



Response to Senator Lankford's "Federal Fumbles, Vol. 3"

The National Science Foundation (NSF) has been the backbone of America's science and engineering research enterprise for more than 60 years. NSF is the only federal agency that supports all fields of fundamental science and engineering research and education.

Each year, NSF competitively awards thousands of grants that collectively advance our nation's scientific capabilities and engage the talents of hundreds of thousands of researchers, postdoctoral fellows, technicians, teachers, and students in every field of science and engineering. Each proposal submitted to NSF—including those deemed "wasteful" and "irresponsible" in the "Federal Fumbles" report (authored by Senator James Lankford)—is reviewed by science and engineering experts well-versed in their particular discipline or field of expertise according to two merit review criteria: Intellectual Merit and Broader Impacts.

NSF-funded discoveries have expanded our understanding of the world in which we live, led to life-saving medical advances, enhanced our national security, improved our everyday lives, and yielded insights into the creation of the universe. The following summaries of the projects highlighted in "Federal Fumbles" illustrate examples of promising NSF-funded research that were awarded support through the merit review process.

Rapid Phenotypic Evolution and Speciation in a Lake Stickleback

NSF Award 0320076

Collaborative Research: Evolutionary genomics of rapid adaptation in threespine stickleback

NSF Award 0919234

NSF Award 0919090

Diversification of sensory systems in novel habitat: enhanced vision or compensation in other modalities?

NSF Award 1638778

Collaborative Research: Diversification of sensory systems in novel habitat: enhanced vision of compensation in other modalities?

NSF Award 1638567

NSF Award 1638861

Federal Fumbles: “I Want My Nickel Back”

University of Alaska-Anchorage, University of Oregon, Michigan State University, University of Idaho, University of Texas at Austin

Senator Lankford’s entry titled “I Want My Nickel Back” links six awards that study complex biological processes -- how genes produce organisms with unique morphological, behavioral, and physiological traits -- in a model system. The stickleback has become one of the premier “model systems” for studying such biological processes because at different times in Earth’s history, this marine fish has repeatedly colonized freshwater lakes, evolving a range of body plans over and over again in new habitats. Virtually no other species has this frequent replication of independent evolutionary histories among its different populations; sticklebacks are the subjects of natural “experiments” that help scientists understanding the rate and direction of genetic changes in new environments, and the consequences of those changes for the organisms.

Due to its status as model system, research into sticklebacks provides benefits that go far beyond understanding a single type of fish. Studying sticklebacks is akin to studying another well-known model system, the fruit fly. Similarly, sticklebacks provide a mechanism for learning about evolution and the genetic basis of various traits. Continuing to build a research base on sticklebacks will enable a fuller understanding of how the brain and other neural systems, in organisms including humans, change over time.

The first set of research projects, funded in 2006 and 2009, were foundational in establishing the regularity of genetic changes driven by similar environmental pressures leading to predictable morphologies within multiple freshwater lakes. Additional projects, funded in 2016, go several steps further, exploiting the unique diversity of freshwater lakes that vary greatly in water clarity. For this research, U.S.-based researchers traveled to Iceland to focus on the evolution of sensory systems in response to different environmental pressures. A central question is whether vertebrate neural systems must undergo genetic change to gain new capabilities in different environments or whether existing plasticity in brain architecture is adequate to allow adaptation to novel conditions or perturbations.

Together, these three NSF-funded projects demonstrate how fundamental research works, building on itself and expanding on previous research that has demonstrated promise. Despite the characterization in Sen. Lankford’s report of “similar” research, this is an example of research progressing. While the report conflates the funding for all of these awards into a single total, the 2016 grants were issued to an entirely different group of researchers than the earlier awards. That later group of scientists was able to focus on a much more specialized question, thanks to the previously funded research.

Syrian Refugee Families in Iceland

NSF Award 1641180

Federal Fumbles: “The Freezer”

San Jose State University

The Federal Fumbles entry titled “The Freezer” has the potential to inform institutions, health care providers, and policy makers on best practices for addressing challenges related to human displacement and refugee migration. The small Arctic country of Iceland started accepting Syrian refugees in early 2016. The country offers a manageable case study for researchers to follow the refugee experience and the governmental response, arrival to settlement.

NSF provided an established researcher with funding to gather data on a group of Syrian refugees resettled in Iceland to assess the integration of these families into Icelandic society and the services, policies, and procedures developed by the Icelandic government to respond to these new migrants.

Prior to receiving NSF funding, the researcher had spent a year meeting with stakeholders in each of the Icelandic communities receiving refugees, and from previous experience working with refugees, was able to assess the communities’ preparedness for the refugees. The researcher also trained staff at the International Federation of Red Cross, school staff and administrators, staff at health centers and staff at the Ministry of Welfare to identify trauma and anticipate issues that might occur with the families and community members. Finally, the researcher had worked with program managers to develop procedures and processes for intraagency and inter-agency coordination.

The project has generated a very unique dataset on the refugee experience and institutional responses by a nation. The research findings have already sparked the development of new studies with social scientists from the fields of psychology, education, sociology, environmental science and public policy. This has facilitated the networking of researchers and policy makers from various disciplines to work together. For example, the researcher is now working with social scientists on resiliency and forced migration, and with computer scientists to develop social media applications to aid agencies and refugees during resettlement.

NSF has made significant contributions to our nation’s prosperity, health and well-being. Understanding the impact of refugees and resettlement influences all of those things, not just for the U.S. but worldwide.

Documenting Domaaki, an Endangered Indo-Aryan Language

NSF Award 1664396

Phonetic and Phonological Documentation of Kalasha, an endangered Indo-Aryan language

NSF Award 1562134

Typological and historical discovery through language documentation of Walman, Srenge, Aro, and Eho, four critically endangered languages

NSF Award 1500751

CAREER: Documenting the Languages of Manang, Nepal for Local and International Impact

NSF Award 1149639

A reference grammar and tonal documentation of Seenku, an endangered Mande language

NSF Award 1664335

Federal Fumbles: "I Can't Understand"

San Jose State University, North Carolina State University, SUNY at Buffalo, Southern Illinois University at Edwardsville, Dartmouth College

Sen. Lankford's report acknowledges the importance of documenting, revitalizing and preserving Native American languages. The goal of all awards funded by NSF's Documenting Endangered Languages Program (DEL), is to develop and advance knowledge concerning all human languages. There are an estimated 7,000 languages worldwide, with federal census data for 169 Native American languages still spoken in the U.S. NSF support has funded research on more than 100 Native American languages. But with the majority of the 7,000 languages spoken outside of the U.S., fundamental research into linguistics requires data from those languages in order to advance scientific theories that explain, predict and better understand human language.

Basic scientific research into linguistic diversity also supports broader impacts that directly impact the U.S. such as training and developing research skills in undergraduate and graduate students, increasing underrepresented groups – like Native Americans – in the scientific enterprise, developing methodological tools applicable to languages spoken in the U.S., and creating linguistic resources for languages in strategically important regions that other federal agencies can use. The DEL-funded research included in Federal Fumbles include research on many diverse topic, including a focus on endangered languages in regions of strategic importance to the U.S., and awards to develop and test computational tools that would automate tonal transcriptions, which could enable faster and more accurate tonal transcriptions for a large number of tonal languages, including Native languages like Navajo.

A better understanding of the nature of how languages are different is essential for understanding what is possible in human cognition for language comprehension and production, and what is physically possible for producing and perceiving sounds.

Collaborative Research: Legislative Audiences and Dear Colleague Letters

NSF Award 1627422

NSF Award 1627358

Federal Fumbles: “Dear Colleague: Do What I Say, Please”

Boston University, The Ohio State University

NSF’s Political Science program funds research that attempts to help us better understand what makes effective democracy happen, at home and elsewhere, in order to support the public good.

This project offers a new theoretical explanation of legislative behavior based on the audiences that Members of Congress must be responsive to, and the actions that they take to do so. The research addresses important questions of how Members of Congress use interest groups to advance their own agenda, how members benefit from collaboration with their colleagues, and how members choose to prioritize and promote different types of legislation. Ultimately, the results of this research will allow us to move beyond the traditional understanding of Congress to account for the relationships that members must maintain within a complex network of legislators and outside stakeholders, and provide a clearer picture of how these relationships affect the policies developed by Congress.

This research could lead to a better understanding of legislative politics, which is an important underpinning of democratic politics. As the United States seeks to support the spread of democratic principles around the world, studies such as this one is important to help us use our resources economically in this endeavor. Without such work, our resources may be wasted by supporting unwise or inefficient policies.

Documenting Traditional Ecological Knowledge in the Sierra Nororiental de Puebla, Mexico, in Synchronic and Diachronic Perspectives

NSF Award 1401178

Federal Fumbles: "Name That Plant"

Gettysburg College

Traditional knowledge of plants, animals, climate and ecology is often encoded in the local language, and when languages become endangered, that local traditional knowledge is often the first to disappear. Specialized knowledge is highly vulnerable to language endangerment. This project uses innovative bar coding of plant specimens together with recording inventories of local plant names, classifications, and uses in the targeted regions in central Mexico. Western scientific plant names do not always easily get identified to the specific local species; those plant names are not used in communities, they are used by scientists. Using DNA barcodes mean that mismatches can be avoided, and the local traditional knowledge increases scholarly knowledge of these plants' characteristics, uses, and habitat. One of the languages in this study, Nahuatl, is from the Uto-Aztecan language family which has many members in the United States, ranging as far north as Idaho (Northern Paiute) and as far east as Oklahoma (Comanche). This means a greater understanding of the cultural, historical and botanical knowledge of Nahuatl can potentially be of value to Native American communities in the U.S.

This study is creating a large set of botanical specimens in the United States at the University of Texas, the Missouri Botanical Garden, and the Smithsonian. The project is also generating a set of field guides on the plants in at least 7 of the language communities with photos and linguistic details on the plants and their names. The specimens and databases will benefit the botanical community of researchers, other linguists and anthropologists interested in documenting this kind of "ethnobotanical" knowledge encoded in local endangered languages, and even the general public through a publicly accessible web portal. These materials are also of benefit to K-12 and university students in science studies in ecology and biology.

Long-term benefits and implications of this study include establishing a baseline of plant locations in their current and historical locations, based on linguistic data. In addition, these innovative and interdisciplinary documentation methods of traditional plant and linguistic knowledge are being adapted by other teams of linguists and biologists, so the scientific advances may expand beyond what is learned in this region of Central America.

A Linguistic Ethnography of the Global Trade in Indigenous Plants

NSF Award 1325025

Federal Fumbles: “What’s in a Name?”

Brown University

Salvia divinorum is a plant that has long been used for religious rituals by Mexico’s indigenous Mazatec culture. It is also a plant that has seen an exponential increase in global trade due to increased global awareness of its hallucinogenic properties. While it remains legal in most countries, some western countries (the United Kingdom, Australia) and some U.S. States have passed laws banning its trade and use. Much remains unknown about the cultural, social, economic, and anthropological ramifications of the global trade in Salvia divinorum. Having a more complete picture of the market for this plant can inform policy-makers as they contemplate legislative actions related to this powerful hallucinogenic substance and other similar substances.

This research project is based in Oaxaca, Mexico, the only place where this plant grows indigenously. The research explores the fundamentals of how the commodity chain that has grown up around this new global trade impacts social and cultural structures in Oaxaca and how language and culture in turn effect the trade of this plant.

In addition to researching the implications of this new and booming commodity market, the award provided support for several graduate students as they learn research methods in linguistics and anthropology and develop field based research skills.

Presidents' Legislative Preferences

NSF Award 1655792

Federal Fumbles: "My Fellow Americans"

University of California, San Diego

This project investigates to what extent presidential requests serve to set Congress' agenda. The work aims to identify both structural and personal conditions that help explain the observed variation in presidential effectiveness. In doing so, the research will provide better metrics of the ideological content of presidents' legislative preferences vis-à-vis Congress, and how this ideological positioning influences their capacity to lead their co-partisans in Congress. In other words, the project investigates whether legislators respond to signals from the president, and if so, do these signals affect the content of the agenda Congress pursues. This work will provide insight into fundamental questions related to the US separation of powers systems and how this system affects both presidents and legislators during periods of unified and divided party control of government.

This study is being conducted in a rigorous and objective manner by analyzing data from several presidential administrations. While some of the documents are publicly available from the Office of Management and Budget (OMB), one of the major contributions from this project is that there will be a systematic collection and provision of this data to the scholarly community. The exploitation of the information contained in OMB logs and statements of administrative policy -- statements sent to Congress by the executive branch -- is a particularly interesting way to study presidents' strategy in the legislative arena. In particular, statements of administrative policy provide useful information about the president's position on particular pieces of policy.

This work will provide insight into these fundamental questions related to the US separation of powers system and how the system affects both presidents and legislators during periods of unified and divided party control of government. It will provide a better understanding of our system of government and presidential systems in general.

Government Accountability Office Report 17-721: Actions Needed to Improve Oversight of Indirect Costs for Research

Federal Fumbles: “Spending Your Money How I Want

NSF recently responded to the findings and recommendations of the Government Accountability Office (GAO) report entitled *National Science Foundation: Actions Needed to Improve Oversight of Indirect Costs for Research* (GAO-17-721). The Foundation has taken corrective actions as a result of the GAO report. NSF appreciates the considerable study undertaken by the GAO on this topic, in order to ensure efficient and effective use of taxpayer dollars for science research and education.

The Foundation does emphasize that both direct and indirect costs are **real costs** that are essential to the conduct of research. NSF follows indirect cost rate negotiation protocol as set forth in Office of Management and Budget’s (OMB) *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards*¹ (*Uniform Guidance*). The *Uniform Guidance* – a government-wide framework for grants management – is an authoritative set of rules and requirements for Federal awards. Indirect cost rates for individual institutions are generally negotiated annually on behalf of the Federal Government by the cognizant agency for indirect costs. Per the *Uniform Guidance*, the cognizant agency is the federal agency that provides the predominance of direct federal funding to an awardee in a given year. The *Uniform Guidance* requires that the rate negotiated by the cognizant agency must be accepted by all federal agencies, except in certain circumstances where a different rate may be required by Federal statute or regulation. NSF complies with this requirement, and requires awardee organizations to charge indirect costs to NSF awards using the rates established by their cognizant federal agency. Of the approximately 45,000 awards in NSF’s current portfolio, 98.5% were made to organizations that negotiate indirect cost rate agreements with other federal agencies.

NSF exercises oversight of the application of indirect cost rates through post-award monitoring efforts including site visits and desk reviews of awardee organizations through an audit process. These activities review the indirect cost rate calculation, and the application of the approved rate to claimed indirect costs on individual awards. In addition, the NSF Office of Inspector General’s Audit Office also performs incurred cost audits of NSF awardees. NSF Management is responsible for resolving all issues raised in these audit reports.

¹ Office of Management and Budget, *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards*, 2 CFR 200, (Washington, D.C.: December 2014).