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Speech to Chemical Heritage Foundation

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Good morning everyone. I want to thank the Chemical Heritage Foundation for, launching this conference. And because they are doing this, I want Arnold to hear this, Arnold are you here? The level of expectation now is higher than it was before. So many groups and so many individuals become involved in science education activities, which is a good thing. But, the expectations that I have are commensurate with the capacity that you have. And it is indeed important for the Chemical Heritage Foundation to provide reliable information about the heritage of chemistry education, in particular, but also of all science education. So, time will tell whether the involvement of the Chemical Heritage Foundation will be effective and will be significant. And I say this with a great deal of expectation, like I said, and time will tell.

I want to start by asking you a question, because you all know it is not possible for me to get up and make a speech even as I did in the halls of Congress without doing a demonstration, so here goes a demonstration. What do you see me holding in my left hand here? It's a coffee mug, right. It's empty but for air. Do you suppose there is a way for me to hold this cup up in the air without touching it? Probably? He doesn't even know me. Maybe he does, I don't know. I mean I can take *Science and Engineering Indicators Anniversary Edition*, and I could put the cup on it and I can say, well I am not touching it, right? But, that is not what I meant. Is there an easy way to do this? And the answer is yes. What you need is a balloon. Can you see okay? What you do is hold the mug like this, put the balloon inside and blow up the balloon. Ta da! What is holding the mug up? Air pressure. Any other ideas? Friction. Any other ideas? Mechanical strength of the rubber. I am just repeating what I hear. I'm not necessarily agreeing with what I hear. I am just collecting information. What do you think will happen if I let the air out of the balloon? You all have sufficient experience what to predict will happen. Right? So,

do I. That's why I am going to hold the mug, before I let the air out. Now, this is a simple experiment that gets us to think about a lot of different things. We can test several of the statements that were made. Air pressure. We can talk about what that is. We don't have time to talk about that this morning. What I normally do, in addition to doing this experiment, I bring along a beaker. A glass beaker and the bottom of the glass beaker has been sawed off. And then I ask the same question. Do you suppose I can hold this beaker up in the air without touching it, and so on. And after having done this and I put the balloon in and the beaker is held up in the air without me touching it. So that pretty much takes care of the first suggestion that was made, right. And then leads to the second one and so on. To test the second one you can put a lubricant on it, you can use it, all kinds of different things.

What I'd like to do this morning is share with you some observations and convictions about the status of Science Education. This is the title of my talk. I am in my 30<sup>th</sup> year at the University of Wisconsin, Madison. My 33<sup>rd</sup> year of formal assignment as a teacher. Two years at the University of Illinois and one year at Bowdoin College. And what I would like to do is impress upon you that in this period of time there has been a tremendous increase in the interest among decision makers, among the public, in general, in science education. This is in part the result of the characteristic of the American public because the American public responds to a crisis. And the crisis that occurred has caught everyone's attention and the scientific community and the government very cleverly capitalized on was Sputnik. That was perceived as a military threat. A threat to our national security. A threat to our society. It was played out that way. And all kinds of very fabulous programs were initiated by the government and by the private sector. To respond to that perceived threat. Now, with the cold war being over, there is no such threat. And what we experienced and what we talked about in recent years, is an economic threat. Well, what does the economy do shortly after we start talking about an economic threat? The economy takes off. So the public attention to issues in science education is not all that great. Yet there are enlightened individuals and there are enlightened groups that persist in paying

attention to science education. And the status now days, I'll just characterize it very quickly, before I show you some transparencies that I have, in my opinion, the status is both healthy and not so healthy. It's mixed. It's healthy because a lot of good people want to do good things. It's not so healthy because the direction and the goals are not very clear and are not sufficiently subscribed to by the people who are involved in these activities. Every group just about, does it's own thing. The only unifying scheme is the presence of the National Standards.

The National Standards which have come about, with a great deal of debate, a great deal of acrimonious debate, and I'm not going to tell you things out of turn here, but I refereed some of those debates, in my capacity at the NSF, between leading individuals in Washington and others. But that document is a very important document. That document is, in my opinion, the only unifying scheme that we have nowadays to try to achieve what different groups have advocated, science for all Americans. Science literacy for the public at large. I want to talk about those in a moment. I have a few transparencies, here. I am not going to show them all to you. I can't resist showing this one, but people ask me, do I miss Washington? What are you doing now?

I want to put my remarks in context. I want to borrow from the teachings and from the writings from a distinguished scientists and that is Freeman Dyson. He said science is a hexagonal mountain with six faces. The three beautiful faces of sciences are science with a subversion of authority. Do you think of science as a subversion of authority? You bet you do. Because in science we challenge dogma. We question the discoveries and the explanations of those discoveries that have come before us. Science is an art form. And science as an international club. Science is presented to our young people as a rigid and authoritarian discipline. Tied to mercenary and utilitarian ends. Dyson is a physicist, so he knows what he is talking about, in that respect, but it applies to chemistry too. And tainted by its association by weapons of mass murder. The way to attract young people into science is to show them all six

faces and to give them freedom. Freedom. I have goose bumps talking about freedom in Philadelphia. This is what we cherish. This is what we advocate. Give them freedom to explore the beautiful and ugly as they please. This is from one book that Freeman Dyson published in 1997. Just another quotation from Freeman Dyson. If failure of science to produce benefits for the poor in recent decades is due to two factors working in combination. The pure scientist has become more detached from the mundane needs of humanity and the applied scientists have become more attached to the immediate profitability. That's going to happen more so now that we have very rapid advances in a very important area called, biotechnology,. You may not agree with this, but I want to give this as part of the context that I want to deal with.

I consider both teaching and being a scientist to be a privilege. Teaching is a privilege and being a scientist is also a privilege. One dictionary's definition to privilege is to have special advantage or immunity or right or benefit not enjoyed by all. Not enjoyed by all. I want to keep this point in mind here, because when we talk about scientific literacy, I'm talking the privilege that scientist have as distinguished from science literacy which is what we want everyone else in our society to achieve. This is not just a pedantic difference that I am talking about here but scientific literacy is what those of us who are scientists have the privilege of having. And science literacy is what we want everyone in our society to enjoy. The sense of understanding, the sense of appreciation of what science is and what science can do. So, I'd like to ask you for one moment, maybe it can be a long moment, about the one thing that differentiates our society now from society fifty years ago, a hundred years ago, five hundred years ago, a thousand years ago. What is the one thing that differentiates our society now, from all previous societies? It's not a rhetorical question. I'd like an answer. How are you doing over there? Communication. Quality of life. Longevity. Mastering our environment. Computers. Let me bring this to a sharp focus here. The answer that I have is science. Science. All of these things that you are mentioning are the result of science and technology. And of course, nowadays, being an election year, its fashionable to talk about science and technology

being the engines that drive our economy. Well, indeed they are. And it is the practice of science that is a privilege. But the appreciation of what scientists do, the science literacy concept that we advocate, in my opinion, is just as important as what science can do for us.

So I submit to you that what is going on our society in terms of science education is not clearly defined because we lack clarity of purpose. What is the purpose for which, oh, I can pick any example, what is the purpose for which NSTA does what it does. What is the purpose of which Bristol Meyers does what it does? What is the purpose of which DuPont does what does? Or Dow. I want to thank Dow for the Science Is Fun buttons. Is there somebody from Dow here? Well, they made all of these Science Is Fun buttons. They even made Chemistry is Fun buttons. I was going to ask that person to replenish my supply, because I am down to my last two buttons. And I can't get the ones from the NSF. We made one hundred thousand of those and passed them around. But that's an aside.

Clarity of purpose. Why do we do what we do? I'm not asking for unity of purpose. I'm asking for clarity of purpose. Unity may come later on. What are the purposes for which big and small business support science education? What are the purposes? What do they want? They want an education work force. I had a student in my ask that would always give the answer to a rhetorical question. And it was the right answer. So keep it up. I have had some experience with this. Why do they do it? Why? Why are you here? I know that you got invited. It's an honor to be here. And you want to say some things that you feel strongly about, but we need to have clarity of purpose. And talking about an education work force is one such purpose. What I want to ask you, why do we do science? We don't do science so that we can have an educated work force. Is that why we do science? We do science because we are curious. It is our nature. We want to find answers to questions we ask. So, having said that, let me try to share with you quickly, in headline form, what the purposes are, in my opinion, of education. People ask me, quite often, Dr. Shakhashiri, what do you do for a living? I say I am

in education. And they say, oh come on, what do you really do? What business are you in is what I get asked when I talk to business groups. What business are you in? You know what I say when asked that question? I'm in the talent development business. That's the business I'm in that's the business that educators are in. We're in the business of developing talent. And so the purpose of education is to enable individuals to fulfill their human potential. Not to guarantee but to enable them. That's what I believe is the purpose of education.

I want go through these quickly. People ask me what is the purpose of research? What is the purpose of research. The purpose of research is to advance knowledge. None of this workforce business or anything like that. That is the purpose of research. Research is open ended. Organized educational efforts are not open ended. People ask me what is the purpose of technology? The purpose of technology is to advance the human condition. Now how many technologists do you know that subscribe to this notion? But that is what I believe is the purpose of technology.

What we need to do actually is achieve science literacy. That's what we want to do. Science literacy. Not scientific literacy. Scientific literacy is the easier of the two tasks that we have. Science literacy. The sense of appreciation the sense of understanding. So we want to move from understanding to appreciation to fulfillment. That what I believe is the purpose of all efforts in science education. That what I believe is the purpose. To move from understanding to appreciation to fulfillment. Now, as I look back, look around and look ahead. And they are all mixed up together in what I am doing, I just want flash this for purposes of identification. Most of you know this transparency. This is the transparency that helped us get the budget up high. This one. This a personal note in this connection. In April of 1984. I was a houseguest of Don Jones, April 25<sup>th</sup>, to be exact. I told him the next day that there would be an announcement that I would become the Assistant Director of the National Science Foundation for Science and Engineering Education. I leaked it to him, but I trusted him, and he never mentioned it to

anyone else until after it was announced.. In fact he doesn't say to anyone else, except me, that we talked about this. But now that I said it in public, everyone knows about it. And the one thing that I said, on April 26<sup>th</sup> to the staff, when I was introduced, I want to repeat it to you here. I said that our efforts at the National Science Foundation, will be judged by three criteria, my efforts and their efforts. The first criterion is quality. The quality of the work that we do. The second criterion is quality and the third criterion is quality. And I ask you to reflect back on what NSF had done in terms of three criteria.

Well, this display shows the level of interest among high school sophomores in 1977 in science, math and engineering. The blue part of the display has the people who are likely to become scientists, but it is the white part of the display that we want to pay attention to. That's the science literacy group. That's the group that consists of everyone. The non-practicing scientists. The person who lacks the discipline that a scientist has. But needs science. The persons in the white area of this display that those of us in the blue area need. We need them for a lot of good reasons. One crass reason is that we need their financial support to do our research. So we need to be concerned about scientific literacy and science literacy as well. I just flashed that for purposes of identification.

I'd like to mention something about Statewide Systemic Initiative. This had a sliver cover to it. Cleverly selected by Peter Yankwich, who was my Deputy and a Chemist, well known to all of you. This was an attempt fought very hard against by the Director of the National Science Foundation and his special assistant. They were opposed to this, because they thought these efforts would bust the NSF budget. Eric Bloch and his assistant, Luther Williams were opposed to this. It took over a year to get this document out. And the idea was to engage states as political entities in science education activities. And to provide the political will for change. That was the idea. And of course, the history of systemic change in the country, as sponsored by the NSF, and so on, is a very checkered one. I know that we'll hear about the

activities in the state of New Jersey in this conference. But, I want to mention to you, again, in a very painful way, how disappointed I am in the overall effort that the NSF ended up launching after I left. If you go back and look at the document that the cover is shown here, that document had in the very strong elements and code words that was to rally the scientific community, the education community, the business community, all civic leaders and organizations, into participating in meaningful and effective programs for achieving science literacy.

All right, classroom teachers. I want to talk about classroom teachers for a while. I'm looking back, looking around, and looking ahead, shortly. Classroom teachers. This is a tally of the number of classroom teachers, K-12, broken down by elementary and secondary. It is expected that within about nine years we will need about 2.7 million teachers. Where are they going to come from? Well some of them are going to come from overseas. And I'm for that. Having done it myself. But, where will the rest come from? How many temporary certificates will be issued? How low will the level of certification go? How can we, as learned people as individuals and groups tolerate having teachers not be sufficiently qualified to teach in our educational systems. I know education is a locally controlled effort in this country, I know that. But I also know that using that approach is a cop-out. It is a cop-out for engaging in was to address the issues that we are facing and we will continue to face. People ask me when I first got to Washington, They said, Dr. Shakhshiri, What problem are you trying to fix? As if there is a problem that you fix once and for all, and then you move on to something else. This is not like fixing a bridge. And waiting 15 years then check it out.

2<sup>nd</sup> side of tape.....

constant vigilance. If there is a message to be taken back to the corporate leaders from the people that are in this conference, it's that, their presence in Science Education is very important.. The presence of the feds and the presence of the states is important too. I mean the



goal standard for getting funding is the NSF. It means something to get an NSF grant. The color of the money is not any different from any other source. But it means something to have that goal standard. And we need the support of industry. We need not only enlightened support, we need sustained support. That's the word "sustained" support. We need it to survive quarter reports that are issued by companies. We need that to be sustained. We're not going to get it until we are sufficiently clear on the purposes for which we want it. That is what's lacking in the national debate. What are the purposes? And the closest thing to helping us achieve what we want to achieve are the national standards. But I'm talking about teachers and I want to show you the latest data from the American Federation of Teachers. It shows the salaries. It is a ranking of fifty one entities. The fifty states and the District of Columbia. And everybody tries to see where their state is and so on. Look, every time you show a ranking of 50 states, somebody is going to be first and somebody is going to be last. That's not what is important. What's important is this - The average. The average is what is important. The average salary which is \$40,000. In the privacy of this group here, and this conversation we are having this morning, actually it has been a monologue so far, we'll get to the conversation part. In the privacy of this group here, look, teaching is at risk of becoming a blue collar profession in this country. How can we tolerate that? We say teaching is noble, it's a privilege, and all this other stuff, and then we pay them \$40,000. Something is not right there. And you know whose fault it is? It's not societies fault. It's our fault. I always like to point the finger this way. Cause the only change that I can really bring about is change in me. If I can't change myself, I can't change somebody else. So we have to communicate. We have to communicate our values for the importance of teaching and for the significance of recognizing what teachers do. Just for curiosities sake, in the previous survey, the number was \$39,000. So it went up three percent in one year. Not enough.

How many of you have had a chance to look at this publication? How many of you have had a chance to look at this publication? Everybody. You're looking at it now. What happened to

you? Did I stifle your ability to talk back? Have you seen this? Good. That is what most people do. They look at the cover. I would like you to examine the information that is in there. The information that needs to be used by us as knowledgeable individuals. I want to make a distinction between information and knowledge. Information that we need to use to convince ourselves of what the status of science education is. And what we would like that status to be. Here is a sample from this study. The public understanding of the nature of scientific inquiry. Can you see that? It is broken down by gender, by formal education, and you see the numbers here, “percent understanding scientific inquiry”. Here is a hundred percent, eighty percent, forget it. Seventy percent, no. The highest is about fifty some percent. Science and technology are the engines that drive our economy. Why don’t we have a deeper understanding and appreciation of what science and technology do? Is it because of the way we teach science in schools? In part it is. It is mostly because of the attitude that we have. The attitude that scientists have and the attitude that the public at large has.

It’s been said, and I happen to agree with it, that among the most illiterate people in science are the scientists themselves. That’s because they are narrowly focused in specializing in their sub-specialties. And they don’t put things in a broader context. And you know what? In order to excel you have to be sharply focused. In order to excel in research, you have to be sharply focused. And some of you know, in order to excel in teaching, you have to be sharply focused. So the importance of being focused is great, but, things have to be put in a context. Here is another display. “Public understanding of scientific terms”... Okay. What percentage understand the term molecule. Understand the term DNA. Knows that lasers do not work by focusing sound waves. Electrons are smaller than atoms. The earth goes around the sun once a year. Some of you know the video from the astrophysics lab at Harvard? At NSF we funded that study that conducted interviews with graduating seniors at Harvard University in 1987. Not only with seniors but with faculty as well. And the question was, what causes the earth to have four seasons? They didn’t ask if they knew we had four seasons, they just asked what causes the

four seasons. Twenty-three out of twenty-five responses gave the wrong answer. Even though they had physics and other advanced courses at Harvard University, a somewhat distinguished institution in our country, right? Why is that? Because there are misconceptions and issues in understanding science that we need to pay attention to. It just baffles me that about half the people know that the earth goes around the sun once a year. I mean how long ago was it that science discovered that the earth goes around the sun, and not the other way around? How long ago was that? Who was the first one that published about this? So, how can we, a few hundred years later, tolerate the fact that half the population does not know that is what happens? How can you tolerate this? I want you to give me a thoughtful answer, I don't want you to give me a flippant answer. Because all the questions that I'm asking you, which appear to be spontaneous, because they are, but are the result of a great deal of thinking on my part to get you and others to think about this. How can we, as human beings, tolerate this sort of display? It says something, not about the people who are being asked the question. It says something about us. We are the custodians of knowledge in the area. We develop the knowledge. We advance knowledge.

How many of you have looked at this? How many of you have read this? How many of you have studied this? You know the difference between reading and studying? I read the newspaper this morning, I know what the headlines are, but I am not ready to take a quiz on it. I didn't study it. This is a document to be studied by those of us in science education. If we really care about achieving science literacy. We need to study this. We don't have to agree with everything in it. We need to learn what it is that a group of individuals have put together and are called the National Science Education Standards. We need to try not only align, which is a bad word in some circles, align what we teach in the classroom to the standards, but we need to be concerned about the outcome. We need to be concerned about the purposes for which these standards are used. Are they to sort people out and say "you don't measure up"? Or are they to help people achieve those standards. That's what I would like to have everybody think about. Because what we really need to do is face the consequences. And some don't want to face the

consequences. What are the consequences of failure? What are the consequences of having this conference? Or, they'll write up a report and they will fine tune it. It'll be in very good prose. But what is the real consequence of this conference? That is a challenge, Mary Virginia and Arnold. What are the consequences? Face the consequences. Do we want to look the other way, or do we want to face the consequences?

Let me focus now for a few moments on what those of us in education can do and should do. Those of us in higher education deal with three areas. The traditional areas are teaching, research and service. We all know that at the so called research universities these are not equally weighted. We know that, right? Which one has the most weight? Why is research more valued at research universities than teaching and service? Money. Money. What is wrong? I have, many times at my own university said, that the 40,000 students on campus bring in a lot of money to this campus. It is not the whole picture. In a place like mine, it is no longer called a state institution. It is called a state supported institution. What a shame. Why do they call it that? Because they want to hustle more money from private donors to bring up the total budget. The researchers get more visible recognition for what they do. The basic researchers get more visible recognition for what they do. More so than researchers in teaching and education. Even though NSF now has six or seven hundred million dollars for support of education. But still, that is money coming from a different part of NSF rather than the main part of the NSF. And that is another discussion that we can have by itself.

For those of us who are concerned with the communication of chemistry. How do we do it. How do we communicate chemistry? We communicate chemistry in a formal sense in a classroom. We do it through scientific publications, we do it by writing books. We go to professional meetings. These are some of the ways by which we communicate chemistry. We communicate chemistry very well to each other. Very well. But we do not communicate it very well to the public-at-large. We do a lousy job communicating chemistry to the public-at-large.

The public at large believes that toxic chemicals are one word. Well, we do also communicate chemistry in an informal way, we do it on the radio. How many of you have participated in radio programs talking about chemistry? How many have done it on TV. How many have done it on the web? Print media? By going to schools? By doing presentations at shopping malls? Why do you chuckle? Museums and science centers? Political conventions? How many have presented science at a political convention? 1996 Democratic National Convention in Chicago. Sponsored by the American Chemistry Council. There are avenues available. You just have to do it. State government. Halls of Congress. These are just some of the places to which we communicate chemistry. And we need to be concerned about the communication of chemistry. A lot of us are very good about how to do things. What I'm asking that we think about is what to do. What is it that we need to do, and why? And the how part, difficult as it may be, has to come third.

Now what I would like to do is, oh, I have one more thing about research universities. Doctoral programs typically over emphasize research and under emphasize teaching and service. That is what Gerry Gaff says. He is not the one that says that. How do I define service? Who asked that? At my university it is defined as the kind of professorial activities that are done outside of formal classroom settings and outside of conducting research. Paid consulting, volunteer consulting, providing advice to state agencies, to the government, serving on committees on campus, making sure that the so called shared governors, what we have at Madison is in operation. Participating in public debate about science issues. Professional societies.

What is the battle cry now at major research universities is the integration of research and education. Why do I keep saying research universities? Because I want to make a point which is obvious to us, but not obvious to others. Most of the colleges and universities in this country are not research universities. And they teach a lot more people science and technology than those of us at the research universities do. The National Science Foundation, which in a very

remarkable and very important way, promotes this, of course, it is limited with only a subset of those of us who teach science. And I don't want to leave the two year colleges, the four year colleges the comprehensive universities out of this picture. Promotes the integration of research and education. They are spending a lot of money to try to get the researchers to pay more attention to education. A very noble thing to do. But, it is not sufficient. Because science and engineering and technology are taught elsewhere too. And you can't integrate research and teaching there because there is very little research that goes on there. So if you are as concerned about achieving science literacy as I am, it is not sufficient to do this. This is necessary. Because it trains future teachers who will go to these institutions to do this. That's fine. That's what I want to talk about next. The training of future teachers. I want to present one idea. This one idea is not an original idea with me but, I have been using it lately. That is that at the research universities, I would suggest that the PhD. thesis, in addition to the scientific research that is included there, would include a chapter on an educational experiment that the person may have done at the K-21 levels. That is not a typo. It is 21. Or that the person may have do with a museum or with a science center or what the person may have do with the public media. Of course you can do any of this unless the major professor, the thesis advisor, agrees to that. But that is what I am saying, that is what should be included. Or, include something explaining the research to family members, to friends, to civic groups. Or explain the research to state decision makers. Write the chapter in such a way that people can understand the very important scientific discoveries that were made in that very narrow sub-specialty. If you care about communicating science then this is one attempt aimed the changing the culture in which science is practiced. Not trying to change the practice of science, we are trying to communicate the results of science. Of course these are loaded ideas. It's not just writing it up, you have to do the work first. And so that's what it is that I am suggesting.

Well, I have stayed away from a very important topic that I want to deal with you now. In terms of the issues that are facing us in science education. What are some of the issues that

are facing us? What are some of the issues that we have shied away from dealing with as we look ahead in science education. Issues that we should not shy away from. Here's one. Now your going to say, I teach chemistry, I don't deal with any of that . Why should that concern me? Let the biology teachers deal with it and let the ACS and NSTA and AAAS and the National Academy of Science issue statement when something happens in Kansas or Alabama or elsewhere. And that we applaud what the statements say and that's about it. Am I exaggerating a little bit? Yes or No? Well how can we let a scientific issue like that, it is a scientific issue, it's a cultural issue. How many of you know this publication here by the National Academy. You know I'd like, Arnold and Virginia, May to publicize the availability of this book so we can learn about issues in creationism. So we know what we are dealing with. You can't teach something we don't know, right? We can pretend for a little bit, but then it catches up with you. I submit to you that one important issue that we don't deal with in science education is this issue here. It is a hot political issue. But so is the support for science and so is the support for science education. Look the ACS and other organizations are so proud for the lobbying that they do for supporting science. You know what, in part, I lost my job at the NSF for the lobbying that I did. And I am very happy to see that this is happening now. Not only is it fashionable, it is acceptable. But I'd like to see lobbying for getting scientists to communicate science and speak about issue that deal with creationism.

Another issue, AIDS. (((((A question was asked here...I can't hear it)))) There are a whole bunch of issues. I'm just using this as headlines. Even the USA Today, the July 19<sup>th</sup> issue of USA Today, "Evolutions Next Step in Kansas" Did you read this? The ballot box. Hey, they are going to vote to see who is going to be on the school board. Well, why can't we be part of that discussion? And just because they make a statement in Kansas that is not sufficiently informed, and they make a decision that's not sufficiently informed, doesn't mean they are bad people. It doesn't mean we should look the other way. It doesn't mean we should only focus on what we are doing here, we need to be concerned about it. And you know part of it, well, I

didn't want get into this, but you got me back into it, part of what is going here, has to do with something that I am going to talk about shortly. It's called respect. The scientific community do not respect the beliefs of other people in our society. They don't. They don't have to agree with them. I am talking about intellectual issues. I am talking about ways in which we show respect of other view points and engage in dialogue. And engage in a discussion.

All right. I move to AIDS. How many people have died of AIDS in Africa? How many? Twelve million? Do I get thirteen? Eighteen million people have died of AIDS in Africa. This isn't funny. Eighteen million people have died of AIDS in Africa. How can we, as custodians of knowledge in science, tolerate that on our planet? How can we do that? It isn't because the drug companies don't want to give them the medicine and so on, or they can't afford the medication. This is a scientific issue. The president of South Africa stands up and says AIDS is not caused by HIV. You want to look into what he said. That's the point. A political leader made this statement. Try to see that scientific literacy can be achieved by all, that includes political leaders. So that statement are made in an intelligent way. Hey, I settle for semi-intelligent ways. All right? On both sides.

Another issue, drugs and the chronic problem of alcoholism. I use something in my course called The Chemical of the Week. And the first chemical of the week is, Alcohol. You have seen it, I put this on the web sight. We talk about it. It is a very interesting discussion. The University of Wisconsin, Madison does not make the ranks of the tally that's conducted every year as to where universities are ranked by binge drinking and so on. You know why? Because the students there say that is a rank for amateurs. You can get a lot of this information about Chemical of the Week by looking at my web sight. Lots of information and lots of experiments you can deal with.

Another issue is standards. Standards. Yes, the National Science Standards. They are



about to fade from the memory of the public-at-large. We don't want them to fade. We want them not to be an issue any more because they become part of what we deal with everyday.

Another issue is teachers. Supply of teachers. Preparation of teachers. By that I include those that are going to teach at the post-secondary level. Which is a whole discussion by itself.

Now permit me to be somewhat personal about a couple of other issues. One issue I call integrity. Integrity of what we do as individuals, what we do as groups. And the responsibility that goes with the privilege that we have as scientists and the privilege that we have as teachers. I submit that these two issues require a great deal of attention on are part. They require attention because the public at large for the most part, trust us. There is an element of trust that the public has in scientists and what the scientists do and also in the school systems. I mean why do they send their kids to school. I know in the olden day they used to send them to school because they didn't have enough farm work for them to do. That is the origin of the 180 days, by the way, in school.

Trust and accountability. These are loaded words that I use here. And that is true not only of scientists, but also of teachers. So these four, trust, integrity, responsibility and accountability. But across all of that, the one element that I want to focus on is respect.

I already alluded to that when I talked about the lack of respect that different groups in our society have. And how important it is for us to really always be honest and forthright in our behavior. Because I believe that we belong to a special community. And this community of scientists, this community of teachers, they are not the same community, but these communities, are very very important communities and we develop loyalties within those communities. And we teach that, we practice that. I believe that we have a professorial duty or a professional duty to participate in ways that help serve the purposes for which the community exists. What defines

a community? And what are the purposes that this community wants to pursue and achieve? We need to have an institutional commitment so that we can succeed in the work that we are doing. Personal commitment is not sufficient. And we need leadership.