INSIDER

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Turning Plant Cells into Tiny Factories

Metabolomics gets $1 million jumpstart

Imagine if you could manipulate a potato plant to produce tubers that were high in insulin instead of starch. Or a cotton plant that produced natural fibers that were as strong as nylon.

Those and millions of other possibilities may someday prove feasible if the research efforts of Ames Laboratory's Ed Yeung and a team of Ames Lab and Iowa State University scientists can make inroads to understanding plant metabolism. Yeung received notice in August that his proposal in the fledgling field of plant metabolomics would received $1.02 million from the Department of Energy over the next two years with additional money coming in 2007 and possibly beyond.

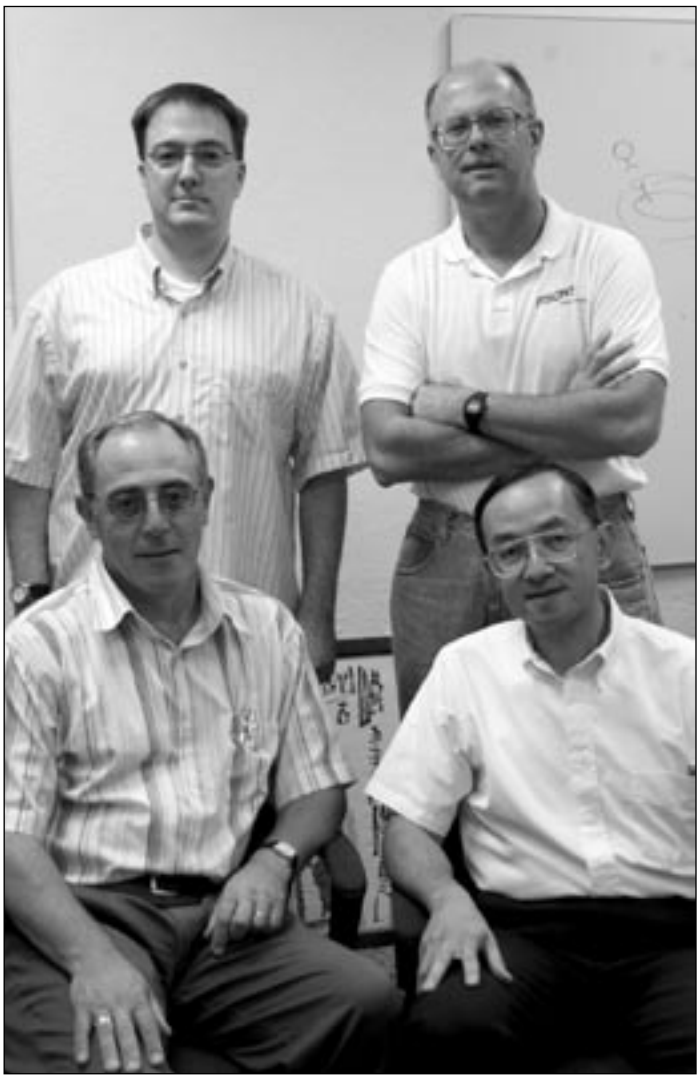
"We know a lot about the genetic makeup of many plants, but we know very little about the chemical changes that take place within plant cells that eventually produce sugars, fibers or waxes," says Yeung, program director of Chemical and Biological Sciences and principle investigator on the project. "If we can understand metabolism, then ideally, all the materials a plant produces can be controlled."

The project, "Mass Spectrometric Imaging of Plant Metabolites," combines the analytical chemistry expertise of Ames Laboratory with the strength of ISU's Plant Sciences Institute. Yeung, who is also a distinguished professor of chemistry at ISU, is internationally recognized for his work in developing separation and detection technologies. He has also won four R&D 100 awards.

Also working on the project are Sam Houk, an Ames Lab senior chemist who specializes in identifying trace elements using inductively couple plasma-mass spectrometry, and associate scientist and ISU chemistry professor Ethan Badman, who specializes in mass spectrometry and gas-phase methods of analysis for biological molecules. Rounding out the team is Basil Nikolau, director of the Plant Sciences Institute's Center for Designer Crops and a specialist in biochemistry and functional genomics of plant metabolism.

Funding from the Chemical Sciences, Geosciences and Biosciences Division of the DOE's Office of Basic Energy Sciences provides $340,000 for operation and equipment this year and another $680,000 in 2006. Additional money is expected in 2007 and could continue if the program receives good marks during a peer review scheduled for 2008.

Before they can study the chemical makeup within plant cells, the team must construct new analytical instruments *(continued on page 2)*



(clockwise from front right) Ed Yeung, Basil Nikolau, Ethan Badman, and Sam Houk will be working on developing new analytical equipment as the first step in a project to study plant metabolomics. The mass spectrometry equipment will be sensitive enough to distinguish the chemicals found within individual plant cells.

Metabolomics project funded *continued from page 1*

capable of identifying molecules in such minute quantities.

"Developing the instrumentation is a large part of the proposal and we're building a special, high-resolution mass spectrometer," Yeung says, "because there's nothing available commercially that meets our needs." He adds that the equipment will be housed in the Roy J. Carver Co-Laboratory on the ISU campus.

Mass spectrometry works by measuring the mass of individual ions – molecules that have been electrically charged. Plant material is ionized into a gas, sorted in an analyzer chamber according to the mass-to-charge ratios, and collected by an ion detector. The detector converts ion flux into a proportional electrical current. Finally, the magnitude of the electrical signals is recorded and plotted as a mass spectrum.

Arabidopsis thaliana

The ability to sort and detect these ions at cellular-scale quantities is where the team hopes to fine-tune the instrumentation.

Once the equipment is ready, the team will look at the chemical content in the cells of *Arabidopsis thaliana*, a small flowering plant that is widely used as a model organism in plant biology. Arabidopsis is a member of the mustard (Brassicaceae) family, which includes cultivated species such as cabbage and radish.

"Arabidopsis is not a major crop like corn and soybeans," Yeung says, "but because so much is already known about it genetically, we can hopefully begin to draw correlations between the chemical and genetic makeup. We hope that such fundamental research will be applicable to other plants as well." ■

~ Kerry Gibson

Meeting to Review Energy Employee Compensation Program

Energy Employee Occupational Illness Compensation Program

During the period of the Cold War, thousands of workers were employed in the nation's atomic weapons programs. The work was dangerous and consequently many workers may have been exposed to radioactive and toxic substances.

Recognizing that workers at these facilities may be suffering from illnesses caused by their work, Congress passed the Energy Employees Occupational Illness Compensation Program Act (EEOICPA) to provide compensation to persons who have become ill as a result of work at atomic weapons facilities. The law became effective July 31, 2001.

Because of the involvement of Iowa State College in the Manhattan Project and subsequent research at Ames Laboratory, individuals, or their survivors, may be eligible for benefits under the Energy Employees Occupational Illness Compensation Program (EEOICP).

To explain the EEOICP, a town hall meeting is expected to be held in Ames in November for former employees and their survivors. A joint mailing from the Department of Energy and Department of Labor will be sent to more than 12,000 former Ames Lab employees to make them aware of the program and the upcoming meeting. Many of these people may have heard of or participated in Part B of the program but need to be aware that they may be eligible for additional benefits granted when the act was amended (Part E) by Congress in 2004.

The following is a brief description of the two parts of the EEOICP:

Part B of the EEOICP was enacted to provide compensation to workers with beryllium disease, silicosis or radiation- induced cancer. Employees, or their survivors, whose claims are approved may receive a lump-sum payment of $150,000 and medical benefits for the covered illness. Uranium workers who received compensation under Section 5 of the Radiation Exposure Compensation Act (RECA) are eligible for an additional $50,000 in compensation under EEOICP.

In October 2004, Congress amended the EEOICP with Part E, which provides compensation and medical benefits for DOE contractor and subcontractor employees whose illnesses were caused by exposure to any toxic substance while working at a DOE facility. Qualified survivors are the spouse of the employee and children who were either under the age of 18, full-time students under the age of 23, or any age and incapable of self support at the time of the employee's death. The passage of this legislation means some individuals who have received payments under the existing Part B may be eligible for a new federal payment if qualified under Part E.

In addition to the informational meeting, former workers will be able to sign up to have medical histories taken. The histories, along with possible medical screenings, will be used to determine if illnesses are work-related and if the employee is therefore eligible for benefits under either part of the program.

The medical review will be done through the University of Iowa Hospitals, which has also been involved in assisting former workers at the Iowa Ordnance Plant in Burlington. ■

New Employees

Steven Carter, engineer IV (Mark Grootveld)
Gezahegn Chaka, postdoctoral fellow (Andreja Bakac)
Joerg Fink, visiting scientist (Adam Kaminski)
Rochelle Henry, administrative specialist II (Mark Gordon)
Xinhua Hu, postdoctoral fellow (Kai-Ming Ho)
Rajeev Kumar, postdoctoral fellow (Marek Pruski)
Pierre Palo, postdoctoral fellow (Marit Nilsen-Hamilton)
Tatiana Prozorov, postdoctoral fellow (Balaji Narasimhan)
Angela Teig, secretary II (Rebecca Shivvers)
Timothy Williams, postdoctoral fellow (Surya Mallapragada)
Bolin Zhu, postdoctoral fellow, (Robert Angelici)

Pat Thiel to Receive Honorary Degree from French University

Patricia Thiel, Ames Laboratory senior chemist and distinguished professor of Liberal Arts and Sciences at Iowa State University, will receive an honorary Ph.D. degree in October.

Thiel will receive the "Doctor Honoris Causa" from the Institute National Polytechnique de Lorraine on Oct. 3, in Nancy, France.

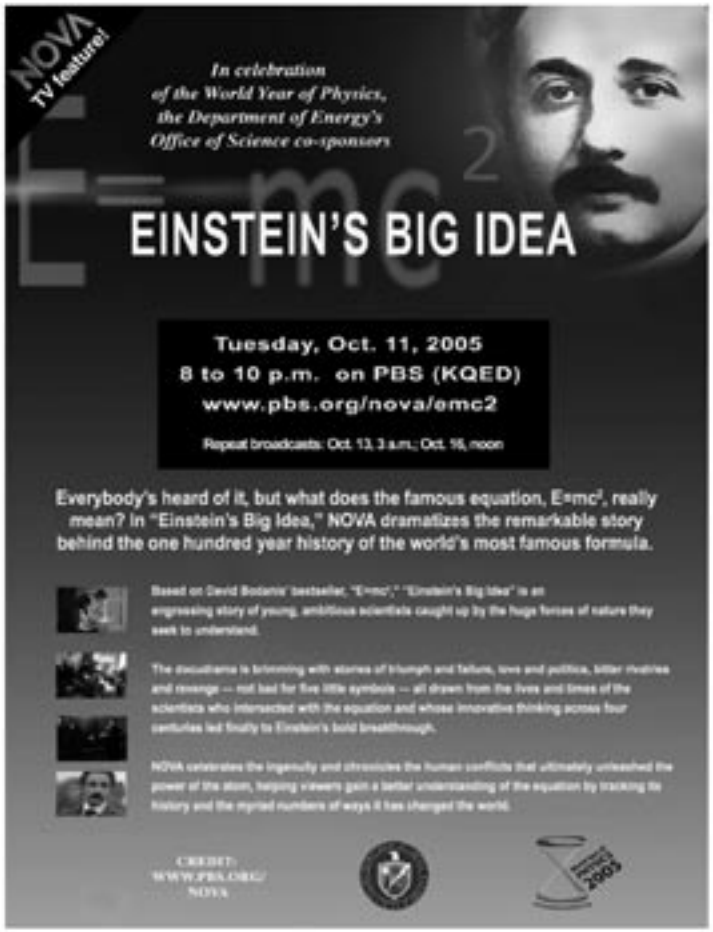
An expert in the chemistry and physics of surfaces, Thiel has made pioneering contributions in investigating the interactions of water molecules with metal surfaces and has contributed to further understanding the evolution and growth mechanisms of metal surfaces and nanostructures.

She has served as a site reviewer for the National Science Foundation and has been a member of the advisory council of the Office of Basic Energy Sciences for the U.S. Department of Energy. At Iowa State, Thiel formerly served as director of Ames Lab's Materials Chemistry Program and as chair of the ISU department of chemistry.

Pat Thiel

Her numerous awards and honors include the NSF Presidential Young Investigator Award, the ISU Foundation Award for Outstanding Achievement in Research and the DOE's Award for Outstanding Scientific Accomplishment in Materials Chemistry. ■

Steve Karsjen, manager of Public Affairs, accepts a check for $1,000 from Cheri Pearson from 3M of Ames. The donation will be used to help fund the Lab's Science Bowl program, which includes both the middle school and high school science bowls.



NOVA Examines History of E=mc²

DOE helps fund "Einstein's Big Idea"

As the federal agency designated to lead the 2005 World Year of Physics celebration in the U.S., the Department of Energy is helping fund the NOVA production of "Einstein's Big Idea," which will air on Tuesday, Oct. 11, from 8-10 p.m. on PBS. (Check your local listings.)

The October NOVA production dramatizes the incredible story behind this equation on "Einstein's Big Idea," a two-hour special narrated by John Lithgow. ■

Hansen Lecture Oct. 13

The Hansen Lecture will be Thursday, Oct. 13, at 2:10 p.m. in 301B Spedding. Robert Hansen was a former director of the Ames Laboratory.

The guest speaker will be Professor Carl Lineberger of the department of chemistry, University of Colorado-Boulder. His talk is titled "Radicals, Reactive Intermediates and Transition States: Chemistry Along the Reaction Coordinate."

Lineberger is interested in the structure and stability of ions and free radicals, photoelectron spectroscopy of anions, and photophysics and dynamics of cluster ions. The experimental methods all involve the interaction of laser radiation with mass-selected ion beams. For more information on Lineberger's research, go to:

http://www.colorado.edu/chem/DEC/people/linebergerc.html

Stars of the Federal Laboratory Consortium

Three from Lab recognized for technology-transfer efforts

Three Ames Lab employees received awards from the Federal Laboratory Consortium at the organization's Mid-Continent Regional Meeting, Sept. 13-16, in Monterey, CA. The FLC awards recognize the Lab for superb efforts in linking its mission and expertise with potential users of government-developed technologies and services.

George Kraus, Ames Lab assistant director of Bio-Related Initiatives and director of the Lab's Biorenewable Resources Consortium, received the FLC Mid-Continent Regional Award for Distinguished Service.

The Biorenewable Resources Consortium develops technologies that use agricultural commodities as energy sources and chemical feedstocks. Major goals of the BRC are to reduce the national dependency on nonrenewable energy and to influence U.S. international economic competitiveness, rural development and a cleaner environment.

In the past two years, the BRC initiated 11 Cooperative Research and Development Agreements, CRADAS, with universities and industry. Projects ranged from developing new products from feathers to uses for sorghum and corn plants.

Kraus is also a professor of chemistry at Iowa State University, where he is the director of the university's Center for Catalysis, which has recently developed catalysts for the conversion of soybean oil to biodiesel fuel.

Victor Lin, an Ames Lab associate and an ISU associate professor of chemistry, received the FLC Mid-Continent Regional Award for Outstanding Technology Development.

Lin has developed two catalysts that make the production of biodiesel fuels more efficient and less expensive than conventional technology. He is a member of a creative alternative fuels partnership that includes the BRC, the U.S. Department of Energy, ISU, ISU's Center for Catalysis, the U.S. Department of Agriculture and West Central Cooperative.

Tom Barton (left) and George Kraus display one of the three FLC Mid-Continent Regional Awards won by Ames Lab. (far left): Deb Covey, manager of Ames Lab's Office of Industrial Outreach and Technology Administration. (to the right of Kraus): J. Susan Sprake, FLC vice chair, and Pat Rodrigues, FLC Mid-Continent Regional director.

Victor Lin was not present at the FLC awards ceremony.

Heterogeneous catalysts developed by Lin handle with ease, speed the production of biodiesel and can be separated by filtration and reused again and again. Because no toxic wastes are produced, the cost per unit of production has decreased.

Deb Covey, manager of Ames Lab's Office of Industrial Outreach and Technology Administration, received the FLC Mid-Continent Regional Award for Outstanding Laboratory Representative.

Covey's tremendous effort in bringing Ames Lab to the forefront among the DOE's lab "giants" in regard to licensing and partnering resulted in the Lab having the third-highest licensing income among the Department of Energy's national labs, even though it is one of the smallest labs in terms of funding.

Covey has also been influential within the FLC, serving on the FLC executive board as member-at-large and as recording secretary. In addition, she has been an active contributor on various committees, including legal, nominating and selection.

"Each of these outstanding individuals is to be commended for their meritorious service to the Ames Lab and the nation," says Tom Barton, Ames Laboratory director. "Ames has from the beginning been a strong supporter of the FLC and its efforts to find commercial homes for the technology developed in the federal laboratories."

The FLC is comprised of the technology transfer offices of all the federal laboratories throughout the country and has more than 700 members. The FLC creates an environment that adds value to and supports the technology transfer efforts of its members and potential partners. ■

~ Saren Johnston

The Fun Physics of Toys

Youngsters and adults discover toys and physics are a good mix

How does a Slinky "slink" around?
What makes a yo-yo go up and down?
Why does a whistle give off a sound?

These and other physics-related questions were answered at the Totally Toy Workshop, Saturday, Aug. 27, at the Ames Public Library. The toy workshop was the latest in a yearlong series of events planned and coordinated by the Lab's Public Affairs office to help celebrate the 2005 World Year of Physics.

Adam Kaminski, an Ames Lab physicist and an Iowa State University assistant professor of physics and astronomy, led the workshop, giving a brief overview of the toys and the physics they incorporate to the approximately 60 youngsters and parents in attendance. Following Kaminski's introduction, the kids took off for the various toy workstations to experiment with the toys and test out the physics for themselves.

The workstations included air-propelled toys, friction toys, gravity toys, magnetic toys, and toys that demonstrate surface tension. The station for the air-propelled toys was, perhaps, the most popular. There, stomp rockets and screaming balloons provided a tremendously successful introduction to such concepts as propulsion, thrust and drag.

The Slinky station was also a hit with the kids and adults, who learned more about such concepts as inertia, potential energy, kinetic energy and gravity by making the Slinkys "walk the walk." In addition, the Slinkys offered a great way to acquaint the youngsters and their parents with longitudinal, transverse and standing waves.

Another popular toy was the yo-yo, which helped attendees better understand the concepts of gravity, kinetic and potential energy, friction and center of mass.

At the soap bubble station, everyone had a chance to get "wet and wild" while learning about cohesion and surface tension. Friction toys, such as the flywheel toys and friction-powered cars and trucks emphasized the ideas of momentum and rotational kinetic energy. And levitrons, devices that appear to be magic levitating tops, showed participants the power of magnetism and the forces of attraction and repulsion.

Finally, Kaminski explained a less common toy, the Stirling engine, to the many visitors who stopped at that station. He told them about the Stirling cycle, which involves a series of events that change the pressure of the gas inside the engine, causing it to do work.

The Totally Toy Workshop was made possible by an outstanding group of Ames Lab, IPRT and ISU volunteers and their spouses: Connie and Mike Vaclav, Chris and Meagnon Strasburg, Bill and Leona Sears, Lynne Mumm, Linda Dutton, Ed Yu, Jan Weedman, Bob Mills, Saren Johnston and Adam Kaminski. ■

~ Saren Johnston

Stomp rocket ready for launch.

"Making waves." (volunteer: Chris Strasburg)

Sparking an interest. (volunteer: Adam Kaminski)

Air-propelled "screamers."

Holiday Auction set for Dec. 7

Public Affairs is accepting donations for the silent and live auctions that are held in conjunction with the annual Ames Lab/IPRT Holiday Party, which this year will be Wednesday, Dec. 7, from 2-4 p.m. in the Spedding auditorium. Please bring auction items to 111 TASF.

The sooner we get your auction items, the sooner we can post them for people to view by going to http://internal.amelab.gov and clicking on the link to the holiday auction site. Donated items will be placed on display in Public Affairs, 111 TASF, where employees can stop to place silent auction bids.

Mary Greeley's Israel Family Hospice House will be the recipient of funds raised at the Ames Lab/IPRT Holiday Auction this year. The Israel House offers comprehensive end-of-life services in a home-like setting. The facility serves patients in a 50-mile radius of Ames.

Early donations to the mitten, hat and scarf tree and the food pantry may also be brought to Public Affairs. These items will once again be donated to Mid-Iowa Community Action.

Thank you in advance for your support of the holiday auction. With your help, Ames Lab and IPRT can make a positive contribution to the lives of others this holiday season.

R&D 100 Awards

How often have you thought about it but then "blew off" submitting an entry to the R&D 100 Awards competition? Well, here's a word to the wise: "You can't win if you don't send in!" So, go to *http://www.rdmag.com/awards.aspx* and take a look at the application form, which will be available at this Web site in late October.

Yes, the entry form will take some time to complete, but Public Affairs will help you with various aspects of the application process. If you think you might like to apply for a 2006 R&D 100 Award, please contact Saren Johnston at 4-3474 or *sarenj@ameslab.gov*.

Since 1984, Ames Lab has won 15 R&D 100 Awards.

Attention Volunteers — Science Bowl is January 28th

The Ames Lab/ISU High School Science Bowl will be Saturday, Jan. 28, in the Memorial Union. Volunteers are needed to staff the fast-paced, daylong competition that annually hosts over 300 students and their coaches.

Volunteers are needed to serve as judges, moderators, timekeepers and scorekeepers. You don't need to be a scientist to participate. Training sessions will be held prior to the event.

Please complete the volunteer form at *http://www.external.ameslab.gov/sbvolunteer.htm*. Return to Saren Johnston, *sarenj@ameslab.gov*, or send to 111 TASF by Friday, Nov. 18.

SMILE — All-hands Lab Photo is Oct. 4

Better than a fire drill, more exciting than a tornado warning – it's the Ames Lab group photo. Please show up on Tuesday, Oct. 4, at 10 a.m. in front of TASF.

Rain date: Oct. 5, same time, same place.

United Way

United Way of Story County

Your United Way contributions support 90 human services and community initiatives that help over 30,000 people in Story and surrounding counties.

The Ames Lab/IPRT 2005 goal is $10,500.

Please return your envelopes with donations to Public Affairs, 111 TASF. We'll forward them on to United Way.

Campaign ends on October 14 so please return your envelopes.

Thanks,
Steve Karsjen, division leader
Ames Laboratory/IPRT United Way campaign

SASNET Group Tours the Lab

Security managers get a peek at Lab research

Safeguards and Security Network members visited the Lab in September to meet with David Baldwin, Safeguards and Security program director, and Tom Wesels, Environment, Safety, Health and Assurance manager.

SASNET is made up of security managers from Department of Energy Office of Science labs and the manager of the National Renewable Energy Laboratory. The group had gathered to discuss common issues related to Safeguards and Security program management, order implementation and future challenges.

During their visit to the Lab, the SASNET members were treated to a tour of the Materials Preparation Center by Larry Jones, MPC director, and Trevor Riedemann, manager of the MPC's rare earth materials section. They also had the opportunity to learn more about magnetic refrigeration from senior metallurgist Karl Gschneidner and senior scientist Vitalij Pecharsky.

(from left) SASNET members John Bavlish, Princeton Plasma Physics Laboratory; Terry Owens, University of California Office of the President; Mark Logan, Oak Ridge National Laboratory; Jerry Jobe, Stanford Linear Accelerator Center; Chris Burrows, Thomas Jefferson National Accelerator Facility; and Ames Lab hosts, David Baldwin, Tom Wessels and Larry Jones.

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