



## **Non-integumentary melanosomes can bias reconstructions of the colours of fossil vertebrate skin**

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The soft tissues of many fossil vertebrates preserve melanosomes – micron-scale organelles used to inform on original integumentary coloration and the evolution of visual signalling strategies through time. In extant vertebrates, however, melanosomes also occur in internal tissues, and hence melanosomes preserved in fossils may not derive solely from the integument. Here, by analyzing the internal tissues of extant and fossil frogs, we show that non-integumentary melanosomes are extremely abundant; they are usually localised to the torso in fossils but can also occur in the limbs, presumably due to dispersal during decay. Melanosomes from the body outlines of fossils cannot, therefore, reliably inform on integumentary coloration. Crucially, non-integumentary and integumentary melanosomes differ in geometry in both fossil and modern frogs and, in fossils, occur as discrete layers. Analysis of melanosome geometry, distribution and size-specific layering is required to differentiate integumentary from non-integumentary melanosomes and is essential to any attempt to reconstruct the original colours of vertebrate skin.