FLC NORTHEAST REGION NEWSLETTER – WINTER 2010

Note from the Northeast Regional Coordinator – Lewis Meixler

Welcome to the winter 2010 issue of *FLC Northeast News*. You'll find this issue informative, as our laboratories are more involved than ever in activities that not only fulfill their mission, but advance the transfer of technology.

The past year was a successful one for the Northeast Region on several fronts. Among our accomplishments, we:

- Won 2009 FLC awards in the categories of Excellence in Technology Transfer, Outstanding Service, and the Harold Metcalf Award.
- Presented three 2009 Northeast Regional Awards in the categories of Excellence in Technology Transfer, Laboratory of the Year, and Regional Coordinator's Excellence Award.
- Held regional meetings in Newport, R.I., and Princeton, N.J., that drew attendees from all over the country.

For more information on other 2009 successes, please read past issues of our newsletter at http://www.flcnortheast.org/news.html.

As the New Year starts, I would like to extend my thanks to all supporters of the Northeast Region and its laboratories. Much of our success is due to you attending our meetings, sending us tips on events that may be of interest to the local technology transfer community and, most importantly, working with our laboratories to make their technologies accessible to all.

Seminal Work for 2009 Nobel Prize in Chemistry Conducted at Brookhaven Lab

Two of this year's three recipients of the Nobel Prize in Chemistry conducted a substantial part of their award-winning research at the National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory.

Dr. Venkatraman Ramakrishnan, a former employee in Brookhaven's biology department and long-time user of the NSLS, now at the Medical Research Council Laboratory of Molecular Biology in Cambridge, UK, and Dr. Thomas A. Steitz of Yale University, also a long-time NSLS user, share the prize with Ada E. Yonath of the Weizmann Institute of Science "for studies of the structure and function of the ribosome."

Ribosomes make the thousands of proteins that are required for the structure and function of each living cell. Specifically, the ribosome translates the genetic instructions encoded by DNA into chains of amino acids that make up proteins. It is composed of two subunits: 30S, which reads the code, and 50S, which links up the amino acids.

Starting in the late 1990s, both Drs. Ramakrishnan and Steitz used a technique called x-ray crystallography at the NSLS to gather atomic-level structures of these two ribosome subunits—Dr. Ramakrishnan on 30S and Dr. Steitz on 50S. In this technique, scientists analyze how a beam of powerful x-rays is scattered by molecules arranged in a crystal to determine the positions of the molecule's individual atoms.

Dr. Ramakrishnan began his work on ribosomes while employed in Brookhaven's biology department from 1983 to 1997, first at the High Flux Beam Reactor and later at the NSLS. Even after leaving the lab to join the University of Utah, he used the NSLS to collect crystallography data that contributed directly to his Nobel Prize. In 1999, his research at NSLS beamlines, especially X25, resulted in the first report of a low-resolution structure of the 30S subunit. In 2000, Dr. Ramakrishnan helped uncover the high-resolution version of the structure, which was based on data from the NSLS, the Advanced Photon Source (APS) at Argonne National Laboratory, and the European Synchrotron Radiation Facility.

At about the same time, Dr. Steitz worked with Brookhaven's biology department to collect NSLS data on the 50S subunit. The first low-resolution structures were solved in 1998 and 1999 using NSLS beamlines X12B and X12C. In 2000, Dr. Steitz' team presented the first high-resolution structure of the 50S subunit using data from NSLS beamlines X12B and X25 and from the APS.

These studies map ribosome functionality at the most basic, atomic level—providing information that is a springboard for researchers to more detailed investigations. The structures of 30S and 50S have been crucial to understanding everything from how the ribosome achieves its amazing precision to how different antibiotics bind to the ribosome, knowledge that could help researchers come to grips with the problem of drug-resistant bacteria.

New Director Robert Johns Greets Volpe Center

Robert C. Johns, the new director of the Volpe Center, introduced himself to the staff in October 2009 with an address that expressed his commitment to furthering Volpe's organizational excellence and expert performance in transportation research, development, and systems deployment.

Prior to beginning his new post at the Volpe Center in September 2009, Johns had been director of the Center for Transportation Studies (CTS) at the University of Minnesota. As director, Johns more than doubled the revenue attracted to the University for transportation research, education, and outreach, leading CTS to the top echelon of university transportation centers in the U.S.

Johns also held research and management positions with the Santa Fe Railway, the Minnesota DOT, and the Metropolitan Council of the Twin Cities. He has over 20 years of experience leading Transportation Research Board (TRB) committees, and currently is chair of the Technical Activities Council, which oversees TRB's 200 technical committees. Johns received a B.S. in Engineering Operations from Iowa State University, and an M.B.A. and M.A. from the University of Iowa.

SAVE THE DATE: March 1-2, 2010, FLC Northeast Regional Meeting, West Point, N.Y.

The Northeast Region 2010 spring meeting is a one-day "working" meeting preceded by an evening welcome reception. This is your opportunity to discuss areas of technology transfer interest with colleagues from our cadre of active laboratory ORTAs. The meeting is strategically located in the central part of the region and will conclude by mid-afternoon March 2.

Accommodations will be available at the Thayer Hotel (provide link from meeting page). For reservations, call 845-446-4731 by February 15. To receive the $113 per diem rate, be sure to ask for the FLC group code.

Additional information on the meeting, including an agenda, will be posted online at http://www.flcnortheast.org/march2010_meeting.html, so check often.

Picatinny to Construct $18 Million Engineering Complex

During a ceremony November 13 at the U.S. Army Armament Research, Development and Engineering Center (ARDEC) at Picatinny Arsenal, N.J., officials kicked off the first of six renovation and construction projects that will collectively create Picatinny's Fuze Engineering Complex.

Construction of this multi-building complex will bring the entire ARDEC Fuze Division to Picatinny as part of the 2005 Base Relocation and Closure (BRAC) recommendation to establish a joint center of excellence for guns, weapons and ammunition research, said Vicki Naujokas, Picatinny BRAC Project Manager. Forty-five of ARDEC's more than 100 Fuze Division employees are stationed in Adelphi, Md., where they work on fuze science and technology efforts. These positions will relocate to Picatinny as a part of the 2005 BRAC decision, Naujokas said.

The Fuze Division is responsible for the entire life cycle of fuzes, including safing and arming devices, and setters for fuzes in a wide variety of munitions.

The complex will be located in various buildings throughout Picatinny, but collectively these buildings will create a state-of-the-art fuze compound that will increase ARDEC's ability to provide service members with the most advanced weapons technology in the world, said Dr. Joseph A. Lannon, director of ARDEC.

Lannon and Brig. Gen. Jonathan A. Maddux, Picatinny Commanding General, were the featured speakers during the groundbreaking ceremony for building 6, the first building to be renovated for the project. According to Maddux, "Today's groundbreaking... is an important part of our installation's future as it transforms (Picatinny) from the largely Army research, development and acquisition facility it was during the last 30 years to a joint center for excellence for guns and ammunition that the 2005 BRAC commission envisioned."

"Once viewed by some as a candidate for relocation and closure, Picatinny's immediate future appears bright," he continued. "The importance of our mission in support of our nation's warfighters is recognized at the highest levels of government, judging by the new construction we are experiencing."

Lannon said the groundbreaking was significant because it represents an awareness at Picatinny, and in the Department of Defense, of how crucial it is for ARDEC to continue to evolve and enhance its research capabilities if it is going to remain relevant for our nation's warfighters.

While building six will be renovated to include the administrative office space and a fuze laboratory, other complex developments will include:

- Construction of a fuze explosive research building
- Construction of a fuze electromagnetic research building
- Renovation of the anechoic chamber in building 407
- Construction of two ammunition storage bunkers to support the increased fuze mission.

Once completed, the $18 million Fuze Engineering Complex will centralize fuze engineering expertise and facilities, ensuring ARDEC's continued leadership in fuze technology and the development and production support of a wide range of munitions for joint-service warfighters, Naujokas said.

The new facility is expected to open in the fall of 2011, she said. This was Picatinny's second recent groundbreaking event. Officials also broke ground on a new naval packaging, handling, shipping and transportation facility on November 9.

NEFSC, NY Town, and Oyster Grower Collaborate to Understand Potential Impact of Floating Nursery on Local Environment

With demand for seafood growing, shellfish farmers often use a floating nursery called a FLUPSY, or Floating Upwelling System, to improve the growth of very young shellfish known as seed and increase their chances of surviving until they are harvested. Little has been known about the possible impact of these floating systems on the local environment.

A collaborative project between a commercial oyster grower, the town of Riverhead, N.Y., and scientists at the Northeast Fisheries Science Center's (NEFSC) Milford Laboratory in Milford, Conn., is measuring the effect of a FLUPSY on water quality and sediment characteristics in Riverhead's East Creek.

"The town of Riverhead was interested in knowing the potential effect, if any, of the FLUPSY on the water quality in East Creek before issuing any further permits to local oyster growers," said Gary Wikfors, who heads Milford Lab's Biotechnology Program. "A commercial grower, Karen Rivara, also wanted to know if there was any effect, since her livelihood depends on a healthy environment for growing shellfish. We were interested in conducting water quality studies that might help commercial shellfish farmers and the town."

A FLUPSY is a floating dock with small silos or barrels underneath that contain shellfish seed on screens. Surrounding water is pumped up through the silos, enabling the one to ten millimeter long (less than a third of an inch) seed to grow much more quickly and more uniformly than in natural conditions because the young oysters receive a constant supply of food and oxygen from the water.

FLUPSYs have grown popular in coastal areas in the last few decades to culture and protect small shellfish seed through the delicate nursery stage, from the time they leave a hatchery until they are large enough to be placed in shellfish beds in coastal waters to grow to harvest size.

Wikfors' team of biologists, microbiologists, ecologists, chemical oceanographers and lab technicians visited the East Creek site for a pilot study in 2008. They returned four times during the summer and fall of 2009, the last time in October 2009.

Each time the team brought a mobile laboratory, complete with sophisticated analytical instruments like a variable fluorescence fluorometer and a flow cytometer. The fluorometer measures how much light for photosynthesis or growth a phytoplankton sample is exhibiting, while the flow cytometer measures physical and chemical characteristics of individual cells in the water samples.

When the team arrived onsite for a 24-hour experiment in September, Mark Dixon, a biological science technician, set up eight large clear plastic bags suspended from floats on the side of the FLUPSY. Four of the bags were filled with water from the creek before it had been pumped through the FLUPSY, while the other four were filled with water that had come through the FLUPSY. Water samples were then taken from the bags every three hours and split into many smaller samples for various studies.

“By taking water samples before it is pumped up through the silos with the oysters and after it has passed through the oysters, and isolating it, we can determine what the growth of phytoplankton, the oysters’ main source of food, would be in the creek without the oysters being present,” Dixon said. “We can then calculate how much the oysters are affecting the plankton.”

“We examined the differences between day-night feeding behaviors and algal growth,” said Shannon Meseck, a chemical oceanographer. “During the day phytoplankton or algae are growing, and we can see the change with our sampling. Phytoplankton don’t grow at night. Because oysters are such efficient filter feeders, it is important that we see what phytoplankton are doing during a 24-hour cycle.”

Water sampling and other environmental measurements were conducted around the clock to reflect changes in sunlight and tidal cycles. Some samples were taken every three hours, others every six. Samples were analyzed in between for 12 different factors, such as phosphorus, nitrate and ammonia.

Yaqin “Judy” Li, an ecologist, analyzed phytoplankton samples with the lab’s new fluorometer to determine the growth and health of the organisms. The Riverhead project is one of the first uses of this instrument for monitoring aquaculture facilities.

“This type of fluorometer can tell us about the physiology of the phytoplankton, and also help estimate phytoplankton production,” Li said. “Some of the phytoplankton living in East Creek pass through the FLUPSY system and back out into the water. What happens to their growth during that process helps us determine how healthy the environment is with a FLUPSY present.”

April Croxton, a fisheries biologist specializing in shellfish, collected adult oysters from a cage on the FLUPSY and extracted blood to test the immune or defense response to the effects of the FLUPSY. The extracts are run through the flow cytometer, transported to the site in the back of a minivan, and analyzed in seconds.

“We bring this instrument into the field because it gives us an accurate reading of the stress level of the shellfish,” she said. “If we brought the oysters back to our lab in Milford and then analyzed their blood, we would find a reaction to the stress of their trip, not the possible effect of the environment containing the FLUPSY.”

The Milford Laboratory team plans to return to the East Creek site this year, earlier in the season when the oyster seeds are growing the fastest, to continue their water quality and environmental tests. Results will be shared with the commercial oyster grower and with the town of Riverhead, as well as presented at professional conferences and published in peer-reviewed literature.

Popping the Cork on Biofuel Agriculture

Scientists at Brookhaven National Laboratory have identified a novel enzyme responsible for the formation of suberin—the woody, waxy, cell-wall substance found in cork. While effective at keeping wine inside a bottle, suberin's most important function in plants is to control water and nutrient transportation and keep pathogens out. Adjusting the permeability of plant tissues by genetically manipulating the expression of this enzyme could lead to easier agricultural production of crops used for biofuels.

The research, led by Brookhaven biologists Chang-Jun Liu and Jin-Ying Gou, was published online in the *Proceedings of the National Academy of Sciences* the week of October 19, 2009.

Plants use different polymers in constructing cell walls, each with unique qualities essential for growth and survival. Suberin, the polymer analyzed in this study, is mostly located in the cell walls of seed and root systems. It moderates the substances that pass into the organism, acting as a barrier to harmful substances and microorganisms while facilitating the intake and storage of water and other nutrients.

"We sought to understand the synthesis of the 'wall-bound' phenolic component of different biopolymers, including this important suberin polymer, by identifying the enzymes responsible for their construction," said Liu. This information could eventually be used to modify plants for agricultural purposes, including improved biomass production. "Knowing which enzymes do what may allow the properties of polymers to be tailored for specific purposes through either plant breeding or genetic engineering," he explained.

In this experiment, Liu and his colleagues analyzed a strain of *Arabidopsis* (a common experimental plant) that had been genetically modified to disrupt the expression of a gene that codes for an enzyme now known as hydroxyacid hydroxycinnamoyltransferase (HHT). Chemical analysis showed that "knocking out" the HHT gene led to a deficiency of suberin phenolics, indicating that HHT is the enzyme responsible for biosynthesis of the polymer. Liu and his colleagues then isolated the gene and expressed it in bacteria to further characterize its function.

The team also demonstrated that the HHT-deficient plants were much more permeable to salt in solution than their wild-type counterparts. This finding, together with the ubiquitous presence of suberin in plant root tissues that control water and salt uptake, suggests that suberin plays an important role in the adaptation of plants to their terrestrial habitats.

Harnessing the mechanism responsible for suberin production might therefore allow scientists to create crop breeds tailored to thrive in specific—even harsh—environments, an important milestone on the road toward economically efficient biofuel production.

“Identifying the key biosynthetic enzymes and understanding suberin production may be particularly important for growing plants on the marginal soils that have been proposed for use in farming bioenergy crops,” Liu said.

For example, if certain breeds can be created that are more adept at absorbing and storing water and nutrients, the crops could be farmed in much drier climates—maybe even the desert. In addition, the team’s finding that modifications in suberin phenolic production can alter plants’ tolerance to salt suggests that the newly identified gene might be used to generate crops able to grow under salty conditions.

These approaches to biofuel agriculture would leave more-fertile land open for food crops, helping to strike a much-needed balance between the nutrition and energy needs of the world.

Registration for the 2010 FLC National Meeting is Now Open

Be sure to register for the 2010 FLC national meeting, which will take place April 26-29 in Albuquerque, N.M. Themed “The Sky’s the Limit,” this meeting will be filled with informative sessions on technology transfer practices, training, and social networking receptions. The presentation of the 2010 FLC awards will bring the meeting to a festive close. For additional meeting information and online registration, go to http://www.federallabs.org/meeting/.