

BIO/BMB 485
Research Problems in Belize
Term 6, 2015

Instructors: Barbara Christie-Pope & Craig Tepper

Course learning objectives:

- To develop an expertise and working knowledge of the literature related to the research topics.
- To develop and conduct a research project focusing on the biology of fire corals (*Millepora*) and their protest symbionts (*Symbiodinium*).
- To become familiar with research techniques useful for studying the molecular biology of marine organisms.
- To become familiar with scientific writing, scientific publication, and the peer-review process by critiquing published articles and writing a manuscript outlining a research proposal and the results of your research.
- To be able to meaningfully discuss the chosen research topic with other biologists.

This course supports the Educational Priorities and Outcomes of Cornell College with emphases on knowledge, inquiry, reasoning, communication, and vocation.

Expectations:

The research projects will be a collaborative effort between student researchers and instructors. We expect all of us to gain insight and knowledge as a direct result of our research interactions. Students will present oral reports of research progress/challenges and relevant readings at scheduled lab meetings. Students will take primary responsibility for conducting research and do so with professional attitudes and time commitments. With our guidance, we expect students to produce a manuscript, which is modeled after the peer reviewed literature we are reading in class. Students should understand that producing a publishable manuscript generally requires many drafts, reviews, and revisions.

Evaluation:

Your final course grade will be determined according to the following criteria:

- Effort, attitude, and time invested in the research project including lab safety, attention to detail, ability to troubleshoot research problems, obtaining reproducible results, and participation in group paper discussions.
- Organization of lab research results, computer files, and any other documentation that remains in the lab as your research legacy.
- Familiarity with relevant research literature.
- Evidence of original thought regarding the project.
- Oral presentations.
- Quality of your **drafts and final** written research paper.

Daily Schedule:

The daily schedule will be determined by weather conditions and availability of the boat while we are at IZE. On a typical day, we will spend half of our day working in the lab and the other half working at one of a number of reef sites. Additionally, we meet every evening at 7:00 PM to discuss a paper or discuss research results. This schedule will remain the same all week (including weekends).

Reading List:

I. General Reading

- Raven et al. 2011. Phylum Cnidaria. Biology 9th edition Chapters 33 & 34.

II. Reef Health & the Environment

- Jackson 2014 Executive Summary. **In: Status and Trends of Caribbean Coral Reefs: 1970-2012.** pp1-16. Edited by Jeremy Jackson, Mary Donovan, Katie Cramer and Vivian Lam.
- Hoegh-Guldberg et al. 2007. Coral reefs under rapid climate change and ocean acidification. Science **318**:1737-1742.
- Fine and Tchernov 2007. Scleractinian coral species survive and recover from decalcification. Science **315**:1811.

III. Millepore Biology

- Tepper et al. 2012. Cryptic Species: A mismatch between genetics and morphology in *Millepora*. Marine Science **2**:57-65.
- Lewis 2006. Biology and ecology of the hydrocoral *Millepora* on coral reefs. Advances in Marine Biology. **50**:1-55.

IV. Millepore Nematocysts

- Garcia-Arredondo et al. 2011. Effects of bleaching on the pharmacological and toxicological activities elicited by the aqueous extracts prepared from two “fire coral” collected in Mexico Caribbean. Journal of Experimental marine Biology and Ecology **396**:171-176.
- Garcia-Arredondo et al. 2012. Structure of nematocysts isolated from fire corals *Millepora alcicornis* and *Millepora complanata* (Cnidaria:Hydrozoa). The Journal of Venomous Animals and Toxins including Tropical Diseases. **18**:109-115
- Iguchi et al. 2008. Isolation and characterization of a novel protein toxin from fire coral. Biochemical and Biophysical Communications. **365**:107-112.

V. Symbiodinium

- Croffroth and Santos 2005 Genetic diversity of symbiotic Dinoflagellates in the genus *Symbiodinium*. Protist. **156**:19-34.

- Baker 2003. Flexibility and specificity in coral-algal symbiosis: diversity, ecology, and Biogeography of *Symbiodinium*. Annual Review of Ecology, Evolution and Systematics. **34**:661-689.
- Woolridge 2010. Is the coral-algal symbiosis really “mutually beneficial” for the partners? Bioessays **32**: 615-625.
- van Oppen et al. 2001. Patterns of coral-dinoflagellate associations in *Acropora*: significance of local availability and physiology of *Symbiodinium* strains and host-symbiont selectivity. Proc. R. Soc. Lond. B **268**:1759-1767.
- Little et al. 2004 Flexibility in algal endosymbioses shapes growth in reef corals. Science **304**: 1492-1494.
- Thornhill et al. 2009. Reef Endemism, host specificity and temporal stability in populations of symbiotic dinoflagellates from two ecologically dominant Caribbean corals. PLoS ONE **4**: Issue 7 e6262 1-11.
- Jones et al. 2008. A community change in the algal endosymbionts of a scleractinian coral following a natural bleaching event: field evidence of acclimatization. Proc. R. Soc. Lond. B **275**: 1359-1365.
- LaJeunesse et al. 2009. Outbreak and persistence of opportunistic symbiotic dinoflagellates during the 2005 Caribbean mass coral “bleaching event. Proc. R. Soc. Lond. B **276**:4139-4148.
- Stat et al. 2008. Functional diversity in coral-dinoflagellate symbiosis. PNAS **105**:9256-9261.
- Correa et al. 2009. Development of clade-specific *Symbiodinium* primers for quantitative PCR (qPCR) and their application to detecting clade D symbionts in Caribbean corals. Marine Biology. **156**:2403-2411.