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## NSF AT WORK

### Tick-Borne Threats Extend Beyond Lyme Disease

This year's mild winter and early spring were a bonanza for tick populations in the eastern United States. Reports of tick-borne disease rose fast.

While Lyme disease is the most common tick-borne disease in the Northeast and upper Midwest, however, **new research** reveals that it is not the greatest cause for concern in most of the Southeast. According to biologist Graham Hickling of the University of Tennessee, the blacklegged tick species that cause Lyme disease in the north do not commonly bite humans south of mid-Virginia.

"Ticks in the eastern U.S. collectively carry more than a dozen agents that can cause human disease," says Hickling. Many patients in southeastern states who become sick from a tick bite assume they have Lyme disease, but, Hickling and his colleagues say, the odds of that being the case are low. Most bites in the Southeast are from tick species--such as the lone star tick--which spread spotted fever rickettsiosis and ehrlichiosis, but not Lyme disease. This spring, for example, the Tennessee Department of Health reported a 500-percent increase in tick-borne rickettsiosis.

The scientists point out that the bite of the lone star tick can create a bulls-eye rash that appears like the one from Lyme disease, almost certainly leading to misdiagnosis of some patients in mid-Atlantic states, where both tick species are common.

A complicating factor for public health officials is that tick species are on the move as wildlife populations, forest habitats and weather patterns change across the continent. Lyme-infected blacklegged ticks are expanding south through Virginia, and lone star ticks are moving north, the scientists have found.

"Identifying health risks in the face of changing climates will be critical in coming years," says Sam Scheiner, NSF program director for the NSF-National Institutes of Health joint program Ecology and Evolution of Infectious Diseases, which funds Hickling's research.



A nymphal blacklegged tick on leaf litter in Tennessee. *Credit: Graham Hickling, University of Tennessee*

### Police Investigators Can Virtually Revisit Crime Scenes

The images displayed here may look like video game screenshots, but they are serious business. They are faithfully reconstructed crime scenes that detectives and other investigators could



A real crime scene (top) and the same scene simulated (bottom). Credit: R. Michael Young, North Carolina State University

study. The **virtual crime scenes** were prepared using a tool called Interdisciplinary Cyber-enabled Crime Reconstruction through Innovative Methodology and Engagement (IC-CRIME).

In TV shows, criminal investigators have easy access to one sleek, high-tech tool after another. But in the real world, forensic analysis of crime scenes can be laborious and less technologically advanced. Police investigators rely on photographs, sketches and written or taped notes to capture details.

A NSF-supported team led by researchers at North Carolina State University are developing **IC-CRIME**. The program is intended to help police investigators work more efficiently by allowing them to virtually revisit and analyze crime scenes long after the physical spaces have been cleaned up. IC-CRIME also makes it easier for investigators to collaborate across geographic and organizational boundaries.

IC-CRIME provides a 3-D reconstruction that can be viewed from any angle. A laser scanner and high-definition camera capture the scene, and a game engine (Unity 3D) recreates the data in the virtual

environment. The scanner can capture millions of data points within a few minutes. The data are stored on a central server that the IC-CRIME software can access and run within a web browser.

*Did you know ... ? NSF provides other stories like this for "Research in Action" on [LiveScience.com](http://LiveScience.com).*



A researcher explores a virtual crime scene using IC-CRIME. Credit: R. Michael Young, North Carolina State University

## Gradual Climate Change Can Push Alpine Plant Species Past Tipping Point

In the face of climate change, alpine plant populations may sit at the cliff's edge in more than one way. Some plants initially compensate for the physiologically taxing effects of persistent warming with increased growth rates or expanded ranges. However, **results from long-term studies** show that even gradual climate change can push a species past its tipping point, leading to a sudden population crash.

For cold-adapted plants such as **moss campion and alpine bistort**, warmer temperatures have meant difficult times for young plants. Decreases were recorded in their establishment and survival, especially at southern range limits. Working in Colorado, Alaska and Canada, researchers from the University of Wyoming and Duke University observed plant populations for six years. The team documented increased growth rates among plants at lower latitudes--meaning individual plants spent less time in the younger, more fragile stages of life.

The plants' fast-tracking to more stable life stages temporarily compensates for the greater vulnerability of new plants, preventing population collapse in the short term. But in the warmest years, even larger plants begin to succumb to the heat. At that point, the stability provided by a larger base of young plants has been eroded, and total population size plummets.

Determining where such trade-offs and thresholds exist helps scientists anticipate biological responses to increased temperatures and may help them predict which species can adapt and which are most vulnerable.



Moss campion. Credit: Tracy Feldman

DID YOU KNOW?



Credit:  
Jupiterimages

## U.S. Businesses Focus Large Portion of R&D on Health and Defense

Of the \$291 billion in total research and development (R&D) performed by businesses in the United States in 2008, 40 percent was applied to health and medical areas (\$76 billion) and defense areas (\$42 billion). More than 86 percent of the health or medical R&D was paid for by the companies themselves; however, the federal government funded most of the defense R&D performed by companies.

The R&D paid for by the companies reflects their priorities and strategies. Companies in the pharmaceutical industry performed two-thirds of the total company-funded health or medical R&D. Companies in the computer and electronic products or aerospace industries performed most of the company-funded R&D with defense applications.

More information is in this **InfoBrief** from NSF's National Center for Science and Engineering Statistics.

## FACES OF NSF RESEARCH

### Children's "Cars" Hold Promise for Helping With Mobility-related Disabilities

Researchers are helping neurologically impaired children overcome their mobility challenges and explore their environments by providing them with specially designed "toy" cars.

An NSF-supported team outfitted low-tech, ride-on cars with high-tech mechanisms inspired by power wheelchair and robotic technologies. Children's use of the cars shortened developmental delays and reduced other disability-related problems associated with lack of age-typical motor skill development.

Children with Down syndrome, spina bifida, cerebral palsy or autism often suffer limited mobility from birth. Power wheelchairs may become available to them when they reach the age of four or five. Until then, many such children are nearly immobile, often resulting in adverse effects on brain development.

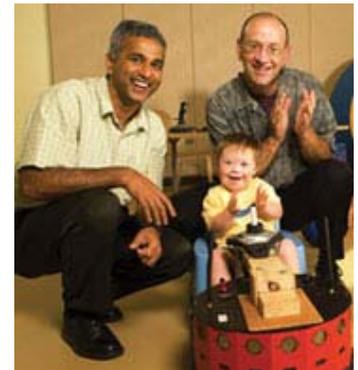


Left: Researcher Cole Galloway guides a child in using a robotic car at the USA Science & Engineering Festival in Washington, DC. Credit: Tracey Bryant, University of Delaware.

In 2007, University of Delaware professors Sunil Agrawal, a mechanical engineer, and Cole Galloway, a specialist in physical therapy and infant motor skills, developed a robotic car that incorporated a joystick and "smart" technology, which includes software that detects obstacles and helps the user learn to navigate around them. Users showed an increase in cognitive, language and motor skills. In 2010, the prototype was converted into a dual power-chair and walker.

At first, the researchers' high-end robotic cars were available to only a few children at the university's Early Learning Center, while parents of other special-needs children anxiously awaited the technology. In response to the parents' interest, the team transferred some of the electrical and mechanical modifications to a "low-tech," commercially available "race car." Even with the less sophisticated cars, the children still enjoyed some developmental benefits from enhanced mobility.

The researchers plan to introduce a prototype in 2020 that will feature smart technology and a more efficient body structure. They are also testing a dynamic harness that will allow children to experience safe walking and falling.



Researchers Sunil Agrawal and Cole Galloway guide a child in using a robotic car. Credit: Kathy Atkinson, University of Delaware



One of the modified toy cars. Credit: Evan Krape

Learn more in this **video**.

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## NSF IN THE NEWS

**The White House Speaks Out on the Economic Power of Big Data** (*Forbes*) - The collaboration between NSF and the National Institutes of Health will yield tools and techniques for research fields with large datasets.

**Humpback Whales Linger in Antarctica** (*NBC News.com*) - An NSF-funded study found that later winters and less ice in Antarctica's bays due to climate change could affect the whales' migration habits.

**School's Out But Summer Programs Keep Young Reporters Busy** (*PBS Newshour*) - While most students were on vacation, some in Florida and Illinois worked diligently on reporting scientific research.

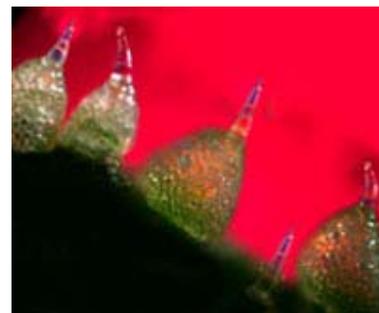
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## THE RIPPLE EFFECT

### NSF Science & Engineering Visualization Challenge: Celebrating 10 Years!

Some of science's most powerful statements are made in visualizations rather than words. NSF and the journal *Science* created the International Science & Engineering Visualization Challenge 10 years ago to celebrate and encourage the visual communication of science for education and journalistic purposes. The 2012 competition is open for entries and is accepting "apps" for the first time. The deadline is September 28, 2012.

Judges appointed by NSF and *Science* will select winners in each of five categories: Photography, Illustrations, Posters and Graphics, Games and Apps, and Videos. The winning entries will appear in a special section in *Science* and *Science Online*, and on the NSF website. Entry information is available at the challenge's **website**.



This microscopic image of trichomes on the skin of an immature cucumber got an Honorable Mention in 2011. Credit: Robert Rock Belliveau

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### NSF-Funded "Design Squad Nation" Wins Emmy



The interactive website for the PBS series "Design Squad Nation" won an Emmy in June for "outstanding new approaches" in children's daytime television. The website extends the impacts of the TV show, produced by WGBH with NSF support, into broadband media.

The **site** is a destination that encourages creative 'tweens and teens to "dream big," solve problems and make things that help people. On the site, youth work with real-life engineers to solve problems with original designs ranging from flying machines to skateboards to pollution solutions.

"Design Squad Nation" highlights engineers, who are often at the forefront of technological revolutions but are not seen by young people as potential role models as often as scientists or other professionals. In particular, the show strives to appeal to girls and minorities. Learn more at NSF's **website** and **video**.



*The National Science Foundation (NSF) is an independent federal agency that supports fundamental research and education across all fields of science and engineering. Its Fiscal Year 2012 budget is \$7.0 billion. NSF funds reach all 50 states through grants to nearly 2,000 colleges, universities and other institutions. Each year, NSF receives more than 50,000 competitive requests for funding, and makes about 11,000 new funding awards. Contact NSF's **Office of Legislative and Public Affairs** at*

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