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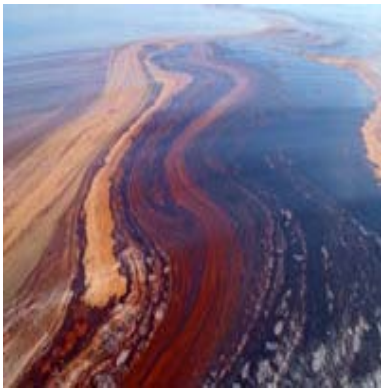
NSF AT WORK

RAPID Response Grant Issued to Study Oil's Impact on Microbes

To examine the impacts of the Deepwater Horizon oil spill on microbes in the waters and sediments near the spill site, the National Science Foundation (NSF) awarded a rapid response grant to marine scientist Samantha Joye of the University of Georgia (UGA) and colleagues. The team traveled aboard the research vessel *F.G. Walton Smith* in the Gulf of Mexico on an oceanographic research cruise in late May and early June. On June 9, 2010, Joye presented testimony about her research at a congressional hearing of the House Energy and Commerce Committee.



Researchers are studying oil's impact on microbial life. Credit: Samantha Joye

The release of oil from the Deepwater Horizon incident on April 20, 2010, is of greater magnitude and scope than any previous spill and is also unique because it has introduced both oil and methane gas into the deep, cold waters of the Gulf of Mexico. "This combination of oil and gas could stimulate a broader microbial population," said Joye, "as well as potentially alter the distribution of the leaking material, possibly leading to more oil and gas pooling in deep waters and sediments."

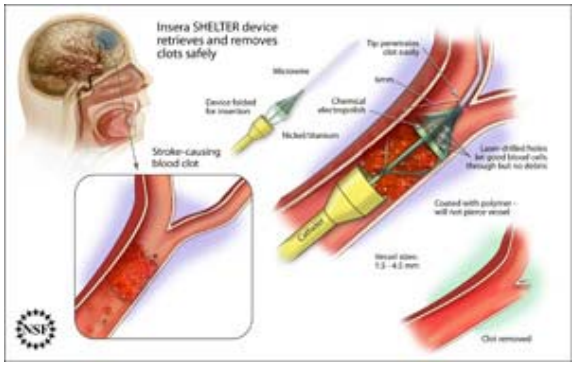
Joye and other researchers are collecting samples of sediments, deepwaters and surface waters at 20 sites in the spill area. The team is studying the factors regulating the activity of microbes in the water column, including nutrient availability, methane concentration, trace metals and vitamins, and the impact of oil on key microbial processes, including the oxidation of methane.

"This research is essential to assessing how massive amounts of oil will affect the health of the Gulf of Mexico in both the short- and long-term," said David Garrison, director of NSF's biological oceanography program. Read more about this RAPID Response project **here**, or see the research team's **blog** for further information on the scientists' observations.

To date, NSF has awarded 39 RAPID Response grants, totaling nearly $4 million, for scientific study of the gulf oil spill. For a regularly updated list of RAPID oil spill awards, see **here**.

New Device for Stroke Treatment

NSF-funded researchers have developed a new tool for efficiently removing blood clots in the brain, the leading cause of strokes. Created with the support of NSF's Small Business Innovation Research (SBIR) program, the new device involves a nickel-titanium mesh filter that allows good blood cells through but captures a clot.



Schematic drawing illustrating new SHELTER™ device. Credit: Zina Deretsky, NSF

The collapsible filter unit is contained within a polymer-coated housing that is directly inserted into the affected blood vessel. The entire unit, known as a SHELTER™ (Stroke Help using an EndoLuminal Transcatheter Embolus Retrieval) device can potentially extend the window of time during which stroke patients are able to seek help.

"Three hours allows an individual to get treatment from a stroke center as far as 65 miles away. Extending the treatment window to eight hours extends the travel distance to 200 miles, a range that would enable 95 percent of the U.S. population to reach a certified stroke center," explains Vallabh Janardhan, a neurologist who developed the new device in collaboration with his brother, Vikram Janardhan, an engineer. Read more about their work **here**.

Turning Plants into Fuel

NSF-funded scientists and engineers are finding new and innovative ways to convert plant material of all kinds into fuel. Unlike petroleum-derived fuel, these alternative sources of energy are derived from crops, agricultural waste or even microbes. A collection of information about this topic is available on NSF's **website**.

Biogasoline produced using new BioForming© process. Credit: Virent.

Virent Energy Systems has developed, with **support** from NSF's Small Business Technology Transfer (STTR) program, a process that converts sugars from agricultural waste and non-food plants into gasoline, diesel, jet fuel and other valuable chemical products. The patented process, called BioForming©, involves the passage of a watery slurry of plant-derived sugars and carbohydrates over a series of catalysts to produce an intermediate compound that can be upgraded into different types of fuels, such as gasoline, jet and diesel. Virent recently announced a large scale-up of its process in collaboration with an international energy corporation.

Other NSF-funded scientists are exploring how to use tiny microbes to produce plant-based fuels. Ben Wen of United Environment and Energy (UEE) recently **described** his company's method, supported by **SBIR funding**, for converting the natural oils produced by algae into useable fuels. UEE's process involves a hollow tube filled with a solid catalyst. When oil extracted from algae flows through the tube, the oil is converted into biodiesel. The tube-shaped reactor improves upon existing processes since the product fuel is automatically separated from the catalyst, a step that can often consume too much energy to make biofuels feasible.

Another project involves the use of microbes that have been modified so that their internal chemical machinery can convert sugar into fuel. The technique, developed by Jay Keasling at **NSF's Synthetic Biology Engineering Research Center**, involves a relatively new method known as synthetic biology. This technique is somewhat different from the older technique of genetic engineering and involves the use of new combinations of existing bits of cellular machinery. "For the most part, genetic engineering is done by taking components, like genes, from nature and using them," Keasling explains. "But nature designed them for a different purpose, so the point of synthetic biology is to have well-characterized components that we can easily assemble, to engineer biology and do genetic manipulation in a much easier way." Read more about Keasling's work **here**.

New Materials for Medicine

MedShape Solutions has created a shape memory polymer that can be used for soft tissue repair in sports medicine. The initial product is designed to ease implantation during anterior cruciate ligament (ACL) knee reconstruction and to provide a decrease in

Shape memory polymer device. Credit: MedShape Solutions

soft tissue failure during ultimate strength testing.

MedShape expects their product to be on the market by the fourth quarter of 2010. MedShape has been working with the Georgia Institute of Technology and is funded by an SBIR **award**.

Did You Know?

Jets and turboprop aircraft leave unusually shaped clouds in their wakes. Credit: Alan Sealls

Scientists have discovered that, under certain atmospheric conditions, as turboprop and jet aircraft climb or descend they can inadvertently "seed" mid-level clouds, causing narrow bands of snow or rain to develop and fall to the ground. Through this seeding process, the aircraft leave behind odd-shaped holes or channels in the clouds. The key to developing these fascinating cloud formations are water droplets at subfreezing temperatures, below about 5 degrees Fahrenheit. As air is cooled behind aircraft propellers or over jet wings, the water droplets freeze and drop to Earth. Read more **here**.

Faces of NSF Research

Predicting Coastal Processes

Antonio Baptista. Credit: CMOP

As director of **NSF's Science and Technology Center for Coastal Margin Observation and Prediction (CMOP)**, Antonio Baptista hopes to help society address the major challenge of better understanding the complex regions where land becomes ocean. He and his CMOP colleagues are looking for ways to predict the possible impacts of climate and human activities near the coast. Coastal areas comprise less than 20 percent of the contiguous U.S., but support more than 50 percent of the US population.

"I have a fundamental belief that science and education are essential to prepare our society to anticipate and steer changes," says Baptista, when asked to explain what motivates his own work. Operating across traditional academic disciplines, he seeks to understand how coastal margins function via the complex interactions of rivers, ocean, climate and human activities. His own work focuses on the observation and **prediction** of physical phenomena in rivers, estuaries and plumes of fresh river water entering saltier ocean waters. As CMOP director, he heads up a large team of scientists from many disciplines, drawn from six universities and numerous other educational, industrial, state, federal and tribal partners.

CMOP was designed to create a new paradigm for team or collaborative science. The center, headquartered at the Oregon Health and Science University, collects data with a number of instruments placed throughout the Columbia River basin, the region where the river enters the Pacific Ocean northwest of Portland, Ore. The instruments measure a large variety of real-time **data**, including salinity, temperature, chlorophyll concentrations, turbidity, and nitrate and oxygen levels. These data support the center's science and education activities, and are integral to the **Integrated Ocean Observing System (IOOS)**, a data-sharing partnership of federal, regional and private organizations, and to regional efforts addressing issues such as fisheries and hydropower management.

Since the Columbia River coastal margin is the geographic focus of CMOP's efforts, Baptista works closely with the Columbia River Intertribal Fish Commission, an agency of the four Native American tribes whose homelands and current reservations comprise roughly one-quarter of the river's basin. He also works with the Quinault Indian Nation in a project that involves observation of coastal hypoxia, or reduced oxygen content, in the waters off Washington state.

CMOP's close partnership with the tribes has led to increased opportunities for Native American students to pursue opportunities in science. One example cited by Baptista is graduate student **Wendy Smythe**, an Alaska Native and recent recipient of an NSF Graduate Research

Fellowship. She is currently pursuing a master's degree in environmental science and doing research at CMOP on microbial populations. She also serves as a mentor for undergraduate students at the center.

Baptista and the other scientists and engineers of CMOP are devoted to developing a better understanding of our coasts in order to anticipate, and prepare for, changes which may occur in the future. Baptista sees his own role as that of team builder. "Although I am trained in civil engineering," he says, "I have never built a bridge of concrete and steel. Yet, my career has been devoted to building bridges between science and society, between disciplines, between education levels, and between institutions. Those are essential bridges." Read more about the center's work **here**.

NSF in the News

New Material Shows Promise in Electronics Applications (*R&D Magazine*) NSF-funded researchers have shown that graphene oxide, a material comprised of a single atomic layer, can easily be converted to graphene by a camera flash. Graphene has shown promise in electronics applications.

Oil Spill Draws Scientists to Gulf to Study Environmental Impact (*The Washington Post*, *NY Times*, *Wall Street Journal*, and others) NSF has already awarded more than $1.15 million in emergency grants to scientists to gather data and study the environmental impact of the ongoing gulf oil spill.

The Ripple Effect

Change of Leadership at NSF

On June 1, 2010, **Arden L. Bement, Jr.**, retired as director of NSF. Bement had served in this post since 2004. **Cora B. Marrett** was appointed Acting Director on June 1, 2010. She had served as Acting Deputy Director since January 2009, and before that, as Assistant Director for NSF's Education and Human Resources directorate. Prior to her NSF appointments, Marrett was at the University of Wisconsin.

On June 3, 2010, President Barack Obama announced his intent to nominate **Subra Suresh**, dean of the Massachusetts Institute of Technology's School of Engineering, as NSF's next director. Suresh's nomination was sent to the Senate on June 8, 2010.

Summer Research Institutes for Students

NSF provides funding for U.S. graduate students in a variety of science and engineering disciplines to travel to and carry out research in laboratories around the world. One program, the East Asia and Pacific Summer Institutes (**EAPSI**), helps students initiate scientific relationships with scientists and engineers in East Asia and the Pacific to better enable future collaboration with their foreign counterparts in this part of the world.

Brian Seok, 2009 EAPSI awardee, conducts research in New Zealand. Credit: David Whitehead, Landcare Research

This summer, 212 students are participating in research experiences at host laboratories in 7 locations: Australia, China, Japan, Korea, New Zealand, Singapore and Taiwan. EAPSI-supported fields of study include the biological sciences; computer and information science and engineering; science, technology, engineering and mathematics (STEM) education; the geosciences; mathematics; the physical sciences; engineering; the social, behavioral, and economic sciences; environmental science; and multidisciplinary research. The students will carry out a variety of research projects ranging from study of photovoltaic power converter control to finding ways to end the poverty trap. Read more about selected EAPSI project results **here**.

Explore the Poles Without Leaving Home

An interactive web-based project of San Francisco's Exploratorium allows anyone to explore the icy polar regions of our world without ever leaving home. "**Ice Stories: Tales from the Arctic**

Blue arch of ice with view of icebergs, from "Ice Stories" online exhibit. Credit: Palmer LTER Project

and Antarctic," showcases scientists' fieldwork in an engaging and interactive way, through webcasts, feature stories, polar news, videos and vivid images of research projects. "Ice Stories" was produced as part of the celebration of the 2007-2008 International Polar Year. NSF provided funding for the project, including cameras and blogging tools to document the fieldwork of scientists in the polar regions.

Ice Stories was nominated for a **2008 Webby Award** for Events and Live Broadcasts in the Online Film and Video category, and was named as an **Official Honoree** in the Science category for 2009. Visit the **Ice Stories website**, which includes a **live webcam feed** from McMurdo Station of Antarctica.

The National Science Foundation (NSF) is an independent federal agency that supports fundamental research and education across all fields of science and engineering. In fiscal year 2010, its budget is $6.9 billion. NSF funds reach all 50 states through grants to over 1,900 universities and institutions. Each year, NSF receives about 48,000 competitive requests for funding, and makes over 11,300 new funding awards. NSF also awards over $400 million in professional and service contracts yearly. Contact ***NSF's Office of Legislative and Public Affairs*** *for more information or for permission to reuse newsletter images.*

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