Remarks to APLU

Presented by Roger N. Beachy, Director
National Institute of Food and Agriculture
November 16, 2009

Ladies and gentlemen, colleagues. A number of years ago while attend a meeting of the Council of the National Academy of Sciences, our good friend Bruce Alberts, then president of the Academy, spent some time describing to new members, including me, the painting in the NAS Board Room that depicts Abraham Lincoln signing the charter for the Academy in 1863. While most people today remember the Lincoln presidency because of his leadership in righting wrongs in individual rights, the Civil War, and his assassination, we here today honor Abraham Lincoln as a president of exceptional vision for how science would serve the citizenry. At a time when the nation faced its most difficult political and economic challenges to date, he signed a bill to establish a National Academy of Sciences.

The year before, as we know, Lincoln signed the Act creating USDA as well as the landmark Morrill Act, which established the land-grant colleges. This legislation would not only change American agriculture, it would transform our society as a consequence. In addition to providing the firm footing for 150 years of excellence in agricultural science, the Morrill Act revolutionized American life by making education accessible to all — a radical notion that created opportunities for millions and helped shape our national character. The Morrill Act was truly a transformative step in America's history.

Even in this time of great national crisis, Lincoln clearly understood the value of both science and education. But his interest in science was utilitarian – he was, after all, our only President to hold a patent – Mr. Lincoln invented a device for lifting a boat off shoals or sand bars (granted in 1849). His charge to the newly formed Academy was not simply to think deep thoughts about science for science's sake; rather, the first task the Lincoln administration set out to the Academy – at the request of Treasury Secretary Samuel Chase – was to study the "uniformity of weights, measures, and coins, considered in relation to domestic and international commerce, an outcome that would benefit the country and its struggling economy.

President Lincoln's support for agricultural research was similarly straightforward, with a simple goal -- self-sufficiency in food production. At the time, a majority of Americans worked directly in agriculture -- agriculture was woven into the very fabric of America, and inextricable from the day-to-day lives and concerns of her citizens. This tie was so deep that Lincoln, in his last address to the Congress, called his newly formed agency "the People's Department."

This commitment to agricultural science, renewed over the years with additional legislation and broadened to encompass many more stakeholders such as the 1890s

institutions and the tribal colleges, has stood this nation in great stead and allowed us to leverage our agricultural leadership into economic world leadership. And we are still world leaders in agricultural science and, as a consequence, agricultural production. It is my firm conviction that we will remain so. President Lincoln's legacy for agricultural research is secure with this Administration.

This legacy has not been in good hands of late. Before WWII, USDA received fully 40% of the nation's science budget; in 2009, USDA ranks sixth among Federal agencies in total Federal R&D investment, not including investments in education or extension/outreach. We have seen a virtual stagnation of funding for agricultural research for the past two decades or more -- except for the past two years of very modest increase for small parts of the portfolio. USDA's share of Federal research has shrunk over the past two decades from about 5% to less than 4%. The stimulus package Congress passed this year was the true wake-up call – while our sister science agencies the NSF, DOE, NIH and others benefited significantly from this legislation (and well they should have), agricultural research was completely shut out. *Completely.*

While we are no less dependent on food, feed, fiber, and fuel coming from agriculture, our great success with production agriculture has allowed most Americans to become complacent about where their food comes from, and what it takes to sustain our agricultural research system and agroeconomy. I and others have called this apparent complacency about agriculture the 'arrogance of plenty' – since most Americans no longer depend directly on farm production for their livelihood; where fuel comes from a pump in the ground; where lumber for houses comes from the local big box home store; and where our food comes from the grocery store or the fast food chain. We have lost our connection to the importance of nurturing and sustaining agriculture, and do not connect with agricultural research that is fundamental to our health and quality of life.

For me and many in this room this casual disregard for fundamental agricultural science and its importance to our health and wellbeing has been nothing short of demoralizing. It is equally demoralizing to the young scientist who is considering whether to be a part of agriculture research or to seek other areas of fulfillment. And if I thought it would persist in this Administration I would never have accepted the chance to come to USDA as the next phase of my career: at the Danforth Center, we were making daily strides in the fight against hunger, and were helping ensure the competitiveness of American farmers. I am proud of what was accomplished in a short period of time. So why make the change to take on a role at the USDA?

Like many of you, I have sensed a great change afoot – the tide of public sentiment is changing. Food safety, nutrition, environmental stewardship, food security worldwide – these are on the minds and lips of Americans, young and not so young, across the country. And we have support from the leadership of this country for transformational change – from a Congress that last year created the National Institute

of Food and Agriculture and established the position of Chief Scientist for USDA; to a Secretary of Agriculture, Tom Vilsack, whose connection to the agricultural legacy of America informs and enriches our Department; to President Obama, whose commitment to science overall is unquestioned and whose priorities both echo and drive our priorities at USDA. This truly is a unique time in the history of agriculture and of the USDA.

I wish you all could have been in the room at the National Press Club last month when we launched NIFA to a standing room only crowd of key stakeholders as diverse as America itself – farm groups, consumer groups, health advocates, fuel companies -- from universities, companies, and the federal and state governments. Educators. Media. And they all heard from Secretary Vilsack, from the President's Science Advisor John Holdren, and from agency officials at the State Department, FDA, NIH, DOE, and NSF – that NOW IS THE TIME to reinvigorate agricultural science, now is the time to bring agriculture not just to the *dinner* table but back to the *policy* table as we grapple with some of society's most pressing issues. And they pledged their complete support for this effort.

Even the science around us is progressing in ways that support transformational change. Advances in genomics and genetics give us unprecedented power to understand how plants and animals grow and thrive, and how humans use the nutrients in these plants and animals for health. Computer simulations provide an unparalleled insight into biological processes.

A timely bellwether for broad scientific change is described in a recent publication from the National Research Council entitled "New Biology for the 21st Century: Ensuring the United States Leads the Coming Revolution." For those of you who don't know the report, I highly recommend it for reading by you, your deans and faculty, and your students and post-docs in all biological sciences, as well as agriculture sciences. The report makes a very compelling case that we are on the cusp of a truly transformative epoch in science and science education, a time in which we can make incredible gains by breaking down the silos that separate physics and chemistry and biology and earth science and adopt a unified approach to big, bold scientific questions. Allow me a quote from the Prefix to the Report:

> *"The lessons of history led the Committee on a New Biology for the 21st Century to recommend that a New Biology Initiative be put in place and charged with finding solutions to major societal needs: sustainable food production, protection of the environment, renewable energy, and improvement in human health. These challenges represent both the mechanism for accelerating the emergence of a New Biology and its first fruits."*

So directly relevant is this report to our work at USDA, as well as in all of the research institutes represented in this audience, that I joked with colleagues that we

should just replace the cover with one that says “The New Agriculture” and release it ourselves. The report has made an even greater impact as a statement about the role of agriculture because, ironically, the report was funded by the NSF, NIH and DOE; not by the USDA.

This is most assuredly a time of momentous change for agricultural science. In talking with many of you since I arrived in Washington, it is clear that we stand at a “teachable moment” in America, where agriculture is again recognized as woven into the fabric of American culture.

We need to take advantage of this moment – it cannot be business as usual.

Having said that, we have some commitments that we must continue to honor. *Our commitment to nurture and support crop and animal production will not waver.* This was the first priority of USDA on the first day its doors opened in 1862, and it has been the priority of every Administration and every Secretary of Agriculture every day since.

Today, however, the production systems are under many different types of pressure as never before: The FAO warns that the combined effect of population growth, strong income growth, and urbanization will require a doubling of food production by 2050. This doubling will need to occur despite climate disruption, critical water shortages, increased soil salinity, and the necessity to reduce the energy and environmental footprints of agricultural practices. And this is not just a problem in “those other countries” we always talk about: American farmers and foresters already are seeing strong downward pressure on the production system, and many areas of the U.S. are as vulnerable to climate disruption as anywhere on earth. Our farmers are proud of their role in protecting the natural resources that they use, and have increasingly adopted practices, learned from <u>your</u> university staff, to be better stewards of the land, water, and air.

Our other longstanding commitment is to make absolutely sure that this production system is sustainable, both in terms of being able to keep supplying America’s and the world’s food, feed, fuel, and fiber, AND in nurturing and safeguarding the natural resources that make this production possible. We can ill afford the divisive rhetoric from our stakeholders that holds we must choose either a healthy environment with low-intensity agriculture or a high intensity sustaining food production system. Both high crop yields and safe and sustainable practices are critically important, and both deserve USDA’s continued full support.

How we work to fulfill those commitments *will* change, however.

Raj and I have spent a lot of time these past few months talking with many of you here today, and with stakeholders from many different sectors. We have listened to

your issues and concerns, and heard how you would re-invent NIFA and other parts of the USDA science portfolio if you were in our shoes. These sessions and this dialogue have been invaluable, and will be even more important as we move forward with USDA's plans to truly transform our work. Thank you for your input thus far, and I thank you in advance for the work we will be doing to keep the dialogue going.

What you have told us, almost to a person, is that we won't accomplish much if we try to do everything. Your advice was to sharpen our focus – don't be afraid to take on big, bold issues like food safety or global food security, but pick a reasonable number of topics to tackle because we are an agency with limited financial and human resources. **We listened**.

What you told us was that we weren't working at scales large enough to make the kind of impact we want –large scale initiatives that draw scientists from a range of disciplines and the totality of public and private research institutions, focused on a few achievable outcomes – can be more successful than a hundred pilot projects on a many different projects. **We listened**.

What you told us was that too often we didn't keep our eyes on the prize, namely improving the lives of real people, here in America and globally. I hear that from President Obama and Secretary Vilsack, too. **And we have listened**.

I want USDA science – extramural and intramural – to focus most of its resources on accomplishing a few, bold outcomes with great power to improve human health and protect our environment. And while contributing to scientific knowledge is critically important – and USDA scientists and the researchers we support make important contributors to articles in leading scientific journals -- this is not sufficient. The scientific knowledge learned from these efforts must be translated into real solutions for real people

We have at USDA, and in the institutions that perform work with USDA funds, a robust infrastructure to perform world-class agricultural science. However, there are too many examples where our funding agencies do little to reduce duplicative research and act as independent sources of knowledge. We should identify which agencies, departments, and institutions have the critical skills to solve the pressing problems, and do all that we can to bring their unique experiences, knowledge of science, and understanding of agroecosystems to bear, in collaborations that allow all partners to contribute to the solutions.

We have at USDA some of the world's best scientists, and many of them work at your universities. This rich and deep talent base is capable of addressing almost any problem we put before it. But instead of focusing on many different problems at once, we should be figuring out how those many problems resolve into a limited and discrete

set of issues and tackle the underlying causes that can ultimately contribute solutions to the wider array of problems.

In short, science at and funded by USDA needs to be focused, leverage other resources, and concentrate on select priorities at a large scale to produce useful outcomes. Our success in science ultimately will be matched by impact in society.

The most visible sign of the transformative change that we have set in motion is the National Institute of Food and Agriculture that we launched in early October. NIFA includes USDA's competitive grants program and distributes the capacity funds that many of your universities apply to great effect. The competitive grants portfolio of NIFA will change to reflect our desire to work at meaningful scale on a discrete set of overarching scientific issues with great potential to improve lives. And like its predecessor agency, CSREES, NIFA will ensure that the research we support finds it way into the hands of farmers, foresters, consumers and others through the unique education and extension system that we help to support. We will do this by requiring meaningful linkages between research and extension and/or education. While other agencies and research performers struggle to effect the translation of bench science to applied science, since 1914 USDA has had a built-in translation capacity unmatched by any other research entity. And we fully intend to support and grow that capacity. More of our awards will have requirements for an education and/or outreach through extension; they will require creating opportunities to recruit more students in the excitement of research in agriculture. We will look for ways to meaningfully engage with colleagues at the 1890's and tribal colleges; and to attract young students to our field. There will, of course, be greater opportunity in priority areas of research than in non-priority areas. Your faculty should prepare themselves well for focusing in the areas of food production and sustainability; biofuels, climate change, and environment; and in food safety and nutrition.

While competitive grants are central to our strategy, intramural research capacity also needs to be transformed to complement competitively funded extramural research. One important focus of intramural research currently is the science that directly supports the needs of USDA program delivery agencies, and that of other federal agencies. This is critical and important work, and it will remain a significant component of our research portfolio. Our intramural research also gives us the flexibility to "turn on a dime" to address emerging problems that require immediate response to a health, safety, or policy challenge. But we also must use the strengths of this intramural capacity to focus on the same kind of concrete results as our competitively funded programs. Increasingly, the work of *both* Intramural and Extramural research will be aligned to focus on the priority areas set out by the Secretary.

So far I've talked mostly about what we will retain from the current portfolio of USDA science. But to do the new things we want, to grow our enterprise in ways consistent with our vision, we'll also need to make some hard choices about what we

won't be doing – or won't be doing as much of. I think it's safe to say we won't be funding as many small, individual-investigator grants as in the past, although we will continue to support new investigators, in particular those that focus their research on our priorities. And I think it's equally safe to say that some resources will be redirected as the RFA solicitations are developed. For example, we will reduce our involvement in conversion of biomass to biofuels in favor of sustainable biomass production.

Doing less of what we don't do well, or what other agencies do better, or what is unlikely to reward our investment, will let us focus on visions and goals for what USDA science *can* accomplish. These five areas represent our vision for USDA science, and identify the expectations we have for what USDA science will accomplish for the American people.

USDA science will support the goal to keep American agriculture competitive while ending world hunger. Many of the goals that we have for U.S. agriculture are identical to those of developing economies. Some of the biggest gains we can make toward ensuring the future of quality of life, building economies, and ending world hunger will involve development of stress-resistant crops and ensuring productivity of agricultural animals. Scientific discoveries that result in drought-tolerant, heat-tolerant, and saline-resistant crops will offer tremendous resilience to climate aberrancies and keep American farmers competitive in the world market, and contribute to crop production for farmers around the world. Sequencing the porcine and bovine genomes will lead to applications that benefit U.S. as well as non-U.S. producers.

Recent advancements have led to development of the tools to unlock complex gene-by-environment interactions. Many of these discoveries came through studies of model organisms. However, to realize our goals for agriculture we need a sharp focus to develop new lines of crops and animal that carry beneficial traits, and to test them in field situations, outside of our labs, animal rooms, and greenhouses. The scale required here is immense. Our new approach to science at USDA will allow us to fund the laboratory and field work in a concerted and strategic way, alone or in partnerships with other granting agencies, NSF, the State Department, the Department of Energy, and others, tapping the knowledge gathered in our great land-grant universities and agricultural experiment stations and international crop science stations to test new varieties of crops and breeds of animals under local conditions. We will develop crops that rely less on chemical inputs and more on their own genetics to resist pests and diseases. We can harness our expertise with extension education and market economics to determine how new food production systems will affect local and international markets, and to make sure these products get to farmers who can use them. These contributions to global food security will go far to help us rebrand America's image abroad.

We have a number of challenges in livestock and animal production agriculture. We need to develop new breeds that are more efficient in the way they use the feed we grow for them. We need better production systems that use less water, fewer antibiotics, and have a smaller environmental footprint. Scientists at the University of Illinois and their collaborators around the United States, funded in large part by NIFA, completed the first draft of the pig genome, a breakthrough that will give us an unprecedented understanding of swine diseases, and could offer a leg up to scientists trying to craft pig and human vaccines against future zoonotic disease. We need this kind of work, and the follow-up research to make sense of what the genomic data actually tell us, for all our major livestock breeds. And, we need to let the public know that many of the advances in animal genomics that will benefit human health are funded by the USDA.

USDA science and education will support our ability to improve nutrition and end child obesity. USDA already is heavily invested in a variety of programs to improve food and nutrition. For example, we deliver meals each day to more than 30 million American school children through our school lunch program, and the Department's Supplemental Nutrition Assistance Program (SNAP) serves nearly 35 million people in more than 12 million households every month. What is less well known is that USDA manages world-class nutrition research at human nutrition research centers across the U.S. USDA scientists discovered the harmful effects of *trans* fats in our diet, research that even now is transforming the kinds of foods Americans eat.

But we can do so much more. One in seven low-income pre-school children is obese; one in three teenagers is either overweight or obese, and these figures are even more grim for many minority communities. Many of these children receive school meals and food assistance from USDA – we can and we should be the front line for confronting childhood obesity. We can attack this problem with focused research on child nutrition at our research centers; implement large-scale programs to improve the nutritional quality of our school meals and food assistance; and monitor the outcomes with the USDA/Department of Health and Human Services National Dietary Survey and other partners across the health sciences. Our common goal is to help our children lead healthy and productive lives. At USDA we want to take the nutrition and food choice insights we have gained from our science to test out some new school lunch approaches. If you're a third grader in Arkansas or the Bronx and the only choices that taste good in the school cafeteria are too high in fat and sugar, you're not likely to learn to eat healthy food. We can change that: research from our Children's Nutrition Research Center in Houston, Tex., already has demonstrated ways to improve kids' nutrition using Texas' new healthy public school nutrition policy in conjunction with USDA's National School Lunch Program. These are great data – but we need to scale this knowledge up to all school lunch programs, nationwide. There may be opportunities through the growth in urban agriculture and in our initiatives to 'know your farmer, know your foods' that can be applied to urban school diets.

USDA science will support our efforts to radically improve food safety for all Americans. Each year in the U.S. alone, food-borne pathogens like *E. coli* kill 5000 people and sicken 75 million more; the cost to the economy from these illnesses exceeds $35 billion. The statistics become much more real, however, to the parents packing a school lunch wondering whether the sandwich they put in the lunch box contains a deadly load of bacteria, or whether the fresh vegetables are produced in conditions that limit bacterial contamination from the growing environment. Where USDA can make the most difference is by focusing on new diagnostic tools to identify food pathogens and trace toxins and chemical contaminants in food, effective interventions to reduce pathogens and contaminants when producing and processing foods, statistical models to understand how food pathogens and contaminants make their way through the food distribution system, and economic research to identify who is most at risk from food-borne illness and from which sources. Our work must complement and support that of regulatory agencies, both at USDA and FDA, and must include producers and distributors. The scale of deployment must be equally expansive and include every food setting, from the farm to the fork – production facilities, supermarkets, restaurants, and homes. USDA can play a lead role in making the U.S. food supply virtually secure from pathogens within a decade.

USDA science will secure America's energy future. President Obama has set ambitious but achievable goals for securing America's energy future from new domestic sources, including 60 billion gallons a year from biofuels by 2030. But the science that supports biofeedstock development is nowhere near on track to help us achieve those goals, despite the wide variety of projects funded through various agencies in the Federal government, or the funds invested by the private sector. We need a fundamental course correction to focus specifically on making rapid progress to improve the amount and quality of plant-based feedstocks that will be the source of biofuels – especially second- and third-generation biofuels – as we have historically done so well for many of the crops that produce our food and fiber products. Through USDA funding, we have great capacity to develop and genetically improve new biofuel feedstocks such as perennial grasses, woody plants, energy cane, algae and others; to optimize the agronomic practices needed to grow and harvest these plants at scale and with low impact on the environment; and to model the economics of bioenergy production and use. This is where USDA's science dollars should be used. We should – and have begun to – team with DOE, which is developing the expertise to efficiently convert a variety of different plant materials into fuel, and with other partners to develop common protocols and standards for biofuel research. We should – and will – team with private sector partners to identify how best to accelerate commercialization of biofuels and with large users of liquid fuels such as the airlines and the U.S. military to understand how the new fuels can best be incorporated into their energy needs.

USDA science will help us mitigate and adapt to climate change. Agricultural and forestry ecosystems are climate dependent and will be affected in a variety of different ways by a changing climate. At the same time, practices used in crop and animal agriculture and forestry can provide valuable offsets as a way to mitigate greenhouse gas emissions under regulation-induced markets. Research aimed at improving crop, animal, and forest management in the face of climate change, and at quantifying the potential for forests and agricultural lands to serve as carbon sinks, can turn a liability into an asset. In fact, we believe that research in this priority area will identify agricultural operations in the United States that, within 10 years, will be net carbon sinks.

But achieving this goal will require intensive research into the effects of climate change at the regional, community, and even individual farm level at a scale we have not even begun to dream of. USDA resources have been used to develop a promising program called GRACEnet that focuses on understanding climate change and carbon sequestration at 30 sites around the country. We need to scale up this research with your universities and others, with their access to research lands and knowledge of local climate, to develop a truly national understanding of climate change, and expand our knowledge at the international level. This understanding also underpins development of technologies and practices that will mitigate climate change, and which will generate rural wealth in an emerging economy of carbon regulation.

In each of these areas that I've described, integrating fundamental and applied research with extension and education will be part of the key to success. We see the possibility that the 4-H program, sponsored in part by NIFA funding, could be critical in engaging youth and their families in the goals of the USDA, and may be a growing source of the next generation of scientists that will choose to serve agriculture.

The change we envision at USDA will be significant and yield measurable outcomes. And I will not be satisfied until I know that the new ways of doing business that we will implement are producing the kind of real impact on society's problems that I know USDA science is capable of.

Clearly, it will not be business as usual at USDA if we adhere to this philosophy. But I am here today to urge that it not be business as usual on your campuses, either -- where so much of the nation's research that is related to agriculture, *writ large*, is performed. One of the most disheartening things that I experienced as a graduate student, post-doctoral scientist, and as a career scientist visiting our colleges and universities, is the great divide – financially, academically, managerially – between the programs where the next generation of agricultural science is taught and research performed, on the one hand, and the teaching and training of ***the very same core sciences*** given in, physics, microbiology, biochemistry, earth science, computational sciences and other programs.

In some cases the traditional College of Agriculture, might as well be a continent removed from the College of Life Sciences or the College of Arts and Sciences for all the cross-pollination and research partnering that occurs. This is not fair to the students, to our field, or to the taxpayers who support our educational systems and expect a payoff in the future in terms of knowledge and service.

The New Biology report lays out a completely new paradigm for leveraging the expertise across the spectrum of the sciences by harnessing biology, physics, earth science, computation, engineering and other fields to address large, fundamental challenges in biology. The report is calling for those of us in agriculture sciences to identify core scientific problems and approach them using all the research tools we can muster. In the era of the New Biology we simply cannot afford to ghettoize agriculture; we need to reach beyond the colleges of agriculture and forestry to engage students across the quad or in the medical school or in the computer lab. We need to reach students in philosophy, public policy, government – everywhere on campus – and engage them in agricultural issues. Auburn University has set a real standard in focusing students and faculty on global food security from across the campus in a Campaign to End World Hunger that draws from every department, every program, and every student group to mobilize awareness and response. North Carolina State University will soon announce a unique consortium of institutions to train graduate students in food, nutrition, and human well being. Arizona State university used NSF funded IGERT programs to develop unique and challenging formats to engage graduate students in different colleges and departments to work on the same problems. These and other creative examples of training students will, we predict, serve to attract and retain some of our brightest and best students in research careers: some of these will be in agriculture-related futures.

I mentioned at the beginning of my remarks today that President Lincoln came to refer to the USDA as "The People's Department." It was literally true at the time – most Americans were farmers of one stripe or another, and agriculture was the principal economic engine for the nation. It is no less true today – we are still "The People's Department" as Secretary Vilsack points out when he talks about USDA touching people's lives every day, in every way. And we are still a powerful economic engine. Science at USDA fuels that engine, and can contribute meaningfully to American lives in many other ways.

There are few issues in society where science cannot provide answers. There are many ways that good science can be applied to create an agriculture that is part of the solution, rather than creating a problem; and there are many ways where we can be ***the most important*** part of the solution. The public is energized as it hasn't been in decades about the quality of the food they eat, where it comes from, how it is produced, and the impact that it has on the environment. Congress is poised to support a realignment of

our funding to match our priorities. And this Administration is ready, willing, and committed to supporting science in the service of public good.

We in this room need to take this ball and run with it; and we need to run in the same direction and carry the same message to our stakeholders and our legislators. We won't get another chance anytime soon.

Thank you for listening today – and we commit to listening to you as we together to develop a new agriculture for America and the World.

#