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NSF AT WORK

Biologists Invent Chemical-free Device To Kill Head Lice

NSF-supported biologists invented a chemical-free, hairdryer-like device, the "LouseBuster," which eradicates head lice infestations on children by exterminating the eggs, or "nits." Each year, 6 million to 12 million Americans are infested with head lice. Such infestations cause children to miss between 12 million to 24 million school days annually. Credit: Sarah Bush, University of Utah.

NSF-supported biologists have invented a chemical-free, hairdryer-like device, the "LouseBuster," and conducted a study showing it eradicated head lice infestations on children. The machine exterminated lice eggs, or "nits," and killed enough lice to prevent their reproduction.

Treatments for lice have traditionally included chemical shampoos, louse combs and home remedies. Annual U.S. sales of anti-louse shampoos exceed $160 million, yet they are not very effective at killing the nits. Repeat treatments are often required, and many parents dislike using insecticide shampoos on children. Lice are also rapidly evolving resistance to the chemicals.

The LouseBuster blows warm air through a flexible hose, which has a rake-like hand piece on the end. In one 30-minute treatment, it kills lice and nits by drying them out. Comparatively, chemical treatments require multiple applications one to two weeks apart.

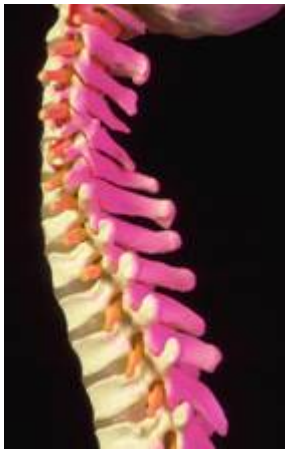
The LouseBuster is in the early stages of commercial development by a University of Utah spin-off company, Larada Sciences. Patents are pending on the LouseBuster technology, which the researchers hope will be on the market within two years for use in schools and clinics. See NSF's "LouseBuster Instrument Shown to Kill Head Lice" for more on this medical breakthrough.

New Gel Solidifies Spinal Cord Injuries

NSF-funded researchers at the Georgia Tech-Emory Center for the Engineering of Living Tissues developed a new injectable polymer that shows promise for repairing bone defects, soft tissue injuries and severe spinal cord injuries that until now have been largely untreatable.

When directly injected into injured areas, the new polymer rapidly turns to a semi-solid gel that bridges gaps and stabilizes damage. In addition, cells and bioactive agents such as proteins can be embedded in the gel to promote enhanced regeneration of bone and nerve cells.

Gel insertion is minimally invasive, and the polymer can fill a wide range of gaps, eliminating the need for specially fabricated inserts. Tissue engineering techniques using injectable polymers hold promise for damaged bone, cartilage and fibrocartilage healing.



An injectable polymer holds promise to heal spinal cord injuries.

Computers "Think" and Name Images

Researchers have created a computer system that names images by 'thinking.' The new system automatically tags images with descriptive words. For example, the computer would describe a photograph of a polar bear with her two cubs with words such as "polar bear," "cubs," "cold," and "Arctic." Credit: Nicolle Rager Fuller, NSF.

Penn State researchers supported by NSF "taught" computers how to interpret images using a vocabulary of up to 330 English words, so that a computer can describe a photograph of two polo players, for instance, as "sport," "people," "horse," and "polo."

The new system, which can automatically annotate entire online collections of photographs as they are uploaded, will result in a significant time-savings for the millions of Internet users who now manually tag or identify their images. It will also facilitate retrieval of images through the use of search terms. Penn State has filed a provisional patent application on the invention.

See Penn State's "Researchers Teach Computers How to Name Images By Thinking" for more on the computer's vocabulary.

Biodiversity Loss in Ocean Threatens Ecosystem and Economy

An international team of ecologists and economists reported that the loss of species biodiversity is profoundly reducing the ocean's ability to produce seafood, resist diseases, filter pollutants and rebound from stresses such as overfishing and climate change. Already, 29% of edible fish and seafood species have declined by 90% -- a drop that means the collapse of these fisheries.

The group conducted a four-year analysis and discovered that every species lost causes a faster unraveling of the overall ecosystem. Conversely, every species recovered adds significantly to overall productivity and stability of the ecosystem and its ability to withstand stresses.

The impacts of species loss also go beyond declines in seafood. Human health risks emerge as depleted coastal ecosystems become vulnerable to invasive species, disease outbreaks and harmful algal blooms. In addition, the economy is impacted because many of the economic activities along our coasts rely on diverse systems and the healthy waters they supply.

The researchers conclude that restoring marine biodiversity through an ecosystem based management approach -- including integrated fisheries management, pollution control, maintenance of essential habitats and creation of marine reserves -- is essential to avoid serious threats to global food security, coastal water quality and ecosystem stability. Read NSF's "Accelerating Loss of Ocean Species Threatens Human Well-Being" for more on the study.

An international team of scientists reported that the world's oceans will be empty of fish by 2048 due to the disappearance of species. Overfishing, pollution, habitat loss and climate change are hastening the depletion of the ocean's biodiversity.

Did You Know?

A team of scientists from the NSF Science and Technology Center for Ultrafast Optics and the University of Michigan's Medical School's Kellogg Eye Center developed the high-precision laser technology that underpins the popular LASIK eye surgery. From July to September of 2006, more than 132,000 IntraLase® procedures were performed worldwide, resulting in vision improvement for many.

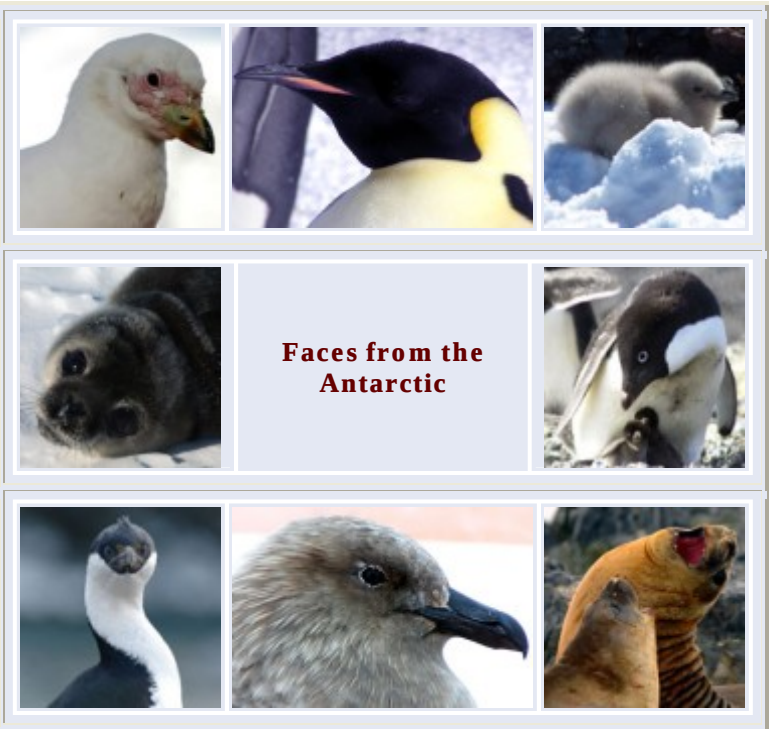
Faces of NSF Research

NSF is set to ring in the International Polar Year that will explore new frontiers in polar science. We caught up with Gretchen Hofmann, an NSF-funded researcher, at McMurdo Station in Antarctica during her interview with "Good Morning America." We listened in and learned about some of the exciting work that's taking place at one of the world's southernmost research stations.

How do the animals adapt to the long periods of darkness? **Hofmann:** Under the sea ice -- which right now is anywhere from 3 to 21 feet thick -- there's a teaming life. There's a really rich benthos, sea stars, fish, all sorts of different organisms that we would see in temperate areas. Here in the polar regions, they're highly adapted to these very, very cold temperatures. And right now, we have research programs under way to study how these organisms are adapted to these extreme conditions. During the International Polar Year (IPY), we're focusing on how these organisms survive in such extreme conditions.

How does what you're learning there help us back at home? **Hofmann:** The organisms down here -- although they're cooler and they're unusual -- show us how animals that never see any change in temperature function. And by looking at that, it really tells a little bit about what we can expect to see in organisms that may or may not be able to respond to changes in ocean temperatures and other things in other parts of oceans. Second, one of the things that's really hidden about this wonderful NSF-supported research program is the really strong education component. I have my graduate students down here; we have teachers here. We're bringing this really exciting science home to everyone.

How cold is it right now? **Hofmann:** It's really cold! The air temperature dropped to about 20 below zero, Fahrenheit. And we have about a 20-knot wind, which makes the wind chill probably 30 below. So, it's chilly!



International Polar Year 2006-2007

Scheduled to officially begin in March 2007, IPY promises to advance our understanding of how the Earth's remote polar regions impact global climate systems, to bring about fundamental advances in many areas of science, and to fire the enthusiasm of young men and women for future careers in science and engineering. See NSF's multimedia gallery for more Antarctic animals and photo credits.

NSF in the News

What Competitiveness Crisis -- *U.S. News & World Report (11/20/06)* -- National Science Foundation figures show that U.S. universities awarded more science and engineering Ph.D.s last year than ever before, but that 41 percent of the degrees went to foreign-born students.

Marshall Receives Grant to Train Teachers in Math, Science -- *Associated Press (11/17/06)* -- Marshall University has received a $2 million National Science Foundation grant under the Appalachian Math and Science Partnership program administered by the University of Kentucky to help teachers in pre-K through 12th grade improve student performance in math and science.

Grid and Bear It -- *Government Computer News (11/20/06)* **--** The National Science Foundation in 2001 spent $53 million to build the TeraGrid network, which today links eight supercomputing facilities.

Asia's New Gods -- *Newsweek (11/13/06)* **--** National Science Foundation figures show that the U.S. share of global high-tech exports dropped from 31 percent to 18 percent between 1980 and 2001 while Asia's share increased from 7 percent to 25 percent.

Pew Internet Survey

Forty million Americans rely on the Internet as their primary source of news and information about science, according to a survey conducted by the Pew Research Center's Internet and American Life Project and the Exploratorium, a science museum in San Francisco. The Internet ranks second only to television, from which 41 percent of Americans get science news and information.

Eighty-seven percent of online users have used the Internet at least once for answering questions, learning more about a discovery, completing a school project, finding charts or graphs, or otherwise seeking information on scientific facts and concepts. The Internet's primary attraction is its convenience.

The study also shows that those who get science information online are more likely to report higher levels of understanding about science. The full report, funded by NSF's Informal Science Education program, is based on a survey of 2,000 Americans in January 2006 and is available online.

Excerpts from

"When the Jobs in the Nation Change, So Does the Job of the Scientist"

by

NSF Director Arden L. Bement, Jr.

as delivered at

Inaugural Civic Scientist Distinguished Lecture Series
Baker Institute, Rice University

November 9, 2006

Today, industries are hungry for science and technology workers and compete with each other for talent. This talent competition is even more intense among nations.

The foundation for the power and wealth of economies has changed. Economic strength used to be rooted in land, physical labor, capital, and natural resources. The new formula is science and technology, highly trained workers, and lifelong learning to be able to participate in our changing economies.

The world is going through a tectonic economic shift where more and more jobs require some understanding of science and technology. And, it turns out that when the nature of everyone else's job changes, so does the job of the scientist and engineer.

Researchers will always work at the frontiers of knowledge but as society becomes more technologically intense, the role and responsibilities for those highly trained in this realm will expand. Enter the transformation to the civic scientist.

The word "civic" is an adjective that means, according to the dictionary, "of or affecting the community or the people." And this was exactly the emphasis of the new role and responsibilities of the "civic" in civic scientist.

First is to create a dialogue with the public about science and technology that is on the one hand a process of educating the public about what they want and need to know. The flip side of the dialogue is learning to listen to what the public thinks about the directions in which our science and technology are taking us.

The second role and direction for civic scientists is to help advance the knowledge-base of the nation's science and math teachers, and their students.