



# NATIONAL SCIENCE FOUNDATION

As the only federal science agency charged with advancing all fields of scientific discovery, technological innovation, and science, technology, engineering and mathematics (STEM) education, the National Science Foundation (NSF) plays a crucial role in driving the economy, protecting the nation and sustaining the U.S. position as a global leader. Through various programs, the foundation supports more than 300,000 scientists, engineers, educators and students at universities, laboratories and field sites across the U.S. and throughout the world. Listed below are just a few examples of the vital and varied impacts of NSF-supported research. For more, visit [www.nsf.gov/FY17](http://www.nsf.gov/FY17).

## KNOWLEDGE

### Power over WiFi

Researchers have tapped into the energy of WiFi signals to power small electronic devices. This advance could help power the Internet of Things in which small sensors embedded in appliances and other devices help the machines communicate with each other. However, energizing these low-power sensors as they become more numerous will be a challenge. To overcome this hurdle, the researchers have optimized a WiFi router to send out “power packets” on unused WiFi channels. They’ve also created sensors that integrate into devices to harvest energy from the power packets. Funded by NSF, the project was named one of the most innovative and game-changing technologies of 2015 by *Popular Science*.



### Mapping the brain

Tools that allow researchers to ask complex questions about how the brain functions are almost nonexistent. However, groups of engineers and neuroscientists are making progress on these much needed technologies. One group funded by NSF recently built and tested light-emitting diodes (LEDs) the size of nerve cells. They are thought to be the smallest implantable LEDs ever made. The diodes allow researchers to learn not just how networks of cells communicate, but how individual cells communicate with each other. This information could pave the way for neural prostheses and therapies for deafness and blindness, as well as treatments for Alzheimer’s and Parkinson’s diseases.

### Taking aim at the “silent thief”

Glaucoma is the second-leading cause of blindness in the world, but treatment is limited. Reducing eye pressure through medication or surgery often limits disease progression, but for 25 percent of patients, vision continues to deteriorate after pressure levels return to normal. To help eye doctors tailor treatment for individual patients, an NSF-funded mathematician designed a computer model to measure multiple factors in the disease’s progression, including eye pressure, blood flow and eye structure. This is the first quantitative tool to measure the severity of the disease.

## ECONOMY

### Energy savings through wind power

Xcel Energy, the leading wind energy producer in the U.S., relies on a highly detailed wind forecasting system developed through a partnership with the NSF-funded National Center for Atmospheric Research (NCAR). Since 2009, the forecasting system has saved Xcel customers about \$49 million. Accurate predictions of wind timing and intensity at turbine sites allow the company to decide when to switch from costly coal and natural gas to wind power to generate electricity. Global Weather Corporation (GWC), an NCAR spinoff company, now markets the forecasting system along with several other forecast modeling technologies. GWC forecasts have a 99.9 percent accuracy.



### Increasing opportunities for Alaska Natives

For Alaska Natives, finding jobs in the state’s key industries—oil, gas and mining—is difficult because they often lack the science and math skills required. However, the Alaska Native Science and Engineering Program (ANSEP) is working to give students from

middle school to graduate school the academic opportunity and industry training to fill jobs in STEM fields. NSF was a founding partner in ANSEP 20 years ago and continues to support the program, which includes more than 100 funding partners, serves 1500 students and has produced 350 graduates with science and engineering degrees.

### **Montana makes its mark in global optics and photonics**

Montana's effect on U.S. global competitiveness in optics and photonics is significant. Companies based in the state provide critical products and services to firms across Europe and the Far East. This robust activity is due in large part to NSF support specifically aimed at spurring economic development by building research capacity in smaller or less populated states. In 1980, Montana had one laser manufacturer. Since 2005, eight new companies have made their home in the state, bringing the total to more than 30. Providing over 400 jobs, the companies conduct a wide range of activities, including developing lasers for scientific research, manufacturing and remote sensing.

### **Move over emoticon**

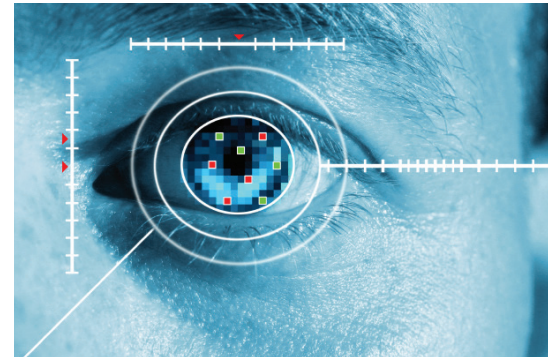
A raised eyebrow. A frown. A smirk. For Affectiva, a feisty startup company, facial clues mean big business. The six-year-old firm, funded in part with backing from NSF, has 1400 clients including Kellogg's, Mars, Hershey and Unilever. With its emotion response software, the Waltham, Mass.-based company helps companies gauge consumer response to digital media in real time. Based on analysis of over 3 million faces from 75 countries in the last three years, Affectiva has the world's largest library of emotional response to digital media. By applying its software to the Internet and other electronic platforms, the company aims to add emotional responsiveness to the digital world.

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## **SECURITY**

### **Cloaking ships at sea**

A recent discovery by researchers funded through NSF and the U.S. Navy suggests Mother Nature may offer a blueprint to improve camouflage for military ships. The research exposed how certain fish in the open ocean escape notice. While the fish aren't quite invisible, their skin cells contain special crystals that help camouflage them. Acting like a set of tiny mirrors, the structures, called guanine platelets, interact with light, minimizing contrast between the fish and its surroundings. The finding is a promising advance for shielding vessels in the open sea.



### **The impact of military service on returning veterans**

Over 200,000 veterans separate from military service annually and return to civilian life. To better understand how active military make the transition, NSF-funded researchers studied veterans from World War II, Vietnam and the all-volunteer era. They found that as private citizens these individuals initially experienced disadvantages in educational and employment pursuits compared to their civilian peers. Over time, these challenges diminished but varied widely depending on military branch, length of service and demographic group. While noncombat, active duty vets experienced better mental health than non-vets and reservists, the differences diminished after discharge. Studies that provide trend data are useful for policymakers, employers and health care providers who deal with transitioning veterans.

### **Preparing the Pacific Northwest for the next 'great' quake**

When Japan experienced a devastating earthquake and tsunami in 2011, 97 percent of the coastal population survived. That's because the country has the highest level of earthquake and tsunami education in the world. With the Pacific Northwest facing a 10 percent chance of a similar catastrophic combination disaster in the next 50 years, NSF is supporting outreach and education efforts in the area that target K-12 teachers, first responders and park rangers who can convey to the public what to expect and how to prepare.

### **Grandmother caregivers falling through the safety net**

Grandparents carry the primary caregiving responsibilities for over 2.9 million children in the U.S. today. African Americans make up 24 percent of these households. Increasingly, these caregivers are urban, low-income African-American grandmothers. In a recent study, an NSF-funded researcher found that these individuals face multiple challenges in caring for their grandchildren. Among them, a lack of information about available resources and services, difficulties navigating state resources, health concerns and child care. Those in the study had annual incomes less than \$15,000, but the majority were employed. Since 2000, the number of children living with a grandparent has increased 22 percent. Such studies can help shed light on how safety net programs can better serve those most at risk.