

National Institute of Environmental Health Sciences  
Division of Extramural Research and Training  
Cellular, Organ, and Systems Pathobiology Branch

**NATIONAL ADVISORY ENVIRONMENTAL HEALTH SCIENCES COUNCIL**

May 12-13, 2010

Concept Clearance

Oceans and Human Health

**Introduction:**

The National Institute of Environmental Health Sciences (NIEHS) has made significant investments in supporting research activities focused on human health effects and health risks associated with marine and freshwater environments. The NIEHS has supported several investigator-initiated research grants using R21 and R01 mechanisms in addition to solicited multi-component projects S11, P01, P30, and P50 mechanisms that address ocean and human health (OHH) research activities. Research foci have primarily been on: developmental neurotoxicity associated with consumption of shellfish and finfish contaminated with marine toxins or pollutants, e.g., domoic acid, ciguatera toxin, methyl mercury; harmful algal bloom (HAB) research focused on mechanisms of toxicity, remote sensing; and the development and exploitation of freshwater models of human disease, e.g., models of zebrafish toxicity. In 2004 we collaboratively funded Centers for Oceans and Human Health with the National Science Foundation (NSF) that supported three specific areas of OHH research: HABs; water and vector-borne pathogens; and the development of marine natural products. Four Centers were established at the University of Washington, the Woods Hole Oceanographic Institute, the University of Hawaii and the University of Miami Rosenstiel School of Marine and Atmospheric Sciences. They are all currently active, with support from ARRA supplements and NSF supplement awards.

**Research Goals and Scope:**

The overall goals of the initiative being developed collaboratively by the NIEHS and the NSF are to continue to conduct Oceans and Human Health (OHH) research using multi-disciplinary approaches in order to both improve the health of the oceans and of the American public who utilize the oceans for recreation and the production of food. The three areas of emphasis to be addressed by this initiative are: harmful algal bloom (HAB) research; marine pollution; marine biochemistry; and global climate change impact. Research in all of these areas will focus on human health consequences.

1. HAB research.

- Investigators are expected to utilize genomic, proteomic and high throughput technologies to assess HAB toxins and mechanisms of toxicity;
- Additionally, the development of enhanced and or novel remote sensing and prediction of HAB events utilizing oceanic, geological and atmospheric measurements as well as retrospective analysis of satellite data will be encouraged.
- Investigate biologically active compounds, e.g.,
  - does bioaccumulation of beta-Methylamino alanine (BMAA) a potent neurotoxin, or other biologically active compound increase human health risks, ALS or Parkinson's
  - are there potential therapeutic benefits to novel marine biologically active compounds?

2. Marine pollution: Examples of research questions to be addressed include

- does eutrophication impact growth kinetics of HAB organisms;
- does bioaccumulation of marine pollutants in shellfish, finfish, and or marine mammals that are consumed impact human health or health risks;
- what are the risks to humans exposure in recreational waters; and
- what are mechanisms of toxicity ?

3. This initiative will also support studies that address human health risks and effects associated with global climate change. Among the impacts associated with climate change marine environments that may be supported by this initiative include:

- studies to determine how climate directly and/or indirectly impacts toxic algal blooms, including their initiation, development, termination, and other characteristics that influence the occurrence and severity of associated human disease ;
- studies to evaluate health risks associated with climate-change induced increases in the release and mobilization of chemical contaminants;
- studies to determine synergistic interactions among ocean-related toxins, chemicals, and waterborne pathogens also likely to be impacted by climate change, and how changes in climate will impact these relationships
- development of methods to detect, quantify and forecast ocean-related health threats, including improved surveillance and monitoring of disease-causing agents in coastal waters, marine organisms (esp. seafood), aerosols, sediments, and exposed human populations

For the first time this initiative will address the associations between the Great Lakes and human health risks and health outcomes. The Great Lakes Basin serves as a major source of drinking water to populations living in the region, as well as providing avenues of recreation, transportation and commerce.

Consequently, there are human health risks and outcomes that are associated

with pollution in the Great Lakes Basin. Cyanobacterial (blue green algae) species that produce cyanotoxins pose health hazards via exposure through consumption or recreational activities. This initiative will support research that focuses on the following:

- utilization of genomic and proteomic approaches to identifying cyanotoxin producing species and the physical, geological, and meteorological conditions associated with propagation of toxin production;
- eutrophication or urban run-off influences on the growth kinetics of cyanotoxin producing blue green algae;
- consumption of contaminated drinking water or freshwater shellfish/finfish that bioaccumulate pollutants associated with wastewater, industrial pollution or urban and or agricultural runoff and there effects on human health.

### **Mechanism(s):**

The current format for the NSF-NIEHS supported Centers for Oceans and Human Health has been extremely productive and successful. However, there are opportunities for single research projects to contribute and benefit from formal interactions with the multi-component projects that will be supported by this initiative. Therefore, we anticipate releasing two parallel solicitations that utilize the P01 mechanism for the multi-project component of the OHH program as well as an R01 program. .

The NSF will support all ship time and activities that are associated with ship time. Moreover, the NSF will support any and all activities associated with the discovery and development of marine natural products. NIEHS will support studies that are associated with investigations of human health outcomes, mechanisms of toxicity, and omics applications involved with HABs research. The OHH RFA is scheduled for submission to the ENS in late April, targeting release at the beginning of June. The application receipt date will be set in October with a March review for May 2011 Council. Awards should be made in July 2011.