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Conspicuous biofluorescence in the Northern Legless Lizard, *Anniella pulchra* Gray, 1852

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In recent years, there have been numerous reports of animals glowing in response to illumination by particular wavelengths of light (e.g., Lamb and Davis, 2020; Crowell et al., 2024; Carr et al., 2025). This glow can be the result of two related but distinct phenomena. It may be caused by simple reflection of the excitation wavelengths (reflectance; see Loe, 2017), or the tissues of the animal may absorb the excitation wavelengths and re-emit them at lower-energy wavelengths (biofluorescence; see Valeur and Berberan-Santos, 2011; Marshall and Johnsen, 2017). While reflectance and biofluorescence are taxonomically widespread, they are not universal features of all species (e.g., Maria et al., 2022; García-Castillo and Basanta, 2023). In most cases, the ecological significance of (or lack thereof) these phenomena remain unknown or dimly understood. A more complete catalogue of reflectant and fluorescent animal diversity may allow researchers to infer meaningful patterns with the potential to better our understanding. Herein, we describe the occurrence of biofluorescence in the Northern Legless Lizard, *Anniella pulchra* Gray, 1852.

As is the case for all species in the genus *Anniella*, *A. pulchra* is a small fossorial lizard found in habitats that feature substrates such as loose soil and sand (Van Denburgh, 1922; Hansen and Shedd, 2025). Multiple individuals were found on 10 March 2026 by searching under cover objects, such as logs and discarded pieces of concrete in inner-dune coastal scrub habitat in Oceano, California, USA. Individuals in this population feature a melanistic phenotype in which the dorsum is dark grey to nearly black, rather than silver with thin longitudinal black stripes, as is typical for the species (Van Denburgh, 1922; Pearse and Pogson, 2000). The ventral colouration of the species is typically yellow (Fig. 1A).

We illuminated two adult *A. pulchra* with shortwave (254 nm; Stimac Engineering), midwave (310 nm; Stimac Engineering), and longwave (365 nm; Convoy C8) ultraviolet (UV) excitation lights. The lizards glowed most conspicuously under longwave illumination (Fig. 1). We photographed the lizards before and after dark in the field. To mitigate the possible reflectance of visible wavelengths, we also viewed and photographed the lizards through a Tiffen #12 yellow longpass filter. The use of such filters limits the observed glow to a narrower band of fluoresced wavelengths. We photographed the animals with a Canon EOS R5 digital camera fitted with an ef-s 35 mm macro lens.

Under unfiltered longwave UV illumination, *A. pulchra* glowed bright blue on the dorsum, and bright yellow on the venter and ventrolateral sides (Fig. 1B). When viewed through the longpass filter dorsal glow was not observed, but the ventral and ventrolateral sides showed conspicuous fluorescence of green light (Fig. 1C).

The presence of biofluorescence is not sufficient to infer an ecological function. Due to the widespread occurrence of fluorescence across diverse taxa, it has been hypothesised that the presence of this trait is often a coincidental byproduct of structure at the tissue or molecular level (Taboada et al., 2017). However, strong cases have been made for potential ecological relevance in species where fluorescence is conspicuous and localised to particular body regions, as in the case of the Web-footed Gecko, *Pachydactylus rangei* (Prötzel et al., 2021). Furthermore, recent research has begun yielding evidence for functional and adaptive explanations for patterns of biofluorescence (Whitcher et al., 2024a, b). Therefore, we find it worth noting that biofluorescence in *A. pulchra* is conspicuous and localised in nature, warranting further investigation for possible functions.

Due to the fossorial habit and small eyes of *A. pulchra*, it is generally assumed that this species does

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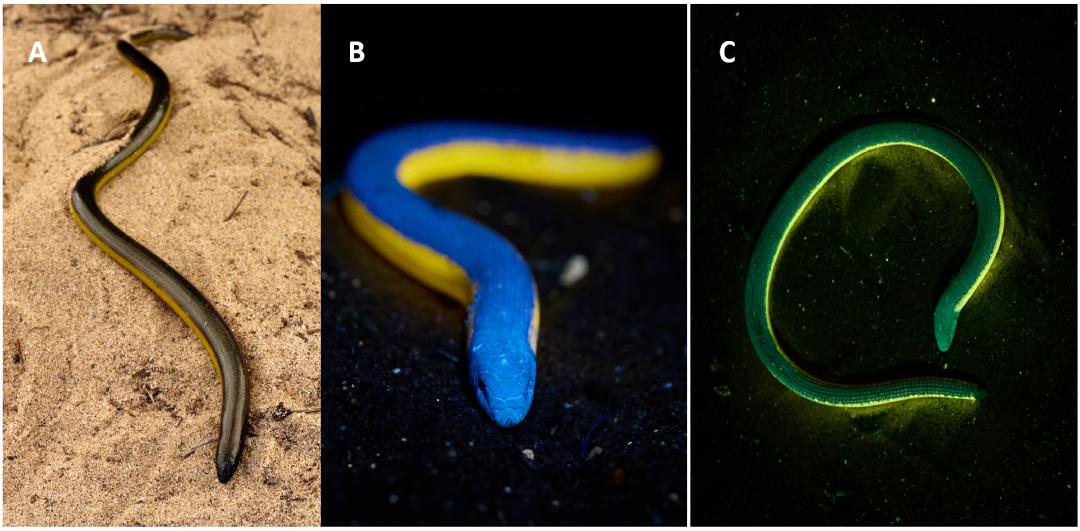

Figure 1. The Northern Legless Lizard, *Anniella pulchra*, viewed under different lighting conditions: under visible light (A), longwave ultraviolet (UV) light (B), and longwave UV light with a longpass filter (C). Photos by Ryan Sikola.

not rely heavily on vision, making an intraspecific communication function of biofluorescence seem unlikely. However, there is no experimental evidence for this assumption, and research assessing the visual acuity of *A. pulchra* needs to be conducted before such a possibility can be ruled out. The behavioural ecology of *Anniella* species is poorly known in general and also requires better resolution before an intraspecific functional biofluorescence hypothesis can be appropriately tested.

To our knowledge, there are no evidence-based explanations in the literature for the bright yellow ventral colouration of *A. pulchra*. Yellow colouration is used as an aposematic signal in many other animal groups (Stevens and Ruxton, 2012). Even mildly chemically defended species, like the California Tiger Salamander (*Ambystoma californiense*) perform threat displays that advertise their high contrast yellow patterning (Alvarez and Wilcox, 2022). It has been hypothesised that biofluorescence may enhance this warning cue against particular predators (Kong et al., 2023). Future research should investigate whether *Anniella* species are chemically defended and whether fluorescent-enhanced cues deter any of their putative predators.

The occurrence of biofluorescence in the *A. pulchra* raises several questions of biological interest. We advocate for further research on the natural history of this understudied lizard clade and suggest that biofluorescence be considered as we attempt to understand their ecology.

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References

Alvarez, J.A., Wilcox, J.T. (2022): Defensive display in the California Tiger Salamander, *Ambystoma californiense* (Caudata, Ambystomatidae). Herpetology Notes **15**: 85–86.

Carr, E.M., Martin, R.P., Thurman, M.A., Cohen, K.E., Huie, J.M., Gruber, D.F., Sparks, J.S. (2025): Repeated and widespread evolution of biofluorescence in marine fishes. Nature Communications **16**: 4826.

Crowell, H.L., Curlis, J.D., Weller, H.I., Davis Rabosky, A.R. (2024): Ecological drivers of ultraviolet colour evolution in snakes. Nature Communications **15**: 5213.

García-Castillo, M.G., Basanta, M.D. (2023): Isthmian Central American frogs with different biofluorescence patterns. Revista Latinoamericana de Herpetologíca **6**: 50–55.

Hansen, R.W., Shedd, J.D. (2025): California Amphibians and Reptiles. First Edition. New Jersey, USA, Princeton University Press.

Kong, B., Preston, K.A., Ishimatsu, M.A., Adelsheim, E.M.C. (2023): Biofluorescence in California Tiger Salamander, *Ambystoma californiense* (Amphibia: Ambystomatidae). Herpetology Notes **16**: 161–163.

Lamb, J.Y., Davis, M.P. (2020): Salamanders and other amphibians are aglow with biofluorescence. Scientific Reports **10**: 2821.

Loe, D.L. (2017): Light, colour and human response. In: Colour Design: Theory and Applications, p. 349–369. Best, J. Ed., Sawston, UK, Woodhead Publishing.

Maria, M., Al-Razi, H., Borzée, A., Bin Muzaffar, S. (2022):

Biofluorescence in the herpetofauna of northeast Bangladesh. Herpetozoa **35**: 39–4.
Marshall, J., Johnsen, S. (2017): Fluorescence as a means of colour signal enhancement. Philosophical Transactions Royal Society B **372**: 20160335.
Pearse, D.E., Pogson, G.H. (2000): Parallel evolution of the melanic form of the California legless lizard, *Aniella pulchra*, inferred from mitochondrial DNA sequence variation. Evolution **54**: 1041–1046.
Prötzel, D., Heß, M., Schwager, M., Glaw, F., Scherz, M.D. (2021): Neon-green Fluorescence in the desert gecko *Pachydactylus rangei* caused by iridophores. Scientific Reports **11**: 297.
Stevens, M., Ruxton, G.D. (2012): Linking the evolution and form of warning coloration in nature. Proceedings of the Royal Society B **279**: 417–426.
Taboada, C., Brunetti, A.E., Alexandre, C., Lagorio, M.G., Faivovich, J. (2017): Fluorescent frogs: A herpetological perspective. South American Journal of Herpetology **12**: 1–13.
Valeur, B., Berberan-Santos, M.N. (2011): A brief history of fluorescence and phosphorescence before the emergence of quantum theory. Journal of Chemical Education **88**: 731–738.
Van Denburgh, J. (1922): The reptiles of western North America: An account of the species known to inhabit California. San Francisco, California, USA, California Academy of Sciences.
Whitcher, C., Beaver, L., Lemmon, E.M. (2024a): The effect of biofluorescence on Cope's gray treefrog: A clay model experiment. Behavioral Processes **215**: 104996.
Whitcher, C., Ron, S.R., Ayala-Varela, F., Crawford, A.J., Herrera-Alva, V., Castillo-Urbina, E.F., et al. (2024b): Evidence for ecological tuning of anuran biofluorescent signals. Nature Communications **15**: 8884.

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