**Symbiotic luminescent bacteria / Luminescent bacteria as a symbiont**

Some marine invertebrates and fish establish mutualistic relationship with luminescent bacteria. Depending upon the particular species, the organs containing the luminescent bacteria may be localized near the eye, abdomen, rectum or jaw.

In squid, luminescent bacteria appear in the pair of glands in the mantle cavity, **Vibrio** and **Photobacteriumspecies**, within special saclike organs that generally have external pores that allow the bacteria to enter and provide for the exchange with the surrounding sea water. The fish supplies the bacteria with nutrients and protection from competing microorganisms. Some fish able to manipulate the organs containing these bacteria so as to emit flashes of light. The flashlight fish **Photoblepharon**, is capable of shutting off its light by drawing a dark curtain, like an eyelid, over the light organ.

Anamalops, small, tropical, light emitting marine fish, has slightly different mechanisms for shutting off its light. Here, the light organ, lined on the inside with reflective guanine-containing cells, is rotated like an eyeball, almost 180ºC. In both Anamalops and Photoblepharon are the light organs are situated under the eyes and may be used to some extend as a flashlight or headlamp by these nocturnal fishes. Both Anamalops and Photoblepharon are gregarious are thought to aid their schooling behaviour and perhaps repel predators. The light organs of both fishes are tightly packed with light –emitting bacteria. Although Anamalops and Photoblepharon live in shallow water, most mutualistic associations with luminescent bacteria occur in deep sea fishes that live below the level of light penetration. The light emitted by the associated luminescent bacteria permits species recognition among these fishes. The pattern and location of the luminescent organs on the fish and the fact that they often occur in only one sex indicate that the luminescent bacteria may be critical for mate recognition. Some light organs located near the eyes include a reflective concave mirror of guanine-containing cells and lenslike focusing structures, indicating that some fishes use the light as searchlights. Movement of the luminescent organs may also allow these fishes to lure prey and to communicate with other fishes.

 Vibrio ﬁscheri bacteria live in the light organs of squid and ﬁsh in the ocean in a symbiotic relationship. Bacterial luminescence helps their squid hosts escape predation through counterillumination or helps ﬁsh hosts attract mates; in return, symbionts obtain shelter and nutrients from the host.

Vibrio ﬁscheri produces N-acylhomoserine lactone (AHL), a small-signaling molecule termed an **autoinducer** that is released into the surrounding water when the bacteria are free-living, where it is diluted. When the bacteria are sheltered within a squid or ﬁsh host, the AHL accumulates as bacterial population densities increase, leading to the binding and activation of LuxR, a transcriptional activator. Subsequently LuxR binds to the lux box, causing enhanced production of luciferase enzymes and other chemicals key to bioluminescence and the lights come on.

References

1. Atlas and Bartha, Microbial Ecology: Fundamentals and Applications, fourth edition, Pearson
2. Larry L. Barton and Diana E. Northup, Microbial Ecology, Wiley-Blackwell