

# **Biophotonic structures in insects through deep time: insights from fossils and taphonomic experiments**

Maria E. McNamara

*<sup>1</sup> School of Biological, Earth and Environmental Sciences, University College Cork, Distillery Fields, North Mall, Cork T23 TK30, Ireland  
[maria.mcnamara@ucc.ie](mailto:maria.mcnamara@ucc.ie)*

Many modern insects possess intricate tissue architectures ordered on the nanoscale that can produce striking structural colours and other visual effects with important functions in signaling. Recent studies have begun to illuminate the evolutionary history of photonic structures in insects through deep time by analyzing fossils and by simulating aspects of the fossilization process through controlled (taphonomic) laboratory experiments. Currently in its infancy, the field of fossil photonics is dominated by several studies of multilayer reflectors in fossil beetles, of various photonic structures in fossil moths and a single study that uses taphonomic experiments to elucidate how such structures are preserved. Here I review research to date and present data on new specimens of structurally colored insects and from new taphonomic experiments that shed light on previously unexplored aspects of fossil photonics. Future studies should focus on the identification and ultrastructural and optical characterization of fossil 3D photonic crystals and structures responsible for producing specific optical effects that may contribute to signalling, e.g. polarization, ‘true’ black, etc. Data from taphonomic experiments allow testing of evolutionary hypotheses and are critical components of models for the preservation and evolution of specific photonic structures in insects through deep time.