



1 10 “Big Ideas” for future NSF investments
 “Enhancing Science and Engineering through Diversity,” “NSF 2050: The Integrative Foundational Fund,” “Understanding the Rules of Life: Predicting Phenotype,” “Work at the Human-Technology Frontier: Shaping the Future”--these are four of the 10 Big Ideas that are expected to drive NSF’s long-term research agenda and ensure that future generations continue to reap the benefits of fundamental science and engineering research. The ideas capitalize on what NSF does best: catalyze interest and investment in fundamental research, which is the basis for discovery, invention and innovation. A [report](#) showcasing these 10 Big Ideas for future NSF investments is available for viewing or downloading from the [NSF Toolkit](#).



2 R&D employment by businesses in the U.S.
 Companies active in research and development (R&D) employed 1.5 million scientists, engineers, researchers, managers, technicians, support staff and other R&D workers in 2013, according to “A Snapshot of Business R&D Employment in the United States,” a recent report from the National Center for Science and Engineering Statistics. Software publishing, pharmaceuticals and medicine, and semiconductors and other electronics components are the top three industry groups employing domestic R&D employees. Read more in this [press release](#).



3 An important anniversary in the history of world-class Antarctic science
 On Oct. 31, 1956, seven U.S. naval aviators did what many thought was impossible -- they landed a plane for the first time at 90 degrees South latitude. With engines running to avoid freeze-up, U.S. Navy Admiral George J. Dufek, commander of Operation Deep Freeze, quickly stepped out and planted the Stars and Stripes at the South Pole. After 49 minutes on the ice, the crew left and returned to what is now NSF’s McMurdo Station. The flight opened up the continent to scientific discovery. See more in a [video](#) providing a short history of U.S. flights that made South Pole science possible.



4 Living Bridge Project shows off the potential of “smart” infrastructure

Engineers at the University of New Hampshire are outfitting an ordinary bridge with sensors to monitor everything from structural stability to traffic to environmental health. The NSF-supported project exemplifies the future of smart, sustainable, user-centered transportation infrastructure. Once the Memorial Bridge between New Hampshire and Maine is outfitted with a suite of 40 sensors, the structure will be a self-diagnosing, self-reporting smart bridge that researchers can use to conduct field tests and evaluate the impact of emerging technologies. Find out more in this episode of the NSF video series [Science Nation](#).

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5 Cold spells chill subtropical species

Two cold spells, two years apart, in two subtropical regions of the world have given scientists clues about what happens when an extreme climate event strikes. By tracking conditions before, during and after a 2008 cold spell in China and a 2010 cold spell in Florida, researchers found chilling effects on plants and animals, but not all the effects were equal. Tropical species suffered more than their temperate counterparts, which were able to resist and recover from the record low temperatures. Read more in this [press release](#) and accompanying [photo gallery](#).

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6 The honeybee algorithm

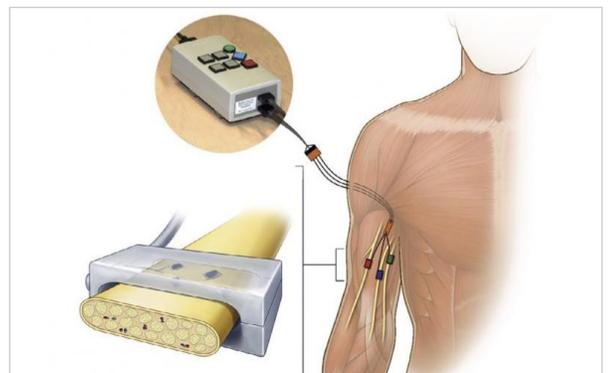
What is the most efficient, and profitable, way to allocate computer servers to ever-changing internet traffic? Researchers funded by NSF turned to honeybees to find the solution. The researchers adapted a decade-old model of how honeybee colonies allocate their foragers among sources of nectar into a novel algorithm for assigning computer servers -- one that is now used by major web hosting companies in a rapidly growing global market worth over \$50 billion. The work earned the scientists a 2016 Golden Goose Award, which recognizes federally funded basic research that has had significant impact. Find out more in this [video about the award-winning research](#).

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7 Restoring the sense of touch in amputees

Scientists at the University of Chicago and Case Western Reserve University have found a way to produce realistic sensations of touch in two human amputees by directly stimulating the nervous system, according to a press release by the University of Chicago Medical Center. The research, partly supported by NSF, confirms earlier research on how the nervous system encodes the intensity, or magnitude, of sensations. Find the link to the full story in this [News From the Field item](#).



8 A day in the life: How NSF research affects you
NSF funding has been crucial for technological advances that affect health care, automotive safety, communications and many other technologies. The Director's November [monthly message](#) included a visual representation of the impact of NSF-funded research in a day in the life of some families. From using low-cost, low-energy clean water in the morning to checking emails on tablets at the end of the day, technology made possible by NSF has an impact on people around the clock. Check out the [infographic](#).



9 "Hacked Off"
Computer networks may never float like a butterfly, but Penn State computer scientists suggest that creating nimble networks that can sense jabs from hackers could help deflect the stinging blows of those attacks. The researchers have come up with a way to neutralize certain network hack attacks by diverting hackers to a decoy network. Instead of finding more ways to *block* hackers' scans, the Penn State system first detects that a large scan is taking place, then uses a network device called a *reflector* to seamlessly redirect the attack to a *fake* shadow network that mimics the real one. Hear more in this [The Discovery Files podcast](#).



10 Calling all nanotechnology-empowered superheroes
NSF and the National Nanotechnology Initiative (NNI) have announced the opening of the second annual Generation Nano: Small Science, Superheroes! competition. The contest invites U.S. high school and home-schooled students to create a superhero that uses nanotechnology--science and technology on the scale of a nanometer, or one billionth of a meter--to solve crimes and meet today's challenges. Read about the competition in this [special report](#).

