

**Northeast Region Labs Among FLC Award Winners**

Two laboratories from the Northeast Region have been selected as winners of 2008 FLC awards. The awards, which recognize outstanding technology transfer efforts from laboratories across the country, will be presented in Portland, Oregon, on May 8.

**Department of Agriculture – New England Plant, Soil and Water Laboratory**

A team from the New England Plant, Soil and Water Laboratory (NEPSWL), located in Orono, Maine, will be presented with an Award for Excellence in Technology Transfer. The NEPSWL team developed the Potato Systems Planner, a decision support tool on compact disk to assist growers in selecting profitable, environmentally sound cropping systems and management practices. Information presented in the Potato Systems Planner helps growers make the most informed cropping system selections and employ the most appropriate management practices that are economically and environmentally sustainable. This translates into higher potato yield and quality, along with substantial economic, environmental, and health and safety benefits associated with less pesticide needed to control diseases that can strike crops.

Since its release in 2005, over 1100 copies of the Potato Systems Planner have been requested by growers, consultants, extension specialists, and scientists who are now using the Planner in 26 states, eight Canadian provinces, and 28 countries. The Potato Systems Planner was selected as one of only 11 “science track” presentations at the World Potato Congress in Idaho and the International Symposium on Farming Systems in Sicily, Italy. The transfer of this technology to customers, stakeholders, and federal laboratory partners is continuing to this day.

**Naval Undersea Warfare Center Division Newport**

Captain Michael Byman, Dr. Paul Lefebvre, and Donald Aker of the Naval Undersea Warfare Center (NUWC) Division Newport will jointly receive the FLC Laboratory Director of the Year award for their strong support of technology transfer. Under the senior leadership of the NUWC team, technology transfer continues to be a major component to the overall science and technology (S&T) thrust at the Rhode Island-based facility.

For instance, the NUWC team made a special effort to reach out to the medical community, realizing that many of the technologies under development may have applications in health care and medical research. As a result, the groundbreaking Digital Image Enhancement (DIE) technology has been successfully transferred and commercialized under a patent license agreement with Advanced Image Enhancement, Inc. Originally used to help sailors identify mines in a cluttered underwater environment, DIE uses mathematical functions called wavelets to help doctors detect tissue anomalies and to interpret digital mammograms. With DIE in place at hospitals and clinics across the nation, doctors will be able to refine and enhance regions of concern within mammography images to improve the detection of cancer in its early stages.

## **FLC Northeast Region Newsletter – Spring 2008**

### **2008 NE Region Spring Meeting Review**

The Northeast Region held its spring meeting February 20-22 in Pomona, New Jersey. The three-day meeting drew a large number of technology transfer professionals from government, industry, and academia, as well as members of the FLC Executive Board.

The Seaview Resort and Spa in nearby Galloway was the site of the kickoff reception the evening of February 20, giving attendees a chance to mingle and have fun in advance of the full meeting schedule. For the next two days the meeting shifted to the FAA William J. Hughes Technical Center (WJHTC), where attendees heard presentations on a number of topics, including educational partnership agreements, emergency preparedness, and activities within the New Jersey Department of Homeland Security.

A highlight of the meeting was a tour of the various testing and research facilities located at the WJHTC, including the Airborne Testing Laboratory, R&D Human Factors Laboratory, and the Department of Homeland Security's Transportation Security Laboratory.

Meeting proceedings and a photo gallery can be viewed at [www.flcnortheast.org](http://www.flcnortheast.org).

## Efficient Catalysts for Making Oxygen for Artificial Photosynthesis

Scientists at Brookhaven National Laboratory and the Institute for Molecular Science in Japan are trying to mimic part of the complex natural process of photosynthesis with the goal of making nonpolluting fuels such as hydrogen for use in fuel cells. In the March 10, 2008, web release of the journal *Inorganic Chemistry* containing a forum on "Making Oxygen," the scientists report they were able to mimic the "water oxidation catalysis" that occurs in natural photosynthesis.

Water oxidation, a step in photosynthesis, is one part of "water-splitting"—splitting water into hydrogen and oxygen, a very complex process. Water-splitting requires a large amount of energy from sunlight and metal catalysts to activate the very stable water molecules. It occurs as two separate "half" reactions: water oxidation produces the oxygen, along with protons and electrons; these protons and electrons are then combined to make molecular hydrogen.

"The water oxidation reaction is generally believed to be the 'limiting' process, meaning that if it is not catalyzed efficiently, it limits hydrogen production," said Brookhaven chemist James Muckerman, co-author of the current paper. "You can't sustain hydrogen production without the protons and electrons generated by water oxidation. So, to make hydrogen from water for use in fuel cells, we must meet the challenge of performing efficient and inexpensive water oxidation."

Brookhaven chemist Etsuko Fujita, co-author of the paper, explains how the Brookhaven team has been collaborating with Japanese scientists Koji Tanaka and Tohru Wada, who in 2001 discovered a novel catalyst that appears quite promising for water oxidation. "We are combining theoretical and experimental studies to determine how this ruthenium complex with bound quinone molecules efficiently catalyzes water oxidation to form oxygen," she said.

To accomplish the water-oxidation reaction, Tanaka and Wada immobilized the ruthenium catalyst on an electrode, placed it in an aqueous solution, and applied voltage, resulting in a rapid turnover for oxidizing water to oxygen. The research team, which also includes Brookhaven's Dmitry Polyansky, continues to collaborate on further studies to understand the details of how the catalyst works.

The scientists have discovered that when the protons from two water molecules are removed due to acid-base reactions in the solution, four electrons are transferred to electron receptor sites in the catalyst. Once all of the protons are removed, the theoretical calculations predict that an oxygen-oxygen bond is formed.

What makes the Brookhaven scientists' catalyst "novel" is that in most metal-based compound catalysts these electron receptor sites are located on the metal atoms; however, in this ruthenium complex the receptor sites are on the quinone molecules. More theoretical and experimental studies will be needed to fully understand and improve the mechanisms of quinone-containing catalysts.

## Efficient Catalysts for Making Oxygen for Artificial Photosynthesis (cont.)

### The Benefits

Producing hydrogen from water would offer several benefits over current methods, including steam reforming of natural gas, which produces carbon dioxide along with the hydrogen. Heat derived from fossil-fuel combustion is currently used to drive the steam-reforming process, and results in even more carbon dioxide as a byproduct, all of which contributes to global warming. Making hydrogen by splitting water would not add carbon dioxide to the atmosphere.

Additionally, hydrogen produced from natural gas contains residual carbon monoxide, which can "poison" the expensive electrodes in fuel cells, requiring their replacement. Hydrogen produced from water does not contain carbon monoxide, and therefore does not subject fuel cell electrodes to poisoning.

"The ruthenium in our catalyst is somewhat expensive, so we plan to continue our studies with more economical catalysts incorporating less expensive metals," Muckerman said. Hydrogen made by water splitting could also be used directly for combustion in a future hydrogen-based economy.

**Navy Lakehurst Wins Chief of Naval Operations Environmental Awards**

Naval Air Engineering Station (NAES) Lakehurst recently received two 2007 Chief of Naval Operations (CNO) Environmental Awards for Natural Resources Conservation for Small Installations, and for Environmental Quality for Non-industrial Installations. The CNO Environmental Awards Program recognizes ships, installations, and individuals (or teams) for their exceptional environmental stewardship.

“I have always been impressed with the work done by our Environmental Department, led by Dennis Blazak, and the overall Station’s attitude of being responsible stewards of our environment,” said Capt. Phil Beachy, Commanding Officer. “These awards confirm what I have always known and give us all a reason to be justly proud. Of course, we cannot ever consider the effort to be responsible stewards of the natural and cultural resources with which we have been entrusted complete. We have much to do to continue to be worthy of these awards and worthy of our earned reputation.”

As a CNO winner, NAES Lakehurst will advance to the Secretary of the Navy Environmental Awards competition. The CNO Environmental Awards are scheduled for presentation on June 3 at the United States Navy Memorial and Naval Heritage Center in Washington, D.C.

## Ribbon Cutting Ceremony Held For SSC-Natick Facility

On March 7, the U.S. Army Soldier Systems Center (SSC) in Natick, Massachusetts, held a ribbon cutting ceremony for the new Thermal Test Facility (TTF). This facility will provide the center's researchers with unprecedented capabilities to evaluate the effect of flame and thermal threats against protective clothing and individual equipment. It also will assist in the development of new and improved materials for flame and thermal protection for the individual soldier.

Brig. Gen. R. Mark Brown, commanding general, SSC and Program Executive Officer Soldier, said the facility was brought about as a byproduct of war. "Flame weapons and injuries have been around since ancient times," he commented. "Since Archimedes threw oil fireballs onto Roman ships, through the use of flamethrowers in World War II, then as we moved into the 20<sup>th</sup> century with the increase of mechanics and fuels, flame threats have always been an issue. Currently, we see the need for this type of work as jihadists use incendiary improvised explosive devices, or IEDs.

"This new facility will be an important asset for our researchers," Brig. Gen. Brown continued. "It will allow us to consolidate this work in one location." Previously, the work was not only done at Natick, but at other facilities throughout the state and country. Brown went on to express gratitude for the work done at the center, saying that he was speaking for soldiers around the world.

Rocco DiRico, Deputy District Director for Congressman Edward Markey, spoke on behalf of the Congressman, who has supported plans for the TTF since its conception. "Congressman Markey is honored to represent SSC in Congress, as all of you at the center work to protect the American soldier at home and abroad. Thank you for all your hard work supporting the soldier."

The Secretary of Housing and Economic Development for the State of Massachusetts, Daniel O'Connell, spoke on behalf of Gov. Deval Patrick. The cooperation between government, both state and federal, business and academia was the main focus of O'Connell's comments. "Good things happen when government, all government, business and academia work together for a common goal." O'Connell went on to say that the state is committed to the center's growth and success.

The last speaker before the ribbon cutting was Dr. Marilyn Freeman, director of the Natick Soldier Research, Development and Engineering Center (NSRDEC). Dr. Freeman said that in addition to the soldiers themselves, the NSRDEC also benefits from having this new facility. "We are giving the scientists and engineers a world-class facility," she said. "Surviving flame, fire and heat is not something we think about every day, but it is something our service members have to live with every day. It takes special equipment and innovation to figure out how to protect them. We can't keep soldiers out of harm's way, but we can help to keep them as safe as possible.

**Ribbon Cutting Ceremony Held For SSC-Natick Facility (cont.)**

“We know we can perform state-of-the-art flame work in the facility,” Dr. Freeman continued, “and we can see whether the flame will burn, extinguish itself, or explode. We can also see if a confined item can stand up to heat without catching fire.”

Although the military will be the primary user, Dr. Freeman commented that she saw both first responders and industry being interested in using the facility. She concluded her comments by thanking everyone who helped to make the facility possible.

After the ribbon cutting, subject-matter experts were on hand to explain the various areas and their capabilities throughout the building. The facility is anticipated to be fully operational in September 2008 and is the only known facility in the nation that has the capability to test and evaluate the thermal performance of milligram quantities of materials through full-scale systems such as clothing and tents.

Brig. Gen. Brown commented that there will be a rededication ceremony for the center on April 19, at which the buildings and streets will be named after Congressional Medal of Honor recipients with ties to Massachusetts. The TTF is to be named after Pfc. Joseph Ouellette, 9<sup>th</sup> Infantry Regiment, who entered service in Lowell and was awarded a medal for “conspicuous gallantry and intrepidity in action against the enemy” during the Korean War.

### **Cream of the Crop: Genetic Preservation of Crops**

During the 900-day German siege of Leningrad during World War II, the city's food supply dwindled and eventually disappeared. More than half a million Russians starved to death, powerless against the fate imposed by a ruthless war. But some died willingly. In the world's largest seed bank—stocked with hundreds of thousands of plant specimens by the Russian botanist Nikolai Vavilov and his colleagues—many staff members chose to die rather than consume the edible genetic materials they'd been maintaining since the 19<sup>th</sup> century.

Their sacrifice is an extreme and moving testament to the importance of preserving and protecting plant genetic material, or germplasm. Today, agriculture's success relies on genetic uniformity, which supports large-scale food production. But crops are ultimately weakened by the same homogeneity because it reduces their resistance to disease, pests, and environmental stresses. Genebanks promote the continuation of our food supply by conserving germplasm with valuable genetic traits that can be used to protect and improve commercial crops.

The Agricultural Research Service's (ARS) National Plant Germplasm System (NPGS) includes more than 20 research locations around the United States where scientists safeguard specimens, or accessions, of agricultural crops and conduct research on genetic improvement. Many of these sites—including the Plant Genetic Resources Unit (PGRU) in Geneva, New York—focus on preserving accessions of specialty crops. Some specialty crops make up a significant portion of our diet, so maintaining their genetic diversity is essential. But NPGS researchers don't simply maintain germplasm—they also improve it. And their work has both national and global benefits.

### **Wild for Tomatoes**

Tomatoes are a specialty crop, yet they are among the highest grossing vegetables grown in the U.S. Fresh and processed tomatoes net about \$2 billion annually. However, the tomatoes that grace our BLTs and marinara sauces have been thought to possess limited genetic diversity. One method of improving diversity is to breed cultivated tomatoes with wild tomatoes. Unfortunately, the resulting fruit tends to be unpalatable according to molecular biologist Joanne Labate.

Labate, computational biologist Angela Baldo, and geneticist Larry Robertson at PGRU have found greater genetic variety in cultivated tomatoes than was commonly believed to exist. Understanding how to effectively harness this variation could enable breeders to improve the U.S. tomato crop without relying on bitter wild plants.

The PGRU scientists examined publicly available sequence data from the National Center for Biotechnology Information. Using software that Baldo developed with Derek Huntley of Imperial College London, they identified potential small variations in DNA sequences, called "single nucleotide polymorphisms," in 764 tomato genes.

**Cream of the Crop: Genetic Preservation of Crops (cont.)**

“Of the 53 genes we examined in the lab, 21 revealed significant genetic variations that could be used to aid breeding decisions,” said Labate. “In fact, some breeders are already using the information to make genetic maps.”

Similar work at PGRU, where scientists maintain more than 5,200 apple trees and 1,400 grapevines in the field, has potential benefits for commercial crops. On trips to central Asia, the probable ancestral home of modern apples, research leader Philip Forsline gathered genetic materials now maintained at PGRU and at the ARS National Center for Genetic Resources Preservation (NCGRP) in Fort Collins, Colorado. Some of those are sources of genetic resistance to common diseases, which breeders may soon be able to use. Nearly 2,500 of the apple field plantings at PGRU are backed up as cryopreserved, or frozen, dormant buds at NCGRP.

Many North American grape species with genes for climate tolerance and disease resistance are also maintained at PGRU. “These grapes can be used in hybridizing to create hardy and disease-resistant grapes for both fruiting grapes and grape rootstocks,” said Forsline.

All of this research will eventually improve disease resistance, flavor, and nutrition for some of our most popular crops.