The Future of Colors – the Unique Mechanism Underlying the Creation of Colors and Their Change in the Body of the Blue-Tailed Damselfly (Ischnura elegans)

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Damselflies exhibit a variety of distinctive colors and patterns. Among the limited number of animal species changing body coloration, the blue-tailed damselfly, Ischnura elegans, stands out, as their bodies undergo many changes of noniridescent vibrant colors throughout their lifespan and under polymorphism - the mechanism underlying this phenomenon is poorly understood. noniridescent colors and in such variety are very rare in nature - they originate from a very unique case of structural color - this study aims to understand and model the mechanism underlying this phenomenon. Biomimicking this phenomena can greatly benefit humanity, since structural color in comparison to chemical colors that are widely used, is environmentally green, does not fade, could replace unhealthy food dyes, and potentially screens emitting light. Due to the motivation presented, I. elegans in particular were previously researched, and computer simulations proposed that the colors are created by epidermal photonic structures made of pigment nanospheres. This study takes a novel approach, the first to experiment on the nanospheres themselves, proves otherwise and that there is more to this phenomenon from past researches, utilizing TEM and diffraction, cryo-SEM, synchrotron (SLS), RAMAN and Spectrophotography to investigate this phenomenon. These unprecedented findings indicate that these nanospheres are liquid crystalline, have inner structure, are arranged as a photonic glass (which explains the non-iridescent color) and provide indication as to the material that makes up the nanospheres. Notably, liquid crystals`s role in generating structural colors is largely unexplored. This research establishes a new and better foundation for further research of color within the whole Odonata order.