Comparative genomics of color morphs in the coral Montastraea cavernosa (NitroFixCorals project)

Website: https://www.bco-dmo.org/dataset/723422
Data Type: experimental
Version: Final
Version Date: 2018-01-12

Project
» Nitrogen Fixing Prokaryotes in Corals: Is Nitrogen Fixation a Core Function of the Coral Microbiome? (NitroFixCorals)

Contributors	Affiliation	Role
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Table of Contents

Dataset Description

Montastraea cavernosa is a common coral in the Caribbean basin found in several color morphs. To investigate the causes for brown and orange morphs we undertook a genomics approach on corals collected at the same time and depth in the Bahamas. The coral holobiont includes the host, symbiotic dinoflagellates (Symbiodinium spp.), and a diverse microbiome. While the coral host showed significant genetic differentiation between color morphs both the composition of the Symbiodinium spp. communities and the prokaryotic communities did not. Both targeted and global gene expression differences in the transcriptome of the host show no difference in fluorescent proteins while the metatranscriptome of the microbiome shows that pigments such as phycoerythrin and orange carotenoid protein of cyanobacterial origin are significantly greater in orange morphs, which is also consistent with the significantly greater number of cyanobacteria quantified by 16S rRNA reads and flow cytometry. The microbiome of orange color morphs expressed significantly more nitrogenase (nifH) transcripts consistent with their known ability to fix nitrogen. Both coral and Symbiodinium spp. transcriptomes from orange morphs had significantly increased expression of genes related to immune response and apoptosis, which may potentially be involved in maintaining and regulating the unique symbiont population in orange morphs.

Methods & Sampling

The methodology can be found in the publication associated with these data:

Jarett JK, MacManes MD, Morrow KM, Pankey MS, Lesser MP (2017) Comparative Genomics of Color Morphs In the Coral Montastraea cavernosa. Scientific Reports 7(1): 16039.

Data Processing Description

The data processing methodology can be found in the publication associated with these data:

Jarett JK, MacManes MD, Morrow KM, Pankey MS, Lesser MP (2017) Comparative Genomics of Color Morphs In the Coral Montastraea cavernosa. Scientific Reports 7(1): 16039.

BCO-DMO Data Processing Notes:

- Data from original publication were compiled into one table with dataset descriptions.
- The PI has not verfied any of the information present on the BCO-DMO website.

[table of contents | back to top]

Data Files

File
nitro_fix.csv(Comma Separated Values (.csv), 3.15 KB) MD5:c14e8519ec531a31b8eb4731f2d8b91f Primary data file for dataset ID 723422

[table of contents | back to top]

Related Publications

Jarett, J. K., MacManes, M. D., Morrow, K. M., Pankey, M. S., & Lesser, M. P. (2017). Comparative Genomics of Color Morphs In the Coral Montastraea cavernosa . Scientific Reports, 7(1). doi:10.1038/s41598-017-16371-9
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
Data_Link	Link to data. All data is either available to download directly from BCO-DMO, or the link redirects to an external site where the data are available for download.	unitless
Dataset_Name	Dataset name	unitless
Dataset_Description	Dataset description	unitless

[table of contents | back to top]

Project Information

Nitrogen Fixing Prokaryotes in Corals: Is Nitrogen Fixation a Core Function of the Coral Microbiome? (NitroFixCorals)

Coverage: Heron Island, Australia; Kaneohe Bay, Hawaii; Curacao

Description from NSF award abstract:
Coral reefs provide crucial services for people and are becoming increasingly threatened by climate change. But many important questions about coral reefs remain unanswered, such as how their incredibly high biodiversity has developed and is maintained. It is well known that reef-forming corals consist of many different

groups of bacteria and algae that live in the tissues of corals, but the function of most of these microbes remain unknown. One of the reported microbial functions is the process called nitrogen fixation. Nitrogen fixation is better known as a very important process on land. For example, alfalfa in agricultural fields has microbes associated with its roots that can capture nitrogen from the air and replace nitrogen lost from soils in water. The nitrogen cycle in the oceans is less well known, especially in tropical waters where nitrogen levels are low, although nitrogen in coral reef systems is known to derive mainly from nitrogen fixation. Recently nitrogen-fixing bacteria have been discovered in the tissues of corals, which begs the overarching question of this project: how important is the contribution of this fixed nitrogen to corals and to the surrounding environment? This research will integrate with an educational program that fosters critical thinking and cooperative learning among participants by involving undergraduate students who will work closely with the scientists. Students from underrepresented backgrounds will be recruited; the undergraduates will become part of an existing undergraduate research opportunities program where they receive mentoring, financial support, and intensive writing support while conducting original research projects of their own. Also a new program will be developed with the university's veterans office to attract and transition veterans into science fields across campus. Finally, outreach activities will be organized at local public high schools, and some public environmental education lectures about the ecology and biology of coral reefs are planned.

Significant gaps in understanding exist about the role of prokaryotes in the physiology, biochemistry and ecology of reef-forming corals. This project will assess how different prokaryotic communities affect the biogeochemistry of nitrogen, specifically nitrogen fixation, within the coral holobiont and how nitrogen fixation contributes to the dissolved organic nitrogen (DON) content of excreted mucus. The introduction of "new nitrogen" though nitrogen fixation and release of DON could have significant impacts on the biogeochemistry of nitrogen in the adjacent benthic communities surrounding corals. High throughput sequencing tools will be used to quantify the taxonomic and functional diversity of these symbioses in corals from the Pacific and Caribbean, as well as the taxonomic diversity of nifH genes in the tissues of corals. Rates of nitrogen fixation on several coral species from Australia, Hawaii and Curacao will be measured, along with the translocation of fixed nitrogen to all compartments of the coral holobiont, and the contribution of "new nitrogen" to the DON of mucus released to the environment determined. The results will increase our understanding of the taxonomic and functional biodiversity of symbiotic prokaryotes in corals. This project will also help guide future studies on the biogeochemical cycling of coral-derived nitrogen on coral reefs.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1437054

[table of contents | back to top]