education if you don't deal with human biology? Well, sex education is somebody else's responsibility. Right? I'm a chemistry teacher, we don't want to deal with that. Can I take

my tongue out of my cheek now? I am a citizen of the community where I live. I am an individual who want to fulfil his human potential. I have responsibilities. Not only to develop my own value system, but to share my value system with others in my career. Throughout education, you want chemistry, you got it, because chemistry is here too, working. But it's not a surprise when sodium chloride is soluble except for when it is insoluble. If you think I am critical because we haven't had textbooks to teach out of, you are right. I am critical of it. It's hard not to be critical. You have to be a part of the solution not only part of describing the problem. On the environment, you know the great concern of chemists had for the past 15 years, if I know chemistry, who's right when talking about chemistry....others - other courses, not chemistry. I submit to you that everything we do in the physical sciences, in the biological sciences, in the earth sciences, in engineering, and anything else fits under the heading of the environment. And we should be thinking in terms of the revision and the revamping of our curriculum about environmental issues. And in chemistry, it's not only a new opening not only the chemistry in sports ....but the chemistry that we know or the chemistry that we try to teach. It should be incorporated into these programs. Now last year, the (sorry), what we really need then is a national strategy. These are the components of the national strategy. Many of you have seen these, you've heard me talk about this before. I don't apologize, I want to hammer away at it again. It's important .... We want science literacy for all people. Not only for the ones who are in the blue area but for all the people, for the bottom half of the population. I'll tell you what one of my criteria are for developing an attitude - a scientific literacy attitude - among my students - the 330 students I had last fall at UW-Madison. One of my criteria is this: If I were to stop two students on the street, not knowing that they were in my class until

afterward, you know it's pretty hard to get to know 330 students, probably most of you know that, stopped them in the street and I showed them the two new things science section from the New York Times or any other newspaper or I ask them a question about what's in that section. I should be able to tell from their responses which one was in my class and which one wasn't. Now that's a pretty tough criteria isn't it? That's how I test myself. I don't always succeed but I try. Do you really believe in literacy in science consider that one of the criteria that you want to have your students to have. Not necessarily now when they're juniors in high school, but later on. We need to have as part of our national strategy the best preparation for careers in science for careers in teaching science. We don't even have a strategy for what we should teach in science. Oh, the NSF has standards and guidelines for being chemists. And now, of course, they are coming out with the chemistry teachers'. I would like to see some of those things they call strategies. What are we a privileged class of some sort? Now we are really going to have to be saints, if we don't pay enough attention to what we do and how we do it. We need to increase representation of women, minorities, the disabled. How do we tell the people who have been denied access to careers in science to careers in teaching? We want to support experimentation. That's what the NSF funding is all about - supporting experiments. It doesn't pay the bills for anything. And we're interested in generating change - fundamental, comprehensive, systemic change. People in the middle of change, as they say on the street, ain't gonna do it. We need massive comprehensive, fundamental, systemic change. We need to make a 90 degree turn in our educational offerings and we have to do that carefully. Every time you do a 90 degree turn, if you don't do it carefully, you fall off. We have to do it carefully. We have to become outcome oriented. What does it mean to be the holder of a Bachelor's Degree

from UW-Madison? What does that mean? What does it mean to be a holder of a high school diploma from your school? I know what it means. It means that the student has fulfilled the requirements from the catalogue. What does it mean, those requirements? How can we change the experience the students go through as they achieve their goal of getting a degree. One manifestation of this, and I'm proud to have had started this, is the so called statewide systemic initiative which the NSF has this year awarded to ten states. This is the NSF money that was given to those ten states and there is the matching funds from other states. Are there people in the audience from Connecticut? or Delaware? Oregon? If you're in the audience from any of those states raise your hands. How many of you know about the state-wide systemic initiative in your state? Okay, about three or four of the dozen hands that went up. I ask you to find out more about the state-wide systemic initiative system project is all about if you are from one of those states. And if you're not, you might also find out what they're doing in your state. Because the NSF is coming back with another round of grants in this area. And remember the grants are only an enabling mechanism. They are a means to an end. This program announcement for state-wide systemic initiative. I think I'd be telling you a lie if I told you I know every word in it. But if I told you I only reported it exactly to a small number, I'd be telling you the truth. It reflects the kind of philosophy that we are talking about and I ask you to read it and in it you'll find that display of the pipeline and the articulation, the complete articulation, of some of the same goals that we have talked about so far. Okay, I'm coming to the end and I want to just spend a few short moments talking about the NSF budget. Why do I want to talk about that? Because money is an expression of our value system in our society. And that's the truth. Here is the NSF budget since day one in millions of dollars. The blue line is the total NSF budget and

the red line is for science and continuing education-SCE. You know one of the things that happened in the universe 1990 is that science education disappeared from the NSF. They're changing the value on it. The name of a group now called education human resources. I'm for that. I'm for **science** education, I'm for **engineering** education. Well, one of the things that has happened - that's all right - provided we still pursue the path that we are set. This is a budget, to seek support for science education on the right here but the small part there those are fractions of the budget of the NSF. This is the same display in thousands of dollars and you see there that the science education budget was very very low in 1983 - you already notice that when the great shut down of the place that's just before I was asked to go to Washington to try to pull the activities back together and launch them. Now, there are so many different ways to explain the data. Here's the budget for science and engineering education on through the year. Science education at one time was 40% of the whole budget...40%!! I'll tell you now why I lost my job as director of science foundation of science and community education. I lost my job because I said publicly, after having said it privately, I said to the halls of congress under oath, that the NSF budget for science education should be 600 million dollars, or 20% of the total NSF budget - 20% is what I said. Well that cost me my job as assistant director of science education but I haven't left the government service because that's a career oriented foundation. I took a leave of absence. I went back to Madison. Bloch didn't fire me for having done what I did. All he could do was to reassign me and that's something they don't want to do. Now, not that I'm going back to the NSF. I still have my career appointment with the government intact. We're now down to 10% or less percent of the total budget. This is the graph that shows support for science education by educational levels - pre-college, red is for undergraduate

and blue is for graduate fellowships. This is the great shut down in 1983. I went to Washington in 1984 to start rebuilding things and notice there is a change in emphasis after 1983 compared to prior to 1983. We wanted to get scientists and the engineers involved in pre-college education as well as college education. This is the budget for fiscal year 1991 that we're in now. You see we're pretty well on our way to the target of 600 million dollars. As Ethel reported this morning, the house of the senate for the next fiscal year of 1992 would like it to be in the neighborhood of 465 million dollars or so, and it is my guess that by 1993 we will hit that number of 600 million dollars. And what worries me is not whether or not we'll hit that number, what worries me is that I've doubts that the science educators across the country can be prepared to be ready to deal with that influx of money. Do you have enough ideas to carry out experimental programs? I'm hoping that the answer is yes. These are the numbers, and I'm proud of this achievement, but I want you to see the same numbers in constant dollars. And you see even in constant dollars we're not even half way, we're about half way from the heyday of the mid-1960's right after the Sputnik. Why do I spend time on this, because money is an indication of our value system; not only as individuals, but as a society. And so I'd like to ask you then in closing to consider, as teachers of chemistry, the various points that I have shared with you this afternoon. Take on, if not all the challenges, a number of the challenges that I have suggested. But I would like to ask you to consider one more challenge; please, as you influence the students in your classroom, in your community, please urge them to consider a career in science, a career in teaching science, but also a career in public service. The country needs competent people in public service. The country needs people with convictions on a good value system to be leaders. Whenever I publish my book about my experiences in Washington, you will see in

my book, you will read about the lack of sufficient competence and the lack of sufficient character of people who are in Washington. I would like to ask you to be part of a concerted effort whose aim is the development of talent. We are in the talent development business. To help make available careers in science, careers in teaching science, careers in public service. Please do not be part of the kind of teachers across the country who find themselves engaged in weeding all our students. Focus on the bottom half of the student population. Lift that bottom half of the student population because if you do that you lift the top half. And remember the dollars, the tax dollars that come to the federal government, the state government from the local government come not only from the people in the blue area of the student population but from the people in the bottom half of our student population.

Thank you very much!! (APPLAUSE!!!)