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## Subject Databases: A to Z - J (On-Campus)

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Multimodal Optical Microscopy Methods Reveal Polyp Tissue Morphology and Structure in Caribbean Reef Building Corals

Mayandi Sivaguru, Glenn A. Fried, Carly A. H. Miller, Bruce W. Fouke

1Institute for Genomic Biology, University of Illinois at Urbana-Champaign, 2Department of Geology, University of Illinois at Urbana-Champaign

An integrated suite of imaging techniques has been applied to determine polyp morphology and tissue structure in the Caribbean corals Montastrea annularis and M. faveolata. Fluorescence, serial block face, and two-photon confocal laser scanning microscopy have identified lobate structure, polyp walls, and estimated chromatophore and zooxanthellae densities and distributions.

Published September 5, 2014. Keywords: Environmental Sciences, Serial block face imaging, two-photon fluorescence microscopy, Montastrea annularis, Montastrea faveolata, 3D coral tissue morphology and structure, zooxanthellae, chromatophore, autofluorescence, light harvesting optimization, environmental change
Multimodal Optical Microscopy Methods Reveal Polyp Tissue Morphology and Structure in Caribbean Reef Building Corals

Mayandi Siraguna, Glenn A. Fried, Carly A. H. Miller, Bruce W. Fouke

Institute for Genomic Biology, University of Illinois at Urbana-Champaign, Department of Geology, University of Illinois at Urbana-Champaign.

Summary

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Summary

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**Keywords:** Environmental Sciences, Issue 91, Serial block face imaging, two-photon fluorescence microscopy, *Montastrea annularis*, *Montastrea faveolata*, 3D coral tissue morphology and structure, zooxanthellae, chromatophore, autofluorescence, light harvesting optimization, environmental change

Cite this Article


Abstract

An integrated suite of imaging techniques has been applied to determine the three-dimensional (3D) morphology and cellular structure of polyp tissues comprising the Caribbean reef building corals *Montastrea annularis* and *M. faveolata*. These approaches include fluorescence microscopy (FM), serial block face imaging (SBFI), and two-photon confocal laser scanning microscopy (TPLSM). SBFI provides deep tissue.
Multimodal Optical Microscopy Methods Reveal Polyp Tissue Morphology and Structure in Caribbean Reef Building Corals

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Summary

An integrated suite of imaging techniques has been applied to determine polyp morphology and tissue structure in Caribbean Reef Building Corals. These techniques include multimodal optical microscopy, which allows for detailed visualization of tissue architecture and cellular organization. The results highlight the complexity and diversity of tissue morphology within polyps, providing insights into the structural basis of coral feeding and growth.
Multimodal Optical Microscopy Methods Reveal Polyp Tissue Morphology and Structure in Caribbean Reef Building Corals

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Multimodal Optical Microscopy Methods Reveal Polyp Tissue Morphology and Structure in Caribbean Reef Building Corals

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1Institute for Genomic Biology, 2Department of Geology, 3Department of Microbiology, University of Illinois at Urbana-Champaign

Summary

An integrated suite of imaging techniques has been applied to determine polyp morphology and tissue structure in Caribbean reef-building corals. These techniques include confocal microscopy, light sheet microscopy, and multiphoton microscopy. The analysis reveals detailed insights into the cellular architecture and tissue organization, providing a comprehensive understanding of polyp morphogenesis and tissue differentiation in these complex marine organisms.
Multimodal Optical Microscopy Methods Reveal Polyp Tissue Morphology and Structure in Caribbean Reef Building Corals

Maynard Dugan1, Greer A. Fried2, Carly A. H. Miller2, Bruce W. Fouke1,2,3
1Department of Geology, University of Illinois at Urbana-Champaign
2Department of Microbiology, University of Illinois at Urbana-Champaign
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Correspondence to: Maynard Dugan at dugan5@illinois.edu, Bruce W. Fouke at fouke@illinois.edu

URL: http://jove.com/video/51624

Keywords: environmental science, issue 91, confocal laser imaging, epifluorescence microscopy, fluorescence microscopy, electron microscopy, 3D coral tissue morphology and structure, zoanthidophora, chromophores, autofluorescence, light harvesting, optimization, environmental change

Abstract

An integrated suite of imaging techniques has been applied to determine the three-dimensional (3D) morphology and cellular structure of polyp tissue comprising the Caribbean Reef building coral Montastraea annularis and M. cavernosa. These approaches include Raman microscopy (RM), serial block face imaging (SBFI), and confocal and two-photon laser scanning microscopy (TPLM). RM provides deep tissue imaging and reveals tissues and the tissue surface structure and 3D visualization to tissues of depths of more than 2.5 mm. Complementary TPLM and SBFI provide ultra-high-resolution images of the cellular structure. Results: First, identically dispersed polyps tissue morphology is determined on the order of micrometers to millimeters and 2) created the first surface images of the 3D distribution and tissue density of chromophores and chlorophyll-like phase contrast images. Additional results: All of these approaches allow for the visualization of cellular structures and the examination of their histological and ultrastructural features. These results indicate that M. cavernosa and M. annularis corals are similar in their tissue composition and structure, suggesting that these corals are suitable for use in future studies on the effects of environmental stressors on coral tissue morphology and structure.

Protocol

STEP 1: Preparation of Full Block Face Imaging of Coral Tissue

1. Prefiltration Wax

   a. Mix 30 ml of DDW and 30 ml of 50% ethanol.
   b. Filter 30 ml of the mixture through a 0.22 mm syringe filter.
   c. Add 0.5 ml of microwave paraffin (100%) and mix well.

2. Embedding Wax

   a. Place 7.2 ml of CTEA wax in a glass block, and mix well with 0.3 ml of 50% ethanol.
   b. Add 0.3 ml of 50% ethanol and mix well.
   c. Add 1.5 ml of 50% ethanol and mix well.
   d. Add 1.5 ml of 50% ethanol and mix well.
   e. Add 0.5 ml of 50% ethanol and mix well.
   f. Place the glass block with a 0.1 ml dropper on the Corals.
   g. Place the glass block with a 0.1 ml dropper on the Corals.
   h. Place the glass block with a 0.1 ml dropper on the Corals.
   i. Place the glass block with a 0.1 ml dropper on the Corals.
   j. Place the glass block with a 0.1 ml dropper on the Corals.
   k. Place the glass block with a 0.1 ml dropper on the Corals.
   l. Place the glass block with a 0.1 ml dropper on the Corals.
   m. Place the glass block with a 0.1 ml dropper on the Corals.
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   o. Place the glass block with a 0.1 ml dropper on the Corals.
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   q. Place the glass block with a 0.1 ml dropper on the Corals.
   r. Place the glass block with a 0.1 ml dropper on the Corals.
   s. Place the glass block with a 0.1 ml dropper on the Corals.
   t. Place the glass block with a 0.1 ml dropper on the Corals.
   u. Place the glass block with a 0.1 ml dropper on the Corals.
   v. Place the glass block with a 0.1 ml dropper on the Corals.
   w. Place the glass block with a 0.1 ml dropper on the Corals.
   x. Place the glass block with a 0.1 ml dropper on the Corals.
   y. Place the glass block with a 0.1 ml dropper on the Corals.
   z. Place the glass block with a 0.1 ml dropper on the Corals.

3. Embedding Coral Tissues for Full Block Face Imaging

   a. Wash the coral polyps with the appropriate buffer solution.
   b. Wash the coral polyps with the appropriate buffer solution.
   c. Wash the coral polyps with the appropriate buffer solution.
   d. Wash the coral polyps with the appropriate buffer solution.
   e. Wash the coral polyps with the appropriate buffer solution.
   f. Wash the coral polyps with the appropriate buffer solution.
   g. Wash the coral polyps with the appropriate buffer solution.
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   v. Wash the coral polyps with the appropriate buffer solution.
   w. Wash the coral polyps with the appropriate buffer solution.
   x. Wash the coral polyps with the appropriate buffer solution.
   y. Wash the coral polyps with the appropriate buffer solution.
   z. Wash the coral polyps with the appropriate buffer solution.
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1Institute for Genomic Biology, University of Illinois at Urbana-Champaign, 2Department of Geology, University of Illinois at Urbana-Champaign

Summary

An integrated suite of imaging techniques has been applied to determine polyp morphology and tissue structures for several Caribbean coral species. These techniques include confocal microscopy, Raman spectroscopy, and second-order nonlinear microscopy. The results provide new insights into the cellular and subcellular organization of coral tissues, which can aid in understanding their physiology and ecology.
### Materials

**Multimodal Optical Microscopy Methods Reveal Polyp Tissue Morphology and Structure In Caribbean Reef Building Corals**

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**D0i**: 10.3791/5824

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