

Research Project 1: *Ciguatera – Dinoflagellate Nutrient Profile and Ecology, Rapid Detection Methods, and Human Health*

Research Project 1 focuses on ciguatera fish poisoning, the most widespread human-health manifestation of harmful algal blooms (HABs) and the most commonly reported marine toxin disease in the world. This serious human-health problem results from the consumption of certain fish having high levels of ciguatoxins that are produced by the benthic dinoflagellate, *Gambierdiscus toxicus*. Ciguatoxins are biomagnified up the foodweb as herbivorous fish are eaten by carnivorous fish and/or man.



(l) Wild *Gambierdiscus toxicus* from environment. (r) *G. toxicus* (Department of Botany, Smithsonian Institute, Washington, DC).

Despite the widespread occurrence of ciguatera throughout the tropical and subtropical regions of the world's oceans, the production, transformation, and toxicological dynamics of ciguatera remain poorly understood. These gaps in knowledge arise from (a) the poor understanding about the ecological requirements for ciguatoxin production, (b) the extreme toxicity of the toxins involved, (c) the difficulties in obtaining sufficient quantities of toxins for study, and (d) the requirements for extremely robust analytical methods.

Hawai'i has long been an epicenter for ciguatera research in foodweb dynamics, chemistry, and detection. Hawai'i also has a long history of ciguatera incidence throughout the islands, and as such represents an ideal living laboratory that

provides the environmental setting, continuous samples of *G. toxicus* and infected fish, and access to the considerable analytical resources at the University of Hawai'i.

Following the hypothesis that environmental conditions influence *G. toxicus* abundance and ciguatoxin production, the research is directed toward a better understanding of the eco-physiology of the organism producing the toxin, and the development of improved methods for detecting ciguatoxins in fish and humans. This pursuit is embraced in three specific aims:

1. Determine the nutrient preferences and physiological ecology of *G. toxicus* in Hawaiian coastal waters;
2. Determine conditions promoting ciguatoxin production in *G. toxicus*;
3. Develop and apply broadly applicable detection methods for ciguatoxins in algae, fish and humans.

This research effort represents a strategic convergence of diverse disciplines, including algal physiology and ecology, aquaculture, ciguatoxin chemistry, bio-product evaluation, and clinical medicine. This confluence of scientists with complementary expertise is designed to overcome the formidable limitations that have previously constrained and hampered ciguatera research. Moreover, strong leadership for this project is provided by Robert R. Bidigare, Ph.D., who brings a distinguished career of contributions to traditional oceanography, marine bio-product chemistry, and human-health effects of toxins of marine microbial origin.

<http://www.prcmb.hawaii.edu/index.asp>