

Shift To Heterotrophy During Coral Bleaching

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Introduction

Coral bleaching associated with climate change is one of the major threats that tropical coral reefs have to face up. Several studies have highlighted the severity of this phenomenon but mechanisms underlying bleaching and subsequent resilience are poorly understood. Indeed, the disruption of the symbiosis between zooxanthellae and the coral host is not the only process occurring during bleaching; complex physiological and cellular mechanisms are also induced and/or modified during and after bleaching.

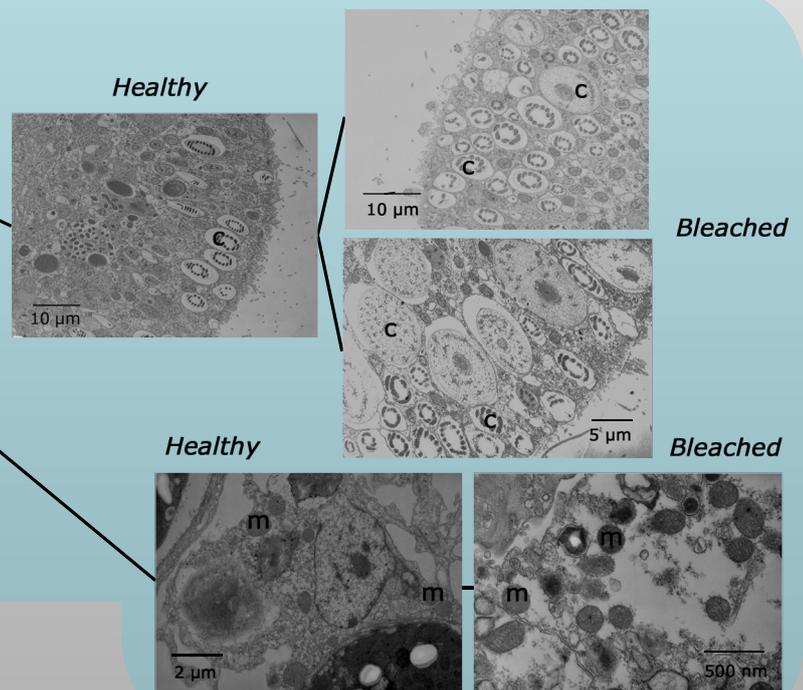


Material and method

Tissue and cell morphology alterations on both healthy and bleached organisms were investigated in three coral species (*Pocillopora verrucosa*, *Acropora globiceps* and *Porites rus*) and one sea anemone (*Aiptasia sp.*), using optical and electron microscopy. Counts of *Symbiodinium*, cnidocytes and mitochondria were performed.

Results and discussion

The present study suggests the shift from autotrophy to a predominantly heterotrophic status of the coral holobiont during bleaching episodes as shown by Grottoli et al. (2006, Nature 440: 1186-89). Higher number of cnidocytes (c) (2 to 4-fold) was observed in bleached corals and anemones while zooxanthellae density decreases (65 to 80%). Indeed, with the loss of zooxanthellae, the coral is deprived of its main energy income and has to find new way of food supply by increasing cnidocytes density. Moreover, mitochondria (m) were more easily observed in bleached organisms suggesting a higher respiration level and thus a higher metabolic activity. This increase of metabolic activity could be associated with energy allocation to host cell-differentiation.



BUT... How to trust these results?

- * Is electron microscopy ultrathin slices representative of the entire organism?
- * How to be sure of the orientation of the slice/tissue?
- * How to do reliable and reproducible counts/measurements?
- * Are other techniques more appropriate? Is there specific probes for cnidocytes, mitochondria or other organites?

The debate is open...

Conclusion

Despite the fact that there are some limitations in the microscopic approach, clear tendencies appear by the way of an increase of cnidocytes and mitochondria densities during or after bleaching. However, other techniques seem necessary to strengthen these observations.

