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The National Science Foundation: Under the Microscope

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The National Science Foundation:

Under the Microscope



A Report by Tom A. Coburn, M.D.
U.S. Senator, Oklahoma

April 2011

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Under the Microscope

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Under the Microscope

Dear Taxpayers,

As a practicing physician and a two-time cancer survivor, I have a very personal appreciation for the benefits of scientific research. Investing in innovation and discovery can transform and improve our lives, advance our understanding of the world, and create meaningful new jobs.

We are all concerned about America falling behind the rest of the world in math and science. As a result, numerous departments and agencies throughout the federal government spend tens of billions of dollars every year to support these fields. At least 15 federal departments, 72 sub-agencies, and 12 independent agencies currently fund research and development. With a \$6.9 billion annual budget, the National Science Foundation (NSF) is our nation's premier broad-based scientific research agency. NSF is the major source of federal backing in mathematics and computer sciences and spends billions more in important fields such as engineering, biology, physics, and technology.

The President's proposed budget for this year would increase NSF funding by nearly \$1 billion—a 13 percent increase—a significant increase at a time of record deficits. In 2007 and 2010, Congress overwhelmingly passed and reauthorized the America COMPETES Act (Public Law 110-69) which would double NSF funding over seven years. This dramatic increase in spending passed with little debate or dissent.

The theory in Washington all too often tends to be if you throw enough money at a problem, you can solve all our nation's problems. But when Congress commits the nation to significant increases in spending, Congress owes it to the U.S. taxpayers to pay careful attention to how those dollars are being spent.

This report is the first comprehensive overview of NSF. It examines the management of the agency, recognizes many of its accomplishments and successes, identifies some areas for improvements, and questions some of its priorities and funding decisions.

The good news for taxpayers is there is no question NSF *has* contributed significantly to scientific discovery.

The bad news is a significant percentage of your money is going to what most Americans will consider fraud, waste and abuse, and there are many areas where NSF could contribute far more with better management and smarter targeting of resources.

This report identifies over \$3 billion in mismanagement at NSF. This includes tens of millions of dollars spent on questionable studies, excessive amounts of expired funds that have not been returned to the Treasury, inadequate contracting practices that unnecessarily increase costs, and a lack of metrics to demonstrate results. Additionally, a significant portion of the agency's budget is spent on efforts duplicating missions performed by other government agencies and a number of NSF officials and grantees have been caught engaging in inappropriate behaviors, but face little or no consequences.

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Very few of the proposals submitted for NSF financial support represented transformative scientific research according to most grant reviewers surveyed. Taxpayers may also question the value of many of the projects NSF actually chose to fund, such as: How to ride a bike; When did dogs become man's best friend; If political views are genetically pre-determined; How to improve the quality of wine; Do boys like to play with trucks and girls like to play with dolls; How rumors get started; If parents choose trendy baby names; How much housework does a husband create for a wife; and When is the best time to buy a ticket to a sold out sporting event.

There is little, if any, obvious scientific benefit to some NSF projects, such as a YouTube rap video, a review of event ticket prices on stubhub.com, a "robot hoedown and rodeo," or a virtual recreation of the 1964/65 New York World's Fair.

And only politicians appear to benefit from other NSF studies, such as research on what motivates individuals to make political donations, how politicians can benefit from Internet town halls, the impact of YouTube on the 2008 U.S. elections, and how politicians use the Internet.

While taxpayers support investing in science, most would likely question the merits of these projects. Who would disagree the dollars spent on these efforts could not have been better targeted identifying more efficient, renewable fuels, developing the next generation of computers, creating new antibiotics for resistant bacteria, or simply reducing the nation's debt?

As part of my commitment to conduct better oversight on how Washington spends your money, this NSF report is the latest in a series of oversight reports. At a time when the U.S. is being both challenged as the world's scientific and technological leader and threatened by a nearly insurmountable \$14 trillion debt, we must learn to do more with less. This report demonstrates how NSF can do both. I hope NSF and the scientific community will welcome this oversight and offer insights on how to better prioritize our nation's limited financial resources to advance science and reduce wasteful spending.

I would encourage you to visit my website, www.coburn.senate.gov to read additional oversight reports highlighting abuse and mismanagement of your tax dollars. I also invite you to join me in the fight to hold the federal government accountable by sending tips (<http://coburn.senate.gov/public/index.cfm/submit-a-tip>) to me about wasteful government spending in your city, town, and state.

Sincerely,



Tom Coburn, M.D.
United States Senator

Executive Summary

With an annual budget of \$6.9 billion, the National Science Foundation (NSF), funds approximately 20 percent of all federally-supported basic research conducted by United States colleges and universities and 60 percent of all non-biomedical life science research.¹

Like the President and others, I am concerned that America is losing an edge in science, math, engineering, and technology.² Increasing NSF funding is seen as a magic bullet needed to bolster our economy, preserve our national security, and educate our youth. As such, the agency has enjoyed strong bipartisan support and annually increasing budgets. The President identified basic research funding one of the key pillars of “winning the future” in his annual State of the Union address.

Spending more money alone will not ensure America’s success in science. We need to target the money we spend wisely to realize meaningful scientific discoveries and advances. This report takes a closer look at whether or not NSF is succeeding with this goal.

The National Science Foundation: Under the Microscope reveals NSF grants fund wasteful and controversial projects—many of which have limited scientific benefit. An examination of the agency’s grant management uncovers deficiencies in oversight and potential criminal uses of taxpayer funds—casting doubt on the agency’s ability to effectively manage its grants and fully leverage proposed budget increases. Finally, a broader look at federal science funding shows that the work of NSF is often duplicative of other federal agencies.

The consensus surrounding the importance of NSF is precisely why it is essential to increase and enhance oversight over agency expenditures. Taxpayers should question whether their science dollars are buying the research that NSF promises.

The National Science Foundation wastes millions of dollars on wasteful projects. Among the grant-funding highlighted in this report:

Key Findings of this Report

- ❖ NSF has an important mission and contributes to meaningful scientific discovery, but there are pervasive problems at the agency.
- ❖ NSF lacks adequate oversight of its grant funding, which has led to mismanagement, fraud, and abuse and lack of knowledge regarding research outcomes.
- ❖ NSF is prone to extensive duplication within the agency and across the federal government.
- ❖ NSF wastes millions of dollars on low-priority projects.

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- Study suggesting playing FarmVille on Facebook helps adults develop and maintain relationships (p.25);
- An analysis of how quickly parents respond to trendy baby names (p.25);
- A grant to produce songs about science including a rap called “Money 4 Drugz,” and a misleading song titled “Biogas is a Gas, Gas, Gas” (p.26);
- Study on why the same teams always seem to be dominating March Madness (p.27);
- Millions of dollars to figure out that people who often post pictures on the internet from the same location at the same time are usually friends (p.28); and
- A study on whether online dating site users are racist in their dating habits (p.28).

NSF lacks adequate oversight of its grant funding, which has led to significant mismanagement, fraud, and abuse. Internal reports and audits reveal systemic problems with the agency’s grant administration, financial controls, and overall stewardship of scientific research dollars.

Mismanagement has led to hundreds of millions of dollars lost to ineffective contracting. Among the fraudulent and inappropriate expenditures highlighted in this report:

- 47 joint trips to the tune of \$144,152 for a pair of romantically involved NSF employees (p.17);
- Bowling and amusement park trips using research funds (p.19);
- Pervasive porn-surfing by NSF employees (p.15);
- Millions spent on alcohol and unrelated costs (p.18); and

NSF’s work faces extensive duplication challenges, both within the agency and across the federal government. NSF is one of at least 15 federal departments, 72 sub-agencies, and 12 independent agencies engaged in federal research and development.³ An NSF-led analysis of the federal research budget explains that the federal government has, “17 science agencies [that] have 17 different data silos, with different identifiers, different reporting structures, and different sets of metrics.”⁴

A dollar lost to mismanagement, fraud, inefficiency, or a dumb project is a dollar that could have advanced scientific discovery. This report alone documents at least \$65 million in wasteful spending on low-priority projects, \$19 million lost to fraud, \$1.2 billion in duplication, and \$1.9 billion in other forms of mismanagement. Altogether this report identifies over \$3 billion lost to waste, fraud, duplication and mismanagement.

Background

The National Science Foundation (NSF) is an independent federal agency created by the National Science Foundation Act of 1950.⁵ Specifically, NSF’s mission is “to promote the progress of science; to advance the national health, prosperity and welfare; and to secure the national defense.”⁶

As an independent federal agency, NSF operates independently of any other agency and only under the eye of the President. The NSF’s director is appointed by the President and confirmed by the Senate to a six-year term. The agency’s policies are decided by a 24-member National Science Board that meets six times per year. Currently, NSF has about 2,100 employees at its Arlington, Virginia headquarters and is divided into seven directorates supporting science research and education.⁷

“...NSF operates independently of any other agency and only under the eye of the President.”

NSF was started as part of the effort to maintain America’s place as a front-runner in the field of scientific development. Following World War II, scientists and academics called for the creation of a single government agency to conduct and fund basic science.⁸ In 1945, a government-commissioned report, “Science – The Endless Frontier,” recommended establishing a single federal agency for scientific research.⁹ The National Science Foundation Act of 1950 was passed amid debate over many key issues that still remain pertinent today, including basic versus applied research, the inclusion of the social sciences, and potential for duplication.¹⁰

By the time NSF was established, the National Institutes of Health (NIH) had already become the dominant medical research agency, and the now-defunct U.S. Atomic Energy Commission was conducting extensive nuclear and physics research. Soon after, the creation of the National Aeronautics and Space Administration (NASA) and the Defense Advanced Research Projects Agency (DARPA) dominated the research fields of space and defense-related activities.¹¹ Today, at least 15

“At least 15 federal departments, 72 sub-agencies, and 12 independent agencies (including NSF) are engaged in federal research and development.”

federal departments, 72 sub-agencies, and 12 independent agencies (including NSF) are engaged in federal research and development.¹²

NSF did not become the single, primary scientific research agency originally conceived, but NSF often boasts that it is the only federal agency with a mandate to support all non-medical fields of research.¹³ This broad mandate lends the agency to be more susceptible to program and project duplication with the work of more specialized agencies. Nonetheless, NSF has continually

expanded its research portfolio—particularly in the social and behavioral sciences, engineering, and support for math and science education.¹⁴

Transformative Research Funded by NSF

Much of this report focuses on questionable NSF expenditures. The agency as a whole, however, funds many scientific proposals that provide real benefits to American society. This year, the NSF celebrated its 60th anniversary. NSF has detailed many of the major accomplishments of the last 60 years and current investments in potentially transformative research. Much of this research is worthy of taxpayer investment.

The potential for scientific breakthroughs is undermined by misplaced priorities and poor use of scarce research dollars. The following are just a handful of worthwhile investments by the National Science Foundation:

The Internet. NSF makes the claim that Internet technology began with government-funded networking efforts that included NSF's "NSFNET." The report explains, "by the mid-1980s, primary financial support of the Internet had been assumed by NSF."¹⁵



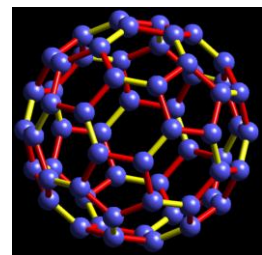
Cloud Computing. In 2007, NSF partnered with IBM and Google to provide computer science students with the necessary skills to develop "cloud computing" applications. Cloud computing is Internet-based—rather than hardware computing—that allows shared resources, software, and information provided to computers and other devices on demand, in a manner similar to an electricity grid. NSF created the Cluster Exploratory Initiative in 2008 to provide researchers access to software and services on the Google-IBM cluster.¹⁶

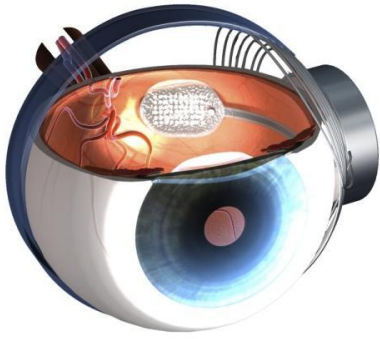


Bar Codes. NSF funding played a key role in the development of bar codes. In the 1970s, NSF helped fund bar-code research "to perfect the accuracy of the scanners that read bar codes." In the 1990s, computer vision research conducted at the State University of New York-Stony Brook led to advances in the science of bar-code readers.¹⁷

Magnetic Resonance Imaging. NSF-supported research "led to the development" of MRI technology, now widely used in hospitals to detect tumors and internal tissue damage in patients and to investigate differences in brain tissue.¹⁸

Buckyballs. Developed in 1985 by NSF researchers, buckyballs are a form of "carbon-composed clusters" bonded in a polyhedral that have similarities to the surface of a soccer ball. Buckyballs can help to diagnose, treat and prevent serious diseases and have other applications. NSF also suggests their structure holds the potential to create everything from more efficient solar cells to coatings for furniture and other surfaces.¹⁹





Vision Care. NSF has supported the development of retinal implant research, which could impact 6 million Americans who have retinal degenerative diseases. The Engineering Research Center at the University of Southern California is working on a “retinal prosthesis.” The prosthesis would potentially include a camera that would transmit images to a computer chip connected to tissue “in the back of the eye, or the retina, and then transmits the signals to the brain.” Initial research has allowed some “patients who had not seen light to see light and to make out some shapes and sizes.”²⁰

These projects provide a contrast to the wasteful and frivolous research projects highlighted in this report—and show the consequences of using limited dollars on low-priority grants. These projects represent good examples transformative science that will change our understanding of important scientific concepts. These research efforts are important scientific ideas that transcend the whims of individual researchers or federal government bureaucrats. And these investments were appropriate expenditures of federal funds.

Real, transformative research should be the standard for all NSF supported projects. Recognizing that all scientific endeavors do not result in the intended outcome, NSF investments can advance knowledge and in many cases improve the human condition rather than simply satisfying the random curiosities of some researchers.

Mismanagement of Taxpayer Funds

Mismanagement of scarce scientific research dollars directly diminishes the scientific return to taxpayers and the country. Unfortunately, tens of millions of dollars are lost each year to waste, fraud, abuse and mismanagement.

Poor Grant Administration Leaves \$1.7 Billion in Limbo. According to the National Science Foundation's 2010 financial statements, the agency currently has \$1.733 billion in "undisbursed balances in expired grant accounts."²¹ Agency policy is to close out grant awards on the award expiration date. One quarter later, any un-liquidated funds are to be de-obligated.²² NSF then identifies funding to be returned to the Treasury from any cancelled appropriations. In 2010, NSF returned \$33.68 million to the United States Treasury, while the agency sits on \$1.7 billion in undisbursed, expired funding. The account has steadily grown from \$1.53 billion in 2008 and 1.66 billion in 2009.²³



\$1.7 billion in undisbursed, expired grants calls into question the proposed \$1 billion increase for the agency in the administration's budget

The total amount of undisbursed balances in expired grants calls into question the proposed \$1 billion increase for the agency in the administration's budget. The agency's record of failing to place an emphasis on closing out expired grants and returning unused funds to the United States Treasury raises question about the overall fiscal management of the agency.

The Government Accountability Office (GAO), which conducted a government-wide review of unexpended grants, concluded that closeout procedures ensure grantees have met all financial requirements, provided final reports, and that unused funds are deobligated. The audits generally attributed the problems to inadequacies in awarding agencies' grant management processes, including closeouts as a low management priority, inconsistent closeout procedures, poorly timed communications with grantees, or insufficient compliance or enforcement."²⁴

"The existence of unspent funds can hinder the achievement of national objectives in various ways, such as leaving projects incomplete, preventing the reallocation of scarce resources to address other needs, or making federal funds more susceptible to improper spending or accounting as monitoring diminishes over time," GAO found.²⁵

The \$1.7 billion of NSF funds that remain in limbo means, in practical terms, less money for research and contributes to our already excessive debt problem.

Poor Contracting Practices. Serious concerns have also been raised regarding the agency's contracting practices, categorizing them as "high-risk."²⁶ In 2010, the NSF spent \$422 million for

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contracts, \$283 million of which went to contracts known as “cost reimbursement contracts.” These contracts are paid “regardless of whether the work is completed.”²⁷

Over 70 percent of these funds—\$204 million—were for contracts permitting advance payments to three specific recipients.²⁸ NSF found that none of these three contractors had an approved disclosure statement—precluding the agency from being able to identify and document actual costs. The IG concluded that, “[g]iven the amount of money it expends on these contracts, the risk of fraud, waste, and abuse by NSF contractors will continue to be high until NSF implements fully adequate cost surveillance procedures.”²⁹

NSF also requires what are called “contingency estimates” in the budgets of large Major Research Equipment and Facilities Construction projects to protect against cost overruns. A recent audit of two projects revealed more than \$169 million of unallowable contingency costs, comprising 25 percent of the combined award amounts, which totaled \$684 million. The IG explained that this occurred because “no barriers existed to prevent the funds from being drawn down in advance.”³⁰



Audits of NSF’s troubling contracting practices revealed \$169 million in unallowable costs within just two contracts—25 percent of the contract amounts

Lack of Accountability. The Office of Inspector General (IG) reports semiannually on the top management challenges confronting the agency. Managing and administering grants remains a top challenge in 2011.³¹

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Almost half of NSF’s required final or annual project reports are submitted late or not at all

Specifically, the IG found that “Ensuring effective oversight throughout the life cycle of an award continues to be an accountability challenge. Prior IG audits of NSF’s operations have indicated that NSF needs to continue to improve its grant management activities including the oversight of awardees’ financial accountability, programmatic performance, and compliance with applicable federal and NSF requirements.” The IG also found that the agency performed 20 percent fewer site visits for its Award Monitoring and Business Assistance Program site visits than it had planned.³²

Past audits indicate that significant numbers of NSF-supported researchers fail to submit final and annual reports on the progress of their projects. A 2005 audit found that “[a]pproximately 47 percent of the 151,000 final and annual project reports required in the past 5 years were submitted late or not at all.”³³ The end result could be

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that the agency and the scientific community, “may not be fully informed about the results of the research funded.”³⁴

The report continues, “[o]f the 43,000 *final* project reports, 8 percent were never submitted, and 53 percent were submitted, on average, 5 months late. Of 108,000 annual project reports required, 42 percent were never submitted.”³⁶

The same report found that although NSF has a policy that prohibits researchers who have not submitted final project reports in the past from receiving new awards, there were 74 instances out of 571 over the five year period in which delinquent researchers received new funding.³⁷

The report sums up the key issue: “because of missing or late project reports, NSF management, the National Science Board, NSF’s advisory committees, and the scientific community may not be fully informed about the results of the research funded by NSF. Tracking the results of NSF’s research is essential to setting future research policy and strategic direction, and ensuring that the research funded contributes to that direction.”³⁹

When asked if things have gotten better, the agency responded that “NSF reengineered business processes and implemented system changes as part of final action,”⁴⁰ which allowed the agency to close the IG’s recommendations out as completed. The IG, however, believes that grant oversight remains as an ongoing management challenge at NSF.⁴¹

| Directorate | Percent On Time | Percent Late | Percent Missing | Percent Late and Missing |
|--|-----------------|--------------|-----------------|--------------------------|
| Biological Sciences | 33 | 53 | 14 | 67 |
| Computer and Information Science and Engineering | 37 | 56 | 7 | 63 |
| Education and Human Resources | 37 | 49 | 14 | 63 |
| Engineering | 48 | 46 | 7 | 52 |
| Geosciences | 38 | 57 | 5 | 62 |
| Math and Physical Sciences | 41 | 52 | 7 | 59 |
| Office of the Director | 38 | 57 | 5 | 62 |
| Social, Behavioral, and Economic Sciences | 33 | 57 | 10 | 67 |

| Directorate | Percent not received |
|--|----------------------|
| Biological Sciences | 39 |
| Computer and Information Science and Engineering | 34 |
| Education and Human Resources | 44 |
| Engineering | 49 |
| Geosciences | 46 |
| Math and Physical Sciences | 31 |
| Office of the Director | 34 |
| Social, Behavioral, and Economic Sciences | 68 |

Limited and Ineffective Program Metrics. A former Director of the White House Office of Science and Technology Policy, John Marburger, has said that we have no reliable metrics on our research investment. He explains, “it is well to keep in mind how primitive the framework is that we use to evaluate policies and assess strength in science and technology.”⁴²

A prominent science policy analyst, Daniel Sarewitz, recently wrote a critique of civilian federal research efforts.⁴³ “For decades, the DOD’s legacy of innovation and economic growth concealed weaknesses in the civilian agencies, which is why so many people still believe that putting more money into civilian research and development is the panacea for what ails U.S. innovation.” The NSF and

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other civilian research agencies lack the attributes necessary for success, including a “focused mission,” Sarewitz said.⁴⁴

In response to recent efforts to evaluate outcomes of scientific investments, he explains, “this worthy goal carries an uncomfortable implication: that the nation's civilian research and development enterprise had been built on a foundation of hidden assumptions and unsubstantiated claims. That foundation is beginning to collapse.”⁴⁵

“The civilian research agencies...are ill-structured to create and sustain essential links between knowledge generation, technological innovation and desired social outcomes,” he concludes. “The United States must transform its science enterprise to enhance links between research and its application to national needs.”⁴⁶

A recent report co-authored by a NSF science policy program director, echoed this concern by detailing a “lack of data in science policy.”⁴⁷ The report details how the federal government focuses on program administration rather than the actual research results. The authors argue that, “the focus of data collection is on awards, which are not the appropriate unit of behavioral analysis. Awards are the intervention of interest; it is the activities of the scientists that receive the awards that need to be followed.”⁴⁸



NSF's Science Policy Program Director authored a report detailing a “lack of data in science policy.”

The report highlights the potential of the STAR METRICS (Science and Technology for America's Reinvestment: Measuring the Effects of Research on Innovation, Competitiveness, and Science) data system. STAR METRICS began as a pilot project twenty-five years ago as a joint effort between many of the federal scientific research agencies and some academic institutions. STAR METRICS could be a potential solution to NSF's grant administration and evaluation management challenges. One of the impacts of the system would be to “standardize their administrative records systems for initial awards as well as annual and final reports.”⁴⁹

Despite its existence for a quarter of a century, the NSF and the National Institutes of Health have been recently publicizing a \$1 million joint investment in the STAR METRICS system for its “first year” of federal support.⁵⁰ NSF and NIH spend a combined \$38 billion annually, necessitating a far greater investment in programmatic accountability and oversight.

The “first phase” of the investment was to estimate the employment impact of federal science spending, started as the administration documented the number of jobs associated with the \$3 billion NSF received in 2009 through the economic stimulus bill. The more important measures of success will

be documented in the second phase of STAR METRICS, which will also measure economic growth, scientific knowledge, and social outcomes.⁵¹



NSF could not tell without substantial effort how much it spent on a program to allow employees to engage in personal research—or even how much time employees spent on such work

while working at NSF, to stay involved in their own research by paying for their travel to and from their home institution or other institutions, as well as attend domestic and international conferences.⁵⁶

Allison Lerner, the NSF Inspector General found a lack of oversight and potential for fraud in this area: “there is no centralized means to review IRD budgets, and therefore no convenient way for NSF managers to compare actual IRD expenditures to plans or budgets, or assess the use of IRD travel across the Foundation’s various directorates or divisions.” She continued, “In fact, we found that NSF could not tell, without substantial effort, how much it spent annually on IRD travel, or how much time NSF [employee participants]... spent on such work.”⁵⁷

The IG “found that some participants used IRD funds for trips and conferences that were not referenced in their plans, some took more trips or longer trips than proposed, and others failed to provide sufficient detail on conference travel. Some of the individuals in our sample used IRD funds for activities not related to the IRD plan, while others spent more on travel than proposed.” A more extensive audit of the program is ongoing.⁵⁸

Pricey Rent. NSF’s headquarters in Arlington, Virginia currently costs taxpayers \$39 per square foot, or \$26 million annually.⁵⁹ The agency is currently at the maximum price per square foot that OMB sets as a “rent cap” in northern Virginia. NSF’s lease is expiring in two years and the agency is currently making plans to lease or construct an entire new building—requesting \$45 million in 2012 just to customize and technology enhancements to their future headquarters.⁶⁰ According to reports, the OMB has denied NSF’s request to waive OMB’s rent cap so that they can lease 690,000 square feet for \$41 per square foot—\$28 million in annual rent.⁶¹

NSF Flying High with First-Class Junkets.

Almost \$35 million in NSF grants included funding for conferences and related travel in 2008.⁵² The \$35 million paid for 932 conferences and 2,246 related employee travel events. The travel budget to send NSF staff to these conferences was more than \$3 million.⁵³

According to a recent report, NSF books 23,000 airline tickets and spends \$16 million total on air travel each year.⁵⁴ The Office of Management and Budget has asked NSF to reduce its travel budget by \$3 million.⁵⁵

The NSF Office of Inspector General (IG) has also raised similar concerns about NSF’s Independent Research/Development (IRD) program. The IRD program allows scientists



NSF's Virginia headquarters is already at the maximum price per square foot, yet the agency is looking for new headquarters that will exceed the rent cap.

According to documents, among the reasons NSF is looking to move from its Ballston, Virginia headquarters is the desire to become more environmentally friendly and create a larger lobby and space for a museum and an auditorium.⁶² Some might find it interesting to note, then, that the NSF currently owns 375 vehicles, including 52 sports utility vehicles.⁶³

Scientists Gone Wild at NSF. Investigative news reports found that some employees at NSF were spending more time viewing pornography than doing their jobs.⁶⁴ The porn viewing was so pervasive that the cases overwhelmed the agency's IG and undermined the watchdog's ability to investigate other misspent funds or fraudulent activities.⁶⁵



One senior executive spent at least 331 days looking at pornography on his government computer and chatting online with nude or partially clad women—costing the taxpayers between \$13,800 and \$58,000.⁶⁶ When caught, the NSF official retired but defended himself by suggesting he visited the porn sites to provide a living to poor overseas women. The

senior executive explained “that these young women are from poor countries and need to make money to help their parents and this site helps them do that.”⁶⁷

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Of the 10 employee misconduct cases during the year, seven were for viewing online pornography.⁶⁸ When the agency's IG was asked to provide an estimate of how much money taxpayers may have lost because of diverted investigative dollars, the IG was unable to provide an estimate. According to congressional reports, the IG had collected just \$2 million in misspent funds the previous year.⁶⁹

Party at the South Pole? In their spare time NSF employees have been jello-wrestling in Antarctica at the NSF research station McMurdo station (picture is taken from the event).⁷⁰

NSF spends \$451 million annually through its Office of Polar Programs to support research efforts in Antarctica and the Arctic.⁷¹

The organizer of the jello-wrestling event was fired for the offense. In an email he sent to the entire staff after his dismissal, he is reported to have referred to NSF as "fun nazis," and claimed that he was "terminated for having harmless jello wrestling."⁷²

In the email, he also mentioned that many participated in a "Polar Plunge," a skinny-dipping excursion, just hours before the jello event. He mentioned the plunge "had plenty of nudity but no one got fired or reprimanded for doing that!"⁷³ News reports indicate that the entire staff at the base was lectured on their moral failure, citing activities involving nudity.⁷⁴



Actual picture of jello-wrestling at the NSF-funded McMurdo station. The organizer of the event was fired for what he called "harmless jello wrestling."

Cheating Taxpayers out of Science Funding

Pervasive mismanagement often manifests itself in not only wasteful expenditures but in willful misuse of taxpayer funds. Fraudulent uses of NSF dollars cheat taxpayers, and science, out of important resources.

Unfortunately, scores of individuals, companies, and even institutions have misspent NSF funds on fraudulent activities. Poor grant administration, in particular, leads to inappropriate uses of awards made by the NSF to individual grantees. Investigators have uncovered a myriad of fraudulent uses of NSF awards, ranging from romantic trysts to bowling and amusement park trips. The following examples have been uncovered by NSF's Office of Inspector General (IG) over the last two years:

Two romantically involved NSF employees go on 47 get-a-ways on NSF's dime. A senior manager at NSF went on 47 trips in a two and a half year period with a direct subordinate, at a total cost of \$144,152 in NSF funds.⁷⁵ The couple extended their business trips and unnecessarily traveled together in order to further their relationship. According to the IG report, "neither the supervisor nor his subordinate disclosed the nature of their relationship to any of the ADs [Assistant Directors]—explaining to investigators that they believed that if the ADs had known about the relationship, trips would have been 'squashed' or 'cancelled.'" ⁷⁶ The senior manager had a performance bonus taken away and both had performance reviews downgraded, but both remained at NSF.⁷⁷

Senior level NSF official took or extended taxpayer-funded trips totaling \$11,283 for romantic liaisons with women in Paris, Tokyo, and Vancouver.⁷⁸ An NSF investigation uncovered inappropriate travel expenses by a NSF official "to facilitate his relationships with female companions, one of whom is an NSF employee."⁷⁹



For a trip to San Diego, messages revealed that he planned his trip around a romantic fling. "Ordinarily I would fly out Sunday [m]y site visit in San Diego begins on Sunday 29th in late afternoon," he explained. "I should be able to fly out a day earlier. ... if you want to come down that evening, stay over and spend the morning by the ocean, we can make that work."⁸⁰

The employee was also found to schedule speaking engagements based on potential romantic benefits. When asked by investigators if it was appropriate to consider a woman's presence in Vancouver in deciding whether to accept an invitation to speak at a workshop there, he responded, "Yeah, why not?"⁸¹

NSF did not fire the individual or reduce his pay. They did rescind "preliminary approval" for an award that would have provided him a \$33,000 bonus, required him to return \$1,215, prohibited him from engaging in any future NSF-funded international travel, and required approval by a superior for any NSF-funded domestic travel.⁸²



New York Public Broadcasting Company required to return \$1.9 million in federal funding, primarily from NSF, they had spent on alcohol, broadcasting talent and other unrelated costs.⁸³ Company documents revealed expenses for gifts for the talent, alcohol, and unrelated costs to the program that were charged to the NSF. The IG also determined that the company had been requesting reimbursements in excess of the actual expenses. For one award, the difference totaled \$476,000.⁸⁴

Company misstates research results, is forced to pay back \$934,000 in NSF funding. An investigation of a small business that received multiple NSF grants revealed several material false statements the company submitted to the government. The false statements “greatly exaggerated the success of the experiments performed under both awards.” The company stated that their research produced high-quality results that were “robust,” “replicated,” and “validated,” while the IG said the results were small-scale, none were repeated, and the results varied widely. The company and its former CEO were each required to pay back half of \$934,000 to the U.S. government. The CEO of the company also voluntarily agreed to exclude himself for receiving federal funds for five years.⁸⁵

Arizona university forced to pay back \$51,688 in NSF funding for gift card and video game purchases. Nearly \$17,000 in personal items, including gift cards and a video game, were charged by a former business manager from the University to an NSF award. The IG also identified nearly \$18,000 in additional charges on a purchase card which the university “could not confirm were properly charged to the NSF award.” The business manager pled guilty to one count of felony theft and was forced to pay the University \$75,000, of which \$51,688 was paid back to NSF.⁸⁶

Employee orchestrates \$450,000 kickback scheme. A research center employee used her position to steer contracts towards a particular business in return for a cut of their contract money. As a result, the business received \$270,000 worth of contracts. Later, the same employee set up a fake company to make bids on contracts. She received over \$450,000 in business for those contracts. As a result, she was terminated and sentenced to a year of home detention, three years probation, and paying restitution of \$80,746.⁸⁷



A Massachusetts university pays back \$380,000 after failing to report the recipient of the award had left the university. An investigation found that the university continued to fund other projects long after the recipient of the \$400,000 CAREER grant had left. The university had spent \$200,000 of the CAREER grant after the recipient had left the university. The university and the award recipient failed to respond to 21 separate overdue project report reminders. The university failed to also report to NSF that the award recipient had left the university.⁸⁸

Colorado contractor overcharged NSF \$14.2 million in indirect costs. The contractor outbid the competition by setting a lower ceiling for “indirect costs” than their competitors. When they were unable to keep their costs as low as they promised, instead of renegotiating with NSF the contractor

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tried to work around their rising costs through an accounting scheme. The contractor implemented their plan after an ambiguous oral statement made by an NSF staffer that they mistook for approval. The improperly charged money was only found after an audit of the contract.⁸⁹

Children reaped the benefit of father’s NSF funding; university pays back \$31,521. A Massachusetts university had to pay back \$31,521 that the award recipient had spent on equipment for his children, double-billing NSF, personal travel, and his office administrator’s travel expenses.⁹⁰



Bowling and amusement park trips funded by NSF money; college forced to return \$500,000. A Georgia university used NSF funds to take students on bowling and amusement park trips. The university also funded non-NSF projects with NSF funds. The restitution amount of \$500,000 was reached in a settlement agreement.⁹¹

Ohio university returns \$105,000 after it is revealed that numerous inappropriate and unsupported costs were charged to an NSF grant. An audit found \$38,000 in illegal charges that included the cost of personal travel for one of the award recipient’s family. This led to audits of additional awards that led to the discovery of more funds that were spent in a similar fashion. In the end, these costs totaled \$105,000, which the university had to repay.⁹²

Notre Dame Professor spends \$190,000 in NSF grant and matching university funds to buy cameras and accessories to take pornographic photos. The University of Notre Dame terminated a tenured electrical engineering professor because he “improperly spent more than \$190,000 in federal grant money and matching university funds to buy cameras and accessories to take pornographic pictures.” The NSF grant was used to buy at “least seven digital cameras, numerous lenses, surveillance cameras, an oversized printer and computer equipment.”⁹³



Audit at the University of Michigan finds \$1.6 million in questionable expenditures of NSF funds, including alcohol, the salary of a terminated employee, and unrelated scholarships. An audit of four awards to the University of Michigan resulted in \$1.6 million in questionable costs. The university was unable to explain these costs due to inefficient or nonexistent record keeping. The audit confirmed that \$61,000 of these costs were for alcohol, salary for a terminated employee, and for unrelated scholarships for a terminated employee.⁹⁴

These abuses indicate a lack of sufficient oversight and management by the NSF leadership. Fortunately, the IG caught many of these abuses—but only after taxpayer funds were misspent or defrauded. The IG’s most recent semiannual report continues to list grant administration as a top management challenge at the agency: “If such monitoring is insufficient, NSF risks paying unallowable or even fraudulent costs.”⁹⁵ Fixing agency oversight of awards is essential in preventing inappropriate use of scarce scientific research dollars.

Duplication

Duplication of efforts across the federal government can lead to inefficiencies and waste of taxpayer dollars. Congress has all too often given government agencies overlapping authorities and responsibilities, often creating new programs without consolidating or eliminating existing programs with the same purposes.

NSF performs an annual survey of federal research and development funding. The report, “Measuring the Results of Science Investments,” finds that the nation’s research infrastructure includes, “17 science agencies [that] have 17 different data silos, with different identifiers, different reporting structures, and different sets of metrics.”⁹⁶



NSF Report: “17 science agencies have 17 different data silos, with different identifiers, different reporting structures, and different sets of metrics.”

The Department of Defense (DOD), Department of Health and Human Services (HHS), National Aeronautics and Space Administration (NASA), Department of Energy (DOE), Department of Agriculture (USDA), Department of Commerce (DOC), and Department of the Interior (DOI) all join the NSF in scientific research and development. NSF is not the only agency supporting the social sciences—the National Endowment for the Humanities \$167.5 million annual budget includes research, fellowships, and institutional support for social sciences.⁹⁷

A breakdown of the federal research and development expenditures by agency is seen in table 1.⁹⁸

Table 1. Federal Research and Development Funding by Agency, FY2008-FY2010

(Budget authority, dollar amounts in millions)

| Department/Agency | FY2008 Actual | FY2009 Estimate | FY2009 ARRA | FY2010 Request | Dollar Change, 2009 to 2010 | Percent Change, 2009 to 2010 |
|------------------------------------|----------------|-----------------|---------------|----------------|-----------------------------|------------------------------|
| Agriculture | 2,336 | 2,421 | 176 | 2,272 | -149 | -6.2 |
| Commerce | 1,160 | 1,292 | 411 | 1,330 | 38 | 2.9 |
| Defense | 80,278 | 81,616 | 300 | 79,687 | -1,929 | -2.4 |
| Energy | 9,807 | 10,621 | 2,446 | 10,740 | 119 | 1.1 |
| Environmental Protection Agency | 551 | 580 | 0 | 619 | 39 | 6.7 |
| Health and Human Services | 29,265 | 30,415 | 11,103 | 30,936 | 521 | 1.7 |
| Homeland Security | 995 | 1,096 | 0 | 1,125 | 29 | 2.6 |
| Interior | 683 | 692 | 74 | 730 | 38 | 5.5 |
| NASA | 11,182 | 10,401 | 925 | 11,439 | 1,038 | 10.0 |
| National Science Foundation | 4,580 | 4,857 | 2,900 | 5,312 | 455 | 9.4 |
| Transportation | 875 | 913 | 0 | 939 | 26 | 2.8 |
| Veterans Affairs | 960 | 1,020 | 0 | 1,160 | 140 | 13.7 |
| Other | 1,074 | 1,141 | 0 | 1,331 | 190 | 16.7 |
| Total | 143,746 | 147,065 | 18,335 | 147,620 | 555 | 0.4 |

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A Congressional Budget Office (CBO) analysis shows that DOD funds 45 percent of federal R&D outlays, NIH constitutes 28 percent, Department of Energy provides 8 percent, NASA funds 7 percent, and NSF comprises only 4 percent.⁹⁹

NSF primarily funds what is known as “basic research,” a specific type of research and development defined by the CBO as research intending “to expand scientific knowledge without regard to commercial applications.”¹⁰⁰ The federal government expended \$27.7 billion on basic research in 2008, of which NSF provided \$4 billion.¹⁰¹ OMB reports that in 2009 HHS spent \$25 billion on basic research, DOE \$4.4 billion, and NSF \$6 billion.¹⁰² DARPA reports \$328 million in its basic research portfolio.¹⁰³

Even a cursory review of NSF grants turns up potential examples of duplication. For example, NSF funds a significant amount of energy research on top of the \$4.4 billion DOE supports. A search of NSF.gov of program areas beginning with the term “energy” yields approximately 1,000 grants totaling another \$590 million.¹⁰⁴ NSF’s trademark Antarctica program has a priority of supporting “national energy security goals.”¹⁰⁵

The U.S. Global Change Research Program (USGCRP), a federal effort to coordinate and integrate federal research on climate change, lists 13 separate agencies that fund climate change research, including NSF.¹⁰⁶

A recent NSF IG investigation is illustrative of the extensive duplication between NSF and the DOD. The report found a researcher at a Florida university had applied for and received funding from three federal agencies for the exact same proposal – NSF, DARPA, and the Air Force. The Air Force made a finding of plagiarism and took actions against the researcher.¹⁰⁷

Some in the scientific community question the ethics behind submitting overlapping proposals to two different government agencies.¹⁰⁸ In an online discussion, researchers discussed how they, or people they work with, had often submitted the same proposal to separate agencies. One commenter asserted managers at the Department of Energy suggest scientists should submit their proposals to multiple agencies.¹⁰⁹ The blog’s author stated, “Some of the DoD basic science calls are pretty broad—I think it would be possible to use more or less the same proposal, reformatted, for various DoD calls that overlap with USDA, DOE, NSF, NIH, or NASA programs.”

NSF also duplicates the work of the Department of Education and other government agencies in the area of Science, Technology, Engineering, and Mathematics (STEM) education. In Fiscal Year 2010, there were 28 STEM education programs at NSF totaling \$1.2 billion (Appendix 1).¹¹⁰

According to a May 2007 report of the Academic Competitiveness Council (ACC), there are 105 federal programs supporting STEM education, with aggregate funding of \$3.2 billion in FY 2006.¹¹¹ Ten of these were DOD administered STEM programs costing \$178.5 million. Removing DOD STEM programs leaves 95 federal STEM programs costing roughly \$3 billion. In FY 2010, the federal government

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managed 99 programs costing \$4.76 billion (excluding those administered by the U.S. Department of Defense) devoted in part or in sum to STEM education.¹¹²

With 99 programs at 11 agencies, overlap and duplication is a significant concern. Consider that across the federal government there are nine programs intending to improve STEM education for minority populations and 15 programs for graduate level STEM education.¹¹³

The GAO recently highlighted the NSF's STEM teacher quality programs as indicative of government duplication.¹¹⁴ The report states, "GAO identified 82 distinct programs designed to help improve teacher quality...administered across 10 federal agencies," and identified "9 of the 82 programs support improving the quality of teaching in science, technology, engineering, and mathematics (STEM subjects) and these programs alone are administered across the Departments of Education, Defense, and Energy; the National Aeronautics and Space Administration; and the National Science Foundation." GAO explains, "The proliferation of programs has resulted in fragmentation that can frustrate agency efforts to administer programs in a comprehensive manner, limit the ability to determine which programs are most cost-effective, and ultimately increases program costs."¹¹⁵

During a recent subcommittee hearing before the House Appropriations Subcommittee on Commerce, Justice, Science, and Related Agencies, Chairman Frank Wolf (R-VA) questioned NSF Director Subre Suresh regarding a long-overdue report on STEM program effectiveness.¹¹⁶ The report, which was due in June of 2010, may shed additional light on how duplicative efforts harm the effectiveness of STEM education programs. Unfortunately, Director Suresh confirmed that nearly a year later the report does not yet exist.

The Congressional Budget Office publishes an annual report detailing cost-savings if certain policy proposals are adopted. In the 2009 "CBO Budget Options" report, CBO identified the elimination of certain NSF spending on K-12 education as a way to save \$366 million dollars the next five years.¹¹⁷ The CBO notes that the DOE spends \$24 billion on a variety of programs that include science and mathematics achievement, and state and local governments spend \$470 billion on public education.

Duplication drags money away from critical research, while diluting the effectiveness of STEM efforts at other agencies. Eliminating programmatic duplication should be a priority of NSF leadership and elected officials.

NSF's Transformative Research Often Does Not Measure Up

NSF's mission is to fund transformative research that finds "novel" approaches to significant scientific questions.¹¹⁸ But as we can see from the following examples, it often comes up short of its lofty goals.

NSF achieves its mission primarily through providing grants in response to research proposals from the academic community. The majority of NSF grants are made to individuals or small groups of investigators, primarily at colleges and universities.¹¹⁹

The Foundation provides grants for research centers, instruments, and facilities used by researchers from multiple institutions. NSF also provides funding for national-scale facilities that are utilized by the entire research community, such as national observatories, Antarctic research sites, and high-end computer facilities.

NSF utilizes a merit-review process to determine which projects to fund. This process emphasizes transformative research, novel approaches to significant questions, and new and promising research areas.¹²⁰ A survey of NSF grant reviewers, however, found "reviewers tended to believe that transformative research was not prevalent among the proposals that they had reviewed (over 60% indicated that less than 10% of the proposals they had reviewed constituted transformative research)."¹²¹

"...over 60% [of NSF grant reviewers] indicated that less than 10% of the proposals they had reviewed constituted transformative research."

On September 24, 2007, the director of the NSF sent a notice to university presidents and other institutions to inform them of a decision made by the National Science Board to place a greater emphasis on "transformative research."¹²² This directive requires every proposal to answer the question, "To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts?" According to the directive, the term "transformative research" refers to research that promises extraordinary outcomes, such as:¹²³

"revolutionizing entire disciplines; creating entirely new fields; or disrupting accepted theories and perspectives — in other words, those endeavors which have the potential to change the way we address challenges in science, engineering, and innovation. Supporting more transformative research is of critical importance in the fast-paced, science and technology-intensive world of the 21st Century."

The purpose of the merit-review process and an emphasis on transformative research is to ensure NSF does not waste taxpayer dollars on frivolous or low-priority research. Unfortunately, a closer look at NSF's research calls into question the agency's record of achieving this mission. If NSF wastes money with their current budget, how many more unnecessary projects would be funded if a substantial budget increase occurs as authorized by Congress?

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My staff spent several years reviewing hundreds of NSF research awards. In our review, we asked specific questions about each grant. I encourage readers to ask the same questions: Is this research potentially transformative? Does it represent an important scientific idea? Is it an appropriate expenditure of federal funds at a time when our national debt is over \$14 trillion?

The projects listed in this report are case studies representing the priorities of the agency. Each study is headlined by the research question

Many will argue the value of particular projects listed below. It is not the intent of this report to suggest that there is no utility associated with these research efforts. The overarching question to ask, however, is simple. Are these projects the best possible use of our tax dollars, particularly in our current fiscal crisis?

Questions for each project:

- ❖ **Does this research represent transformative science that will change our understanding of important scientific concepts?**
- ❖ **Does the subject of this study represent an important scientific idea or the whims of individual researchers and government bureaucrats?**
- ❖ **Is this study an appropriate expenditure of federal funds at a time when the U.S. National debt is over \$14 trillion?**

Questionable NSF Projects

Does playing FarmVille on Facebook help people to make friends and keep them? A \$315,000 NSF study suggests playing FarmVille on Facebook helps adults develop and maintain relationships.¹²⁴ The NSF-funded study, “The ‘S’ in social network games: Initiating, maintaining, and enhancing relationships,” has determined that many adults “are playing games such as Facebook’s FarmVille to help initiate, develop, and maintain relationships.”¹²⁵

FarmVille is a farming social network game available on Facebook and other devices. Participants manage a virtual farm by growing crops, raising livestock, and performing other farming tasks. FarmVille more that 80 million active users.¹²⁶



Michigan State researchers were provided \$314,863 to study “The Role of Social Network Sites in Facilitating Collaborative Processes.”¹²⁷ According to the funding request, the researchers wanted to use social networks to study how undergraduate students collaborated online and to analyze “aggregate behavioral patterns on Facebook.”¹²⁸ The study did not examine whether or not spending too much time playing Farmville with strangers on-line had any impact on Facebook users’ relationships with their own family or friends in the real world.

According to one of the researchers, the study found that people were initiating relationships with strangers because having more friends allows you to advance to a higher level in the game. But in other cases, interacting through the game provided the opportunity “to build on relationships that would otherwise have been left stale.”¹²⁹

How quickly do American parents respond to trendy baby names? Armed with a \$1 million grant



from the NSF, researchers at Indian University-Bloomington and New York University analyzed baby names to determine trends in parents’ naming decisions.¹³⁰ Their conclusion: popular names are popular with parents.

The new research “suggests that parents in the USA seem to prefer baby names that have risen in popularity, rather than those that

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have been popular for a while and may be on the way out.”¹³¹

The researchers were quoted claiming the study as “relevant to understanding how people’s everyday decisions are influenced by aggregate cultural processes.”¹³² In other words, they wanted to confirm that Americans do, indeed, tend to follow trends.

New parents and social scientists do not exactly need to look very hard to see trends in baby names. In addition to many familiar baby name books, a simple google search of “baby name trends” yields 721,000 results, including websites such as nametrends.net, babynames.com, and babynamemstats.com. On babynamemstats.com, you can easily find data on naming trends over the last century.¹³³

Do online music videos such as “Money 4 Drugz,” increase our understanding of scientific concepts?

The National Science Foundation provided \$50,000 for online music videos about science, including “Money 4 Drugz” and “Biogas is a Gas, Gas, Gas.”

NSF provided the \$50,000 grant to Dr. Wendy Silk at the University of California-Davis to develop a website featuring songs about science.¹³⁴ Dr. Silk used this funding to partner with co-investigator Dr. Gregory Crowther to create www.singaboutscience.org.

The \$50,000 grant was provided to “support a broader network of scientists, teachers, and songwriters, and that will support testing of the most effective ways to use music to increase understanding of scientific concepts and natural history.”¹³⁵

Using these funds, Drs. Silk and Crowther have produced and/or highlighted an entire database of online videos featuring songs about science. Dr. Crowther has personally wrote, recorded, and uploaded dozens of songs, including the “Money 4 Drugz” rap video, a song more about getting funding than about science itself.¹³⁶

The lyrics, printed in full:¹³⁷

Working in the lab is a pretty sweet gig / The people are smart and the toys are really big / But we can't be chill when our homies are ill / So we write a new proposal to create another pill / If you have malaria we wanna take care o' ya / And if we succeed then no one has to bury ya / And so we beg for grants, even though it's so demeaning / 'Cause you need a good stash for a high-throughput screening



Chorus: We need money for drugs / We ain't no thugs / But it takes more funds / To kill more bugs (parasites yo!)

We start with expression of recombinant protein / A soluble product is a reason for emoting / We quantify its function and look for inhibitors / And find the delimiters of active-site perimeter

When the SAR is leaving us baffled / We call in the chemists to create a new scaffold / It's not like making meth—it's really hard to do it / But we've got to break through to a brand-new therapeutic

Chorus (repeat and fade)



Other songs composed by Dr. Crowther found on the website include “Glucose, Glucose,” set to the tune of “Sugar, Sugar,” and “Myofibrils” sung to the beat of “My Sharona.” In total, Dr. Crowther has recorded more than 20 videos found on the website, which proudly proclaims it is funded by the National Science Foundation.¹³⁸

One video featured on the site’s homepage is “Biogas is a Gas, Gas, Gas.”¹³⁹ The chorus of the song goes, “Making biogas is a gas, gas, gas / It’s the same as the gas we pass.” Other lyrics include, “It’s time we switch from oil / No need for nukes at all” and “We’ve lived through the age of stupid; the U.S. was king of fools / Spreading blatant propoganda that we needed fossil fuels.”¹⁴⁰

NSF should stick to science and leave music and rap to the recording industry.

Why do the same teams always dominate March Madness? A team of engineers and social scientists at Duke University teamed up to develop a “Constructal Theory on Social Dynamics.” They have been awarded a \$79,998 grant from the National Science Foundation.¹⁴¹

The research helped them conclude that being a top-notch college basketball program helps to attract blue-chip recruits. “The best players will tend to choose winning programs, and these programs send higher percentages of athletes to the NBA, which in turn attracts the best players.”¹⁴² It seems obvious to most, but the mystery kept this team of researchers busy studying the phenomenon with the taxpayer support.



Dr. Adrian Bejan, the lead researcher, also explained that the same dynamic occurs in academia, where universities like MIT attract the best scientists with very little effort.¹⁴³ These conclusions are all part of Dr. Bejan's "constructal law" theory, which seeks to explain how social systems evolve over time.

Many ESPN analysts might argue it doesn't take a PhD to figure this sort of thing out.

Dr. Bejan also throws in his two cents as to whether basketball players get a real education. "When educators and sports announcers refer to college players and scholar-athletes, they misrepresent both worlds," he said. "A more accurate name would be 'basketball students,' just as engineering students are those who study engineering."¹⁴⁴

Are people who post pictures on the Internet from the same place at the same time often socially connected? NSF has provided just over \$2 million to researchers at Cornell University to produce a study concluding if people post pictures indicating they are often in the same place at the same time, they are probably friends or otherwise socially connected.¹⁴⁵



"It's not that you know with certainty, but it's a high likelihood that these people know each other," one of the researchers told *ScienceDaily*.¹⁴⁶ He continued, "As expected, the probability increases as the analysis moves to smaller areas and shorter time spans." The article's title sums up the seemingly obvious conclusion: "Online Photos May Reveal Your Friendships."¹⁴⁷

To arrive at this conclusion, the researchers analyzed 38 million photos uploaded to the Flickr photo-sharing website by about a half million people that were taken by GPS-equipped cameras or tagged by users with location data. They then compared this information to Flickr's social networking service, which showed links between individuals.¹⁴⁸

"I think we've all wondered about questions like this, and there's an opportunity now to start making them precise," one of the researchers concluded—and he wasn't being tongue in cheek. "This paper is trying to begin that line of questioning."¹⁴⁹

Are people more or less racially-focused when seeking love on-line in the Obama era? NSF provided University of California—Berkeley researchers \$580,819 to study racial preferences in online dating.¹⁵⁰ The research was publicized by a UC Berkeley article, "In online dating, blacks are more open to romancing whites than vice versa."¹⁵¹

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The UC Berkeley researchers analyzed the racial preferences of Americans who subscribed between 2009 and 2010 to a major Internet dating service. The dating services ask online daters for a stated racial preference, which could then be compared to whom they actually contacted for a date.¹⁵²

Apparently, the study's objectives were broader than just racial preferences in dating. The researchers were also interested in whether the Obama presidency signals that the United States has entered a post-racial era.

The researchers conclude, "It is clear that we are not yet in the post-racial era, and evidence from studies of online dating suggest that waiting for its arrival will take some patience."¹⁵³



Do twitter users “tweet” in regional slang? Researchers at Carnegie Mellon University received an NSF grant to perform a study of tens of thousands of tweets.¹⁵⁴ A “tweet” refers to a 140-character or less post on the popular social networking site known as “twitter.” The conclusion was that, “regional slang and dialects are as evident in tweets as they are in everyday conversations.”¹⁵⁵



According to the Carnegie Mellon website, “postings on Twitter reflect some well-known regionalisms, such as Southerners’ “y’all,” and Pittsburghers’ “yinz,” and the usual regional divides in references to soda, pop and Coke.” Additionally, their review of thousands of “tweets” –public messages posted by users on the social media platform known as “twitter” – shows “regional dialects appear to be evolving within social media.” Apparently, what’s “coo” (slang for cool) in San Francisco is “koo” in Southern California.¹⁵⁶

The report cites two sources of NSF funding used to support this study—a \$1 million “career” grant to co-investigator Eric Xing and a \$429,000 grant more specifically targeted toward this type of research.¹⁵⁷

Should you buy sporting tickets in advance or at the last-minute? *Science Nation*, the NSF online magazine recently featured a Duke University research project that evaluated the best times to purchase tickets to a sold-out sporting events. The article, “Ticket to Ride: When to buy or not to buy,” explains: “Trying to buy a ticket to a sold-out game? To get the cheapest price you have a decision to make: when to buy.”¹⁵⁸

To answer this question, the article highlighted Dr. Andrew Sweeting’s review of ticket prices on stubhub.com.¹⁵⁹ Dr. Sweeting received a \$259,216 grant from NSF for his work.¹⁶⁰

Sweeting explains that, “The overall aim of my research is to understand how sellers behave and how markets of these kinds of goods should be designed. Once you look at how prices behave, that has a lot of implications for how consumers think about timing their decisions in these markets.”¹⁶¹



The problem, as Dr. Sweeting sees it, that fans are not getting the best deal when they buy tickets to Duke basketball games or a night out at Yankees Stadium. Reviewing the stubhub.com website, he found a consistent and strong trend of declining prices as the game got closer. “Even for the highest demand games such as Red Sox-versus-Yankees games, prices tend to decline,” he explains. “Even popular games have a lot of availability of those tickets close to the game.”¹⁶²

Bottom line, according to Sweeting, is that you should only buy tickets early if you care about airfare or you want a certain number of seats together.¹⁶³ Otherwise, take advantage of lower prices closer to game-time. Sports fans everywhere can rejoice in this purchasing tip, but taxpayers should ask for a refund.

Are boys more likely to play with trucks and girls with dolls? The National Science Foundation funded a \$480,462 study that sought to answer the pressing question of whether a child’s gender predisposes them to prefer certain toys, or if socialization plays a role. Or, more simply, scientists studied if boys like trucks and girls like dolls.¹⁶⁴ To perform the study, scientists evaluated the reactions in 30 infants ranging in age from three to eight months. The scientists used a puppet-theater to show the infants both a pink doll and blue truck, while the children silently watched from car-seats.¹⁶⁵ Because the infants were too young to talk and tell the scientists which toy they favored, the scientists monitored the eye-movements of the infants to determine how long the male and female infants visually fixated on each of the toys.¹⁶⁶



The study, performed at Texas A&M University, found that indeed girls gravitated to the dolls, while boys were evenly split between dolls and trucks.¹⁶⁷ The results of the study on human infants mimicked a similar study the same scientists previously performed in 2002 with green vervet monkeys.

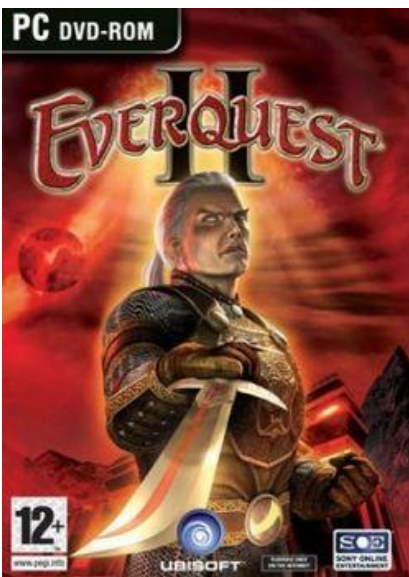
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That study found that male monkeys generally preferred to play with a ball or car, while the female monkeys chose generally to spend the most time playing with dolls and pots.¹⁶⁸

The scientist in charge of both studies, Gerianne Alexander, reported that “[n]o one has taught them to go for this toy or that, yet they gravitated to the toys we see human children typically choose. The possibility that there are features of toys that are innately attractive to male and females was reinforced with our human infant subjects.”¹⁶⁹

Here, scientists may have benefitted from talking to any new parent, since the research just confirmed what most new parents easily learn through casual observation. In fact, one new dad observed that his young son would get “so excited upon seeing any truck. A recent trip to a dealership to pick up some parts resulted in his insisting we visit the trucks and touch them. When I set him in the cab, he was probably one of the happiest kids alive.”¹⁷⁰

What are the group dynamics like in the online video game EverQuest 2? Researchers at University of Illinois at Urbana-Champaign were awarded a \$604,755 grant in 2007 to “use virtual worlds as an exploratorium to...model the dynamics of group behavior.”¹⁷¹ The grant explains, “The most important and complex decisions made by governments and organizations occur in group contexts.”¹⁷²



The award summary specifically suggested EverQuest 2 as a way to study these important group decisions.¹⁷³

EverQuest 2 is a fantasy-based multiplayer online role-playing game produced by Sony Online Entertainment. The grantees explain, “EverQuest 2...is particularly well-suited to theorize and empirically model the dynamics of group behavior. MMOs comprise tens of thousands of players who are at any one point in time coalescing in thousands of groups to accomplish “quests” and “raids” that involve a variety of activities similar to tasks we undertake in real life.”¹⁷⁴

The primary beneficiary of this research will be online networks and games: “The findings and deliverables of the proposed research will be immediately generalizable to training and education related to groups (beyond just MMOs or Virtual Worlds), social networks, and online games.”¹⁷⁵

The same Illinois researchers had previously obtained a \$204,281 grant just one year earlier (2006) for similar purposes.¹⁷⁶

Can twitter predict the stock market? An NSF study analyzed people’s moods on twitter and claims that “Twitter mood” can predict the stock market.

An NSF grant to study charitable responses to the recent earthquakes in Haiti was redirected to predict stock-market activities.¹⁷⁷ Using a \$25,000 grant from the NSF, Indiana University researchers

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published a study, “Twitter mood predicts the stock market.”¹⁷⁸ The report cites NSF Grant BCS #1032101, which refers to a \$25,000 grant for “Models of Social Contagion of Charitable Sentiment Towards Haiti on Twitter.”¹⁷⁹ Interestingly, the Haiti grant was provided as a “rapid” award, bypassing the normal peer-review process and standards because of the time-sensitive nature of the proposal.¹⁸⁰



Instead, the researchers used the money to test their hypothesis that the stock market is a reflection of the public mood—which they felt could be measured by aggregating public posts on the popular social networking site, twitter. They measured the supposed mood of each tweet as “calm, alert, sure, vital, kind, or happy.”¹⁸¹

The study found that measuring the collective public mood by analyzing millions of tweets can predict the rise and fall of the stock market up to a week in advance with up to 90 percent accuracy.¹⁸²

How do rumors get started? To answer the question, NSF has spent nearly \$1 million to investigate. NSF provided the Rochester Institute of Technology (RIT) for \$755,546 to study “rumor propagation.”¹⁸³ The RIT researchers explain, “Like infectious diseases, many rumors engender mistrust, suspicion, and conflict between people groups; such rumors “survive”—even thrive—and are believed as fact despite well-meaning attempts to dispel them. How does this happen?” They further proclaim, “such knowledge is vital for the effective prevention of and response to harmful rumors, especially those that foster intergroup distrust, discord, and hostility.”¹⁸⁴



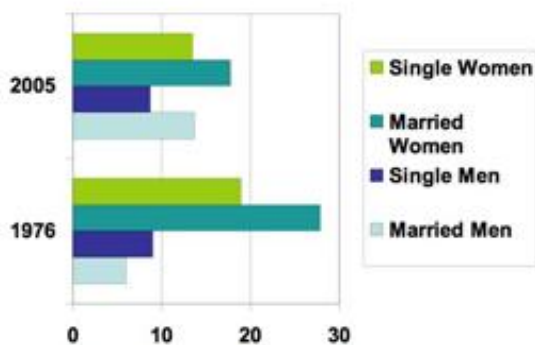
NSF provided a \$7,500 grant to a Cornell University researcher to study “network effects on the spread of rumor and misinformation.” The researcher explains, “computer security experts, corporate executives, and political leaders all contend with separating rumor from verified information, and would welcome a systematic comparison of their diffusion processes.” The study utilizes an internet-based discussion tool, “Netscan,” to analyze internet messages.¹⁸⁵

NSF also provided \$56,597 to a Massachusetts Institute of Technology researcher to study “Rumors, Truths, and Reality: A Study of Political Misinformation.” The grant summary explains, “This project provides an experimental investigation of the effectiveness of different strategies to counter political rumors.”¹⁸⁶

Exactly how much housework does a husband create? One of the recent studies highlighted by NSF is “ground-breaking” research being performed at the University of Michigan’s Institute for Social Research: “Exactly How Much Housework Does a Husband Create?”¹⁸⁷

According to the study, having a husband creates an extra seven hours a week of housework for women. The study also found that both men and women who got married did more housework than single men and women. “Marriage is no longer a man's path to less housework,” remarked one of the lead researchers.¹⁸⁸

Weekly hours of basic housework by gender and marital status



NSF’s website touts these findings as “part of a detailed study of housework trends, based on 2005 time-diary data from a National Science Foundation-funded panel study of income dynamics.”¹⁸⁹

The “Panel Study of Income Dynamics (PSID)” refers to a continuing grant NSF has maintained for the University of Michigan. Most recently, NSF awarded a \$16.5 million grant running from 2007-2011 to continue the PSID.¹⁹⁰ In 1991, 1996, and 2001 NSF provided \$14.8 million, \$13.3 million, and \$14.4 million respectively.¹⁹¹ That’s \$60 million over the last two decades.

Do Turkish women wear veils because they are fashionable? Over the past three decades, the term “veiling-fashion” has developed to describe the type of dress typically worn by Islamic women, including headscarves, overcoats, and other items of women’s modest attire.¹⁹² To better understand this trend, NSF allocated \$199,088 for a survey of “174 veiling-fashion firms in Turkey, case study interviews with three of these firms, and focus groups and interviews with salespeople, garment workers, and consumers in Istanbul and Konya.”¹⁹³ Further, the “investigators will analyze the scope, history, and geography of the veiling-fashion industry headquartered in Turkey by tracing out the circuits of production, design, sales, and finance that characterize the industry.”¹⁹⁴

It does appear that through this research, NSF will be on the cutting edge of the Turkish fashion industry. Indeed, more young, well-heeled, educated, middle-class Muslim women are choosing to wear the veil as “an act of fashion rebellion.”¹⁹⁵ This practice stems from the Turkish government tightening restrictions on veil-wearing for women attending universities in the late 1990s. In turn, many women began to think of the veil as “a means of rebelling against Turkey’s rigid social and political structures” and it became “fashionable, popular, and ordinary.”¹⁹⁶

In fact, one recent poll in Turkey found that 30 percent of women that wore a veil did so for non-religious reasons. Some have even compared the trend to the wearing of blue jeans and tattoos in the United States, which were “styles once ...the province of motorcycle gangs and ex-convicts, [but] eventually came to be adopted by other members of society.”¹⁹⁷



Others feel, however, that women choosing to wear the veil as a fashion trend instead of for religious reasons will lead to the veil's secularization. At present, the veiling-fashion industry has spawned a chain of stores selling ready-made garments called "Veil" and a monthly magazine titled "Hijab Fashion" that "does not convey a religious message and merely gives veiled women shopping options and reviews."¹⁹⁸

What is the relationship between online virtual world users and their avatar? A professor at Southern Methodist University in Texas received \$90,000 to research "Avatar-Self" relationships in virtual worlds.¹⁹⁹ An avatar is the graphical representation of a user or character in an online virtual world or video game. According to the grant summary, "this research addresses the central question with respect to avatars in computer-generated virtual worlds: How does the user negotiate among the many possible relationships between the self and the avatar?"²⁰⁰



The application explains, "this study explores the types of avatar-self relationships that are enacted in virtual worlds, and the conditions under which different relationships become salient and why."²⁰¹ Using real life case studies, the research focuses on the "residents of Second Life, one of the largest virtual worlds."²⁰²

Professor Schulze—known more widely by her avatar name Uskla—describes her research as "a social diary," consisting of a number of interviews with people who spend more than 10 hours per week in Second Life.²⁰³

She also described her avatar: "[s]he doesn't look like me at all. She's not particularly interesting because in my case I use the avatar for teaching, so basically have them be engaged in role play for example. She wears jeans and boots and has black short hair whereas in real life, I have blondish long hair."²⁰⁴

Professor Schultze cautions that "the avatar is me, but not quite me." She explains "the avatar is not quite me also means that you can deny actions or activities that you would consider morally questionable in real life—for example, infidelity. For someone who is married in real life, is having an

intimate relationship in Second Life cheating or just fantasy?”²⁰⁵ Your tax dollars are answering these important questions.

Can Members of Congress improve their approval ratings through internet town halls? NSF awarded \$161,522 to the Congressional Management Foundation (CMF) to study how Members of Congress can improve the approval of their constituents through internet town halls. The study analyzes the impact participation in online town hall meetings had on constituents’ views of their Members of Congress and on their participation in political activities, such as talking about politics and the Member and voting.²⁰⁶

Among the conclusions? Participants are more likely to agree with, approve of, and vote for their congressman.²⁰⁷

The organization’s press release, circulated to Congressional staff along with an invitation to attend a corresponding briefing, reads: “New Study Finds That Internet Town Hall Meetings Increase Constituent Trust, Perception of Lawmakers: Approval Ratings Jump by 18% Average.”²⁰⁸ CMF subsequently held a briefing for Congressional staff on the benefits of internet town halls.²⁰⁹

How long can a shrimp run on a treadmill? Scientist put shrimp on a tiny treadmill to determine if sickness impaired the mobility of the crustaceans. Researchers at the Grice Marine Laboratory at the College of Charleston, South Carolina have received at least 12 NSF grants totaling over \$3 million over the last decade for their work, including a \$559,681 award “Impaired Metabolism and Performance in Crustaceans Exposed to Bacteria.”²¹⁰



“As far as I know this is the first time that shrimp have been exercised on a treadmill and it was amazing to see how well they performed,” David Scholnick, a biologist from Pacific University told *LiveScience*. “Healthy shrimp ran and swam at treadmill speeds of up to 20 meters per minute [66 feet per minute] for hours with little indication of fatigue.”²¹¹

LiveScience reports “to further challenge the healthy shrimp, the researchers designed a small backpack made of duct tape to add extra load to the shrimp.”²¹² But even when loaded down with the backpack, the shrimp were still active for up to an hour.

The researchers did find that sick shrimp did not perform as well and did not recover as well from exercise as healthy shrimp.

Shrimp dealing with an infection would be less active and might be limited in their ability to migrate, find food, and avoid being eaten.

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These findings that sick shrimp have more limited mobility may mean they are less likely to avoid being eaten. “A decrease in performance may mean the difference between life and death,” Scholnick points out.²¹³

The value of these finding can be debated by scientists and taxpayers, but with millions of views there is no question the videos of the shrimp on a treadmill have become an Internet sensation (video available here: <http://www.youtube.com/watch?v=cMO8Pyi3UpY>).

What’s next? “We plan on building one for lobster,” lead investigator Lou Burnett exclaimed. “We have one for blue crabs.”²¹⁴

Does birth order impact willingness to take economic risks? At least \$6,500 of taxpayer funds were spent to help determine whether the order in which you were born impacts your willingness to take risks.²¹⁵



University of South Carolina scientists found the oldest siblings in a family are “more risk adverse and more patient” in making financial decisions and the youngest siblings were “willing to gamble for a higher [financial] payoff.”²¹⁶

The researchers collected data about the family structure and then information about their willingness to participate in risky behaviors.²¹⁷ The researchers “offered participants the possibility of larger payoffs with higher risk, smaller payoffs with lower risk.”²¹⁸ But to make the scenario feel real, they used real money, provided by taxpayers through a NSF grant. “You have to use real currency in experiments like this,” one of the researchers commented.²¹⁹

Does Intelligent Extraterrestrial Life Exist on Other Planets? The Search for Extraterrestrial Intelligence (SETI) Institute is a private, nonprofit organization located in California established in 1984, in part, to find intelligent extraterrestrial life in the universe.²²⁰ Over the years, SETI projects have received financial support from a number of government agencies including NASA, the Department of Energy, U.S. Geological Survey, and the National Science Foundation.²²¹ Since September 2008, NSF has provided over \$1.3 million to SETI.²²²



As part of the American Recovery and Reinvestment Act of 2009 (“the stimulus program,” Public Law 111-5), NSF is spending \$597,600 “for the continuation of the Research Experiences for Undergraduates (REU) Site at the SETI Institute (SI), with a focus on astrobiology and the study of the living universe.” Funding for the grant, entitled “REU Site: Life in the Universe - Astrobiology at the SETI Institute,” began in 2009 and is estimated to continue through May 2012.²²³ Major components of the project include

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“educational, social and cultural activities via research-related field trips” and a full week at the Allen Telescope Array (ATA) at Hat Creek Radio Observatory,²²⁴ which is utilized to “search for signals of intelligent, extraterrestrial origin.”²²⁵ Three main areas emphasized are “Planetary Science and the Search for Life in the Solar System,” “Astronomy and the Search for Extraterrestrial Intelligence,” and “Biochemistry and the Origin and Evolution of Life on Earth.”²²⁶

In addition to having fun searching for Martians, the handful of students involved in this project may learn more about the universe and astronomy. But if the previous twenty-five years of searching for aliens by SETI is an indicator, it is unlikely the half-a-million dollars spent on this project will result in the discovery of E.T. or any other intelligent extraterrestrial life. The White House, however, claims the federal stimulus funds being spent on the project have saved or created precisely 3.11 jobs.²²⁷

The recent announcement that the SETI Institute was putting the Allen Telescope Array into “hibernation” due to lack of financial support surely is disappointing to REU participants expecting to participate in making contact with life from other planets.²²⁸

If you trust your laundry folding to a robot, how long will you have to wait? Folding laundry may top the list of as one of the most unpopular household chores. Now with the help of a \$1.5 million NSF grant, scientists have designed a robot that can fold laundry.²²⁹



Unfortunately, as great as a laundry-folding robot may sound, you still may wait a long time to finish a few items. In trials, the robot took nearly 25 minutes to fold each towel.²³⁰

The researchers from the University of California-Berkley have built a robot that can find a towel in a pile of laundry, pick it up, fold it and then stack it.²³¹

“Existing work on robotic laundry and towel folding has shown that starting from a known configuration, the actual folding can be performed using standard techniques in robotic manufacturing,” said Jeremy Maitin-Shepard, one of key investigators on the project.²³²

Here is how it works: using its mechanical arms, the robot picks up the laundry and turns it slowly around. It then finds the corners of the laundry and begins the flattening process. After the folding is finished, the robot smoothes out what it had folded.²³³

Do your genes impact your political views? Scientists have thought for years that an individual’s upbringing and experience as a child were the biggest indicators of their future political views. For example, a child of Iraq war protesters is thought more likely to be more left wing than a child of tea party activists.

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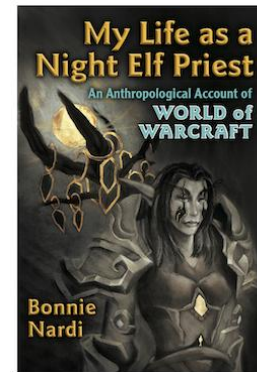
However, studies over the last few years appear to indicate that it is much more likely that our political leanings are genetically pre-destined.²³⁴ Some have even connected the existence of certain genes to specific political leanings.²³⁵

Scientists from the University of Nebraska received \$587,068 from the NSF to determine what role genes play in determining “political temperaments.” The study will use multiple test methods including, “genotyping, brain imaging, physiological tests, surveys, and hormonal assays” and apply it to subjects in the United States and Australia.²³⁶

Dr. Lee Sigelman, editor of the American Political Science Review, said that while in many fields these conclusions “would create nothing more than a large yawn...in ours, maybe people will storm the barricades.”²³⁷

Where is the line between work and play in online virtual worlds? NSF funded a conference, “Convergence of Play and Labor in Online Games,” to answer this important question.²³⁸

A workshop took place in April 2008, entitled “Cultures of Virtual Worlds.”²³⁹ According to the grant summary, “this workshop will bring together knowledgeable computer and information scientists in the human-computer interaction and computer-supported work fields, as well as experts from the game and online research community, to assess the current status and likely future development of massively multiplayer online worlds (MMOWs) in work applications. ... The objective of this workshop is to advance our *understanding of relations between work and play in online virtual environments.*”²⁴⁰



According to NSF’s records, these funds were also used to publish an article, “Productive Play: Beyond Binaries,” coauthored by Professor Bonnie Nardi, along with the grant recipient Celia Pearce.²⁴¹ Professor Nardi has received multiple NSF grants, totaling over \$3 million, part of which was for her playing World of Warcraft and publishing her findings.²⁴² She recently wrote a book based on her NSF-supported research titled, “My Life as a Night Elf Priest.”²⁴³

Did the 2009 confirmation hearings for Justice Sonia Sotomayor impact racial attitudes? The



National Science Foundation provided an \$81,370 grant to researcher Dr. Tyson King-Meadows to investigate “how the 2009 confirmation hearings on Supreme Court nominee Sonia M. Sotomayor might affect political and racial attitudes.” Specifically, the NSF funding was provided to conduct a pre- and post-hearing national survey of 1100 adult citizens along with an oversample of 500 blacks and 500 Hispanics.²⁴⁴

According to a news article, the “project measures the feelings surrounding the confirmation hearings, as well as whether the hearings have influenced the attitudes of racial and ethnic minority groups. The project analyzes positions on select controversies

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such as abortion, redistricting, racial competition, affirmative action, and, of course, Sotomayor's nomination."²⁴⁵ Dr. King-Meadows collected 2,100 surveys and enlisted two undergraduate students to report on the Senate hearings and analyze commercials that were aired during the confirmation hearings.²⁴⁶

Dr. King-Meadows' survey led him to say that citizens felt that Sotomayor is qualified, but were concerned because of her "Wise Latina" comment.²⁴⁷

Which wasn't a surprise because during the hearings for Justice Sonia Sotomayor, there were numerous public opinion polls taken before, during, and after her confirmation.²⁴⁸ The "Wise Latina" comment and Richie case were widely debated and analyzed by Congress, news networks, and in many other forums.

How do you ride a bike? In 2009, scientists at the University of California-Davis received a \$300,000 grant to study how humans ride bicycles.²⁴⁹ Two professors, five graduate students, and four undergraduates are not only studying how people interact with and control their bicycles, but also attempting to build a 'robot bicycle' based on their findings.²⁵⁰ By studying motion capture technology and attaching sensors to riders in labs, the research team plans to develop software and computer models to "pave the way to the design of bicycles for a wider population and for a wider range of tasks...which in turn will lead to lower cost, healthier, and more sustainable modes of personal transportation."²⁵¹



Currently less than one percent of local trips in the United States are made on a bicycle, but the research team believes that bicycle usage might increase if designers had more insight into their design choices for different populations and different tasks.²⁵²

The study is being conducted at the UC-Davis Sports Biomechanics Lab, which is also currently studying "Disc Flight Dynamics," "Passive dynamic walking," and the "Design of safe ski/snowboard jumps."²⁵³

Why did America vote as it did on Election Day? In January of 2010, the University of Michigan and Stanford University received a total of \$10 million as part of the "American National Election Studies (ANES)" project to "inform explanations of election outcomes"²⁵⁴ Specifically, the grant intends to answer the question, "why did America vote as it did on Election Day?" The grant runs through the end of 2011 and will study the 2010 election and will also prepare questions specific for the 2012 elections.²⁵⁵ Michigan and Stanford researchers received a similar award close to \$10 million in 2005 to study the 2006 and 2008 election cycles.²⁵⁶



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New to the 2010 grant is a “series of internet surveys called the 2010-2012 Evaluations of Government and Society.” A lead researcher explains, “given the central role of race and racial attitudes in American politics, it is essential that we assess the effects of the nation’s first black president on racial attitudes and the racial divide in public opinion on a variety of public policy and socioeconomic issues.”²⁵⁷

The project has been conducted since 1948 and began receiving NSF funding in 1977.²⁵⁸ Some might question whether federal taxpayer dollars—intended to fund major scientific breakthroughs—are necessary to continue the project. The University of Michigan and Stanford University have endowments of \$6.5 billion and \$12.6 billion respectively.²⁵⁹

How often do people lie in text messages and online messaging? According to ground-breaking new research supported by the NSF, people are deceptive in text messages and instant messaging.²⁶⁰ The \$476,000 NSF-supported study performed by Cornell professors found that about 10 percent of these messages are deceptive in some way.²⁶¹

They also found that 20 percent of the messages examined contained “butler lies,” referring to lies people tell to save time or preserve others’ feelings. The researchers examined SMS and IM messages, two of the most popular types of text-based communications.²⁶²



“The key message is that media make certain things ambiguous in communication — what the sender of a message is doing, where they are, when they read a message. People sometimes take advantage of that ambiguity in crafting deceptive explanations for their behavior that may be more polite than the truth,” the lead researcher explained.²⁶³

Reacting to the study, college student Mahina Wang didn’t sound blown away by this important research. “I’m not surprised by any of these statistics. Thinking back, I do tell white lies or exaggerate in texts. ... For example, if I’m running late I might tell a friend five minutes rather than 10 or 15.”²⁶⁴

Nor do researchers believe these “butler lies” are a problem. “We don’t think it’s always useful to share more information ... You may be okay sharing your location with some friends, but not others... sharing photos with people who were also at a party, but not your parents or future employers,” the researcher concluded.²⁶⁵

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How many birds live in the “hood?” The Cornell University Ornithology Lab has received millions of NSF dollars for “Informal Science Education” purposes. The lab received a \$1.7 million award titled, “Project NestWatch,” which includes 50 “nest-cams”.²⁶⁶

NSF also preciously received \$1 million to Cornell for a project called, “Birds in the Hood,” or “Aves del Barrio.” The Birds in the Hood project to create a web-based citizen science program for urban youth to retrieve data on birds found in urban habitats.²⁶⁷



Finally, this year marks the 14th annual “Great Backyard Bird Count,” sponsored by the NSF and led by the Cornell University Ornithology Lab.²⁶⁸ The survey asked bird watchers to tally the birds they saw in their backyards and report those numbers online. Also included in the survey is an annual photo contest in which photo submissions are judged in one of six categories: overall; bird in its habitat; behavior; group shot (2 or more birds); composition; and people enjoying birds.²⁶⁹

How do people interact in digital worlds? Stanford University’s “Virtual Human Interaction Lab (VHIL)” has received \$1.4 million in NSF funding since 2005 to “explore people as they interact in these digital worlds.”²⁷⁰

NSF has provided Stanford with three separate grants to study the way humans react to digital versions of themselves.²⁷¹ One project, “Treatment through Virtual Self,” is explained as a “scientific research program examining the effectiveness of self-models in virtual worlds.” VHIL developed virtual worlds in which participants interacted with avatars of themselves. Researchers studied effects of “self-modeling” on their perception of aging, advertising, and exercising and weight management.²⁷² Participants were able to view a virtual version of themselves exercising on a treadmill or being inactive.

The researchers found seeing the self-model exercise in the virtual environment led to real exercise in the real world, and participants who saw their virtual-self gain weight due to (virtual) physical inactivity were led to exercises more frequently. The researchers concluded “self-models in virtual environments can be effective treatments that may be useful in encouraging fitness and curbing the obesity epidemic.”²⁷³

Another VHIL project, called “The Proteus Effect,”²⁷⁴ explores whether avatars impact the psychology of the user. “At the click of a button, we can alter our gender, age, attractiveness, and skin tone. But as we choose our avatars online,” do they “change us in turn?” The lab also conducted a series of

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studies that measured the impact of “putting people in avatars of different attractiveness or height change how they behave in a virtual environment.”

“Avatar Identity,” asks “what are the implications of having an avatar, that is, a digital model that represents you in virtual reality?” The researchers explain, “we are studying the ties that individuals have to an avatar. Specifically, how much does an avatar need to resemble (both visually and behaviorally) its owner in order for person-specific influences to take effect?”

“Avatars in Second Life,” is another project that focuses specifically on Second Life: The research asks, “What exactly do people do inside of SL [Second Life]?” and “What are the effects of interacting via avatars over time?”²⁷⁵

How do political candidates use the World Wide Web? In 2008, a Northwestern University researcher received a \$32,316 grant, and an Oberlin researcher received \$28,527 for a research project titled, “Campaigns in a New Media Age: How Candidates use the World Wide Web.”²⁷⁶ The purpose of the research was to study “how the Internet affects the conduct of electoral campaigns.”

According to the proposal, this important work “will help in evaluating the ever-increasing amount of speculation and punditry concerning politics and the Internet,” and about the “many ways in which congressional candidates go about seeking their support”²⁷⁷

Can you trust other people in virtual worlds? The NSF funded the New School University to study “the ways in which people voluntarily develop ‘virtual civility’ and trustworthy identities in 3-dimensional virtual communities such as Second Life.”²⁷⁸ The \$150,000 grant is titled, “Virtual Civility, Trust, and Avatars.”

Specifically, the researchers will be identifying aspects of Second Life where “spirituality” or “self-help” plays a key role. In virtual worlds, the anonymity of avatar-actors calls into question the nature of “virtual civility and trust among geographically-distanced ‘strangers,’ and what specific cultural mechanisms prompt and enable these avatars to develop trustworthy identities.”²⁷⁹



The lead researcher Eiko Ikegami is known in Second Life as Kiremimi Tigerpaw (avatar pictured).²⁸⁰

How can politicians motivate people to make political donations? Doctoral candidate Adam Levine received a \$6,900 grant for his dissertation entitled “Examining When Impersonal Donation Solicitations are Successful.”²⁸¹ The grant summary explains, “This research focuses on how and when individuals decide to donate money to social organizations.”²⁸²

One of the key findings from the dissertation was that “a major factor influencing people’s decisions to donate is the simple fact of receiving a persuasive request for money. Indeed a majority of people who make small donations report that they donated upon receiving a persuasive solicitation.”²⁸³ Politicians

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and special interest groups are likely to be the only beneficiaries of this questionable “scientific” research.

For organizational performance, are routines advantageous? There is nothing routine about the study of routines. That may be the reason why two Michigan State University received \$370,000 in American Recovery and Reinvestment Act (ARRA) funds to study how organizations work and their routines.²⁸⁴

The scientists will evaluate how organizational routines are formed and change over time.²⁸⁵ The study seeks to “advance our understanding about when routines are advantageous or disadvantageous to organizational performance.”²⁸⁶

In 2002 one of the principal investigators explained the research of organizational routines this way: “Some routines show a lot of variation; others do not. Some are flexible; others are not. Some are easy to transfer; others are not. These variations may seem like noise or bad measurement, but they are not.”²⁸⁷

Was the Medicare Part D prescription drug benefit politically advantageous? In 2007, NSF provided a \$130,525 grant to conduct a survey on the impact of Medicare reform on senior citizens’ political views and participation.²⁸⁸ This research examined whether or not changes to the program enacted by



the Medicare Modernization Act of 2003—which created a prescription drug entitlement program for the elderly— influenced seniors’ “orientations toward government, vote choice, and regard for the two political parties.”²⁸⁹

“This project... will also contribute to future debates on one of the largest public programs in the United States. By examining how senior citizens have fared under this highly consequential reform of Medicare, this study will help lawmakers and other policy actors as they continue to reform the program and address the needs of this vulnerable population.”²⁹⁰

A resulting paper concluded, “electoral and organized interest pressures forced Republicans to adopt expensive legislation that both failed to meet their ideological goal of further privatizing Medicare and is likely to produce exactly the outcome they most feared: a huge and growing new entitlement, on the cusp of baby boomer retirement no less.”²⁹¹

Exactly how do the genitalia of fruit flies assist them in hooking up? A five-year NSF grant totaling \$326,018 was used by University of Cincinnati researchers to study how the complexities of the male genitalia of fruit flies impacted their sexual relations.²⁹² In their published results, the grantees found that “the males’ penile peculiarities assisted them in copulation.”²⁹³

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The University of Cincinnati published an article, reprinted by the popular *Science Daily*, describing this research titled, “When Hooking Up with Opposite Sex, Genital Complexities Do Matter, Fruit Fly Research Finds.”²⁹⁴

Lead researcher Michael Polak indicated that their fruit fly genitalia research is just getting started. Polak intends to use the same methods to “surgically excise other genital traits and the tiny but elaborate male sex ‘combs’ used in courtship, and to study their adaptive function in sexual selection.”²⁹⁵

Are party leaders in Congress effective at controlling members of their own party? NSF awarded \$143,254 in 2004 to a Professor at the College of William and Mary to study what are known as “whip counts,” which refer to instances in which party leadership in the House or Senate attempt to persuade—and often coerce—their party membership to vote a certain way on a particular piece of legislation.

Some of the explicit purposes of the study were to determine the “impact of party leaders in the legislative process,” and ask “how successful are party leaders at mobilizing support for party programs?”²⁹⁶

Few Americans other than political party leadership in Washington, D.C. are likely to benefit from the findings of this research.

Other NSF grants help party leaders learn strategies to increase voter turnout. In 2006, University of California-Berkeley and SUNY Binghamton researchers were provided collaborate research grants totaling \$165,000 to study “The Costs of Voting.” By “costs,” the researchers indicate they are referring to, “the time one spends voting, locating the voting place, waiting in line to vote, traveling to and from a polling place and learning enough about the ballot choices to make one's vote minimally informed.”²⁹⁷ One of the goals of the research is to suggest “strategies that might be used to increase turnout.”²⁹⁸

What exactly does a low-budget robot rodeo and hoedown look like? While robots may take humankind into space, win Jeopardy, and advance manufacturing processes, they do not appear ready to replace us on the dance floor.



That’s not for lack of effort by humans, aided with federal funds: This year, two technology educators received a grant to host a “Robot Hoedown and Rodeo.”²⁹⁹ The participants attempted to “set the record for the most robots ever dancing in unison to the same tune.”³⁰⁰

The event, part of a symposium on computer science education, reportedly involved computer science teachers programming dozens of robots to dance to “the Chicken Coop Shuffle.”³⁰¹

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The event was intended to give participants, including many teachers, the opportunity to program a robot, according to Jennifer Kay, a professor at Rowan University who co-directed the project.³⁰² According to the award abstract, “There is recent evidence that students in courses with personal robots show greater motivation to complete assignments in the course and that these courses have better retention rates.”³⁰³

Videos of the event posted to YouTube suggest the effort was a source of enjoyment for observers.³⁰⁴

What are the social impacts of tourism in Norway? An Indiana University (IU) professor received a \$263,281 grant from the NSF to study the social impact of tourism in the country of Norway.³⁰⁵

Norway is considered “one of the most visited arctic destinations in Europe” as well one of the most popular.³⁰⁶ The mild weather and outdoor sporting opportunities make the country a very popular tourist destination.³⁰⁷ The NSF-funded research will focus on the needs, perceptions and opinions of “local residents, businesses, and policy makers, as well as tourists” as it relates to tourism in a number of Norwegian cities.³⁰⁸

The IU researcher had received a \$5.5 million grant a couple of years ago from the Norwegian Research Council to do similar research.³⁰⁹

It is still unclear why the U.S. government is footing the bill for tourism research in cities of Norway rather than the city of Norway, Michigan or other U.S. destinations that could benefit from tourism.

What was the impact of youtube.com on the 2008 elections? The University of Massachusetts at Amherst received a \$50,000 grant to hold a workshop in April of 2009. The conference, “YouTube and the 2008 Election Cycle in the United States,” set out to “bring together scholars in Political Science, Computer Science, and related disciplines to examine this topic.”³¹⁰



The conference provided “perfect information for campaigners and consultants.”³¹¹ Some of the best papers presented were, “Checking the Data: The number of candidates using political videos surged in '08. A look at the numbers shows how and when you should get online, too,” and “Going Viral: The will.i.am ‘Yes We Can’ video was a huge viral sensation. How can that success be repeated?”³¹²

YouTube videos of the entire conference are available online for politicians and campaign consultants to review: <http://youtubeandthe2008election.iitp2.net/conferencevideo>.³¹³

Can avatars in online virtual worlds become more social engaging? Since 1998, NSF has invested heavily in psychology and human behavior virtual world research at UC-Santa Barbara, including

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research to make avatars more socially engaging.³¹⁴ UC Santa Barbara researchers have received a total of \$4.6 million to study virtual worlds.

NSF provided \$255,396 in 2009 as part of a \$500,000 joint-research project for the “Design and Evaluation of Socially Engaging Avatars.” Along with the University of Houston, UC-Santa Barbara researchers were awarded NSF funds to develop a computer model to embed “dynamic expression and socially engaging non-verbal gestures into talking avatars.”³¹⁵



Objectives for the project include creating “expressive talking faces,” and modeling “dynamic facial expressions,” as well as developing “socially engaging non-verbal facial gestures.”³¹⁶

NSF also provided a \$1 million from 2002-2007 to explore “Using Virtual Environment Technology to Understand and Augment Social Interaction.” The project focused on “facilitating and augmenting social interaction in virtual environments, particularly immersive virtual environments.”³¹⁷

According to their website, studying immersive virtual worlds is important because “immersive virtual environments allow for conversational strategies that are not possible in face-to-face interactions or videoconferencing.”³¹⁸

An additional \$1.8 million was provided to broadly study “Virtual Environments and Behavior.” This project “focuses on immersive virtual environments as a basic research tool” to “establish the validity and reliability of immersive virtual environments as a research tool.”³¹⁹

Professor Jack Loomis explains, “the idea is to bring people into a virtual environment where they're confronted with simulated people and to see whether you can elicit social reactions—if the people will respond to these computer-generated people as if they were real.”³²⁰

Why are people for or against American military conflicts? A Duke University researcher received \$91,601 in funding to study American public attitudes toward war. Specifically, the study will explore whether the public holds elected officials accountable for deploying armed forces—including what factors shape public opinion toward American military conflicts.³²¹

The main thrust of the research, however, is asking the question, “is the American public capable of holding their leaders accountable for the use of this authority?”³²²

In a separate instance, NSF provided \$11,825 to a doctoral student at Vanderbilt University to study the impact of the media on American public opinion on military conflicts. The project, “Prime Time Politics: Television News and the Visual Framing of War,” asks the question, “How does the public react when television news images put them on the frontlines of battle?”³²³ The research analyzes the “lead stories from the national evening news programs from ABC, CBS, NBC, Fox News and CNN during the Vietnam War, Persian Gulf War and current war in Iraq.”³²⁴

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Are French Muslims discriminated against in the European job market? Muslims sending out resumes in France are 2.5 times less likely to receive a positive response to their application, and Muslims were also found to have a lower monthly salary than Christians, according to an NSF-backed study.³²⁵ The study was supported in part by a \$344,320 grant by NSF titled, “Muslim Integration into EU Societies: Comparative Perspectives.”³²⁶

The project summary suggests the project will provide, “a perspective that can improve public policy” in regard to the assimilation of Muslim immigrants in Europe.³²⁷ Many taxpayers might wonder if this type of research in France should be a priority for U.S. scientific research dollars.

Did terrorism warnings hurt Senator John McCain’s 2008 presidential candidacy? NSF funding was provided to University of California—Berkeley researchers in 2008 to test the impact of terrorism threats on the presidential race. However, terror threats have little influence on how self-described conservatives and liberals cast their ballots,” but “politically moderate voters or swing voters are less likely to vote for McCain in the face of an imminent terror threat.”³²⁸

“Most past research led us to expect that terror threats would increase support for conservatives,” according to the study’s lead author. “But discontent with Bush’s approach to the war on terror could be impacting views of McCain.”³²⁹

The study also found, “while the war in Iraq still ranks as a major concern, the economy is a greater priority than the ‘war on terror.’”³³⁰

The National Science and Arts Foundation? The Office of Polar Programs funds an “Antarctic Artists and Writers Program” which is of limited scientific value. According to NSF, the purpose of the program “is to enable serious writings and works of art that exemplify the Antarctic heritage of humankind. In particular, the program seeks to increase public understanding of the Antarctic region, including the continent and the surrounding oceans, as well as the associated research and education endeavors.”³³¹

In order to facilitate their work, the program “provides opportunities for professional artists and writers to travel to Antarctica—at research stations, field camps, and aboard ships—to make the observations necessary to complete their proposed projects.”³³²

In March of 2009, NSF provided the Maryland Science Center in Baltimore a \$322,313 grant to “feature artwork, photography and sculpture and other media produced by Artists & Writers participants.”³³³



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Are Bill O'Reilly, Rachel Maddow, and Chris Matthews polarizing figures? The National Science Foundation provided a \$66,638 grant to Temple political scientist Kevin Arceneaux to study the influence of political programming in mass media. He set out to test the claim that cable television shows allow the public to insulate themselves from opposing viewpoints—polarizing the electorate.³³⁴

For the study, Arceneaux conducted two experiments. In the first, subjects were forced to watch a 15-minute segment from The Rachel Maddow Show or The O'Reilly Factor, and in the second they were allowed to choose between Hardball with Chris Matthews or one of two unrelated entertainment shows.³³⁵



Apparently, being forced to watch Maddow or O'Reilly did contribute to viewers “adopt[ing] more extreme positions,” but giving individuals a choice not to watch these programs—such as the ability to change the channel—showed significantly less effect on political opinion.³³⁶

Can traveling the world answer how dogs became man’s best friend? Using funds provided by the American Recovery and Reinvestment Act of 2009 (the stimulus bill), Cornell researchers have received \$300,000 to uncover the origins of dog domestication.³³⁷

The grant was used to send married PhD students Ryan and Cori Boyko to Qatar to investigate stray dogs in the region. In a news interview about their work, Ryan explained that Qatar is one of seven country visits funded by the NSF grant. “We will be going to Lebanon, Turkey, Croatia, Papua New Guinea, Vietnam and India after this,” he explained.³³⁸



Can the National Science Foundation boost the wine-making industry? The National Science Foundation is currently funding a program called “VESTA,” which stands for the “Viticulture and Enology Science and Technology Alliance.” Between 2007 and 2010, NSF provided approximately \$3 million in funding for two-year colleges in Missouri, Oklahoma, Illinois, and Iowa “to meet the current and future education and training requirements of the grape growing and wine making industry in the

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Mid-America region.” On their website, NSF lists “related publications” to their grants. Under this funding award, they list just one related publication: “VESTA Offers Wine Education Online.”³³⁹



The National Science Foundation is also providing \$570,504 from 2010-2013 to help Yakima Valley Community College expand its viticulture (grape growing) and enology (winemaking) program.³⁴⁰

The college plans to adjust the two-year associate’s degree in viticulture and enology to conform to the wine industry’s practices and allow students to shadow and learn from local vineyards and wineries through externships.³⁴¹

University of Nevada-Reno researchers received \$3.7 million to make wine-making more efficient and improve the quality of the wine.³⁴² The award is to investigate the scientific reasons that “water-deficit-stressed grapevines produce superior quality wine.”³⁴³

The grant proposal explains, “the proposed research will...enable improvements to be made in both production efficiency and wine quality under environmentally adverse growing conditions.”³⁴⁴

What’s more photographed...the Fifth Avenue Apple Store or the White House? Cornell University researchers received \$2 million to help create a more searchable version of the Internet Archive, a website, an “Internet Library” of 40-billion pages of archives websites.³⁴⁵ The researchers’ grant description extolled the virtues of the project by explaining that government investigators could use and trace the web for organizing and coordination of terrorism.³⁴⁶

Their award application also boasts “these tools can be used to identify market trends, the rise and fall of demand, and the spread of consumer opinion.”³⁴⁷ It may be surprising, then, that these funds have been used, in part, to determine the most-photographed cities and sites on the popular online photo management and sharing application website, “Flickr,” found at www.flickr.com.³⁴⁸



The Flickr study, which also received funding from Google and Yahoo, found that the top 25 most photographed cities on Flickr were, in order: New York City; London; San Francisco; Paris; Los Angeles; Chicago; Washington, D.C.; Seattle; Rome; Amsterdam; Boston; Barcelona; San Diego; Berlin; Las Vegas; Florence; Toronto; Milan; Vancouver; Madrid; Venice; Philadelphia; Austin; Dublin; and Portland.³⁴⁹

The “striking result in the Flickr data” was that the Apple Store in midtown Manhattan is the 5th-most photographed place in New York City and the 28th-most photographed in the world.”³⁵⁰ The Apple store was apparently more popular than Buckingham Palace, the Statue of Liberty, and the White House.³⁵¹

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Interestingly, the study does not actually prove whether these locations are the most photographed in the world—just how often they are posted on Flickr.

What would it have been like to attend the 1960s New York World’s Fair? Lori C. Walters and a team of researchers at the University of Central Florida (UCF) were awarded a 1.17 million grant to create a



“3-D, multi-user virtual environment (MUVE) of the 1964/65 New York World’s Fair” for “virtual fairgoers of all ages.”³⁵² The grant summary continues, “the virtual world can be freely explored through self-designed avatars, and avatar-led guided tours.”³⁵³ The University’s materials explain, “Walters’ team utilizes an immersive 3D virtual environment to unfold the sights, sounds, personal memories and lessons of the World’s Fair.”³⁵⁴

“It’ll function like a video game, where you can walk through it and interact with the various pavilions that were at the fair,” according to one professor working on the software.³⁵⁵

The 1964/1965 New York World’s Fair was an international exposition to showcase art, architecture, and technological advances produced by participating countries. The 1960’s expo in New York was themed, “Peace through Understanding,” and featured an exhibit by the federal government that focused on President Lyndon B. Johnson’s “Great Society” proposals.³⁵⁶

Ironically, the fair was tarnished by financial mismanagement—it was unable to repay many financial backers and became mired in legal disputes with creditors for years afterward.³⁵⁷

The project has previously received \$35,000 in funding from the National Endowment of the Humanities (NEH).³⁵⁸

Recommendations

Retaining America’s position as the world’s scientific and technological leader in the 21st century must remain a primary goal. Financial realities, however, threaten to undermine our scientific and economic competitiveness.

Decades of excessive borrowing and spending has resulted in a nearly insurmountable \$14 trillion national debt. The \$147 billion the federal government spends a year on science is dwarfed by the \$225 billion spent just to finance interest on the debt. You do not have to be a PhD or brain surgeon to realize more responsible stewardship of our nation’s finances would mean more resources to invest in science and research rather than making debt payments. Securing our scientific leadership role, therefore, is dependent upon setting better priorities so we can do more with less.

As demonstrated by this report, there are many areas where the National Science Foundation could be more efficient, trim waste, and better target and manage resources.

Congress must also do its part. Rather than simply approving more dollars for NSF to spend, active oversight and meaningful reform are necessary to ensure the agency continues to focus on producing ground-breaking results taxpayers expect.

The President’s proposal to increase National Science Foundation research funding by almost \$1 billion is an achievable goal *without* increasing the agency’s overall budget.

The following reforms would provide more than \$1 billion to invest in transformative scientific research ensuring we can retain America’s scientific edge without adding to the debt threatening the economic engines that power our nation’s leadership role in the world.

Establish Clear Guidelines for What Constitutes “Transformative” and “Potentially Transformative” Science

NSF could advance science simply by better prioritizing the types of research eligible for federal funding. To do so, NSF needs to establish clear guidelines outlining what constitutes “transformative” or “potentially transformative” science.

Science is often art with imagination being an essential component to discovery. Hypotheses and theories must be developed to be proven or disproved. Questions must be asked to be answered.

Yet, not all questions and not all theories are of equal value. As this report finds, many of the studies supported by NSF have been of great scientific value while others were questionable, if not silly. It is the responsibility of NSF to carefully weigh grant applications to determine those with the potential to be transformative and those that are more whimsical.

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It is important to recognize not all research can guarantee transformative results. That does not mean lessons cannot be learned from these studies or they should not be supported if they appear to hold the potential to be transformative.

Ultimately, the decision as to what constitutes “transformative” or “potentially transformative” should be left to the scientific community rather than Congress. Yet, it is the role of Congress to ask questions and conduct oversight of how these decisions are made and how wisely taxpayer dollars are being spent and managed.

And while evaluating the overall quality of grant application should remain in the hands of scientists with clear NSF guidance, scientists, agency officials, policymakers, and taxpayers should all be able to agree any research receiving federal funds should be able to affirmatively answer each of the following questions:

- Does this research represent science that could significantly change our understanding of important scientific concepts?
- Does the subject of this study represent an important scientific idea rather than the whimsy of individual researchers?
- Is this study an appropriate expenditure of federal funds at a time when the U.S. national debt is nearly \$14 trillion?

Set Clear Metrics to Measure Success and Standards to Ensure Accountability

In December 2009, Congress directed NSF to identify the ingredients of successful science, technology, engineering, and mathematics (STEM) education programs in U.S. elementary and secondary schools by June 2010. The report is now nearly one year overdue. The failure of NSF to answer such a question regarding one of its central missions exposes its lack of metrics.

Along with the National Institutes of Health (NIH), NSF and the Office of Science and Technology Policy (OSTP) are creating a repository of tools to assess the impact of federal R&D known as STAR METRICS. This effort is long overdue and should be a priority to ensure taxpayers, policymakers, and agency officials can accurately measure and better invest in success.

The relatively small amount of resources NSF and NIH have directed towards the STAR METRICS system is a certainly a step in the right direction, but not the comprehensive solution necessary. Whether it is the STAR METRICS system or something analogous, the agency must find a way to place real performance measures on the research it funds.

It is impossible, of course, to place any metrics on research if the agency refuses to hold grantees responsible for promised deliverables. NSF must improve its grant administration and collect annual and final reports as required. These reports must be analyzed and essentially graded for the value of the research.

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A strong emphasis must be placed on whether NSF supported research contributed to new discoveries or advancements. It is realistic to expect that most projects may not yield transformative or ground-breaking research, but it is important to determine whether or not the effort presented a meaningful attempt to advance scientific knowledge or if it could still play a small role in a larger discovery.

Assigning value to basic research proposals may not be easy, but it is important nevertheless.

Eliminate NSF's Social, Behavioral, and Economics (SBE) Directorate (\$255 million in FY 2010)

Social studies include business administration, economics, geography, political science, sociology, international relations, and communication. To varying degrees, each of these fields represents interesting and—many times—important areas of research and discovery.

But do any of these social studies represent obvious national priorities that deserve a cut of the same pie as astronomy, biology, chemistry, earth science, physics, and oceanography? The recent tragedy in Japan highlights the importance of nearly all of these natural sciences and how a better understanding of each can improve our abilities to protect life and property from natural occurrences such as earthquakes and tsunamis.

From the inception of the National Science Foundation, spending scarce scientific research dollars on the social sciences has been controversial. Many of the questionable NSF studies outlined in this report, including the political science studies, were funded through the SBE Directorate.

Eliminating NSF's SBE directorate will not end federal spending in these fields. For example, the Department of Education provides funding for behavioral, economic, and social endeavors. The Department of Health and Human Services provides support for social, behavioral, and economic research with health applications. The National Endowment for the Humanities also provides support for social sciences.

The President has been proposing significant increases for this directorate rather than prioritizing the scientific fields with a more obvious benefit to our nation and the world. The President's 2012 budget recommends an 18 percent increase in funding for the directorate, including a 14.9 percent increase for the social and economic sciences.

Rather than ramping up the amount spent on political science and other social and behavioral research, NSF's mission should be redirected towards truly transformative sciences with practical uses outside of academic circles and clear benefits to mankind and the world.

Consolidate the Directorate for Education & Human Resources (\$872 million in FY 2010)

NSF's Directorate for Education & Human Resources is focused on four areas: Preparing STEM professionals; Integrating STEM research and education; Increasing scientific literacy in America; and Closing achievement gaps of underrepresented groups in science.

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These are all noble goals and ones already being supported by a plethora of other government agencies. As this report reveals, there are nearly 100 federal STEM programs administered by 11 federal agencies, including NSF. An additional \$150 billion in financial aid and student loan programs also provide assistance to those seeking higher education.

There are specific teacher training programs and other elementary and secondary education programs that could be consolidated with other federal programs, which could save taxpayers at least \$366 million over the next five years, according to the Congressional Budget Office (CBO). With total NSF spending on K-12 STEM education expected to total \$272 million in 2011, there are many more opportunities to save money through consolidation. In total, halting appropriations for human resources and training would save taxpayers \$872 million annually.

NSF could continue to collaborate with other federal agencies where appropriate, but consolidating this duplicative mission could yield greater results for taxpayers and science. The current activities of national importance conducted by this directorate could be carried out by the multitude of government agencies whose missions are primarily dedicated to education, most notably the Department of Education. In so doing, the mission of this directorate could be advanced more efficiently and strategically. This would also assist to redirect NSF's mission towards supporting research, enhancing discovery, and advancing innovation within the scientific fields where it can make the greatest impact.

Use It or Lose It: NSF Should Better Manage Resources It Can No Longer Spend or Does Not Need and Immediately Return \$1.7 Billion of Unspent, Expired Funds It Currently Holds

This report exposes significant problems with the NSF's grant administration. Perhaps the most costly is the agency's inattention to undisbursed balances in expired accounts. NSF currently is sitting on \$1.7 billion that has expired. This represents a significant amount of resources that could have either been directed towards scientific research or returned to the Treasury for purposes of debt reduction.

GAO has called for "systematic resolution of these undisbursed grant balances," to "facilitate the return of these funds to the Treasury."³⁵⁹ This should be done promptly and NSF should pay greater attention to the expiration of grant funds to ensure those monies can either be reprogrammed towards scientific priorities or are returned to the Treasury as required. Our fiscal challenges today do not allow for such inattention to the proper financial management of taxpayer funds.

Reduce Duplication: Develop a Strategic Plan to Streamline Federal Research and Development

The federal research and development budget has led to overlap and waste. Some may believe it is a good idea for multiple agencies to be supporting similar research. While that may be true in some cases, such inefficiencies consume resources that could be better targeted. As outlined in this report, some NSF missions duplicate the missions of many other federal agencies. With clearer missions and less redundancy, agencies can better set priorities, target resources, measure results, and reduce administrative costs.

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The White House Office of Science and Technology should immediately develop a strategic plan to streamline the federal research and development budget to reduce duplication. The proposal should recommend cost-savings that can be achieved through reducing overlap among all the agency research budgets.

Congress must also work to eliminate the excessive duplication between federal research and development agencies and programs. Most of the overlap is a result of Congress passing bills creating new programs that mirror existing programs and expanding the mission of one agency to overlap a similar mission already being performed by another agency. Policymakers must make a greater effort to understand the patchwork of programs that already exist and ask more questions of agency leaders about why goals are not being set or met—rather than simply create new programs to accomplish unmet goals.

Provide the NSF Inspector General Additional Resources and Place a Greater Emphasis on the Office of Inspector General’s Findings

According to recent testimony by the NSF Inspector General Allison Lerner, “OIG also has an important oversight role, but given the breadth of our mission, we can only review a small number of awards each year.”

In its most recent semi-annual report, the NSF’s Office of Inspector General (OIG), which has an annual budget of \$14 million, identified \$89 million under “Recommendations for Better Use of Funds” category and \$65 million of questioned or unsupported costs. There are currently 42 open recommendations from the IG, 15 of which have been outstanding for over a year and 24 that have been outstanding for longer than 6 months.

Congress should consider the cost-savings associated with increasing the Inspector General’s overall budget. In order to incentivize NSF to act on the IG’s recommendations, any increase in resources for the Office of the Inspector General should come from existing research accounts. After all, recouping fraudulent spending and better oversight of funding will ultimately increase the resources available to fund high-quality scientific research and sends a clear message that Congress and the agency takes seriously any attempt to commit scientific fraud or misuse taxpayer funds.

Appendix A

**NSF STEM Education Programs by Level of Education
NSF FY 2012 Request to Congress
(Dollars in Millions)**

| Level | Program Name | FY 2010 Actual | FY 2010 Enacted/ Annualized FY 2011 CR¹ | FY 2012 Request |
|--------------------|---|-----------------------|---|------------------------|
| K -12 | Discovery Research K-12 | \$118.38 | \$118.50 | \$99.23 |
| K -12 | GEO Teach | 2.98 | 3.00 | 2.00 |
| K -12 | Innovative Technology Experiences for Students and Teachers (ITEST) | 20.85 | 25.00 | 25.00 |
| K -12 | Math and Science Partnership (MSP) | 57.93 | 58.22 | 48.22 |
| K -12 | Research & Evaluation on Education in S&E (REESE) | 64.16 | 63.50 | 54.72 |
| K -12 | Research Experiences for Teachers (RET) Sites – ENG | 4.78 | 4.20 | 2.20 |
| Total, K-12 | K-12 STEM Education Programs Subtotal | \$269.08 | \$272.42 | \$231.37 |
| UG | Advanced Technological Education (ATE) | 64.51 | 64.00 | 64.00 |
| UG | Broadening Participation in Computing (BPC) | 14.00 | 14.00 | - |
| UG | CISE Pathways to Revitalized Undergraduate Computing Education (C-PATH) | 4.37 | 5.00 | - |
| UG | Climate Change Education (CCE) | 10.24 | 10.00 | 10.00 |
| UG | Computing Education for the 21st Century (CE21) | - | - | 15.50 |
| UG | Cyberinfrastructure Training, Education, Advancement & Mentoring (CI-TEAM) | 4.85 | 5.00 | 4.00 |
| UG | Engineering Education (EE) | 13.74 | 11.85 | 11.85 |
| UG | Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences (UBM) | 2.70 | 2.70 | - |
| UG | International Research Experiences for Students (IRES) | 3.43 | 3.15 | 3.15 |
| UG | Opportunities for Enhancement of Diversity in the Geosciences (OEDG) | 4.18 | 4.60 | 3.60 |
| UG | Research Experiences for Undergraduates Sites (REU Sites) | 56.74 | 49.70 | 49.45 |
| UG | Robert Noyce Teacher Scholarship Program (Noyce) | 54.93 | 55.00 | 45.00 |
| UG | Scholarships in Science, Technology, Engineering and Mathematics (S-STEM) | 75.96 | 75.00 | 75.00 |
| UG | Transforming Broadening Participation through STEM (TBPS) | - | - | 20.00 |
| UG | Historically Black Colleges and Universities Undergraduate Program (HBCU-UP) | 32.06 | 32.00 | 32.00 |
| UG | Louis Stokes Alliances for Minority Participation (LSAMP) | 44.55 | 44.75 | 44.75 |
| UG | Tribal Colleges and Universities Program (TCUP) | 13.35 | 13.35 | 14.35 |
| UG | STEM Talent Expansion Program (STEP) | 31.64 | 32.53 | 35.53 |
| UG | Transforming Undergraduate Biology Education (TUBE) | 5.06 | 10.90 | 14.90 |
| UG | Transforming Undergrad Ed in STEM (TUES) [was CCLI] | 41.60 | 42.21 | 47.97 |

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| | | | | |
|--------------------|---|-------------------|-------------------|-------------------|
| UG | Undergraduate Research Mentoring in Biology (URM) | 9.00 | 3.00 | - |
| UG | Widening Implementation and Demonstration of Evidence-based Reforms (WIDER) | - | - | 20.00 |
| UG/Grad | Teacher Learning for the Future (TLF) | - | - | 10.00 |
| Total, UG | Undergraduate STEM Education Programs Subtotal | \$486.92 | \$478.74 | \$521.05 |
| Grad | Alliances for Graduate Education and the Professoriate (AGEP) | 16.73 | 16.75 | 16.75 |
| Grad | East Asia & Pacific Summer Institutes for U.S. Graduate Students (EAPSI) | 1.74 | 2.40 | 2.40 |
| Grad | Enhancing the Mathematical Sciences Workforce of the 21st Century (EMSW21) | 15.07 | 17.07 | 11.77 |
| Grad | Ethics Education in Science & Engineering (EESE) | 2.65 | 2.74 | 2.75 |
| Grad | Federal Scholarship for Service / Cybercorps (SfS) | 14.87 | 15.00 | 25.00 |
| Grad | Graduate Research Fellowship (GRF) | 136.13 | 135.92 | 198.14 |
| Grad | Graduate STEM Fellowships in K-12 Education (GK-12) | 55.97 | 54.31 | 26.95 |
| Grad | Integrative Graduate Education & Research Traineeship (IGERT) | 69.70 | 69.23 | 62.47 |
| Grad | Post-doctoral Fellowship Programs (PFP) | 21.45 | 23.37 | 23.35 |
| | <i>BIO Postdoctoral Research Fellowships in Biology</i> | 4.74 | 3.80 | 3.80 |
| | <i>GEO Postdoctoral Fellowship Programs</i> | 1.17 | 2.97 | 5.02 |
| | <i>MPS American Competitiveness in Chemistry Fellowships</i> | 2.40 | 2.00 | - |
| | <i>MPS Astronomy and Astrophysics Postdoctoral Fellowships</i> | 1.79 | 1.80 | 2.00 |
| | <i>MPS Math Sciences Postdoctoral Research Fellowships</i> | 5.13 | 4.03 | 3.93 |
| | <i>MPS Math Sciences University-Industry Postdoctoral Fellowships</i> | 0.08 | 0.10 | 0.10 |
| | <i>SBE Minority Postdoctoral Fellowships</i> | 0.94 | 1.00 | 1.00 |
| | <i>OCI Fellowships for Transformative Computational Science Using CI (CI TRaCS)</i> | - | 2.17 | 2.00 |
| | <i>OISE International Research Fellowship program</i> | 4.27 | 4.50 | 4.50 |
| | <i>OPP Polar Postdoctoral Fellowships</i> | 0.93 | 1.00 | 1.00 |
| Grad | Science Masters Programs (SMP) | - | - | - |
| Grad/UG | Teacher Learning for the Future (TLF) | - | - | 10.00 |
| Total, Grad | Graduate and Professional STEM Education Programs Subtotal | \$334.33 | \$336.79 | \$379.58 |
| OIE | Centers for Ocean Science Education Excellence (COSEE) | 5.70 | 5.69 | 4.24 |
| OIE | Excellence Awards in Science and Engineering (EASE) | 5.18 | 5.20 | 5.20 |
| OIE | Informal Science Education (ISE) | 65.85 | 66.00 | 68.14 |
| Total, OIE | Outreach & Informal Ed STEM Education Programs Subtotal | \$76.73 | \$76.89 | \$77.58 |
| | TOTAL, STEM Education Programs | \$1,167.06 | \$1,164.84 | \$1,209.58 |

Totals may not add due to rounding.

¹ A full-year 2011 appropriation for these programs was not enacted at the time the budget was prepared; therefore, these programs are operating under a continuing resolution (P.L. 111-242, as amended). The amounts included for 2011 reflect the annualized levels provided by the continuing resolution.

¹ NSF at a Glance, The National Science Foundation, available at <http://www.nsf.gov/about/glance.jsp> (April 25, 2011), and Testimony of William T. Talman, M.D., President, Federation of American Societies for Experimental Biology, Before the House Committee on Appropriations Subcommittee on Commerce, Justice, Science, and Related Agencies, “FY 2012 Appropriations for the National Science Foundation,” March 11, 2011,

<http://appropriations.house.gov/files/FederationofAmericanSocietiesforExperimentalBiology.pdf> (March 27, 2011).

² The National Academies, “Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5,” 2010, <http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12999> (March 27, 2011).

³ National Science Foundation, “Survey of Federal Funds for Research and Development,” Last updated June 2009, <http://www.nsf.gov/statistics/srvyfedfunds/> (April 4, 2011).

⁴ Julia Lane and Stefano Bertuzzi, “The STAR METRICS Project: Current and Future Uses for S&E Workforce Data,” The National Science Foundation and the National Institutes of Health, June 2010, <http://www.nsf.gov/sbe/sosp/workforce/lane.pdf>.

⁵ Public Law 81-507

⁶ Public Law 81-507. The law explicitly authorizes NSF to conduct basic scientific research and research fundamental to the engineering process; programs to strengthen scientific and engineering research potential; science and engineering education programs at all levels and in all the various fields of science and engineering; programs that provide a source of information for policy formulation; and other activities to promote these ends.

⁷ The seven directorates are as follows: Biological Sciences; Computer and Information Science and Engineering; Engineering; Geosciences; Mathematics and Physical Sciences; Social, Behavioral and Economic Sciences; and Education and Human Resources. More Information available at NSF at a Glance, The National Science Foundation, available at <http://www.nsf.gov/about/glance.jsp> (April 25, 2011) Who We Are, The National Science Foundation, available at <http://www.nsf.gov/about/who.jsp> (April 25, 2011).

⁸ “The National Science Foundation: A Brief History,” George T. Mazuzan, NSF Historian, July 15, 1994, available at <http://www.nsf.gov/pubs/stis1994/nsf8816/nsf8816.txt> (November 5, 2008).

⁹ “Science The Endless Frontier,” A Report to the President by Vannevar Bush, Director of the Office of Scientific Research and Development, July 1945. United States Government Printing Office, Washington: 1945, available at <http://www.nsf.gov/od/lpa/nsf50/vbush1945.htm> (November 5, 2010).

¹⁰ National Science Foundation, “NSF 88-16 A Brief History,” July 15, 1994, <http://www.nsf.gov/pubs/stis1994/nsf8816/nsf8816.txt> (March 27, 2011).

¹¹ National Science Foundation, “Science and Technology in Times of Transition: the 1940s and 1990s,” <http://www.nsf.gov/statistics/seind00/access/c1/c1h.htm> (March 27, 2011) and “The National Science Foundation: A Brief History,” July 15, 1994, <http://www.nsf.gov/about/history/nsf50/nsf8816.jsp> (April 25, 2011).

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