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Bioinspired Structures and Devices for Nanophotonics

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The catalog of novel material structures and device concepts being discovered in biological systems continues to grow with astonishing speed. Nature's "innovations" include various strategies for structural coloration,¹ broadband nanostructured low- and high-reflective surfaces, photonic crystal light collection schemes and unique multi-colored polarization based vision systems. Nature achieves these effects using very low-index structures and hierarchical fabrication schemes. In this presentation we review some of these key discoveries and present physical based fabrication strategies that emulate nature. For example, the green wing color of the *Papilio palinurus* butterfly results from a micro-bowl array formed from multilayers of air and chitin and is a consequence of the mixing of yellow light reflected from the bottom of the bowls and blue light reflected from the sides of the bowls.² We have emulated this strategy by using breath figure templated self-assembly to mimic the microbowl structure and then by atomic layer deposition of TiO₂/Al₂O₃ multilayer films obtained the same coloration as the original butterfly structure. Additionally, other bioinspired schemes, such as those derived from the fluorescence properties displayed by the *Princeps nireus* butterfly which have lead to new concepts for detecting thermal neutrons, are presented.

¹M. Srinivasarao, Chemical Reviews 99, 1935 (1999)

²P. Vukusic, J. R. Sambles, C. R. Lawrence, Nature 404, 457 (2000)