Ontogenetic Color Switching as a By-Product of Chromatophore Maturation

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26/10/2021, 12:00, by Zoom

The evolutionary origins and formation mechanisms of many animal colors remain enigmatic. Here, we elucidate the mechanism underlying ontogenetic changes in defensive colors in fringe-fingered lizards. Hatchling lizards have conspicuously blue, autotomizable tails which are used to redirect predator attacks away from vital organs. The blue color is produced by light scattering from pre-formed guanine crystals in premature iridophores and is a consequence of delayed chromatophore development. Cryptic adult colors emerge upon chromatophore maturation, as the blue scatterer transforms into a broad-band photonic reflector via gradual orientational ordering of guanine crystals. The substituent guanine crystals form by the attachment of individual nanoscopic platelets which independently nucleate and coalesce during growth to form single coherent crystals. These observations show how ontogenetic changes in defensive colors evolve not as a tailored innovation per se but as a by-product of chromatophore cell development.