The optical fiber like-structure of the bioluminescent brittle star *Amphiura filiformis*: a path to light

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Bioluminescence is a phenomenon that has emerged in numerous phyla, from bacteria to certain bony fish (Lau & Oakley, 2021). Marine living beings with this ability to emit visible light are commonly associated with abyssal species. But luminous organisms can be found even in shallower waters of European seas. This is the case of certain brittle stars such as *Amphiura filiformis*. In this species, a blue light is emitted when stimulated mechanically as a hypothetical defense against predators (Delroisse *et al.*, 2017a). More precisely, this light emission is observed at the level of the spines which traverse the brittle star's arms (Delroisse *et al.*, 2017b). This brittle star has become a well-studied species in terms of echinoderm bioluminescence, but it hasn't yet revealed all its secrets ... especially about the biochemical and mechanical players involved in its bioluminescence control.

The luciferase enzyme is the central biochemical player in the photogenic reaction. Through *in silico* analysis, at least 9 genes coding for luciferase-like proteins have been found in a new *A. filiformis* reference genome (Parey *et al.*, 2023). *In situ* hybridization revealed that several of these genes are expressed at the level of the brittle star's spines, and therefore have a potential involvement in bioluminescence.

Morpho-functional analyses revealed that different morphotypes of ciliated structures (called *stäbchens*) are observed on the spines surface of *A. filiformis*. These structures are typical of brittle stars tegument and are generally considered to be mechanoreceptors or chimioreceptors (Delroisse *et al.*, 2017a). For *A. filiformis*, further evidence in this study points to a potential connection between these structures and the light-producing cells found in the spine inner tissues. So these *stäbchens* could be at the origin of the light response after a mechanical stimulation. Once produced, this light would be channeled along the spine thanks to the presence of a calcareous skeleton and a pigment sheath, in a manner comparable to an optical fiber.

By seeking to clarify some gray areas surrounding *Amphiura filiformis* bioluminescence, these findings may also provide clues to the process of bioluminescence in the marine world.

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