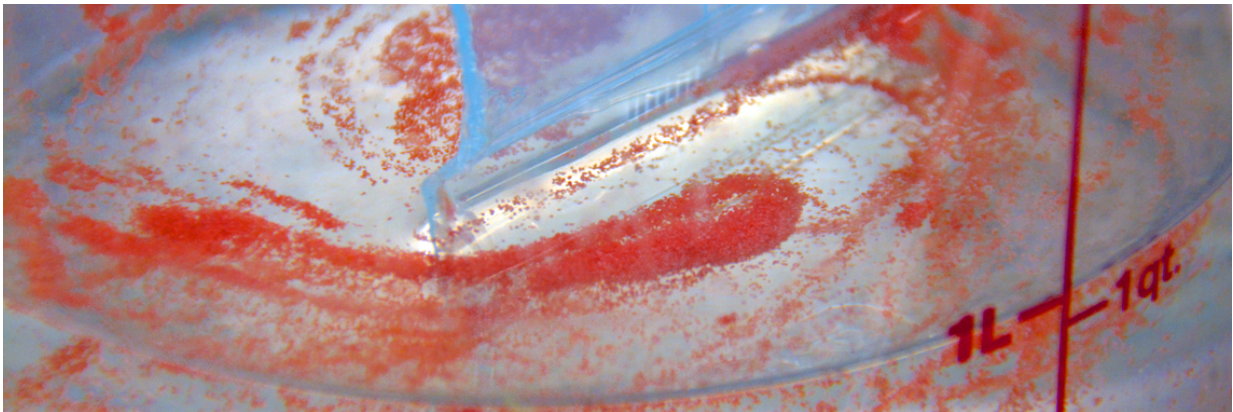


Preparing for a new relationship: Coral and algae interactions explored

June 23 2016, by Rebecca Hofland



The larval stage in coral is the only time it does not have a symbiont to survive, which allows researchers to experiment with the interaction between coral and its symbiont: algae. Credit: OIST

Coral cannot survive on its own for long. It needs to create a symbiotic relationship with algae to survive. Algae provides approximately 90 percent of the energy coral needs, which means that their partnership must be preserved in order to keep the coral healthy. In order to protect coral, algae, and the marine species that live in reef environments, scientists need to know more about how the symbiotic relationship between coral and algae begins. In collaboration with Amin Mohamed and Prof. David Miller at James Cook University, Prof. Noriyuki Satoh and Dr. Chuya Shinzato of the Okinawa Institute of Science and

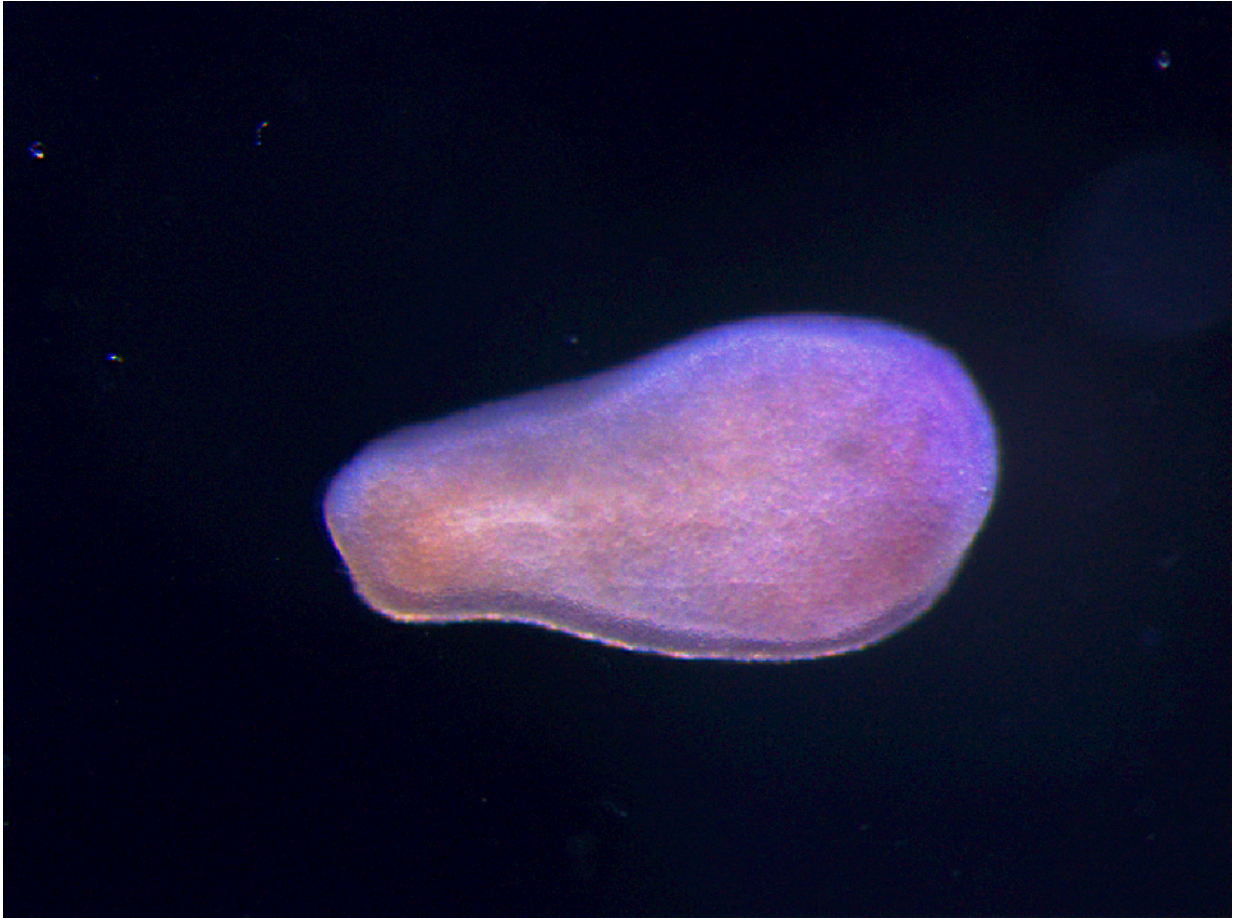
Technology Graduate University (OIST), found changes in coral gene expression when introduced to algae. They have recently published their results in *Molecular Ecology*.

The only time when coral does not have an algae symbiont is during the larval stage. When the symbiont is introduced, which happens naturally in the wild, the coral absorbs the algae and the algae continues to live within the coral cells for the remainder of the coral's life.

"We wanted to investigate the [gene expression changes](#) when the symbiosis starts in the [coral larvae](#)," Dr. Chuya Shinzato, co-author and group leader of OIST's Marine Genomics Unit.

Previously, it was thought that in the time when the algae were introduced to the coral, there were minor changes in [gene expression](#). However, using the latest technology in genome analysis and checking many different time points following the introduction of the algae, the team discovered that changes in gene expression did occur in coral during symbiosis, but these were only detected at four hours after the first interaction with the symbiont. Past studies had missed this window of gene expression, as they had looked only at later time points: 12 and 48 hours after first interaction.

"This study succeeds in analysing the very early stages of coral symbiosis," Shinzato said. "We saw suppression of the genes related to mitochondrial metabolism and protein synthesis, which means that the metabolism stops working for a short time."



Coral at the larval stage is the only time the coral does not have an algae symbiont for energy. Credit: OIST

This means that the coral has to adapt and react to the introduction of the symbiont, instead of passively accepting the algae.

"The coral has to change its cell conditions to adjust to the symbiosis," Shinzato said. "Coral needs to prepare to welcome the symbiont. Then, the mutual relationship can begin."

The researchers also found evidence to support that the symbiosome - the membrane around the symbiont - is derived from the host

phagosome - the membrane around the entire cell that is meant to catch and kill pathogens. This affects the functionality of the phagosome in its role in catching and killing pathogens.

"Normally, the phagosome kills the pathogens," Shinzato said. "But in this [symbiotic relationship](#), the phagosome function is stunted."

These discoveries help in understanding the process of symbiosis, as well as the continuing symbiotic relationship between coral and algae. This is particularly important for protecting coral. As the sea temperatures rise with climate change, even by one or two degrees, the symbiotic relationship can be destroyed and the symbiont is expelled from the coral, which leaves the coral without its biggest energy source. This is called coral bleaching and is a real threat to the [coral reef ecosystems](#). Understanding the symbiotic relationship can help scientists to fight against coral bleaching.

"About 25 percent of [marine species](#) live in the [coral reefs](#)," Shinzato said. "If coral reefs disappear, it means that those marine species will also disappear. The symbiotic relationship is the basis for these ecosystems, which is why it is so important to study. We must understand the mechanism of [coral](#) symbiosis in order to combat [coral bleaching](#)."

More information: A.R. Mohamed et al, The transcriptomic response of the coral to a competent strain: the symbiosome as an arrested early phagosome, *Molecular Ecology* (2016). [DOI: 10.1111/mec.13659](https://doi.org/10.1111/mec.13659)

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