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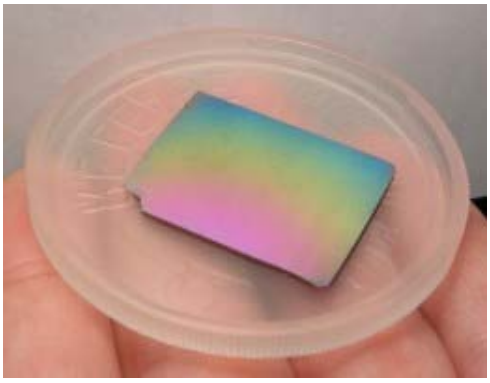
December 2006

## NSF AT WORK

### Super-Stable Glass May Aid Drug Delivery Through the Body

Researchers at the University of Wisconsin-Madison have developed a method for crafting some of the most stable glasses ever formed--materials that are strong and durable like crystal yet free of the confining properties of an ordered atomic skeleton.

The new method deposits vaporized glass materials layer by layer onto a surface at a temperature ideal for yielding stable glasses. The research team is working toward possible medical applications for the new stable glass.

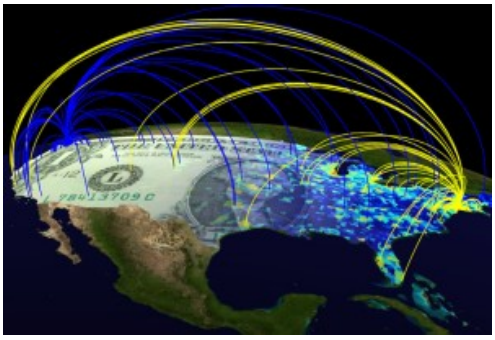


*A type of glass created by researchers at the University of Wisconsin-Madison using a new vapor-deposition method is extremely stable. The rainbow of colors in this super-stable glass comes from variations in its thickness. Credit: University of Wisconsin-Madison.*

By using their method as a general technique to control stability and solubility of molecular glass, it may be possible to develop drug compounds that were previously unusable. They may also be able to use stable glass films to extend the shelf life of existing medical tools like off-the-shelf blood and pregnancy testing kits.

So far, the team has successfully made stable glass with a non-steroidal anti-inflammatory called *indomethacin*. Encouraged by the results, they next plan to test more materials in the search for additional applications. For more on this approach to glass making, see NSF's "Melts in Your Body, Not in Your Hand."

### Show Me the Money!



*The movement of banknotes in the United States. Each line symbolizes the geographic movement of a single banknote between the place of origin (blue: Seattle, yellow: New York) and various destinations. Each banknote traveled for less than a week. Image: Max Planck Institute for Dynamics and Self-Organization.*

Ever-increasing human mobility is a key cause of the geographic spread of modern epidemics. Bacteria and viruses are now transported across great distances and transmitted to people worldwide.

In order to better understand and predict the spread of disease, NSF-supported researchers from the University of California at Santa Barbara, the Max Planck Institute for Dynamics and Self-Organization, and the University of Göttingen evaluated data from a popular U.S. Internet game in which participants register dollar bills and monitor their geographic circulation for fun. Like viruses, money is transported by people from place to place.

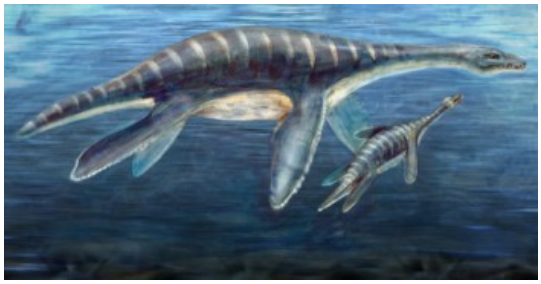
Surprisingly, the scientists found that the human movements follow "universal scaling laws" and subsequently developed a mathematical theory describing the observed movements of travelers from just a few to thousands of kilometers. Because the mechanisms of disease transmission between humans are already well understood, the scientists can use the new theory to investigate new models which describe the global spread of disease much more realistically.

The researchers "are optimistic that this will drastically improve predictions about the geographical spread of epidemics." For more on tracking money to understand disease spread, see the Max Planck Society's press release, "Trace the Money."

## Volcanic Blast Likely Killed and Preserved Juvenile Fossil Plesiosaur Found in Antarctica

Amid 70-mile-per-hour winds and freezing Antarctic conditions, an American-Argentine research team recovered the well-preserved fossil skeleton of a juvenile plesiosaur--a marine reptile that swam the waters of the Southern Ocean roughly 70 million years ago.

The fossilized remains represent one of the most-complete plesiosaur skeletons ever found and are thought to be the best-articulated fossil skeleton ever recovered from Antarctica. The creature would have inhabited Antarctic waters during a period when the Earth and its oceans were far warmer than they are today. The NSF and the Instituto Antártico Argentino funded the expedition. See the NSF press release for additional information about this finding.



*This artist's rendering depicts how a mother and juvenile plesiosaur may have looked. Credit: Nicolle Rager Fuller, NSF.*

## Understanding the Building Blocks of Language and Thought

*With this type of toy, English-learning toddlers learn the concept of "in" while Korean-learning toddlers learn the concept of "tight-fit." Through research to discover whether English-learning toddlers could think like their Korean-learning counterparts, Casasola found that babies as young as 18 months old can adapt to new language patterns. Credit: Photos.com.*

Plastic nesting cups and Legos™ are more than mere playthings for babies. They are powerful tools in developing an understanding of spatial concepts, according to Marianella Casasola, an associate professor of human development at Cornell University who has received NSF support early in her research career.

She is documenting the connections between language input and human thought processes by studying the building blocks of language acquisition in infants. Her research shows that infants comprehend spatial relationships such as "in" and "on" through language input from caregivers and the babies' own play behaviors.

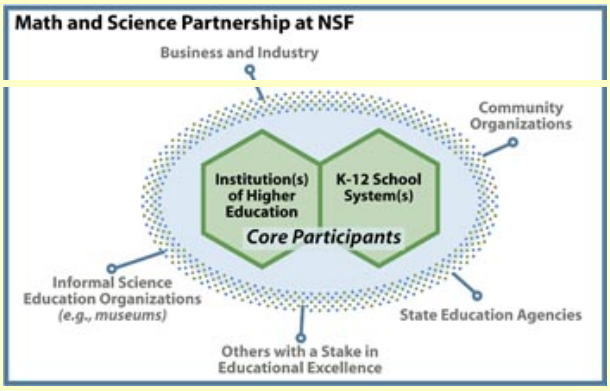
"Some argue that spatial concepts shape language," said Casasola, who received an NSF Faculty Early Career Development program (CAREER) award and the Presidential Early Career Award for Science and Engineering (PECASE). "But our research suggests that it also may be the other way around. Our specific language can actually help us form particular spatial concepts."

See the NSF Discovery to learn more about the interesting results coming from this researcher's studies with babies of English-speaking and Korean-speaking parents.

## Did You Know?

A major research and development effort, NSF's Math and Science Partnership (MSP) program responds to concerns over the performance of the nation's children in mathematics and science. Forty-eight partnerships and more than 30 other tool-development and evaluation projects comprise NSF's current MSP portfolio. NSF's research and development focused MSP complements programs at the U.S. Department of Education that disseminate educational tools and strategies to all 50 states via formula funds.

To date, NSF's MSP program has impacted over 141,000 science and math teachers and 4.2 million students in over 530 local school districts. Since its inception, NSF has funded 72 Math, Science Partnership projects. Visit NSF MSPnet for more information on the individual projects.




*Through the Math and Science Partnership program, NSF awards competitive, merit-based grants to teams composed of institutions of higher education, local K-12 school systems and supporting partners. At their core, Partnerships contain at least one institution of higher education and one K-12 school system. Credit: Nicolle Rager Fuller, NSF.*

## Faces of NSF Research

### Starting Small but 'Thinking Big' -- An Interview with NSF Program Director Art Hicks

**At Tougaloo College, a small historically black institution in Jackson, Mississippi, Art Hicks was inspired to change his major from history to biology when his professor recognized his talent and encouraged Hicks to become his laboratory assistant. Hicks found biology so exciting that he helped organize the college's first Biology Club. The road from college has taken Hicks on a tremendous journey with stops in academia and government. Now, as the program director of NSF's Louis Stokes Alliance for Minority Participation (LSAMP) program, Hicks is inspiring young, minority students to pursue careers in science and math. Hicks recently received Congressional honors for his leadership of the LSAMP program.**

***NSF: Please share your early experience with science and how it led to NSF.*** **Hicks:** In the late 1950's, Dr. Brown, an NSF representative, spoke to selected students at Jim Hill High School in Jackson, Mississippi, about careers in science and math. My classmates and I were energized by Dr. Brown and the seemingly countless number of opportunities in science and math fields that he mentioned. Many of us went on to earn graduate degrees in a number of fields including teacher education, math, physics, engineering and botany.

***NSF: What do you consider to be the biggest challenge to LSAMP?*** **Hicks:** The lack of employing best practices and strategies at the colleges and universities in the LSAMP portfolio remains a challenge, but significant progress is being made. Selected states and regions continue making major budgetary commitments to broaden participation. For example, South Carolina contributes greater than $600,000 annually to LSAMP, and Alaska-Anchorage opened a $14-million science and engineering facility that houses the LSAMP program.

***NSF: With your early research experience as an undergraduate, what advice would you give institutions to provide similar opportunities to their students?*** **Hicks:** Clearly, the integration of research and education looms large for most institutions given the traditional teaching and learning delivery system. An instructional model involving 'active learning' in contrast to the 'old straight lecture' approach would likely reach the mark. The active learning model would provide small group interactions as a teaching-learning strategy in answering research questions. Institutions can change the instructional delivery system.

**LSAMP has increased the quantity and quality of underrepresented minority students graduating with STEM degrees. Since its inception, minority enrollment in STEM majors at more than 450 LSAMP-participating institutions increased from 35,670 in 1991 to more than 205,000 in 2003. Annually, almost 25,000 baccalaureate degrees are conferred to minority students as a result of LSAMP alliances.**

***NSF: What advice would you give undergraduates choosing between graduate school and the workforce?*** **Hicks:** Regardless of the size of the institution they attend, I would encourage them to 'Think big, Sight Globally, Act Locally, and Work with a Passion!' The best and brightest students must look beyond their individual campuses and regions. They must incorporate a world view in the learning process, get involved in selected community service activities, and work with focused enthusiasm -- fire and fervor!

## NSF in the News

Plugging in to Science -- *The Scientist (12/15/2006)* -- A Web-based game now under development with funding from NSF is designed to help high-schoolers understand how policy decisions affect global warming by challenging them to make tough choices as a politician, a scientist, and an economist and then having them evaluate the results of their choices.

Science Called Key to U.S. Competitiveness -- *Chemical & Engineering News (12/05/06)* -- Harvard University economics professor Richard Freeman, a scholar at the D.C.-based think tank Brookings Institution, in recommending a renewed commitment to technological innovation in the United States notes that while the number of college students graduating with bachelor's degrees in science and engineering has increased threefold in the United States since the early 1960s, the same number of NSF fellowships are still granted.

Papers Urge Plans to Enhance Economic Competitiveness Through Academic Research -- *The Chronicle of Higher Education (12/04/06)* -- The Brookings Institution has posted on its Web site a white paper by university scholars that urges an increase in the number and value of graduate research fellowships awarded by NSF.

*Excerpts from*

## "Shaping the Workforce"

**NSF Graduate Schools Annual Meeting**

*by*

**NSF Deputy Director Kathie L. Olsen**

**December 8, 2006**

It's not mere coincidence that "advancing" and "promoting" are in both the mission of the Council of Graduate Schools and NSF. We all agree that the foundation of America's competitiveness is a well-educated and skilled workforce.

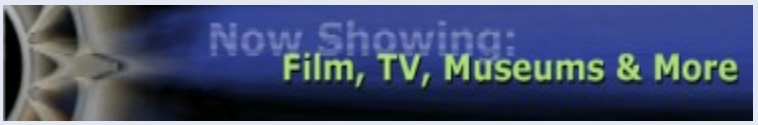
At the same time, the U.S. labor force is hungry for qualified scientists and engineers. The Bureau of Labor Statistics forecasts that employment in traditional science and engineering science and engineering (S&E) occupations will increase about 70% faster than the overall growth rate of all occupations.

Additionally, jobs not typically classified as S&E will increasingly require some understanding of science and technology. Encouraging S&E students to consider "untraditional" career options is now part of our broader responsibility. Pursuing a Ph.D. in science and engineering opens up the door to an incredible number of opportunities.

In essence, we might have to add strategic planning to the graduate student vocabulary. It's becoming more and more important for students to think about career paths while deciding about classes, research projects, or summer jobs.

We need a cadre of workers who can collaborate across interdisciplinary and international borders. Part of NSF's mission is to educate an S&E workforce to meet changing times. This means being capable of quickly absorbing new knowledge, and adapting to new and advanced technologies.

*Visit NSF's Office of the Director for more speeches by Dr. Olsen.*




***NSF supports a wide variety of educational and informational television programs. A few of these features are highlighted below.***

**Be sure to tune in!**

When Things Get Small -- This program teaches viewers about nanoscience -- technology at one-millionth of a millimeter -- through an entertaining mix of science and humor. *Credit: UCSD-TV.*

Cyberchase -- A mystery-adventure cartoon produced by Thirteen/WNET, this show is a vehicle for teaching mathematics and problem-solving, with action centering around three kids and their avian sidekick Digit.


DragonflyTV -- A PBS science series produced by Twin Cities Public Television that promotes authentic science inquiry by presenting "real kids doing real science."


Einstein's Big Idea -- NOVA pays tribute to Albert Einstein's remarkable equation, a special two-hour presentation that dramatizes the stories of the men and women whose innovative thinking across four centuries led to Einstein's bold breakthrough.

"Fetch! With Ruff Ruffman" -- features real kids, real challenges, real science and an unreal animated host -- a dog named Ruff Ruffman. *Credit: ©WGBH Educational Foundation.*

See NSF's Now Showing for more on NSF-supported television programs, museum exhibits, movies and more!

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**SAVE THE DATE! ... SAVE THE DATE!**
**NSF FY 2008 BUDGET ROLLOUT and OPEN HOUSE**
**NSF Headquarters in Arlington, VA**
**February 5, 2007**
**DETAILS TO BE ANNOUNCED**

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