

January 2006

## NSF AT WORK

### Researchers Discover Gene Linked to Human Pigmentation

Until now, the genetics underlying human skin pigmentation mystified researchers. But while studying the zebrafish, a fish common to household aquariums and research laboratories, scientists found a gene that plays a major role in human coloration.

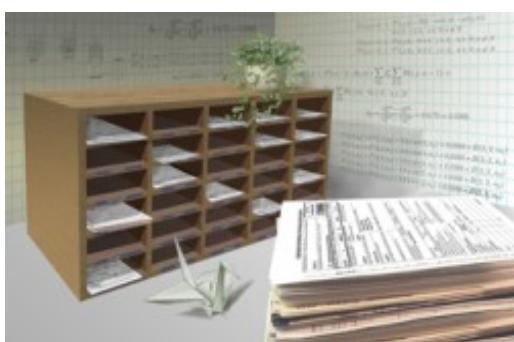
Keith Cheng and his Pennsylvania State University colleagues first discovered a gene they called "golden" that regulated pigmentation in the golden zebrafish, a variety of lighter-colored zebrafish. Next, the scientists found the gene's counterpart in humans by searching an on-line database.

This and other work suggested to the team that the golden-like gene could be involved in human coloration. And in fact, a specific tiny variation in this human gene was prevalent in individuals from lighter-skinned European populations, while the gene without the change was common among West Africans and East Asians with darker pigmentation. For more on this story, see NSF's "[A Fish of a Different Color](#)" press release.



Researchers at Pennsylvania State University discovered that a gene controlling pigmentation in zebrafish also plays a role in human skin coloration. Credit: ZFIN and Oregon Zebrafish Laboratories.

### Complex Work Scheduling Made Simple



NSF funds about 11,000 new grant proposals every year based upon reviewer recommendations. One challenge is to assign each grant application to the appropriate reviewers while ensuring that no one reviewer is overworked or has a potential conflict of interest. Credit: Z. Deretsky, NSF.

Chemical engineers at Princeton University did not set out to invent a computer program to transform the way day-to-day work assignments are handled across government and industry. But this is precisely what happened while they were determining the best way for NSF to assign grant proposals efficiently and fairly to its many external reviewers.

The team developed an algorithm that can optimally assign 100 proposals to dozens of different reviewers within a matter of seconds.

So, why did chemical engineers end up solving a problem with no apparent tie to chemistry? They specialize in "optimization," the science of inventing mathematical solutions to make things run at maximum efficiency.

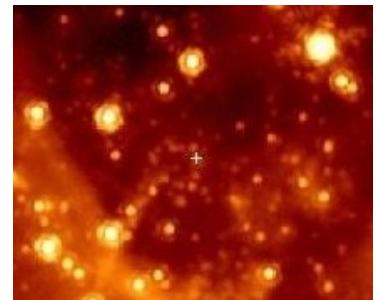
NSF Program Manager Maria Burka began using the algorithm on an experimental basis in April 2005 and said, "It works beautifully." To learn more, see "[Computer Program Streamlines Complex Work Scheduling](#)".

## Clarity at the Core: First Clear Picture of Milky Way's Center

Using a new laser-generated "virtual star" at the W.M. Keck observatory in Hawaii, UCLA astronomer Andrea Ghez and colleagues took the first clear picture of the heart of our Milky Way galaxy 26,000 light years away--including evidence of a super-massive black hole at its very center.

From its perch atop Hawaii's Mauna Kea, the 10-meter Keck II Telescope is the first instrument of its size to incorporate Laser Guide Star adaptive optics. The new technology uses a laser-generated reference point high in the Earth's atmosphere to correct the effects of atmospheric distortions and clean up the telescope's images.

This NSF-supported research will advance the study of black holes and planets in the Milky Way and other galaxies. Read NSF's press release, "Clarity at the Core," for more details.



The Milky Way's core--seen here in infrared courtesy of the Keck Laser Guide Star system--has a super-massive black hole at its center (marked by the white cross). Credit: W.M. Keck Observatory and UCLA Galactic Center Group.

## Web Tool Provides Answers for Doctors

DynaMed, the Dynamic Medical Information System, is a Web-based tool offering a collection of clinical summaries on more than 1,800 medical topics. Developed with support from an NSF Small Business Innovation Research (SBIR) award, DynaMed offers doctors an online resource to compare patients' ailments with a peer-reviewed, searchable database.



The DynaMed Web site contains summaries of more than 1,800 medical topics. Credit: DynaMed, LLC.

In a new study, primary care clinicians were able to answer more clinical questions in the same amount of time when using DynaMed in addition to their usual information sources.

NSF's SBIR program emphasizes high-risk, high-payback innovations congruent with NSF's mission to advance science, engineering and education. For more, see NSF's "[Web Tool May Help Doctors Make Better Decisions](#)."

## DID YOU KNOW?

NSF-supported researchers provided the Federal Communications Commission (FCC) with its current system for apportioning the airwaves; and since their inception in 1994, FCC "spectrum auctions" have netted over \$45 billion in revenue for the federal government.



As wireless communication blossomed in the early 1990s, the FCC received a concomitant increase in requests to use the limited commercial frequencies of the electromagnetic spectrum. The upsurge rendered the FCC's lottery-based licensing method inadequate, but economists Paul Milgrom, Robert Wilson and Preston McAfee had a solution: an auction system based on their research in the field of game theory.

The team's NSF-funded studies had already documented conditions under which the proposed spectrum auction was expected to perform well, and experiments in NSF-supported labs run during the FCC's decision-making process provided additional evidence that the new system surpassed the proposed alternatives.

"NSF-supported research played an indispensable role in the design of the auction and in supplying the evidence to support the FCC's adoption decision," said researcher-economist Paul Milgrom.

According to Milgrom, "It is simply unimaginable that the FCC could have designed, tested and implemented such a radically new design in barely six months. Furthermore, we could not have confidently recommended the plan if NSF-sponsored research had not already answered so many of the relevant design questions."

## Facets of NSF Research

### NSF Grantees Among the Brightest of 2005

In 2005, a number of NSF awardees were featured in *Popular Science* magazine's "Annual Brilliant 10" issue and *Technology Review's* "Top 35 Innovators Under the Age of 35." Keep a watchful eye for their names in the Discoveries section of the NSF website in 2006. For now, our hats are off! Meet a few below!



#### From Popular Science's Brilliant 10:

**Amy Barger**, an astronomy professor at the University of Wisconsin-Madison, uses telescopes such as NASA's Chandra X-Ray Observatory to probe some of the furthest, most mysterious objects in the universe.

**Hope Jahren**, a geobiologist at Johns Hopkins University, examines the isotopes within ancient fossils to understand Earth's climate history.

#### From Technology Review's Top 35:

University of Wisconsin-Madison chemist **Helen Blackwell** is developing tools to change how bacteria communicate with implications for human health, agriculture and the environment.

**Matthew DeLisa**, a bioengineer at Cornell University, designs microorganisms with new or improved protein machinery to help synthesize therapeutic drugs.

**Paul Hergenrother** of the University of Illinois at Urbana-Champaign studies the molecular defects involved in various cancers and neurodegenerative disorders, designing personalized drugs for each subtype of these diseases.

**Trey Ideker**, an engineer at the University of California, San Diego, is working to integrate the multitudes of data that researchers collect about cells into functional computer models.

**Samuel Madden**, a computer scientist at MIT, builds tools for managing data in large computer networks. One of his projects, CarTel, is a system for collecting and interacting with congestion, emissions and performance data in real time from cars.

Cornell University engineer **Rajit Manohar** designs "clockless" computer chips that are faster and more powerful than conventional chips -- in some cases, ten times as efficient.

## NSF IN THE NEWS

### 2005: A Banner Year for Science Research -- A Review of Top News Stories Featuring NSF

**Bipedal Bots Star at AAAS Media Briefing** (2/17/05) Members of three independent research teams jointly unveiled a new breed of powered, energy-efficient, two-legged robots with a surprisingly human gait. All three robots verified a long-held hypothesis that suggests motors can substitute for gravity in passive-dynamic walking devices. A slope is not required, only careful engineering. -- #59 in *Discover Magazine's Top 100 Stories of 2005*

**Geologists Find First Clue to *T. rex* Gender in Bone Tissue** (6/2/05) North Carolina State University paleontologist Mary Schweitzer and colleagues extracted unusual bone tissue from a 68 million-year-old *T. rex* fossil and determined that the fossil was that of a young female producing eggs when she died. Also see related NSF news release, "*T. rex* Fossil Yields Soft Tissue" (3/25/05). -- #7 in *Discover Magazine's Top 100 Stories of 2005*

**Reappearance of Missing Genetic Information Poses Exception to the Rule** (3/23/05) For more than a century, a basic tenet of inheritance has dictated that an organism's genome passes directly from one generation to the next in a predictable manner: from grandparents-to-parents-to children. Susan Lolle, Robert Pruitt and colleagues showed this cardinal rule of inheritance is sometimes broken. The team reached their conclusion by tracking how genetic information passes through multiple generations of the plant *Arabidopsis*. Violating current genetic theory, they found a significant percentage of plant grandchildren with genetic information identical to that of the grandparent, but not the parent. -- #3 in *Science Magazine's Top Ten of 2005*

**Inka Textile Devices Served as Business Ledgers** (8/11/05) New evidence shows Peru's original inhabitants used a three-dimensional system of knotted strings to keep track of things. Harvard University anthropologist Gary Urton and database developer Carrie Brezine say their computer analysis of 21 of the knotted objects, known as "khipu," revealed distinct patterns that help confirm the textile devices were used for record keeping and to communicate affairs of state throughout the sprawling empire of the Inka. -- #55 in *Discover Magazine's Top 100 Stories of 2005*

For the complete list, see the press release, "2005: Year in Review."

## Director Sets Agenda for 21st Century Science



**Dr. Arden L. Bement, Jr.,  
states NSF's number one  
priority -- to "dog the  
frontier."**

"Our current number-one priority is to maintain an unwavering focus on the frontier by funding risky, but potentially rewarding research, or as I like to say, to continually dog the frontier.

"Our task is to enhance the nation's science and engineering capacities in order to strengthen the nation's economic and social future. In that process, we support the disciplines in their constant effort to reach the furthest frontier while maintaining their capability in fundamental research."

*Excerpts from Bement's keynote at the Council of Scientific Society Presidents on 12/5/05.*

## Science & Engineering Visualization Challenge

The ability to convey the essence and excitement of research in digitized images, color diagrams, multimedia and animation has given researchers the perspective needed to set new research directions and equipped other citizens to see and understand complex scientific concepts.

The National Science Foundation and *Science*, published by the American Association for the Advancement of Science, invite you to participate in the fourth annual Science and Engineering Visualization Challenge. The competition recognizes scientists, engineers, visualization specialists and artists for producing or commissioning innovative work in visual communication.

**Award categories:** Photographs, Illustrations, Interactive Media, Non-Interactive Media and Informational Graphics. Winners in each category will be published in the Sept. 22, 2006, issue of *Science* and displayed on the NSF website.



The National Science Foundation (NSF), an independent federal agency, supports fundamental research and education with an annual budget of nearly \$5.47 billion. NSF funding reaches all 50 states through grants to nearly 2,000 universities and institutions. Each year, NSF receives about 40,000 competitive requests for funding and makes about 11,000 new funding awards. Contact [NSF's Office of Legislative and Public Affairs](#) for more information, to unsubscribe, or for permission to reuse newsletter images.

## Save the Date...

### NSF FY 2007 Budget Briefing

**February 6, 2006**



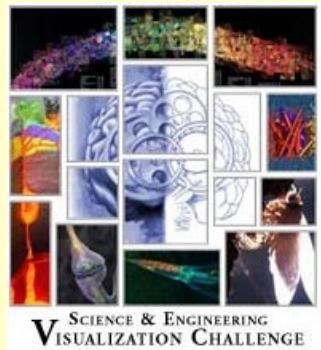
On Monday, Feb. 6, 2006 (Time TBD), Dr. Arden L. Bement, Jr., will present the NSF FY 2007 Budget Briefing for members of the science and engineering community, congressional staff, NSF staff and the general public.

NSF Assistant Directors will follow with presentations to discuss details of their specific budgets.

Contact [Sheila Macklin](#) (703-292-8070) for event updates.

## Call for Entries

**Deadline: May 31st, 2006**



*Complete entry information is available on the NSF website.*