Flexibility of the symbiosis between Bivalves and chemosynthetic bacteria : mechanism, control and resilience

Symbiosis between mussels of the genus *Bathymodiolus* and sulfur-oxidizing and methanotrophic bacteria located in their gills enables these bivalves to live in harsh environments, such as deep-sea hydrothermal vents. This symbiosis is flexible, as the abundance of each symbiont varies according to the available chemical substrata. Our goal was to investigate mechanisms underlying this flexibility based on experiments in vessels, pressurized or not. Cell proliferation in gills, monitored by immuno-labelling of mitosis markers and by *in vivo* incorporation of synthetic nucleotides, showed multiplication areas in the ciliated zone and in the dorsal region of the gills. Apoptosis, quantified by specific labelling, shows that *Bathymodiolus* gills display a higher apoptotic rate than coastal mussels without symbionts. Bacteriocytes with a low symbiont content are most frequently undergoing apoptosis, which invalidates the hypothesis of a direct regulation of the quantity of symbionts by apoptosis. The comparison with the coastal mussel *Mytilus edulis* enabled us to show a high cell turnover rate in the ciliated zone of *Bathymodiolus*, a possible adaptation to symbiosis and to the environment. The mussel gills maintained without substrates for the symbionts changed, and ended up displaying similarities with those of coastal mussels. *Bathymodiolus* releases little amounts of both types of symbionts, this could facilitate lateral transmission of the symbionts to neighbouring mussels. This first integrative approach of the mechanisms involved in symbiosis flexibility opens new perspectives on the way hosts and symbionts interact.