

Project Summary

Experimental investigations of the giant colonies of *Phaeocystis globosa* in Chinese waters

This proposal seeks funds to experimentally investigate the mechanisms by which giant colonies of the haptophyte *Phaeocystis globosa* survive and grow in Chinese coastal waters. In recent years long-lived (~six months) blooms along the Guangdong coast have formed and caused substantial fish kills in aquaculture cages, resulting in substantial economic losses to the local economies. The blooms are relatively predictable, in that they repeatedly occur in one location each year. One unique feature of the colonies of these Chinese blooms is their size: they reach up to **3 centimeters in diameter, a full order of magnitude larger than any other known phytoplankton**. As such, the colonies are subject to different physical factors, and aspects of their cellular/colonial physiology and carbon nutrition, nutrient uptake, and ecology must be much different than their smaller counterparts.

Intellectual Merit: We propose a collaborative, international investigation of the ecology of these giant colonies in conjunction with colleagues from Jinan Universities. We specifically propose to investigate

- The relationship among colonial cell abundance, density and carbon, mucous carbon, and colony size and the relationships among colony size and cell density with nutrient uptake and photosynthesis;
- Sinking rates of colonies as a function of colony size and physiological state; and
- Intracolony fluid contents, including pH, O₂, DOC, DMSP_d and how it influences sinking.

We will develop a theoretical framework for *Phaeocystis globosa* colonies that includes the effects of turbulence, diffusion, and sinking on carbon and nitrogen uptake, and use the experimental results as part of the theoretical development. The experimental program will be conducted at Jinan University, using samples of giant colonies collected near Guangzhou. Through the combined experimental and observational programs, we hope to develop the beginnings of a predictive understanding of how this population thrives to such levels in these coastal waters. Giant colonies of *P. globosa* are the largest phytoplankton known, and represent one of the few planktonic autotrophs that extend into sizes that are influenced by turbulent motion; hence, a study of the colonies' ecology will represent a unique investigation of a novel adaptive mechanism: giantism in phytoplankton.

Broader Impacts: The proposed project represents a true collaboration between two countries and three institutions, all focused on a single, compelling scientific question. The US investigators will perform significant outreach activities within this project that include

- Train a VIMS graduate student and a Jinan Visiting Professor in modern algal techniques;
- Participate in an undergraduate course at William and Mary entitled "Asian Environmental Issues" and highlight the role of harmful algal blooms in coastal Chinese waters;
- Teach mini-courses on *Phaeocystis globosa* at two Chinese Universities (Jinan and Ocean University in Qingdao), and repeat the course at VIMS (available to all graduate students in the broader area at no cost); and
- Convene an international symposium on the biology and ecology of *Phaeocystis*, to be held in China, and publish the proceedings in a peer-reviewed volume.

Jinan will pay for all costs involved in sample collection, most laboratory supplies, and provide extensive equipment (microscopes, fluorometers, LSC, etc.) to be used in the project, as well as Dr. Wang's salary.