NATIONAL INSTITUTES OF HEALTH • NATIONAL CENTER FOR RESEARCH RESOURCES

NCRR Reporter

FALL 2007

CRITICAL RESOURCES FOR YOUR RESEARCH

www.ncrr.nih.gov

U.S. Department of Health and Human Services

Taking Science Education on the Road

FROM THE DIRECTOR

Inspiring the Next Generation of Researchers

What better way to demonstrate the challenges and excitement of a career in science to young students than to bring a traveling laboratory to their school? In such a laboratory, outfitted with the latest biotechnology equipment, students gain skills and engage their imaginations as they puzzle through the mysteries of disease, learn about their bodies, and perhaps set a course for their future careers.

As described on page 4 of this magazine, mobile labs grew out of NCRR's Science Education Partnership Awards (SEPA) program. Since the first mobile lab was launched in 1998 in Boston, 11 similar vehicles have set forth across the country.

This is just one example of SEPA's innovative and colorful activities, aimed at exciting students to pursue research careers. Now in its 16th year, SEPA is active in more than 30 states, Puerto Rico, and five Native American communities, reaching tens of thousands each year.

Lively museum exhibits that explain front-page topics such as genetics and stem cell research, documentaries created by inner-city students that explain how HIV/AIDS spreads, and hands-on activities in classrooms are just a few examples of the activities sponsored by SEPA. I encourage you to read about the latest SEPA awardees, announced on November 13, and their ambitious plans at http://www.ncrrsepa.org.

In addition to inspiring the next generation of researchers, SEPA projects provide communities with a better understanding of health and medical research. Such knowledge will help them make better lifestyle and health decisions.

As the examples on page 3 illustrate, SEPA grantees often collaborate with Clinical and Translational Science Award recipients, taking advantage of their investigators and resources. This is one of the many instances in which NCRR programs work together to leverage resources and maximize outreach.

Although expressed in different forms, all of our programs, at NCRR and throughout NIH, share the same goal: to improve the nation's health through biomedical research.

Barbara Alving, M.D.

Barbara Alving, M.D.
Director, NCRR

INSIDE

FALL 2007, VOL XXXI, NO. 4

NCRR Reporter

This quarterly publication of the National Center for Research Resources fosters communication, collaboration, and resource sharing in areas of current interest to scientists and the public.

Editor
Joyce McDonald, NCRR

Managing Editor
Laura Bonetta,
Palladian Partners, Inc.

Publication Design
Palladian Partners, Inc.

NIH Publication#: 07-6251

Please send comments and ideas about future articles to:
Office of Science Policy and Public Liaison, NCRR, NIH
One Democracy Plaza
6701 Democracy Blvd., 9th Floor
Bethesda, MD 20892-4874
Telephone: (301) 435-0888
Fax: (301) 480-3558
E-mail: info@ncrr.nih.gov
Web site: www.ncrr.nih.gov

On the Cover: Students at South Middle School in Edinburg, Tex., conduct experiments on board a 40-foot bus equipped with state-of-the-art biotechnology equipment. The mobile laboratory, developed by the University of Texas-Pan American Regional Biotech Program, serves schools in the Rio Grande Valley region.

PHOTO BY JOSUE ESPARZA, UNIVERSITY OF TEXAS-PAN AMERICAN

NCRR Programs Collaborate on Science Education

"I can do that!" should be the motto of HEADS UP (Health Education and Discovering Science while Unlocking Potential). That's the reaction this K–12 science education project, funded through a NCRR Science Education Partnership Award (SEPA), often receives when students watch videos of people in science-related careers, part of a self-described "initiative to excite students about science."

Through multimedia science curriculum modules, middle and high school students learn about such topics as genetics, nutrition and physical activity, and the nervous system while listening to graduate students, investigators, and other experts talk about their work. "We present cutting-edge content and role models for the kids," explains HEADS UP principal investigator Nancy Murray at the University of Texas School of Public Health. One result: students in the Spring Branch Independent School District of Houston have shown a significant improvement on Stanford 10 Achievement test scores in science as well as increased interest in the subject.

To develop the curriculum, HEADS UP staff collaborates with researchers and clinicians at the university's Health Science Center in Houston, a member of NCRR's Clinical and Translational Science Award (CTSA) consortium. Interactions like these, between SEPA and CTSA programs, are taking place across the country. They are helping educators and researchers reach out to communities to bring NIH health messages to a wider audience while building awareness of the value of clinical research.

According to Murray, "the CTSA and SEPA programs come together in community engagement, which depends on developing long-term relationships." HEADS UP also trains teachers, sponsors family nights, and, with the CTSA, works with a 100-member community advisory group and offers health screenings and informative displays at community events.

As another example, in Portland, Ore., investigators from Oregon Health & Science University (OHSU), another CTSA recipient, developed a series of interactive exhibits about different health topics at the Oregon Museum of Science and Industry. The effort is the most recent installment in a long-standing collaboration between these two NCRR-funded organizations.

■ Jonathan Purnell, a researcher at the Center for the Study of Weight Regulation at Oregon Health & Science University, puts a wristband on a visitor to the Oregon Museum of Science and Industry. The wristband allows researchers to anonymously collect body weight and other data from museum visitors who agree to participate in a nutrition study.

The exhibits, sponsored in large part by the CTSA grant, were located at the exit of the extremely popular Body Worlds 3 traveling exhibition. One group of NIH-funded researchers from the university's Center for the Study of Weight Regulation recruited more than 1,300 museum visitors willing to participate in a clinical study. Data collected anonymously through five separate stations included dietary assessments and measurements of height, girth, heart rate, and blood glucose and cholesterol concentrations. In addition, some study participants agreed to receive periodic e-mail suggestions for better health based on their individual assessments and an invitation for a three-month follow-up assessment. "We're trying to be a model in the way we've leveraged our SEPA programs with the research-funded centers," says William Cameron, principal investigator for the SEPA-funded Teacher Institute for the Experience of Science at OHSU. ■

PHOTO BY RICK RAPPAPORT PHOTOGRAPHY

Taking Science Education on the Road

Traveling laboratories deliver engaging science lessons to classrooms everywhere. **BY LAURA BONETTA**

The crown jewels were stolen from the City Museum. *"Once on the scene, I noted that the only window in the room was broken. Officer Ligase approached me and said that there were no prints or any apparent evidence left at the crime scene. However, upon further inspection of the window, my partner, Dee Enae, noticed some blood on the sill…"*

"Dee Enae," a pun on DNA, is the quick-thinking sidekick in this popular science education module for high school students, created by Boston University School of Medicine's CityLab program. Dee and other characters visit schools around Greater Boston, providing hands-on science lessons that engage students' imaginations.

"If you want to teach someone to play baseball, you don't give them a video of someone playing the game," says Carl Franzblau, associate dean for graduate and biomedical science at Boston University School of Medicine. "You give them a ball and bat."

To solve the case of the crown jewels, students are given gloves and pipettes to perform DNA restriction analysis, or DNA fingerprinting. They then look for a match between the DNA fingerprint of the blood sample collected at the crime scene and that of one of four suspects. Other modules have the students purifying proteins or diagnosing a disease. (See sidebar, "Mobile Lab Modules.")

Franzblau launched the CityLab program in 1992 with funding from an NCRR Science Education Partnership Award (SEPA). Initially, the program offered science lessons on the Boston University Medical Campus. But in 1998, CityLab unveiled a 40-foot bus outfitted with state-of-the-art biotechnology equipment that could deliver the lessons directly to students at their schools.

■ High school students onboard Boston University School of Medicine's MobileLab are hard at work identifying the culprit of a crime. They are using DNA fingerprinting and other molecular biology techniques.

PHOTO BY VIVIAN RONAY PHOTOGRAPHY

■ Mobile labs are located across the United States. There are 12 mobile labs in nine states. Several of these programs—Boston University School of Medicine's MobileLab (an extension of the CityLab program), the University of North Carolina at Chapel Hill's DESTINY Program, and The University of Texas-Pan American's Regional Biotech Program—are supported, at least in part, by NCRR.

The ensuing demand for the traveling lab inspired the creation of similar programs across the country, many of which use the same lesson plans and materials. Each program quickly became oversubscribed. "The reason mobile labs have been so successful is that people running the programs share all their resources," says Tony Beck, SEPA program officer at NCRR. "Their first priority is the kids."

HOW IT ALL STARTED

The original CityLab program, using four biotechnology laboratories housed at Boston University School of Medicine, provided a great way for kids to learn about molecular biology and biotechnology methods. But field trips are unwieldy: Teachers must justify taking a group of students out of school for an entire day, and many students can't pay the required transportation costs. So Franzblau and colleagues decided to build a laboratory that could go to the students. (See sidebar, "A Q&A with Carl Franzblau.")

Dubbed "MobileLab," the traveling laboratory was unique. At the time, there were programs that brought science educators to classrooms or lent science equipment to teachers, but nothing like what the Boston group created.

"In many ways, MobileLab really levels the playing field," says CityLab director Don DeRosa. "Whether a school is well equipped or not, the students are exposed to the same program and with the same staff and equipment. It does not matter if the school does not have running water or computers or microscopes. No one gets shortchanged."

MobileLab typically visits one school within 75 miles of the university each week, hosting five to six science classes every day. "We can do four different lessons for each class in one week, all during regularly scheduled science classes," says DeRosa. "The students don't have to miss math or English."

The six years DeRosa had already spent learning from visiting teachers and students at the on-campus lab made startup easier, but not without challenges. "I had to get a bus driver's license and learn the protocol for going into a truck stop and filling up the gas tank," says DeRosa. "The first time I had to back down a little alleyway, I was sweating."

FROM ONE TO MANY

One of the programs that followed in CityLab's footsteps is headed by George Eyambe at the University of Texas-Pan American (UTPA). An associate professor in clinical laboratory

■ Sixth graders from Cuellar Middle School in Weslaco, Texas, verify the micropipette setting as they begin to work on a protocol for analyzing protein samples. They are participating in a project offered by The University of Texas-Pan American Regional Biotech Program.

science, Eyambe had heard Franzblau speak about his education programs, including MobileLab, during a SEPA-sponsored meeting at NIH.

"I thought a mobile lab could be useful in the Rio Grande Valley," says Eyambe. A four-county region situated along the south Texas border with Mexico, the Rio Grande Valley is one of the poorest metropolitan areas in the United States. It comprises 30 independent school districts with a predominantly Hispanic population. Many of the students are from migrant families who speak little or no English.

With SEPA funding, Eyambe established UTPA's Regional Biotech Program. Initially, the program provided a university-based clinical lab for students and teachers and an equipment lending program. Program staff used several CityLab modules, translating some of them into Spanish. They also created new lesson plans. "The teachers wanted us to do something about evolution and, because we have high rates of diabetes in Rio Grande, we are now developing a module on glucose determination in diabetes testing," recalls Eyambe.

Although the on-campus program was, and continues to be, popular with many teachers, it was clear to Eyambe that it was not serving all students. "We realized that a lot of students and school districts could not come to us because they could not afford the transportation," says Eyambe. "And many of the teachers did not have the skills to use the loan program."

In 2004, with support from the Howard Hughes Medical Institute, the group built a mobile lab to take its SEPA curriculum to rural schools within 120 miles of UTPA—from Brownsville to Rio Grande City. "The mobile lab filled an important niche," says Eyambe. "It quickly became very popular, and it is booked one year in advance."

IS IT WORKING?

There is no shortage of personal accounts that programs like CityLab and the Regional Biotech Program are increasing students' interest in science careers. "A mother called to tell us that her son attended our weeklong summer lab at Boston University and is now going to get a degree in molecular biology," says DeRosa. Another student, who is now an investment banker, wrote to CityLab staff to say that her experience at the lab "provided my first taste of modern biotechnology and medical science and sparked my interest in this field and its commercial applications."

In addition, according to a 2002 survey, 76 out of 91 teachers polled indicated that their experience at CityLab affected their teaching in a positive way. Fifty-three percent of respondents indicated that aspects of the CityLab curriculum were directly incorporated into their lesson plans.

Following SEPA guidelines that require all its projects to move beyond anecdotal evidence, Eyambe hired a professional evaluator to gather and analyze data about the program. Preliminary findings from a group of students who spent a month at UTPA, including two weeks in the on-campus teaching lab, show that "at-risk" students—those who were not performing well in science—start to perform as well as non-at-risk students after this experience. Other mobile lab programs are similarly being evaluated to gauge their effectiveness.

Most educators agree that many students see science as something beyond their grasp and that this notion can only be changed through exposure to positive hands-on experiences and role models. "When students see themselves accomplishing tasks and begin to see this is something they can do, they become interested in it," says Eyambe.

Martha Medina, a teacher at Veterans Memorial High School in Mission, Tex., agrees. "My students spent three hours in the

PHOTO COURTESY OF UNIVERSITY OF TEXAS-PAN AMERICAN

lab at UTPA, and then we went for lunch in the university cafeteria," she recalls. "All the other kids looked like them; they dressed the same. They said 'You mean I could fit in here?' They were very excited."

THE MOBILE LABORATORY COALITION

In addition to MobileLab and the UTPA bus, there are at least eight other mobile lab programs in the country. The interest in these programs has been growing so rapidly that mobile labs have formed their own organization. "We were constantly getting calls asking for advice," recalls DeRosa. "We realized we were all sharing ideas but not in a very organized fashion. We decided we needed to come up with a mechanism to do this better."

In 2006, DeRosa and others established the Mobile Laboratory Coalition (www.bu.edu/mobilelab), a partnership of traveling laboratory programs, institutions of higher education, and K–12 schools and school systems. The organization has grown to include almost 80 members.

The members meet annually to share information and resources. They also meet in smaller groups throughout the year to evaluate each other's programs. The meetings help

■ Regardless of whether a vehicle began its life as an army truck, trailer, mobile home, or school bus, it can be outfitted to include lab benches; video players; and storage space for centrifuges, gels, pipettes, and reagents and to have its own electrical power, plumbing, and Internet connectivity.

PHOTO COURTESY OF ESSENTIAL EYE PHOTOGRAPHICS, LLC

MOBILE LAB MODULES

In **The Case of the Crown Jewels,** students become forensic scientists who analyze drops of blood found at a crime scene as they determine which suspects are guilty or innocent. It is one of many science modules funded through NCRR's Science Education Partnership Awards (SEPA) that can be taught "on wheels." Other SEPA modules, with equally engaging names, include:

In Search of the Body's Antibodies. Students perform enzyme-linked immunosorbent assays to screen fictional patients' blood samples for HIV (using simulated viral extract). (Created by Boston University's CityLab.)

Amp Up Your DNA. Students use polymerase chain reaction and gel electrophoresis to amplify and visualize a portion of their own DNA. In particular, students are taught to amplify the Alu insert on chromosome 16. This is a DNA sequence that is repeated hundreds of times in the genome; the number of repeats varies from person to person. (Created by Boston University's CityLab.)

Nothing Fishy About Evolution. Students isolate muscle proteins from various fictional fish species and analyze them with denaturing polyacrylamide gel electrophoresis. They then look for a correlation between the properties of the proteins and the evolutionary relatedness of the fish species. (Created by the University of Texas-Pan American's Regional Biotech Program.)

Weigh to Go! Students explore connections between obesity, diabetes, high blood pressure, and high cholesterol. Using chromatography, students purify a protein called leptin, a hormone that regulates appetite. Other activities help students become more aware of the obesity epidemic at global and individual levels. (Created by the University of North Carolina at Chapel Hill's DESTINY Program.)

The State We're In. Students perform a bioassay experiment using the water flea *Daphnia*, an indicator of ecosystem health, to detect and assess what would be considered a harmful level of a toxic chemical. While discovering the effects of environmental toxins, they gain insight into the interplay between scientific data and human judgment that underlies legislation. (Created by the University of North Carolina at Chapel Hill's DESTINY Program.)

The Beat Goes On. Students focus on the cardiovascular system and identify the genetic and environmental factors that influence an individual's likelihood of developing heart disease. They use EKG sensors to make graphical recordings of their hearts' electrical events, identify the waveforms produced, and determine the patterns typically associated with them. (Created by the University of North Carolina at Chapel Hill's DESTINY Program.)

■ At the June 2007 annual meeting of the Mobile Laboratory Coalition in Rockville, Md., participants shared information and resources. The meeting was hosted by the J. Craig Venter Institute and MdBio.

educators gain insight and advice on how to get a mobile lab program up and running—and not just within this country. One of the attendees at the coalition meeting held in June 2007, an entrepreneur from Malaysia, contacted DeRosa for help in establishing a mobile lab there.

In less than a decade, the mobile lab has gone from a daring experiment by one group to a coalition of programs with common goals and a shared vision for science education. Students from all walks of life, regardless of the resources available at their schools, are experiencing science in exciting new ways.

In years to come, colorful mobile labs could become common sights on school parking lots across the nation and Dee Enae and Ligase well-known characters in every science class. ■

TO GAIN ACCESS: NCRR's SEPA program funds grants for innovative educational programs. Such projects create partnerships among biomedical and clinical researchers and K–12 teachers and schools, museums and science centers, media experts, and other educational organizations. For a list of currently funded programs, please visit www.ncrrsepa.org/projects/Active.asp.

A Q&A WITH CARL FRANZBLAU

How did you come up with the idea of a traveling laboratory?
I was attending a meeting at the Convention Hall at the University of Miami and I saw a bloodmobile parked outside. I thought, 'Why can't we build a lab the way they are building a bloodmobile?'

Why did you think there was a need for such a program?
At the time, we had an on-campus lab dedicated to teaching high school students. But teachers were yelling at us because they did not want their students out all day. In the old days, if you could not go to the doctor's office, the doctor would make a house call. So I thought we could do the same.

What is your vision for science education?
I would like to create 30 to 40 mobile lab units throughout the country. We could enlist young graduate students and teachers to volunteer to staff them. I call it a 'Science Core.' Its mission would be to bring science education to all students. From the foothills of South Dakota to the inner city of Chicago, students would be exposed to the excitement of science.

■ Carl Franzblau (left) and Don DeRosa of Boston University School of Medicine stand in front of their MobileLab. The traveling science laboratory made its debut in 1998.

PHOTOS BY ESSENTIAL EYE PHOTOGRAPHICS, LLC, AND VIVIAN RONAY PHOTOGRAPHY

From Discovery to Market

Making novel technologies commercially available leads to advances in research and medicine. **BY LISA CHIU**

From instruments that can peer deep inside cells and tissues, revealing previously unknown processes, to methods that can find signs of disease before any clinical symptoms arise, many tools and devices routinely used in the laboratory and clinic began their lives as challenging technical problems.

Researchers at NCRR-funded Biomedical Technology Research Resources (BTRRs) focus on finding solutions to such problems. Over the years, BTRRs have been the source of countless breakthrough technologies with wide applications in biomedical research and medicine. But as difficult as it is to develop a useful new method or instrument, it is also challenging to build it into a finished, easy-to-use product and put it in the hands of researchers and clinicians worldwide. This process sometimes requires collaborating with an established company or, in some cases, starting a new one.

Many BTRR discoveries have followed commercial paths. Two recent examples—a technique to enhance clinical imaging and another to detect changes in oxygen in different tissues—illustrate how some inventions make it to the clinic.

GETTING THE FAT OUT OF MRI

As a radiology resident at Stanford University School of Medicine, Scott Reeder set out to overcome a problem that had long vexed researchers working with magnetic resonance imaging (MRI).

MRI works by applying a strong, constant magnetic field to a sample and then measuring how the nuclei of hydrogen atoms—found in water, fat, and other body tissues—respond to a short burst of radio waves. The method can be thought of as ringing a bell: exposing the body to energy waves is the "ding," and the resulting echoes are used to construct an image.

The problem is that echoes from fat are very "loud" and can obscure those from tumors and inflamed or infected tissues.

■ Scott Reeder, currently at the University of Wisconsin–Madison, and colleagues at the NCRR-funded Center for Advanced Magnetic Resonance Technology at Stanford University, developed a new method for enhancing magnetic resonance imaging (MRI). Through a collaboration with General Electric (GE), the technology has been further developed into an easy-to-use option on many of GE's MRI instruments.

PHOTO COURTESY OF GENERAL ELECTRIC

AGREEMENTS WITH INDUSTRY

When academic scientists collaborate with industry, both parties draw up legal agreements that detail responsibilities for the work, ownership of intellectual property, communication of results, and other issues. Master Agreements, also referred to as "blanket" or "umbrella" agreements, are used when a company expects to sponsor multiple projects with an academic institution over a long period of time. In such cases, the legal terms and conditions are pre-negotiated. When a new project is proposed, the terms of the Master Agreement are incorporated by reference into the new agreement, considerably speeding up the negotiation process. Stanford University, home to the NCRR-funded Center for Advanced Magnetic Resonance Technology, has a Master Agreement for sponsored research with several companies, including General Electric.

(Source: www.stanford.edu/group/ICO/agmts/index.htm)

And although there are ways to eliminate fat signals from an image, they are difficult to implement in breast tissue, extremities, and the head and neck. As a result, these remain problem areas of the body for imaging.

To better distinguish between fat and other tissues, Gary Glover, head of the NCRR-funded Center for Advanced Magnetic Resonance Technology (CAMRT) at Stanford University, developed in 1991 a method that records MR signals at three different time intervals. Glover's technique provided considerable improvements to image quality in difficult areas, but it was not easy to implement routinely.

Reeder decided to work with CAMRT scientists to build on Glover's approach. "I wrote my first algorithm late at night while on call at the hospital, when the ER was slow," remembers Reeder. "We came up with a more general and flexible method to acquire and analyze the echoes."

COLLABORATING WITH A COMPANY

Reeder and colleagues took advantage of a collaborative research agreement established between Stanford University and General Electric (GE) to create a prototype of the algorithm that could be used with GE's MRI machines. (See sidebar "Agreements with Industry.") "When we have a new technology that may have broad applications, we work very closely with GE," says Brian Hargreaves, an assistant professor of radiology at CAMRT. "One of their strengths is making technologies work more reliably and efficiently so that any researcher can use them."

Today the technology that Reeder and colleagues at CAMRT developed with GE, dubbed IDEAL*, is being used by the Stanford group for a variety of applications, including to distinguish silicone from breast tissue; to image fatty tumors; and to suppress fat signals and improve imaging in the ankle, head, and neck.

And within a year, researchers and clinicians across the country will benefit from IDEAL technology as it becomes available as an easy-to-use option on many of GE's commercially available MRI devices. "It has taken a lot of communication between the groups to make IDEAL happen," says Reeder. "But the pace of development has been fantastic."

Reeder, who joined the University of Wisconsin–Madison Department of Radiology in 2005 as division chief of MRI, notes one key reason IDEAL will come so quickly to market was the research agreement in place with GE. "It is extremely important for an academic site to establish a comprehensive research framework with a collaborating company," he says. "The agreement needs to define intellectual property and other important principles that facilitate cooperation and ensure open communication."

MEASURING OXYGEN

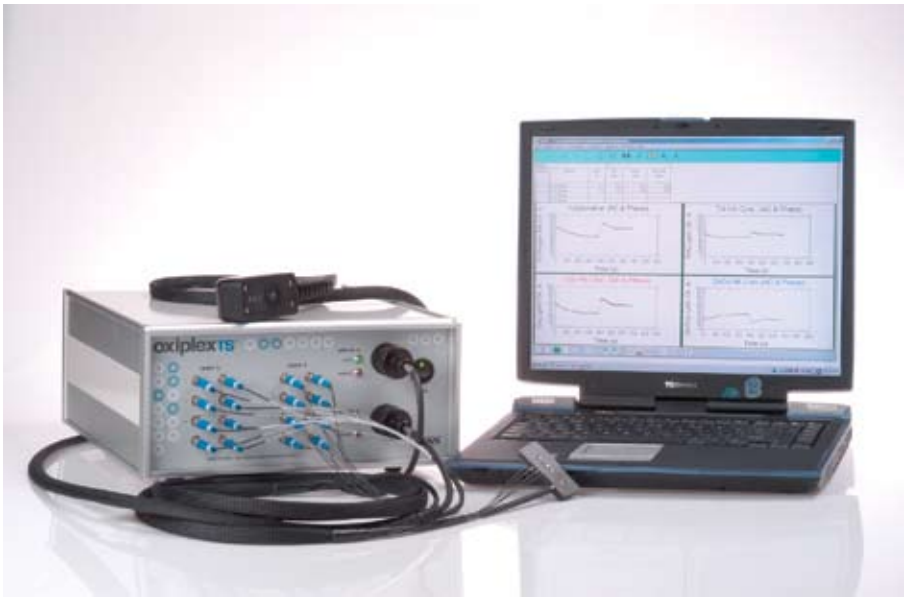
Enrico Gratton, head of the NCRR-funded Laboratory of Fluorescence Dynamics (LFD) at the University of California, Irvine, took a different track in bringing his discoveries to market. In 1984, Gratton founded the company ISS Inc. in Champaign, Ill., to make some of LFD's technologies commercially available.

One such technology, which has a broad range of applications in the clinic, grew out of a curious finding by the University of Pennsylvania's Britton Chance, a renowned expert in the field of optical imaging and a friend of Gratton.

In 1988, Chance's group was working with near-infrared lasers to understand how different tissues responded to laser light. Chance discovered that the light took a fair amount of time to pass through the brains of the graduate students in the lab, but it passed through very rapidly when the laser was pointed at his own head.

Chance was concerned that he might be witnessing the effects of aging on his brain. But Gratton had an insight: Brain activity results in an increase in blood flow and of oxygenated hemoglobin. Gratton realized that differences in the speed at which laser light traveled through the brain could be caused by changes in oxygenation. Further testing revealed that near-infrared lasers could be used to precisely quantify oxygen amounts in various tissues.

* Iterative Decomposition of Water and Fat with Echo Asymmetry and Least-Squares Estimation



■ ISS Inc., a company in Champaign, Ill., has developed numerous technologies from the NCRR-funded Laboratory of Fluorescence Dynamics (LFD), currently located at the University of California, Irvine. One of their products is OxiplexTS, a portable device to precisely measure oxygen levels in different tissues.

The finding put to rest Chance's worries and led to technological innovation. "Here we were helping a friend, and suddenly we have made a discovery that put us very far ahead in our field of research," says Gratton. "We could measure oxygenation of tissues in a quantitative way."

STARTING A COMPANY

ISS developed several instruments from this discovery, including OxiplexTS, a portable device that measures tissue oxygenation. Such measurements are useful because problems with oxygenation may reveal bad circulation or explain labored breathing.

Eighty OxiplexTS devices have been sold worldwide since the instrument came to market in 1998. They are used in research to study a variety of problems, from peripheral vascular disease and sleep apnea to the kinesiology of an exercising athlete. ISS is now in the process of filing a 510(k) application to the U.S. Food and Drug Administration (FDA) to use OxiplexTS in the clinic, specifically for use in patients with peripheral vascular disease. (See sidebar "Obtaining FDA Approval.")

Gratton has seen many of his discoveries benefit researchers and patients, but starting a company wasn't his first choice. "It was very time consuming to start a new company," says Gratton, who at the time he founded ISS was an assistant professor at the University of Illinois at Urbana-Champaign, where the LFD was located until 2006.

But Gratton was driven to this choice because he had not found anyone to commit to one of his first inventions: an instrument biochemists could use to measure fluorescence decay times to understand and quantify interactions among molecules. This product is now available through ISS and is used in many research laboratories.

Gratton left ISS in 1987 to focus exclusively on his academic career and remove any concerns about conflict of interest. But he still serves as a scientific advisor for the company.

Seeing their inspirations transformed into products that help researchers and improve health has been deeply satisfying to both Gratton and Reeder. "It is a really awesome feeling to know that I could think about the physics of a problem and see it become something useful in the clinic," says Reeder. "This has never happened to me before. Not all successful ideas result in helping patients." ■

TO GAIN ACCESS: NCRR supports 50 BTRRs across the United States. They develop new tools and applications and offer different types of services and training, free of charge, to qualified scientists. For more information, visit www.ncrr.nih.gov/BTRR.asp.

OBTAINING FDA APPROVAL

Before medical devices—such as surgical lasers, pacemakers, vascular grafts, as well as diagnostic tests—can be marketed for use in the clinic, they must be approved by the U.S. Food and Drug Administration (FDA). According to the Medical Device Amendments of 1976 and the Safe Medical Devices Act of 1990, manufacturers wishing to introduce a new medical device to the market may have to submit a pre-market application to the FDA and carry out the necessary clinical studies. But in some cases, clinical studies are not necessary. If a device is deemed to be "substantially equivalent" to another device marketed prior to the Amendments, the manufactured can file a 510(k) application. If the FDA agrees that the new device is substantially equivalent, it can be marketed immediately.

(Source: www.fda.gov/oc/ohrt/irbs/devices.html)

PHOTO COURTESY OF ISS, INC.

RESEARCH BRIEF

Vitamin D for the Heart

Many people know the human body needs vitamin D for strong bones. But a recent study suggests that the vitamin is also good for a strong heart. The research, published in the May 2007 issue of *Archives of Internal Medicine,* hints that taking vitamin D supplements could have a positive impact on people's health—but a single recommended dose might not necessarily be a good fit for everyone.

Several earlier studies revealed high rates of hypertension and diabetes, two risk factors for cardiovascular disease, among people with low amounts of vitamin D in their blood. But these studies were conducted in small groups of people or in groups that were not representative of the general population.

To address this weakness, Keith Norris and colleagues at Charles R. Drew University of Medicine and Science and associated collaborators analyzed data from the Centers for Disease Control and Prevention's Third National Health and Nutrition Examination Survey (NHANES), which combined interviews with physical examinations. The survey sample of more than 15,000 participants included sufficiently large numbers of individuals aged 60 years and older, African Americans, and Mexican Americans to more precisely estimate the prevalence of different conditions in these groups.

Norris, who heads the Comprehensive Center on Health Disparities in Chronic Kidney Disease at Charles R. Drew University, a center supported by NCRR's Research Centers in Minority Institutions (RCMI) program, found that many people have low levels of vitamin D, particularly women, the elderly, and racial and ethnic minorities. The lowest amounts of vitamin D were found in people with hypertension, obesity, diabetes, and high triglyceride levels—even after adjusting for many other factors—suggesting that vitamin D deficiency contributes to these cardiovascular disease risk factors.

Although vitamin D deficiency is not the only cause of these conditions, it is easy to treat. "Even if it's half or a third as good as other treatments, but much cheaper, taking a vitamin supplement becomes an important therapy, particularly for minority communities in which people are apprehensive of the medical system," explains Norris.

■ Research by Keith Norris and colleagues at Charles R. Drew University of Medicine and Science suggests that current recommended doses for vitamin D supplements, based on the amounts necessary to maintain strong bones, are inadequate. Higher amounts of the vitamin could be needed to protect some people from cardiovascular disease.

The study also suggests that the recommended intake of vitamin D, based solely on the levels needed to maintain strong bones, might be inadequate for preventing heart disease. Recommendations might need to be adjusted particularly for the elderly, women, and minorities, who typically have smaller amounts of this vitamin than other groups.

The finding points to the importance of including diverse populations in clinical research. "If the evidence is there for Caucasians, we usually say it's okay for other racial and ethnic groups. If it's there for men, we say it's okay for women," says Norris. "That's not always true."

The NCRR-funded Translational Research Network, a collaboration of RCMI institutions headed by Norris, will make it easier to conduct such studies. The Network, launched earlier this year, will help participating institutions, many of which focus on diseases that primarily affect minorities, to pool their resources and expertise and create more opportunities to conduct multisite clinical and translational studies.

—FRANCES MCFARLAND HORNE

NCRR RESOURCES: The RCMI program enhances the research capacity and infrastructure at minority colleges and universities that offer doctorates in health sciences. For more information, visit www.ncrr.nih.gov/RIrcmi.

PHOTO COURTESY OF ISTOCKPHOTO.COM

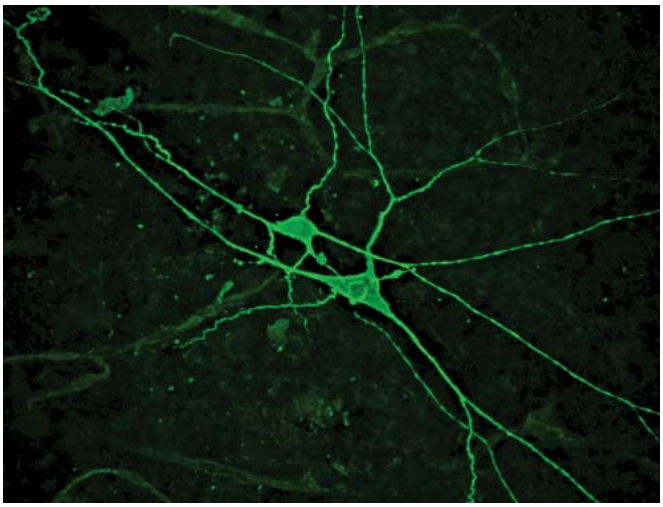
RESEARCH BRIEF

Revving Up the Brain

When a person sleeps, the brain hums slowly, like an idling automobile engine. The slower the engine idles, the deeper the sleep. As the engine is revved up, a person wakes up and—provided the foot remains on the accelerator—stays awake. Researchers at the NCRR-funded Center for Translational Neuroscience in Little Rock, Ark., have now discovered how that process works.

During sleep, two parts of the brain, called the thalamus and cortex, take turns firing at rhythms below 10 oscillations per second. For a person to wake up, oscillations between the thalamus and cortex need to speed up to around 40 per second. In the past, researchers believed that sleep and waking were controlled by chemicals called neurotransmitters. But these chemicals, although crucial to brain functioning, might not create rhythms that are sufficiently fast to keep the brain awake and alert.

The new research, published in the April 2007 issue of the *Journal of Neurophysiology* and in the November 2007 issue of the journal *Sleep,* shows that groups of nerve cells in a region of the brain stem called the reticular activating system (RAS) communicate electrically through tiny openings in their membranes, or gap junctions. Cells that communicate this way are said to be coupled. "An electrical message moves across a whole population of coupled cells extremely quickly, synchronizing their firing," says lead author Edgar Garcia-Rill, director of the Center for Translational Neuroscience. "Think of this process like the clapping of hands by an audience. If the clapping is synchronized, the sound is louder."



■ Groups of cells in the reticular activating system (RAS) of the brain communicate electrically with one another through tiny openings in their membranes. Such cells are said to be electrically coupled. The photo shows two RAS cells injected with fluorescent dye filling the cell body and dendrites visualized using a confocal microscope.

PHOTO COURTESY OF EDGAR GARCIA-RILL, CENTER FOR TRANSLATIONAL NEUROSCIENCE

When the RAS in the brain receives a signal from the outside world, such as a loud noise, it fires, essentially stepping on the accelerator. The firing causes oscillations between the thalamus and cortex of the brain to speed up. These faster oscillations, called gamma rhythm, alert higher centers of the brain and cause a person to wake up. Gamma rhythms occur during both waking and rapid eye movement sleep, the time when we dream. "People remember dreams and waking hours because the brain is revved up," explains Garcia-Rill.

The work sheds new light into the nature of wakefulness and sleep, but it also has important medical implications. "If you know that waking up people has to do at least partially with gap junctions, the same mechanism could explain why some anesthetics put you to sleep," explains Garcia-Rill. "Armed with this knowledge, you could explore treating coma patients with drugs that modulate gap junctions."

Indeed, researchers at New York University recently discovered that the stimulant modafinil, a drug approved for people with the sleep disorder narcolepsy, could increase the "coupling" of cells through gap junctions (Urbano et al. *Proc. Natl. Acad. Sci. U. S. A.* 104: 12554-12559, 2007).

In addition, because the sleep-wake cycle is thought to be disturbed in certain psychiatric disorders, the knowledge gained through Garcia-Rill's research might eventually be used to develop new treatments for anxiety disorders, depression, and schizophrenia.

—NANCY VOLKERS

NCRR RESOURCES: The Center for Translational Neuroscience (www.uams.edu/ctn) is the recipient of a $7.5-million Institutional Development Award (IDeA) from NCRR. The IDeA program was developed to provide support for training and research in states that have historically received a relatively low amount of NIH funding due to the challenges of serving rural or dispersed populations. For more information, visit www.ncrr.nih.gov/research_infrastructure/institutional_development_award.

NIH Expands CTSA Consortium

NIH has expanded a national consortium of academic health centers across the country that is transforming how clinical and translational research is conducted. The goal of the consortium, which grew out of the NIH Roadmap for Medical Research initiative, is to speed the translation of laboratory discoveries into treatments for patients.

Funded through NCRR's Clinical and Translational Science Award (CTSA) program, the consortium adds 12 more academic health centers to the 12 that were announced last October. When fully implemented in 2012, the consortium will include 60 institutions, linked together to energize the discipline of clinical and translational research.

The new consortium members are:

- Case Western Reserve University (Cleveland, Ohio).
- Emory University (Atlanta, Ga.), partnering with Morehouse School of Medicine.
- Johns Hopkins University (Baltimore, Md.).
- University of Chicago (Chicago, Ill.).
- University of Iowa (Iowa City, Iowa).
- University of Michigan (Ann Arbor, Mich.).
- University of Texas Southwestern Medical Center (Dallas, Tex.).
- University of Washington (Seattle, Wash.).
- University of Wisconsin (Madison, Wis.).
- Vanderbilt University, partnering with Meharry Medical College (both in Nashville, Tenn.).
- Washington University (St. Louis, Mo.).
- Weill Cornell Medical College, partnering with Hunter College (both in New York, N.Y.).

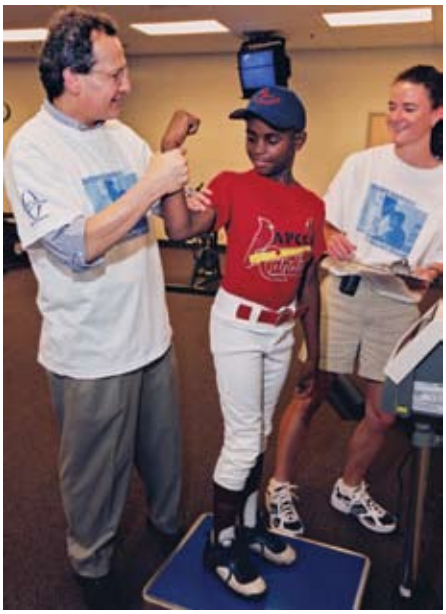
The new grantees will further strengthen the consortium's goal of providing enriched environments to educate and train the next generation of clinical and translational researchers, design improved clinical research informatics tools, support outreach to communities, assemble interdisciplinary teams of researchers, and forge new partnerships with private and public health organizations.

In addition, the new grantees offer unique features and enrich the CTSA program in the following ways:

- Three of the new institutions have formed partnerships with research centers in minority institutions: Morehouse School of Medicine, Meharry Medical College, and Hunter College.
- The CTSAs at three of the new institutions have female principal investigators, helping to increase the role of women in leadership positions.
- The University of Washington is partnering with academic institutions in states supported by NCRR's Institutional Development Award program to create greater opportunities to reach underserved populations.
- The consortium is integrated with other NCRR and NIH programs. For example, six of the eight National Primate Research Centers are now located at institutions with CTSAs. In addition, 19 of the 24 institutions with CTSAs also have National Cancer Institute-funded cancer centers.

Total funding for these new awards will be approximately $574 million. This total represents a nearly five-year budget period. A third funding opportunity announcement for CTSAs has been issued, calling for the next round of applications to be submitted by November 7, 2007, with the awards expected in June 2008.

This funding announcement and other information about the CTSA program are available on the CTSA consortium web site at www.CTSAweb.org.



■ Samuel Klein and Jennifer McCrea offer health and nutrition tips to ten-year-old Van Carter at the Adams Park Elementary School Wellness Fair. Klein is the director of the Clinical Interactions Resources Core at the Washington University Institute of Clinical and Translational Sciences.

PHOTO COURTESY OF WASHINGTON UNIVERSITY

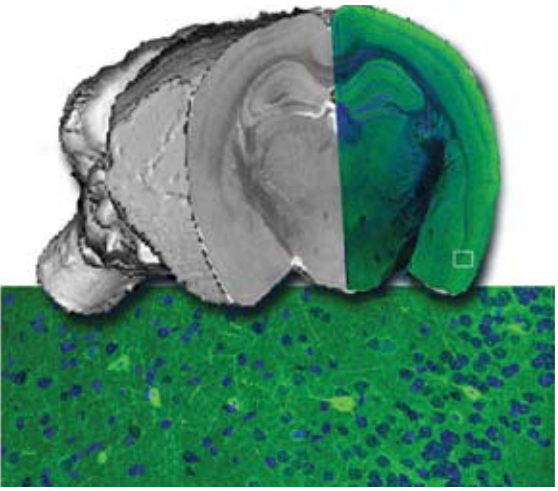
Funding Opportunity for Data-Sharing Projects

NIH will be supporting new projects that encourage biomedical researchers to use the Biomedical Informatics Research Network (BIRN) and the cancer Biomedical Informatics Grid (caBIG), two major programs for data and tool sharing.

BIRN, an NCRR-funded initiative, aims to foster large-scale collaborations that use high-speed networks, high-performance computing, and integrated software. First used in neuroimaging, BIRN has now matured and could serve a broad range of biomedical research groups. Similarly, caBIG, launched by the National Cancer Institute, offers infrastructure and tools applicable beyond the cancer community.

To increase these tools' impact, NIH has announced a funding opportunity for projects that facilitate wider use. One of the key factors for allowing BIRN's use by many researchers is the "federation" of data. A federated infrastructure removes some of the complexities of how the data were obtained or where they are located. The user simply asks and the data are made available. Similarly, federated software tools allow researchers to access bioinformatics and other tools from different sources.

This funding opportunity is affiliated with the NIH Blueprint for Neuroscience Research, a collaborative effort to accelerate the pace of discovery and understanding in neuroscience research (for details visit http://neuroscienceblueprint.nih.gov). The opening date for applications is December 18, 2007.



■ The Biomedical Informatics Research Network (BIRN) infrastructure has been used extensively in neuroimaging. A new NIH funding opportunity would increase its use in new areas.

PHOTO COURTESY OF UNIVERSITY OF CALIFORNIA, SAN DIEGO, AND DUKE UNIVERSITY

Interdisciplinary Consortia Will Tackle Complex Health Issues

NIH will fund nine new research consortia focusing on areas ranging from obesity and aging to organ design and genome-based drug discovery. These areas represent complex biomedical problems that have been resistant to solutions using traditional research approaches.

Each consortium consists of independent but linked research projects. Many consortia also have core research support facilities and training, career development, and education programs. Whereas various components of each consortium will be funded and administered by different NIH institutes and centers, NCRR and the Office of Portfolio Analysis and Strategic Initiatives will oversee the program as a whole.

Part of the NIH Roadmap for Medical Research, an NIH-wide initiative to speed the progress of medical research, the consortia will develop novel ways to think about challenging health issues by creating and supporting interdisciplinary teams of researchers.

As opposed to multidisciplinary research, which involves teams of scientists approaching a scientific question from their own disciplines, interdisciplinary research integrates elements of disciplines, creating novel approaches for tackling problems. "Interdisciplinary research involves large team interactions and a blending of minds," says Greg Farber, who spearheaded the effort at NCRR. "The synthesis is really key."

The consortia will be funded at a level of $210 million over five years. Each consortium has an overall principal investigator responsible for coordinating the efforts of the individual grant components. The interdisciplinary consortia, overall principal investigators, and their institutions are:

- Consortium for Neuropsychiatric Phenomics (Robert Bilder, University of California, Los Angeles).
- Interdisciplinary Research Consortium in Geroscience (Dale Bredesen, The Buck Institute for Age Research, Novato, Calif.).
- NeuroTherapeutics Research Institute (Paul Hagerman, University of California, Davis).
- Taskforce for Obesity Research at Southwestern (Jay Horton, University of Texas Southwestern Medical Center at Dallas).
- SysCODE: Systems-Based Consortium for Organ Design and Engineering (Richard Maas, Brigham and Women's Hospital, Boston, Mass.).
- Northwest Genome Engineering Consortium (Andrew Scharenberg, Children's Hospital and Regional Medical Center, Seattle, Wash.).
- Genomic-Based Drug Discovery (Edward Scolnick, Broad Institute of MIT and Harvard University, Cambridge, Mass.).
- Interdisciplinary Research Consortium on Stress, Self-Control, and Addiction (Rajita Sinha, Yale University, New Haven, Conn.).
- The Oncofertility Consortium: Fertility Preservation for Women (Teresa Woodruff, Northwestern University, Chicago, Ill.).

Now Available by E-mail

NCRR Reporter
Critical Resources for Your Research

National Center for Research Resources
NATIONAL INSTITUTES OF HEALTH

Stay informed with a FREE subscription to the NCRR Reporter

Sign up now to receive NCRR's quarterly *NCRR Reporter* magazine—direct to your inbox! The new electronic edition of the magazine links to the full content of the print *Reporter* and to additional web-exclusive news.

You'll find timely articles about:

- Research tools and resources that might aid your scientific investigations
- Significant biomedical advances and their potential impact on human health
- New funding opportunities and profiles of grantees
- Late-breaking news from NCRR

It's easy to subscribe:

Sign up to receive the electronic edition of the *NCRR Reporter* at www.ncrr.nih.gov/e-Reporter

To request a free subscription to the print magazine, contact info@ncrr.nih.gov

---

U.S. Department of Health
and Human Services
National Institutes of Health
National Center for Research Resources
One Democracy Plaza, 9th Floor
6701 Democracy Blvd. MSC 4874
Bethesda, MD 20892-4874

Official Business
Penalty for Private Use, $300

Presorted Standard
U.S. Postage Paid
DHHS/NIH/RR
Permit No. G-818