Alan Leshner Transcript

Ok, good afternoon. Ok, so you heard I used to work in drug abuse. Drug abuse, you know they hold hands, sing Kumbaya, you say good afternoon they "ARRGH, good afternoon". Good afternoon. Good afternoon. Thank you very much, I'm addicted to that. Can you hear me ok? I, first of all I'm delighted that so many people came out on a Monday afternoon when the sun is actually shining; I understand that's not such a common phenomenon here in Michigan. I had a very interesting trip through Detroit where the pilots and I ran around the airport looking for the airplane. We eventually found it and I was about an hour late. So anybody who I have been rude to by being late, I apologize.

I dithered for quite a while about how to talk about this subject with all of you, many of whom are in fact as much or more experts in public engagement as I. And therefore for security I thought I would start in a rather simple way, first of all asking the most obvious question: why do we support or have science anyway? Although it's true that many individual scientists do what they do because it's interesting and provocative, society only supports science because it thinks it's good for it. And I'm fond of saying we try to provide natural explanations; the nature and workings of the natural world. You may have noticed the overuse of the word "nature", "natural" and that's to denote the limited domains of science and the places in which it cannot stray, or should not stray. And then the little piece about whether we like the answers or not seems to be more and more an important concept. And I'll come back to this, but the truth is only we, in science, are stuck with the answers that we provide. The rest of society can either say I wish you hadn't asked that question because I don't really want to know your answer, or I don't like your answer so stuff it. So that side piece of it, though, is that in fact society's interest in science is only sporadically in it's inherently interesting and provocative answers. But more importantly the reason society supports science is a belief that it will improve the human condition.

A second truism is that science and technology are evermore embedded in every aspect of modern life. And there is a list of every issue affecting modern life, just about. And I'm not going to go through them all in any detail but take my word for it; there is not an issue in modern life that doesn't have a scientific component either as a cause or as a cure. And the consequence of that is that in order for people, all people, to thrive in modern society they have to have a fundamental understanding and comfort with science and technology. That does not mean they have to understand all of the nuances of pituitary adrenal cortical function, which I can tell you by the way, is the most important thing in the world. They don't actually need to understand that. But they do need to understand the nature of science. What is science, what isn't science? And they need to be able to tell when they are being duped about science. And that's everybody, there is no one who is not confronted with a science and or a technology related something every day of their lives.

More and more countries have realized that in order for them to prosper they have strong scientific capacity and national policies that reflect the best science. I collect countries where the president of the science minister in my physical presence has in fact said science is good for innovation, and invocation is good for the economy. And in some cases—like China—we're gonna take over the world, therefore we are going to invest in science. And I'm up to about twenty two countries on my own list. But it's a phenomenon you see more and more frequently. The United States right now is uttering that mantra rather enthusiastically. But so are many so called developing countries around the world.

My favorite example is Rwanda in Africa. Rwanda, one of the poorest countries in the world, who as you may remember had that terrible genocide more than a decade ago. But the current President, Paul Kegame, has decided that in a country with no natural resources, the future of the country can only be built if they can build science and science education capacity. And some of you may know that he has been running around the world recruiting partners in the process. And I'm delighted that we at AAAS are high level partners, but he has gone to every major university in the United States and talked their leadership into doing things with Rwanda. The most recent science minister of Rwanda is spending a year with AAAS and he is probably, his name's Romain Murenzi, and he's probably the guy most influential in getting Kagame to do this. But it is just amazing to watch. And the motivation is not it's interesting and provocative, it's we need a future as a country, science and technology can help give us one. And the converse of course is also true if people need science and nations need science, oops, science needs people because in fact, in order for us to prosper the science-society relationship has to be strong and we have to have their support.

This is my favorite quote in the world from Abraham Lincoln, "Public sentiment is everything. With it nothing can fail, without it nothing can succeed". Rather prescient and certainly, I think, true for science. Just to give you a sense of where I'm going in this talk, I noticed I had this slide here on the airplane. And this doesn't quite track, but later you'll see why I had it. The science-society relationship, in fact, is determined by a variety of factors, internal and external to science. And a big problem is that over the last decades the relationship has been a bit of a roller—do you like that, I made that myself. When I was in the government I had six people whose sole function was taking care of my life, now I have to do all this stuff myself. So I'm really thrilled when I can make something like that happen. Anyway, as you may have noticed, over the course of the last decade or more the relationship has not always been wonderful. As Charles Dickens would say, "We've been living in the best of times and the worst of times".

I can't control myself; I have to tell you my favorite story about this. I did not have exactly the best classical education in the world. And while I was still at NIH I had a slide like this and it said, 'As Shakespeare said". Well the truth is when you give out a billion dollars a year; nobody ever tells you that you're wrong. So I did it, and I came to AAAS and I decided that it applied in the science world and like within twelve seconds somebody in the audience goes "Idiot!" It is now correct, it was Charles Dickens.

Ok, so on the one hand we are living in the best of scientific times, and I think there's no question of that. Advances in science are coming at an incredible pace, both in terms of incremental advances in science—those gradual increases that give us greater and greater understanding. And I believe that the advent of new technologies are enabling us to answer entirely new questions that we never could think of before. So I'm a neuroscientist in my business; just think about what it means that you can use MRI scanning or PET scanning and look into a living, breathing individual and watch their mind in action by looking at what's going on in their brain. That is a phenomenal advance that allows us to ask all kinds of questions at all kinds of levels. And it, as I'll come back to, actually raised some problems in the science-society relationship. Just to give you some quick examples: nanotechnology. I'd never heard of a nano before about fifteen years ago. Now again, we spoke about the quality of my education. That notwithstanding nanotechnology is not something most of us thought about.

I have to show a cover of Science or I won't get paid; that by the way, do you see that t-shirt? That is the single most popular thing we have ever done as a sort of promotion for Science is that t-shirt. I have to tell you I think it's incredibly ugly. We have actually sold thousands of copies of it. But the genome project is not just interesting and provocative; it's what's giving us that promise of personalized medicine, the ability to tailor treatments to individual characteristics of people. And of course stem cell research—whether it's embryonic, adult, induced, whatever you want—stem cell research is an example of the progress, so scientific progress has been great.

On the other hand, there have been an array of issues within science. These are the ones I call internal to science that aren't going so well and that negatively affect the science-societal relationship, the societal context. So the obvious ones are human subjects' issues, violations of human subjects' policies, scientific misconduct. We published the human embryonic stem cell incident with the South Korean researcher, Hwang. Let me tell you that consumed thirty percent of my life. It damaged; that was false, right, remember that? It damaged the image, not only of our journal, but of the entire scientific enterprise. Every single incident, rare as they may be, has a tremendous affect. They are widely reported in the media, and that's what the public hears: animal welfare, conflict of interest. NIH grossly underestimated the cost to both the NIH and the broader scientific enterprise, of a very limited number of conflict of interest cases in the NIH Intramural Program. I was at one point the acting director at the National Institute of Mental Health where three or four of those incidents were, and I can tell you that the effect was phenomenal.

Well most recently we have also been seeing the consequences of what I call hyperbole, or exaggerated claims. So there was the IPPC report on climate change, glaciers receding in the Himalayas and all over the world. They just might not be all gone by next year or whatever the date was that had been stated. And I've come up with a new life principle which goes; hyperbole is the enemy of credibility. So having worked in the drug abuse; I made that too. Having worked in the drug abuse business, I can tell you that every time a major anti-drug ad went on TV and said your brain was going to rot because you took drugs, reduces the credibility of all the science surrounding drug abuse. I by the way tried to get the Partnership for a Drug Free America to stop

using the egg frying on the sidewalk or in a pan, you know, brain on drugs, frying brains. And finally I talked them into at least rethinking it; it then received the top award in advertising that can be given. And you can imagine how successful I was. Drugs don't actually fry your brain. So these are factors that are internal to science.

But it's not, as I eluded originally, just about things that happen internally to science that affect the science-society relationship. There are external factors as well. And a big one of course, if you just look at what's happening to science, has to do with the way the government behaves, its attitudes and its behavior. And those attitudes and behavior are expressed in a whole variety of ways: budgets, priorities, what can be funded. And I put in this thing called administrative policies, and the only thing you'll remember from this whole talk is that number. You ready? Forty-two; this was a study done by the Federal Demonstration Project. Forty-two percent of a researcher's research time is consumed in administrative matters. That is a shame for the neighbors, that is a national embarrassment. Forty-two percent of the time is consumed because they can't harmonize policies across agencies. Every university, every institution has an array of administrative tasks. And researchers are spending way too much of their time writing grant proposals. It affects the climate tremendously and I can tell you that I've been trying to work on this in a variety of venues, including the National Science Board. And I am constantly being told, "Don't worry the White House Government Council among the National Science and Technology Council is working on it". And I think back to that great saying, "We're the government, we're here to help you".

Now in terms of the government-science relationship, the truth is that the last decade was a pretty tough one. And I think that needs to be acknowledged because it spread to the broader societal relationship with science. The science advisor position was downgraded; the science advisor to the president was no longer an assistant to the president. That may not sound like a big deal to you, but take my word for it in Washington jargon, it's a very big deal about was has access, who can talk to who, whom, who can talk to whom. There was rather uneven budget growth. NIH, after being doubled through 2003, actually decreased for five consecutive years in real dollar funding. Congress administration did pay us the stimulus funding that was good. And you all are aware that they administration was accused of distorting or ignoring data, and other constituencies received higher priority. The consequence was the scientific community became rather discouraged and disaffected. But why did that happen? Well my belief—and I'll come back to this theme because it spread more broadly to society—is in fact that there are two kinds of issues that set that general climatic tension,, that generate that tension.

One is when there are conflicts with political priorities or policies like climatic change. What's the controversy about climate change? Well the origin is of course that it's very expensive and politically inconvenient to deal with it. Therefore, it's much simpler to say "Sorry, it's just not true" or "I don't believe it", or "There's controversy in the scientific community and when you guys get your act together then we'll do something about it". So that's one kind of conflict.

The other one that's more pervasive and gets played out, not only in broad societal terms, but in governmental terms, is conflicts with public values, with societal values, or with individual norms and values. Teaching evolution in the schools is a great example. And you may recall a couple of years ago your US Congress came within four votes of defunding four NIH grants, five NIH grants, because they studied sexual behavior and it made the members of Congress uncomfortable that they were studying sex well which is a little odd to think about. Well it didn't matter that these were studies of actually HIV/AIDS transmission. And actually the studies came from both NIMH and from NIDA, so I took it very personally. But these kinds of issues are very pervasive, and I'll come back to that in a minute. And the point I'll make here is that government attitudes track broader societal attitudes, and I'll come back to that.

So everybody always asks me this question, and so I'll try to answer it a little bit, "So what's going to happen now?". I spent about thirty percent of my time over the last seven years protecting the integrity of science from distortion or from people ignoring it. New administration comes in, sounds very science friendly, what am I going to do for a livings? Well they've actually kept us busy and you may recall the President Obama virtually assumed as he was inaugurated, made the declaration that he would restore scientific integrity to the White House. And he has in fact, done a very wide array of certainly symbolic, if not actually very important things. He appointed a wide range of luminary scientists to positions that traditionally have been held by less than luminary scientists. You may not know all of them. Jane Lubchenco there; Harold Varmus along with Eric Lander, the co-chairs to the President's Council of Advisors; John Holdren, the Science Advisor to the President; that guy looks familiar I'm sure. That is Nobel Laureate Steve Chu, who is the Secretary of Energy. I like this one; it pays to have been an AAAS President. Virtually all these people are related to AAAS directly, or indirectly. John Holdren, that other guy's Vice President Biden. And this is Jane Lubchenco; the head of NOAA, both of whom are former AAAS selected Presidents. And then you just have to look at the array of appointments that they've made to be very impressed with the quality of scientists who've been recruited into the government.

We even have been exposed to some rather unusual things. Last year, we at AAAS, had the first ever science exhibit on eggs at the White House Easter Egg Roll. And it was absolutely incredible. My grandson was delighted with Curious George, who was also at the Easter Egg Roll. But this was emblematic of an interest in science where I, or course, thought we would be way off on the side somewhere. I get there and there are microscopes and all of that stuff about eggs is right in the middle as you walk out of the White House. It was very cool. So I thought this would be a onetime thing and of course they called up last week and asked us if we could have three exhibits this year. And if we didn't mind could we do it on April the 5th or whatever that near term thing is. So while I'm here enjoying you, there's about seven people spinning like mad trying to figure out how to make it pretty like that.

There also is a lot of science talk on policy issues, though Holdren and the President's Council of Advisors have had more time with the President than aggregate the last three Presidents. Last week they spent an hour and a half with President Obama. A month before they

spent an hour and a half with President Obama. You know about his speeches on climate, energy and health. Ad we've started to see the budgets turn around. This is by the way a very famous, in Washington, chart. This was produced by the White House but it's the guy who used to do it for the AAAS budget analysis. This is constant dollars. You'll see the fall-off here, and overall government funding, then the stimulus funds, and then it started to eek back up again. And this is real dollars, not absolute dollars, so that's coming back. But the critical question is: is it really changed? Well I think the answer is we don't know yet. The question is, will the country deliver on science based policy? So it feels good, and I can tell you, I feel good. And you should feel good; we never have had a President who talked science that much. I have been in the President's physical presence more than I was in the presence of either Bush and Bill Clinton. And I used to do warm up acts when Bill Clinton went out to do—don't ever do a warm up act for him. No one will remember you were in the room, there's no point doing it. But I would do them when he went to talk to teenagers and stuff like that—really stupid of me. But the truth is we don't really know. We're getting the first increases, it's creeping up, and we will see over the course of the next months whether in fact, they will stick and can stick with the notion of science-based policies. Btu so far it does look substantially different than it did before. The rubber has yet to hit the road.

Ok, so that's about the government. And I put that in just 'cause I'm the Washington guy whose, you know, the government is here to help you. But I think we need to look more broadly. And that is really what happens when we think about the science-society relationship. Well the truth is, and the good news, the best of times is that people generally like science. In fact, scientists are the second most prestigious profession in the United States, second only to Fire Fighters. Doctors come next, nurses. You may not be surprised that lawyers are down here somewhere. I was relieved that athletes were down here since I am not anything credible as an athlete. But it's arguable if I'm credible as a scientist but I can pass at least, so far. Prestige is very high and public attitudes about scientific research have been high for thirty years, and they're stayed high.

These are data from the National Science Board Science Indicators. Seventy or more percent of the population believes that the benefits of science out way the harmful effects or the risks. The problem is people have no idea what they're talking about. Extrasensory perception, by the way, probably not true for those of you who are in there. Astrology, mmptmmmpt, and the scariest one is actually the last one. Forty-seven percent of the population doesn't answer true to the statement, "Human beings develop from earlier species". And the problem really is not just a lack of understanding. I believe that a lot of the tension comes from exactly those same issues I referred to talking about the government. Well the government's just a reflection of what's going on in the broader society. So sometimes it's political or economic expediency, but sometimes it's this encroachment on core human values. And that is much more difficult to deal with than is even the political one.

So climate change I already mentioned, I just used that as a lead. This is my new favorite cartoon last week in the Washington Post. Take a minute and look at it, I'll read it for those of

you who were foolish enough to sit in the back. “After a comprehensive review of the climate, science, and a newscaster, we have concluded that climate change is 99.5% certain, not 100% as we previously stated”, “Aha, I knew it!”. And the truth is this guy Toles, who’s fabulous, has been writing cartoons like this to torture me over the course of the last few weeks. But any nick in the credibility of science is grabbed on immediately by the opposition and exploited. You can’t blame them, right? Their motivation is straight forward and they are exploiting any nicks. So anytime there is any nick that we’re responsible for is terrible, but a lot of it is just externally generated. And a lot of it is because as science has advanced it is more and more encroaching on issues of core human values. And as it abuts against them it causes conflict. Is this boring? If it’s boring don’t’ tell me, A, and if you’re going to sleep, quietly.

Alright, so what are kinds of issues? So embryonic stem cell research is a great example where the controversy is at its core around an issue of values. So first of all, the public knows about embryonic stem cell research. If you ask them about it they know enough, they have a general idea. And their objection to it has nothing to do with the science and nothing to do with whether or not they think embryonic stem cell research will lead to great cures for dreaded diseases, they know it might. It has to do with when they believe life begins. If you believe life begins early in pregnancy, like at the moment of fertilization, well then killing an embryo is killing a human being right, because you’re taking a life. If, like some religions believe, life begins later during gestation, actually Islam, actually Judaism believes that it begins later. Buddhism can’t even figure it out. Sorry. So if you believe life begins later in gestation, you don’t have a problem with embryonic stem cell research because you’re not taking a life. Well that ain’t a scientific question, that’s a values question, that’s a belief question. Science has nothing to say about when life begins, it’s not a scientific question.

I mentioned the personal topics like sex, genetics, behavior; remember genetics of intelligence? You know genetics of violence, made people crazy. They misinterpreted it because we misrepresented it. But that notwithstanding, the issue around intelligent design in science classrooms, the objection to teaching evolution has nothing to do with the science of evolution, it has to do with whether you believe in a literal biblical account of creation. If you do, evolution bad. If you don’t, evolution AHA, pretty interesting. So I’ve got two new ones for you. One is synthetic biology. As people come to understand what synthetic biology--the discipline that is what is sounds like, synthetic biology—they’re not going to like it. Neuroscience issues, my own field, I promise you is an issue.

Now I’ve been working with the Institute of Medicine and the Society for Neuroscience to agitate that we need to do something preemptively to prepare for this set of issues. I’ll explain it in a second. And the task is how do you do it preemptively without causing the problem? So what’s the problem? Well as you can look into the brain and watch the mind in action, you quickly realize so where’s your mind? Oh it’s in that mush up there I the hard stuff on your shoulders and it’s sort of clicky clickies of chemistry and electricity. Oops, it’s pretty physical. Well I don’t have any problem imaging that you don’t have a separate mind and body, I get it. I have a little more trouble about me. My own mind a little bit more esoteric and abstract. How

about your soul? Where's your soul? Soul? Hmm, pretty tough when you get down to you don't have a separate mind and a separate body, when it's all these physical, chemical components to it. So initially people thought I was paranoid about this. And I've been hocking this issue for a long time. And then the Discovery Institute, the Intelligent Design people, put out a little statement objecting to mental materialism. That's this. Why, because it conflicted with our understanding of the importance of the soul and the, whatever the word is, the nonhuman, nonphysical aspects of the soul. And candidly I have a little trouble imagining it floating around my body somewhere. But, I mean yours; I don't have trouble with my own. Yours I'm not so sure.

Anyway you watch, those issues are coming. There is now a discipline called neuroethics and a subgroup of the Neuroethics Academic Community is now taking this on in very good ways. If you think this is esoteric the National Science Board back in 2006, but the data seemed to hold up. Fifty-six percent of the American population thinks that scientific research doesn't pay enough attention to the moral values of society. And fully fifty percent of the American population thinks we depend too much on science and not enough on faith. We have a problem. So what do you do about it? Well think back to the fact that that could pose a big problem. If we don't have a good relationship between science and the rest of society, everybody suffers. Society suffers, nations suffer, and the scientific enterprise itself will suffer. And it is having rather dire consequences. It's created a growing divide between science and the rest of society. Our image in society is far more fragile and what we say is being viewed as less and less credible. And this last part I got from Japanese Science Minister, who pointed out that we are in an era when more and more parts of society want to influence what we do study and what we don't study. It goes back to that original question. You know we do science to tell us about the nature and the natural world, whether you like the answer or not. Maybe they don't want to answer. So do me a favor, don't ask the question. Studying sex makes these members of Congress uncomfortable, good don't do it. Don't do it? Don't we need to know? No. Very alarming, at least to me.

So what do you do about it? Ok, the first response of the scientific community is always we need to do public education. We need those poor, unwashed people just to understand us brilliant scientists and then they'll get it. If we explain it to them, yet again, it'll be ok. The problem is, as I alluded with embryonic stem cells, it isn't that they don't understand it they understand it, they don't like it. And if they don't like it, the conflict with their values trumps their view of the societal benefits and they go with the values. So you can't they can. Only scientists are stuck with what science says. Members of society don't have a consequence; they just can just say "No I don't believe it".

I told somebody earlier today; so I have this good friend, a Ph. D physicist from Russia. One day we are having dinner. Very smart guy, he says to me, "Climate change, it's not true". You say that to someone like me, the tape starts. Bbbrrr data, graphs, charts, this study, that study, boom boom. He says, "Yeah, it's not true. And if it is true, people didn't do it". Blah! Ninety-seven percent of the scientific community agrees on this, it's not a controversy; the

controversy is with the slope of the curve. “Aha, no”. What’s the consequence other than he didn’t get dessert? So this was from the Philadelphia Enquirer, I really like it. And it’s not untrue.

One of the things I’m fond of saying, by the way, is that it’s really a shame the scientific term “theory” is an English language word. Because theory in science does not mean the same thing as theory in English language parlance, right? You go out there, “you know I got up this morning, took a shower, and I had a theory about how my flight might be coming to Lansing, Michigan’. Well that’s not quite the same as the theory of gravity. It’s a little less sophisticated and a couple fewer studies went into its formulation.

I like these cartoons; I’ve been collecting this kind of stuff. So what do you do about it? Well the most obvious thing you do when people violate the integrity of science is to whine. And I am the official US whiner. So every time somebody violates the integrity of science I do stand up and go “Ehhh, you can’t do that”. Well the definition of insanity is doing the same thing over and over and expecting a different outcome, but I have yet to learn. It actually is not very effective. It’s not ineffective, and you certainly need to draw people’s attention to it, but you need to understand the limits of it. And many of us have been advocating this more assertive strategy, which you all and we all call public engagement; to engage with the public on the issues. But NOT simply about making them understand, that’s where the confusion comes. We really need to work with the public and try to find common ground. We need to change not only the style and the content of the conversation, but the intent of it. From communicating to, or at, the public which is our tradition—you know that very nice patronizing approach where we go in and say “Poor dumb you. Here we are, we are going to explain pituitary adrenal cortical function to you and show you its importance to your everyday life”—as opposed to communicating WITH the public. True public engagement means the public understanding science, but scientists understanding the public as well. And that part is much more difficult, much more difficult for all of us. We need to be listening to the public about their concerns, their priorities, and questions they would like us to answer. Very very hard, I believe, for scientists to do. But I can tell you I’ve had an experience with that search agenda issue. And again, I’m not suggesting we should leave to the public which questions we should NOT answer. That’s different from saying, “What is it you would like to know? What do you need to know?’.

So I had this great experience, I’ll just pause. I am watching the clock so don’t worry in case you’re nervous. So this is a good anecdote, there I am when I was the director of the National Institute on Drug Abuse, we had fourteen town meetings around the country. And, you know, I would get up and make some big, fabulous speech and then people of the audience would ask questions. And so this woman in the back of the room—a member of the public—gets up and said, “So tell me doctor…”—I was flattered immediately, my mother would have been pleased. I actually once asked my mother-in-law if it ever bothered her that I wasn’t a real doctor. She said, “No, I never tell anybody”. So, you laugh. Forty one years. Anyway, so this woman says, “So it’s very interesting, you said drugs and brains. Drugs do brains. And that drugs are worse early in adolescence than they are late in adolescence; they’re more dangerous to

young adolescents than later. So what's the difference between what drugs do to the brains of young adolescents than late adolescents?". And the answer back in 1995 was we had no idea. We still thought the brain was fully developed by the beginning of adolescence. And we actually, in response to that woman's question—cause we had money—put out a request for applications, spent about twenty million dollars and learned that the brain develops substantially over the course of adolescence; is overlaying white matter into the prefrontal cortex—the area responsible for impulse control—over the course of adolescence. And it's no wonder that an early adolescent is a different species from a late adolescent, right? And if you have adolescents you understand what I just said. And the truth is we never asked that question, and weren't asking that question until some woman from the public asked to question. They all forget to pose the question.

So how do you do this public engagement effectively? Well there are a lot of approaches to it, and I won't go through all of them. But I will tell you that every scientist's great idea is to have a public forum or a town meeting. I will tell you that having done many of them—now I am an expert at failure by the way, I have failed more at doing different things than most living people—and this is one. A big town meeting where a bunch of brilliant scientists each get up and give a very boring talk, after which they open two microphones out on the floor. One is captured by the crazies on one end of the issue, the other by the crazies on the other end of the issue, and they yell at each other the whole time., Then someone finally asks a question—every member of the panel has to answer the question—the fact that they are repeating the answer or what they said in their talk is not relevant, they do it continuously. It is not a very effective vehicle. This other stuff is. I love going out and meeting with community groups. It's actually the best thing individual scientists can do. Go out to the local Kiwanis; go out to the local churches, and synagogues. I happen to love going to retirement communities because they have nothing else to do, they come to the talk. And some of them stay awake. And you know what, old people are pretty smart. And it's really a very reinforcing thing to do that I urge you to do it. There are also a variety of natural opportunities. You know, science museums and centers are among my favorite vehicles, they are incredibly effective. And I would argue all of you to hook up with the local science museums and centers and see what you could do together in public engagement. They have gotten this notion over the neighbor's fence, talk to you neighbors.

One more quick anecdote. So here I am the new guy at AAAS—and I am somewhat known in Washington for this whole public understanding, public engagement stuff—and so I right away get invited to be on a panel. And at the time president of an unnamed large biological society beginning with the initial FASEB, says "In my new presidency I am going to have every member of our society go out and talk to his neighbors about his work". And I whispered, forgetting the microphone is on, "God forbid". And the truth is you don't want every scientist and academic going out and boring their neighbors with what they do, they're not very good at it. But there are many opportunities to do it and I would urge people to do it. Physicians' offices are the best place, you're a captive audience. Doesn't matter you don't have any clothes on.

Ok, the problem is that doing this public engagement is a learned skill; it is not an innate skill. Now I grew up in the Catskill Mountains. My grandparents had a hotel in what's known as

the Borscht Belt, and I can tell you that I thought I was really smooth. But the secret truth is it's a learned skill. You have to learn how to do it, you have to train people, and you need to tell students and colleagues that it's good to do. Because most academic institutions and academic departments say to their scientists, "Keep your nose at the grindstone. Don't stop. My God he went out and talked to thousands of people but he could have published another paper in Science'. Probably not. It needs to be built into the training programs and into the reinforcement contingencies because we have got to get out there and do it. As you've heard, we at AAAS, have a Center for Public Engagement in Science. We run an array of training programs. Unfortunately we allowed to woman who runs most of those programs to become pregnant and have a baby and therefore she's on leave. But we have now run fourteen of them around the country. Colleagues and universities request them. It's been funded by NSF. We're now in the process, actually, or trying to see if we can allow universities to support the project. It's a learned skill and I'll talk a little bit about some of the principles we've learned. And we carry out an array of them ourselves. This is the website for any of you who might be interested.

So let me end with a few of the lessons that I think we've learned from our own experiences. This usually triggers some fury in some people in the audience and it will generate questions. So the first one is never debate an ideologue. It is pointless. So during the intelligent design stuff, I was actually one of the organizers of boycotting the school board's so called debates in Kansas. And I got quite a bit of criticism for it. But I had learned during the medical marijuana issue, when you are debating an ideologue, you the scientists can't violate your scientific integrity, you have to say what the science shows. They can say whatever they want. And there's a limited number of times you can say you're wrong or you're lying, and then you can't do it, so point one, ever debate an ideologue. You can speak sequentially with them, but don't engage in a back and forth, you will lose.

Don't let ideologues redefine what is and isn't science. That happens all the time, "Intelligent design said we are just another scientific theory". They're not. If you're looking for a fabulous definition of it, this report chaired by Francisco Ayala—who's the evolutionary biologist from the University of California, Irvine and a former Catholic priest—is a terrific report which lays out what is science and what are the limits of science, in addition to talking about evolution and creationism. It's freely available from the National Academy of Science's Press. Never pit science against religion. They're separate domains; they have nothing to fight with the other about. I also believe that you can't engage with the extremes. Now not everybody agrees with this. Some people think they are able to talk the extremes of the Evangelical Fundamentalism, I argue that you also can't talk to the Evangelical Atheists at the other side, like Richard Dawkins. You know the guy who gets up and says science has proven there is no God? Science has nothing to say about God, science can't answer that question. Then there's that other category in the middle that I call Militant Agnostics. They're the people who say, "I don't know if there's a God, and neither do you". What else? You can work with the undecideds in the rational middle.

There also is a problem that scientists are people and that they have values. And one of the things we've learned is that you're not allowed to have values when you're representing science. This is the toughest thing for scientists, particularly when they go talk to member of Congress and want to tell them what to do. Uhhuh, you get to tell them what the science is. Your opinion is you opinion, the facts are the facts, and you have to remain the fact person. Very, very difficult to do. And I can tell you that's it's one of those win the battle, and loose the wars. So you go in and tell them what you want them to do and you're giving them the facts and you win that time. And then you leave and they say, "See, it's just another interest group who brought in the same values issues that the Milk Board brought in". Very difficult for scientists.

Hank Greely at Stanford was a part of the symposium we had in October at the Society for Neuroscience, and he had some great advice for engagement. Don't push your point of view in other people faces, don't be overly provocative; that's obvious. Hyperbole, I mentioned that before. Don't over claim what we know. This one I really liked because it was instructive for me because I have a tendency to simplify things and to cast them as A or B. And the truth is that very few things are, in fact, as blunt as creationism and evolution. Pay attention to the subtleties, and humility always helps. Not easy for most scientists.

One other principle is the word "glocal" so you'll remember this word. This is not a speech impediment; this is in fact a term I leaned from the science museum director in Mexico. Going glocal means to take a global issue and make it meaningful at the local level. People only care about things that affect them individually or locally. Your task is to make it meaningful for them, and there are a whole variety of ways to do it; working with local opinion leaders and resources. This is a though thing.

But I really applaud Michigan State, that you all are involved in this to the degree that you are. We were talking earlier; there are really very few institutions that have come to understand the need for community engagement, for public engagement, for going out and building a relationship. It's not only important for you budgets, it's important because our purposes as scientists is to improve the human condition. And we can't do it if there isn't a receptive audience for that we do. So the usefulness of our work is totally dependent on the receptivity of the receptors for our work. And it will not happen if we don't engage with them in a respectful dialogue where in fact we are listening as well as talking. If we want to realize the full potential for science and for society we've got to keep that relationship much better balanced than it is. And if you like that, I'll do it again, because I like it also. Thank you very much.