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Discovery Porthole

Sharing Research with Educators and the Public

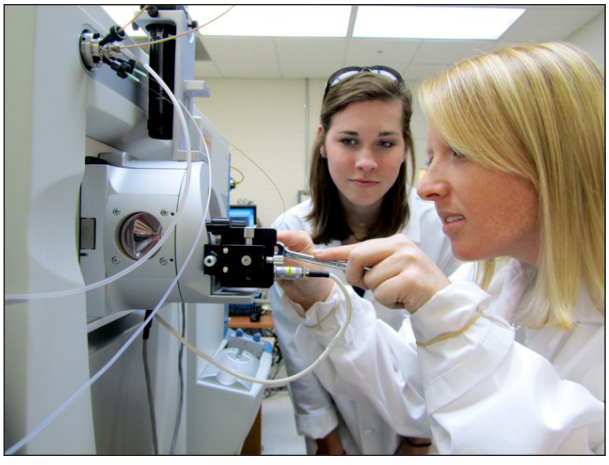
Fish health and oil exposure

In the past, oil exposure has been associated with devastating infectious disease outbreaks in wild populations of fish. The links between these outbreaks and the oil exposure are circumstantial but they suggest an associated disruption of the immune system. Scientists at Mississippi State University hope to use state-of-the art laboratory techniques to determine if the Deepwater Horizon oil spill is affecting the health of fish populations in the Gulf of Mexico.

Scientists are examining sea trout, gulf killifish and alligator gar to monitor effects of the oil spill. Photo credit: Louisiana Sea Grant

Dr. Lora Petrie-Hanson is using a laboratory technique known as ***flow cytometry*** as a sensitive method for evaluating the health of sea trout, alligator gar and gulf killifish in the Gulf of Mexico. The flow cytometer allows researchers to rapidly examine immune cells from the blood of fish affected by oil. In August 2010, alligator gar and gulf killifish were collected from an oiled site near Terrebonne Bay, Louisiana. In addition to testing these collected fish, Drs. Peter Allen and Petrie-Hanson conducted experiments directly exposing fish to oil. These exposure experiments were used to determine how oil affects fish health and the functions of the ***immune system***. Alligator gar, experimentally exposed to oil, were evaluated for changes in their ability to control the levels of water and mineral salts in their blood (osmoregulation), metabolic (chemical) changes, the immune system's ability to clear pathogens and changes in the liver known to be associated with oil exposure over time. The changes that occur in the experimentally exposed fish will be related to the findings from fish that had been exposed to the Deepwater Horizon oil spill. This integrated study will evaluate the effects of oil on cells of the immune system and will help determine how exposure may result in the increased likelihood of disease.

Drs. Mariola Edelmann and Tibor Pechan, another research team from MSU, are looking at oil spill effects on the sheepshead minnow, a fish commonly found in salt marshes along the gulf coast, and on microbes (microscopic organisms) living in the open waters of the Gulf of Mexico. Protein samples collected from the fish and microbes are processed using a novel approach of ***Adaptive Focused Acoustics Technology***. Additional techniques, including ***high performance liquid chromatography*** and ***mass spectrometry***, are used to separate and analyze complex protein mixtures. The information acquired at a protein level will be integrated with the data collected from genes, provided by collaborators, in order to obtain more comprehensive analysis. The results of this study will help scientists better understand the microbial community across the Alabama continental shelf and what effects the oil spill may have had on it. It will also reveal potential toxic effects of oil and dispersant on sheepshead minnow. These results will give scientists and managers a greater ability to estimate long-term effects of oil spills and also to predict the outcomes of similar disasters in the future.



Dr. Edelmann's laboratory assistants use a mass spectrometer to analyze protein samples. Photo credit: MSU

Education Extension

Key Terms: *immune system, bacteria, microbes, toxins, immune response*

Classroom Activity: The Immune System

The immune system is made up of special cells, proteins, tissues and organs designed to protect our bodies from invading bacteria, microbes, viruses, toxins and even parasites. In most cases, the body's immune system does a good job of preventing infection. But sometimes stressors can result in a weakened immune system. NGI scientists are examining how oil exposure may be affecting the immune response of several species of fish.

Ocean Literacy Principles:
5. The ocean supports a great diversity of life and ecosystems

National Science Standards: A. Science as Inquiry: Abilities necessary to do scientific inquiry; C. Life Science: Structure and function of living systems; F. Science in Personal and Social Perspectives: Personal and community health

Supplies: *small white and orange balls (table tennis), reusable container, labels*

Directions: 1) Assign half your students labels, identify them as healthy, stressed, sleep deprived, dehydrated, malnourished, etc. Fill their containers with white balls (white blood cells) according to their level of health. 2) Assign the other half labels identifying them as cold, flu, *Rotavirus*, *E. coli*, etc. Fill their containers with orange balls (pathogens). 3) Allow students to move about the room while the pathogens try to infect them by placing orange balls in their containers. 4) Discuss how the healthier students were resistant to infection because of their strong immune systems. 5) Expand terminology for older students.

Visit **http://dhp.disl.org/resources.html** for lesson plans and additional marine-related activities.

****Use the key terms above to search for additional lesson plans on the web!***

Did You Know...

Flow cytometry uses a laser to examine microscopic cells, characterize and sort them based on size and shape, and then count how many cells occur in each category.

The ***immune system*** includes cells and processes that protect the body from damage caused by invading microorganisms and cancer cells. Increased white blood cell production indicates a defense response from the immune system.

Adaptive Focused Acoustics Technology sends a high frequency acoustic energy to a biological sample of interest for complete extractions of bio-molecules.

High-performance liquid chromatography is a laboratory technique used to separate a complex mixture of compounds and is used in biochemistry to identify, measure and purify the individual components of the sample.

Mass spectrometry is an analytical technique used to determine mass of molecules by measurement of their mass-to-charge ratio. It is often used in combination with high-performance liquid chromatography to identify and measure peptides (protein building blocks) and other compounds.

Project Contact Information

Lora Petrie-Hanson, Ph.D.
College of Veterinary Medicine
Mississippi State University
P.O. Box 6100
Mississippi State, MS 39762
(662) 325-1291
lora@cvm.msstate.edu

Mariola Edelmann, Ph.D.
Institute for Genomics,
Biocomputing and Biotechnology
Mississippi State University
Pace Seed Technology Building
P.O. Box 6040, Mailstop 9758
Mississippi State, MS 39762
(662) 325-7611
MEdelmann@mafes.msstate.edu

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Northern Gulf Institute Program Office
Building 1103, Room 233
Stennis Space Center, MS 39529
Phone: (228) 688-4218 Fax: 228-688-7100
www.NorthernGulfInstitute.org

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