In echinoderms, ophiuroids count 78 species able to produce light. Brittle star bioluminescence, linked to an anti-predation function 6, can be mediated by different “photogenous systems” such as a coelenterazine-luciferase system in the case of Amphiura filiformis 3.

**RNA-seq De novo illumino sequencing**

Renilla-like luciferase mRNA were detected in arms of the brittle star A. filiformis (RNA-seq). To confirm the implication of the Renilla-like luciferase in the photogenous process, immunodetections using polyclonal antibodies against Renilla luciferase were performed.

**Fig 1: Photogenous areas localization**

**Cnidarian-type luciferases in non-luminous echinoderms**

Common sea-star

Purple Sea urchin

RNA-seq

De novo (Lumino sequencing)

(December 2020)

Genomic sequence data

Tube feet

Renilla-like Luciferase

Functions? Expression pattern?

Renilla-like luciferases mRNA were detected in oral tube feet of the sea-star A. rubens (RNA-seq) and are also predicted by the genome of the Purple sea-urchin S. purpuratus. Surprisingly, both species are not luminous.

**Evolution of the luciferases**

**Fig 3: Phylogenetic tree of luciferases.**

A. filiformis, A. rubens, S. purpuratus and Renilla sp. luciferases are included in a monophyletic group. All these luciferases are clearly homologous to the bacterial haloalkane dehalogenases 10, which are not involved in light emission.

The tree also confirm that luciferase enzymes (but also coelenterazine-based luciferases) have emerged multiple times in evolution.

**In conclusion**, the bioluminescence of the brittle star A. filiformis is mediated by a cnidarian-type luciferase similar to the one of the Sea-urchin *Renilla sp*. Phylogenetic analysis indicate that this type of luciferase is originated from the bacterial haloalkane dehalogenates enzymes, not involved in bioluminescence. These results highlight the “protein function shift” which happened in luciferase evolution and indicate a high pressure for the luminescence emergence. *Renilla*-type luciferase expression (common starfish) and prediction (Purple sea urchin) ask interesting questions about the putative other functions/substrates of these proteins and the potential limitation of the substrate for the light emission.