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Remarks of President Barack Obama – As Prepared for Delivery
National Academy of Sciences
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April 27, 2009

It is my privilege to address the distinguished members of the National Academy of Sciences, as well as the leaders of the National Academy of Engineering and the Institute of Medicine who have gathered here this morning.

I'd like to begin today with a story of a previous visitor who also addressed this august body.

In April of 1921, Albert Einstein visited the United States for the first time. His international celebrity was growing as scientists around the world began to understand and accept the vast implications of his theories of special and general relativity. He attended this annual meeting, and after sitting through a series of long speeches by others, he reportedly said, "I have just got a new theory of eternity." I'll do my best to heed this cautionary tale.

The very founding of this institution stands as a testament to the restless curiosity and boundless hope so essential not just to the scientific enterprise, but to this experiment we call America.

A few months after a devastating defeat at Fredericksburg, before Gettysburg would be won and Richmond would fall, before the fate of the Union would be at all certain, President Lincoln signed into law an act creating the National Academy of Sciences.

Lincoln refused to accept that our nation's sole purpose was merely to survive. He created this academy, founded the land grant colleges, and began the work of the transcontinental railroad, believing that we must add "the fuel of interest to the fire of genius in the discovery… of new and useful things."

This is America's story. Even in the hardest times, and against the toughest odds, we have never given in to pessimism; we have never surrendered our fates to chance; we have endured; we have worked hard; we have sought out new frontiers.

Today, of course, we face more complex set of challenges than we ever have before: a medical system that holds the promise of unlocking new cures and treatments – attached to a health care system that holds the potential to bankrupt families and businesses. A system of energy that powers our economy – but also endangers our planet. Threats to our security that seek to exploit the very interconnectedness and openness so essential to our prosperity. And challenges in a global marketplace which links the derivative trader on Wall Street to the homeowner on Main Street, the office worker in America to the factory worker in China – a marketplace in which we all share in opportunity, but also in crisis.

At such a difficult moment, there are those who say we cannot afford to invest in science. That support for research is somehow a luxury at a moment defined by necessities. I fundamentally disagree. Science is more essential for our prosperity, our security, our health, our environment, and our quality of life than it has ever been. And if there was ever a day that reminded us of our shared stake in science and research, it's today.

We are closely monitoring the emerging cases of swine flu in the United States. This is obviously a cause for concern and requires a heightened state of alert. But it is not a cause for alarm. The Department of Health and Human Services has declared a Public Health Emergency as a precautionary

tool to ensure that we have the resources we need at our disposal to respond quickly and effectively. I'm getting regular updates on the situation from the responsible agencies, and the Department of Health and Human Services as well as the Centers for Disease Control will be offering regular updates to the American people so that they know what steps are being taken and what steps they may need to take. But one thing is clear – our capacity to deal with a public health challenge of this sort rests heavily on the work of our scientific and medical community. And this is one more example of why we cannot allow our nation to fall behind.

Unfortunately, that is exactly what has happened.

Federal funding in the physical sciences as a portion of our gross domestic product has fallen by nearly half over the past quarter century. Time and again we've allowed the research and experimentation tax credit, which helps businesses grow and innovate, to lapse.

Our schools continue to trail. Our students are outperformed in math and science by their peers in Singapore, Japan, England, the Netherlands, Hong Kong, and Korea, among others. Another assessment shows American fifteen year olds ranked 25th in math and 21st in science when compared to nations around the world.

And we have watched as scientific integrity has been undermined and scientific research politicized in an effort to advance predetermined ideological agendas.

We know that our country is better than this.

A half century ago, this nation made a commitment to lead the world in scientific and technological innovation; to invest in education, in research, in engineering; to set a goal of reaching space and engaging every citizen in that historic mission. That was the high water mark of America's investment in research and development. Since then our investments have steadily declined as a share of our national income – our GDP. As a result, other countries are now beginning to pull ahead in the pursuit of this generation's great discoveries.

I believe it is not in our American character to follow – but to lead. And it is time for us to lead once again. I am here today to set this goal: we will devote more than three percent of our GDP to research and development. We will not just meet, but we will exceed the level achieved at the height of the Space Race, through policies that invest in basic and applied research, create new incentives for private innovation, promote breakthroughs in energy and medicine, and improve education in math and science. This represents the largest commitment to scientific research and innovation in American history.

Just think what this will allow us to accomplish: solar cells as cheap as paint, and green buildings that produce all of the energy they consume; learning software as effective as a personal tutor; prosthetics so advanced that you could play the piano again; an expansion of the frontiers of human knowledge about ourselves and world the around us. We can do this.

The pursuit of discovery half a century ago fueled our prosperity and our success as a nation in the half century that followed. The commitment I am making today will fuel our success for another fifty years. That is how we will ensure that our children and their children will look back on this generation's work as that which defined the progress and delivered the prosperity of the 21st century.

This work begins with an historic commitment to basic science and applied research, from the labs of renowned universities to the proving grounds of innovative companies.

Through the American Recovery and Reinvestment Act and with the support of Congress, my administration is already providing the largest single boost to investment in basic research in American history.

This is important right now, as public and private colleges and universities across the country reckon with shrinking endowments and tightening budgets. But this is also incredibly important for our future. As Vannevar Bush, who served as scientific advisor to President Franklin Roosevelt, famously said: "Basic scientific research is scientific capital."

The fact is, an investigation into a particular physical, chemical, or biological process might not pay off for a year, or a decade, or at all. And when it does, the rewards are often broadly shared, enjoyed by those who bore its costs but also by those who did not.

That's why the private sector under-invests in basic science – and why the public sector must invest in this kind of research. Because while the risks may be large, so are the rewards for our economy and our society.

No one can predict what new applications will be born of basic research: new treatments in our hospitals; new sources of efficient energy; new building materials; new kinds of crops more resistant to heat and drought.

It was basic research in the photoelectric effect that would one day lead to solar panels. It was basic research in physics that would eventually produce the CAT scan. The calculations of today's GPS satellites are based on the equations that Einstein put to paper more than a century ago.

In addition to the investments in the Recovery Act, the budget I've proposed – and versions have now passed both the House and Senate – builds on the historic investments in research contained in the recovery plan.

We double the budget of key agencies, including the National Science Foundation, a primary source of funding for academic research, and the National Institute of Standards and Technology, which supports a wide range of pursuits – from improving health information technology to measuring carbon pollution, from testing "smart grid" designs to developing advanced manufacturing processes. And my budget doubles funding for the Department of Energy's Office of Science which builds and operates accelerators, colliders, supercomputers, high-energy light sources, and facilities for making nano-materials. Because we know that a nation's potential for scientific discovery is defined by the tools it makes available to its researchers.

But the renewed commitment of our nation will not be driven by government investment alone. It is a commitment that extends from the laboratory to the marketplace.

That is why my budget makes the research and experimentation tax credit permanent. This is a tax credit that returns two dollars to the economy for every dollar we spend, by helping companies afford the often high costs of developing new ideas, new technologies, and new products. Yet at times we've allowed it to lapse or only renewed it year to year. I've heard this time and again from entrepreneurs across this country: by making this credit permanent, we make it possible for businesses to plan the kinds of projects that create jobs and economic growth.

Second, in no area will innovation be more important than in the development of new technologies to produce, use, and save energy – which is why my administration has made an unprecedented commitment to developing a 21st century clean energy economy.

Our future on this planet depends upon our willingness to address the challenge posed by carbon pollution. And our future as a nation depends upon our willingness to embrace this challenge as an opportunity to lead the world in pursuit of new discovery.

When the Soviet Union launched Sputnik a little more than a half century ago, Americans were stunned: the Russians had beaten us to space. We had a choice to make: we could accept defeat – or we could accept the challenge. And as always, we chose to accept the challenge.

President Eisenhower signed legislation to create NASA and to invest in science and math education, from grade school to graduate school. And just a few years later, a month after his address to the 1961 Annual Meeting of the National Academy of Sciences, President Kennedy boldly declared before a joint session of Congress that the United States would send a man to the moon and return him safely to the earth.

The scientific community rallied behind this goal and set about achieving it. And it would lead not just to those first steps on the moon, but also to giant leaps in our understanding here at home. The Apollo program itself produced technologies that have improved kidney dialysis and water purification systems; sensors to test for hazardous gasses; energy-saving building materials; and fire-resistant fabrics used by firefighters and soldiers. And, more broadly, the enormous investment of that era – in science and technology, in education and research funding – produced a great outpouring of curiosity and creativity, the benefits of which have been incalculable.

The fact is, there will be no single Sputnik moment for this generation's challenge to break our dependence on fossil fuels. In many ways, this makes the challenge even tougher to solve – and makes it all the more important to keep our eyes fixed on the work ahead.

That is why I have set as a goal for our nation that we will reduce our carbon pollution by more than 80 percent by 2050. And that is why I am pursuing, in concert with Congress, the policies that will help us meet this goal.

My recovery plan provides the incentives to double our nation's capacity to generate renewable energy over the next few years – extending the production tax credit, providing loan guarantees, and offering grants to spur investment. For example, federally funded research and development has dropped the cost of solar panels by ten-fold over the last three decades. Our renewed efforts will ensure that solar and other clean energy technologies will be competitive.

My budget includes $150 billion over ten years to invest in sources of renewable energy as well as energy efficiency; it supports efforts at NASA, recommended as a priority by the National Research Council, to develop new space-based capabilities to help us better understand our changing climate.

And today, I am also announcing that for the first time, we are funding an initiative – recommended by this organization – called the Advanced Research Projects Agency for Energy, or ARPA-E.

This is based on the Defense Advanced Research Projects Agency, known as DARPA, which was created during the Eisenhower administration in response to Sputnik. It has been charged throughout its history with conducting high-risk, high-reward research. The precursor to the internet, known as ARPANET, stealth technology, and the Global Positioning System all owe a debt to the work of DARPA.

ARPA-E seeks to do this same kind of high-risk, high-reward research. My administration will also pursue comprehensive legislation to place a market-based cap on carbon emissions. We will make renewable energy the profitable kind of energy in America. And I am confident that we will find a wellspring of creativity just waiting to be tapped by researchers in this room and entrepreneurs across our country.

The nation that leads the world in 21st century clean energy will be the nation that leads in the 21st century global economy. America can and must be that nation.

Third, in order to lead in the global economy – and ensure that our businesses can grow and innovate, and our families can thrive – we must address the shortcomings of our health care system.

The Recovery Act will support the long overdue step of computerizing America's medical records, to reduce the duplication, waste, and errors that cost billions of dollars and thousands of lives.

But it's important to note: these records also hold the potential of offering patients the chance to be more active participants in prevention and treatment. We must maintain patient control over these records and respect their privacy. At the same time, however, we have the opportunity to offer billions and billions of anonymous data points to medical researchers who may find in this information evidence that can help us better understand disease.

History also teaches us the greatest advances in medicine have come from scientific breakthroughs: the discovery of antibiotics; improved public health practices; vaccines for smallpox, polio, and many other infectious diseases; anti-retroviral drugs that can return AIDS patients to productive lives; pills that can control certain types of blood cancers; and so many others.

And because of recent progress – not just in biology, genetics and medicine, but also in physics, chemistry, computer science, and engineering – we have the potential to make enormous progress against diseases in the coming decades. That is why my Administration is committed to increasing funding for the National Institutes of Health, including $6 billion to support cancer research, part of a sustained, multi-year plan to double cancer research in our country.

Fourth, we are restoring science to its rightful place.

On March 9th, I signed an executive memorandum with a clear message: Under my administration, the days of science taking a back seat to ideology are over. Our progress as a nation – and our values as a nation – are rooted in free and open inquiry. To undermine scientific integrity is to undermine our democracy.

That is why I have charged the White House Office of Science and Technology Policy with leading a new effort to ensure that federal policies are based on the best and most unbiased scientific information. I want to be sure that facts are driving scientific decisions – and not the other way around.

As part of this effort, we've already launched a website that allows individuals to not only make recommendations to achieve this goal, but to collaborate on those recommendations; it is a small step, but one that is creating a more transparent, participatory and democratic government.

We also need to engage the scientific community directly in the work of public policy. That is why, today, I am announcing the appointment of the President's Council of Advisors on Science and Technology, known as PCAST, with which I plan to work closely.

This council represents leaders from many scientific disciplines who will bring a diversity of experiences and views. I will charge PCAST with advising me about national strategies to nurture and sustain a culture of scientific innovation. It will be co-chaired by John Holdren, my top science advisor; Eric Lander, one of the principal leaders of the Human Genome Project; and Harold Varmus, former head of the National Institutes of Health and a Nobel laureate.

In biomedicine, for example, this will include harnessing the historic convergence between life sciences and physical sciences that is underway today; undertaking public projects – in the spirit of the Human Genome Project – to create data and capabilities that fuel discoveries in tens of thousands of laboratories; and identifying and overcoming scientific and bureaucratic barriers to rapidly translating scientific breakthroughs into diagnostics and therapeutics that serve patients.

In environmental science, it will require strengthening our weather forecasting, our earth observation from space, the management of our nation's land, water and forests, and the stewardship of our coastal zones and ocean fisheries.

We also need to work with our friends around the world. Science, technology, and innovation proceed more rapidly and more cost-effectively when insights, costs, and risks are shared; and so many of the challenges that science and technology will help us meet are global in character. This is true of our

dependence on oil, the consequences of climate change, the threat of epidemic disease, and the spread of nuclear weapons, among other examples.

That is why my administration is ramping up participation in – and our commitment to – international science and technology cooperation across the many areas where it is clearly in our interest to do so. In fact, this week, my administration is gathering the leaders of the world's major economies to begin the work of addressing our common energy challenges together.

Fifth, since we know that the progress and prosperity of future generations will depend on what we do now to educate the next generation, today I am announcing a renewed commitment to education in mathematics and science.

Through this commitment, American students will move from the middle to the top of the pack in science and math over the next decade. For we know that the nation that out-educates us today – will out-compete us tomorrow.

We cannot start soon enough. We know that the quality of math and science teachers is the most influential single factor in determining whether or a student will succeed or fail in these subjects. Yet, in high school, more than twenty percent of students in math and more than sixty percent of students in chemistry and physics are taught by teachers without expertise in these fields. And this problem is only going to get worse; there is a projected shortfall of more than 280,000 math and science teachers across the country by 2015.

That is why I am announcing today that states making strong commitments and progress in math and science education will be eligible to compete later this fall for additional funds under the Secretary of Education's $5 billion Race to the Top program.

I am challenging states to dramatically improve achievement in math and science by raising standards, modernizing science labs, upgrading curriculum, and forging partnerships to improve the use of science and technology in our classrooms. And I am challenging states to enhance teacher preparation and training, and to attract new and qualified math and science teachers to better engage students and reinvigorate these subjects in our schools.

In this endeavor, and others, we will work to support inventive approaches. Let's create systems that retain and reward effective teachers, and let's create new pathways for experienced professionals to enter the classroom. There are, right now, chemists who could teach chemistry; physicists who could teach physics; statisticians who could teach mathematics. But we need to create a way to bring the expertise and the enthusiasm of these folks – folks like you – into the classroom.

There are states, for example, doing innovative work. I am pleased to announce that Governor Ed Rendell will lead an effort with the National Governors Association to increase the number of states that are making science, technology, engineering and mathematics education a top priority. Six states are currently participating in the initiative, including Pennsylvania, which has launched an effective program to ensure that his state has the skilled workforce in place to draw the jobs of the 21st century. I'd want every state participate.

But our work does not end with a high school diploma. For decades, we led the world in educational attainment, and as a consequence we led the world in economic growth. The G.I. Bill, for example, helped send a generation to college. But in this new economy, we've come to trail other nations in graduation rates, in educational achievement, and in the production of scientists and engineers.

That's why my administration has set a goal that will greatly enhance our ability to compete for the high-wage, high-tech jobs of the 21st century – and to foster the next generation of scientists and engineers. In the next decade – by 2020 – America will once again have the highest proportion of college graduates in the world. And we've provided tax credits and grants to make a college education more affordable.

My budget also triples the number of National Science Foundation graduate research fellowships. This program was created as part of the Space Race five decades ago. In the decades since, it's remained largely the same size – even as the numbers of students who seek these fellowships has skyrocketed. We ought to be supporting these young people who are pursuing scientific careers, not putting obstacles in their path.

This is how we will lead the world in new discoveries in this new century. But it will take far more than the work of government. It will take all of us. It will take all of you.

And so today I want to challenge you to use your love and knowledge of science to spark the same sense of wonder and excitement in a new generation.

America's young people will rise to the challenge if given the opportunity – if called upon to join a cause larger than themselves. And we've got evidence. The average age in NASA's mission control during the Apollo 17 mission was just 26. I know that young people today are ready to tackle the grand challenges of this century

So I want to persuade you to spend time in the classroom, talking – and showing –young people what it is that your work can mean, and what it means to you. Encourage your university to participate in programs to allow students to get a degree in scientific fields and a teaching certificate at the same time. Think about new and creative ways to engage young people in science and engineering, like science festivals, robotics competitions, and fairs that encourage young people to create, build, and invent – to be makers of things.

And I want you to know that I'm going to be working along side you. I'm going to participate in a public awareness and outreach campaign to encourage students to consider careers in science, mathematics, and engineering – because our future depends on it.

And the Department of Energy and the National Science Foundation will be launching a joint initiative to inspire tens of thousands of American students to pursue careers in science, engineering and entrepreneurship related to clean energy.

It will support an educational campaign to capture the imagination of young people who can help us meet the energy challenge. It will create research opportunities for undergraduates and educational opportunities for women and minorities who too often have been underrepresented in scientific and technological fields – but are no less capable of inventing the solutions that will help us grow our economy and save our planet. And it will support fellowships, interdisciplinary graduate programs, and partnerships between academic institutions and innovative companies to prepare a generation of Americans to meet this generational challenge.

For we must always remember that somewhere in America there's an entrepreneur seeking a loan to start a business that could transform an industry – but she hasn't secured it yet. There's a researcher with an idea for an experiment that might offer a new cancer treatment – but he hasn't found the funding yet. There is a child with an inquisitive mind staring up at the night sky. Maybe she has the potential to change our world – but she just doesn't know it yet.

As you know, scientific discovery takes far more than the occasional flash of brilliance – as important as that can be. Usually, it takes time, hard work, patience; it takes training; often, it requires the support of a nation.

But it holds a promise like no other area of human endeavor.

In 1968, a year defined by loss and conflict, Apollo 8 carried into space the first human beings ever to slip beyond the earth's gravity. The ship would circle the moon ten times before returning home.

But on its fourth orbit, the capsule rotated and for the first time earth became visible through the windows.

Bill Anders, one of the astronauts aboard Apollo 8, could not believe what he saw. He scrambled for a camera. He took a photo that showed the earth coming up over the moon's horizon. It was the first ever taken from so distant a vantage point, soon to become known as "Earthrise."

Anders would say that the moment forever changed him, to see our world – this pale blue sphere – without borders, without divisions, at once so tranquil and beautiful and alone.

"We came all this way to explore the moon," he said, "and the most important thing is that we discovered the Earth."

Yes, scientific innovation offers us the chance to achieve prosperity. It has offered us benefits that have improved our health and our lives – often improvements we take too easily for granted. But it also gives us something more.

At root, science forces us to reckon with the truth as best as we can ascertain it. Some truths fill us with awe. Others force us to question long held views. Science cannot answer every question; indeed, it seems at times the more we plumb the mysteries of the physical world, the more humble we must be. Science cannot supplant our ethics, our values, our principles, or our faith, but science can inform those things, and help put these values, these moral sentiments, that faith, to work – to feed a child, to heal the sick, to be good stewards of this earth.

We are reminded that with each new discovery and the new power it brings, comes new responsibility; that the fragility and the sheer specialness of life requires us to move past our differences, to address our common problems, to endure and continue humanity's strivings for a better world.

As President Kennedy said when he addressed the National Academy of Sciences more than 45 years ago: "The challenge, in short, may be our salvation."

Thank you all for your past, present, and future discoveries. God bless you and may God bless the United States of America.

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