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EDITORIAL

Shining light on deep-sea bioluminescence. Editorial comment on the highlight article "Biochemical characterization of diverse deep-sea anthozoan bioluminescence systems" by M. Bessho-Uehara et al. 2020

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The study "Biochemical characterization of diverse deep-sea anthozoan bioluminescence systems" by Bessho-Uehara et al. (2020) that is published in the upcoming issue of Marine Biology significantly advances our understanding of deep-sea bioluminescence, that is light produced and emitted by living organisms. Bioluminescence was described as early as 1558 (Boussuet, 1558) in sea pens and more recently in anthozoans (Herring 1987), a class of animals that comprises a diverse group of marine invertebrates including sea anemones and the ecologically important reef-building corals (Bellwood and Hughes 2001).

In the current study, Bessho-Uehara et al. assessed multiple deep-sea anthozoan species for their ability to emit light. The authors could describe one hexacoral and three octocoral organisms to be bioluminescent for the first time, adding to the roster of described bioluminescent deep-sea organisms, and suggesting that bioluminescence is broadly prevalent across deep-sea anthozoans. Equally important, the authors could show that while all species employed coelenterazine as a substrate for light generation, only octocorals displayed immunoreactivity against the *Renilla* luciferase, the light-generating enzyme from the shallow-water sea pansy. Consequently, the findings suggest that all luminous octocorals share a common biochemical mechanism to generate light that was already present in their last common ancestor. Bioluminescence across the phylum Cnidaria (comprising anthozoans, hydroboans, among other mainly marine animal classes) at large, however, must have evolved multiple times. This is because, despite all cnidarians showing specificity towards the same light-producing substrate, coelenterazine, multiple different photoproteins are employed across cnidarian groups (with the *Renilla*-type luciferase being found across octocorals), providing an intriguing model to study parallel evolution.

Taken together, the authors present conclusive evidence for the widespread presence of bioluminescence across deep-sea anthozoans. Studying the homology of the underlying molecular mechanisms allowed the authors to place their findings into an evolutionary context. As such, the work provides a well-rounded study that connects discovery, mechanistic insight, and evolutionary history of marine deep-sea bioluminescence, teasing further exciting findings at the horizon.

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References

Bellwood DR, Hughes TP (2001) Regional-scale assembly rules and biodiversity of coral reefs. Science 292(1532–543):1535

Bessho-Uehara M, Francis WR, Haddock SHD (2020) Biochemical characterization of diverse deep-sea anthozoan bioluminescence systems. Mar Biol 167:114

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Boussuet F (1558) De natura aquatilium carmen, in universam Gulielmi Rondeletii…quam de piscibus marinis scrip-sit historiam: cum vivis eorum imaginibus, opusculum nunc primum in luce emissum. Apud Mattiam Bonhomme, 551 Lugduni, 2 vols

Herring PJ (1987) Systematic distribution of bioluminescence in living organisms. J Biolumin Chemilumin 1:147–163