



Supporting Online Material for  
**Directionally Controlled Fluorescence Emission in Butterflies**

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**This PDF file includes:**

Figs. S1 to S5

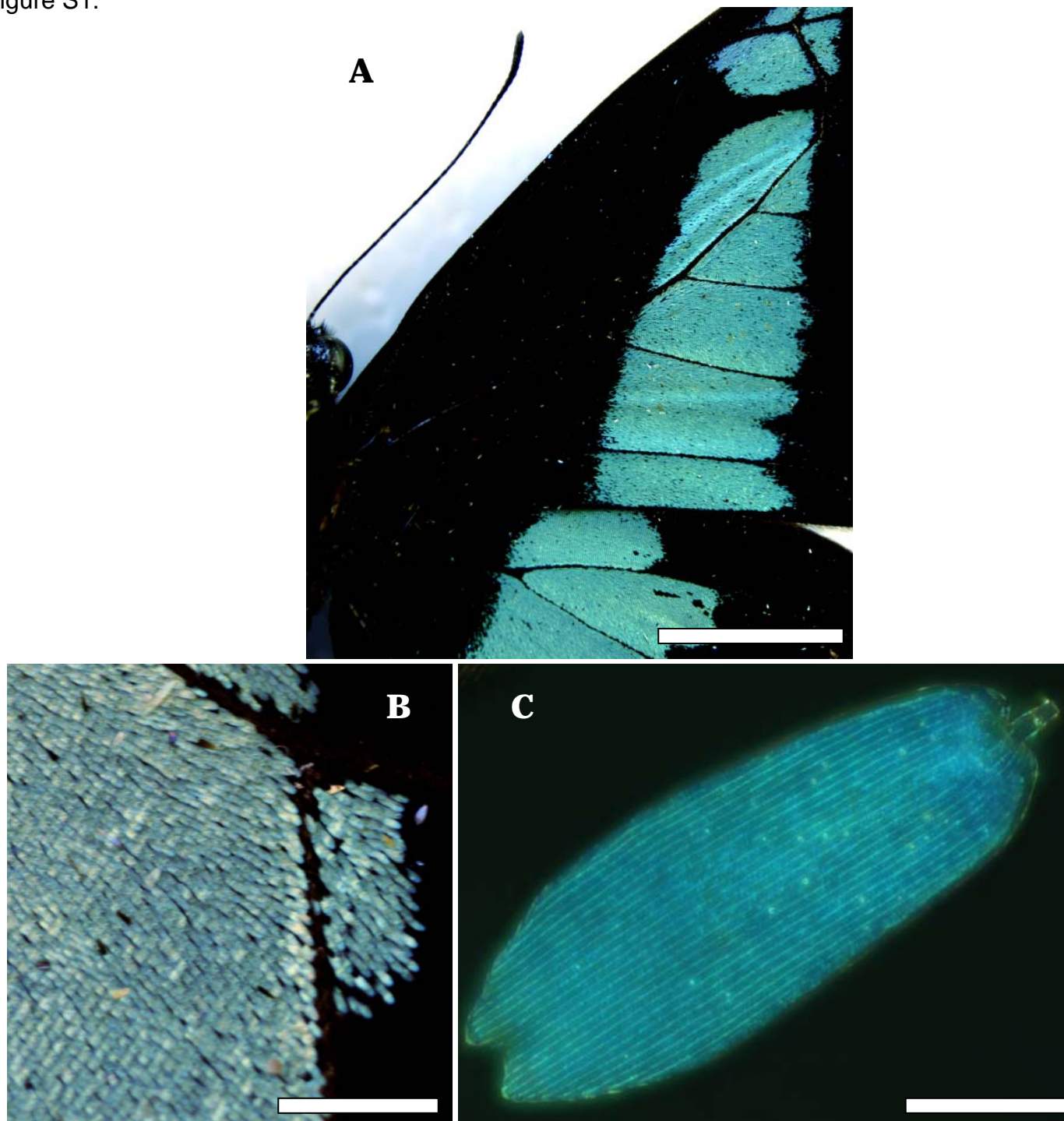
References

## Directionally-Controlled Fluorescence Emission in Butterflies.

(Pete Vukusic and Ian Hooper: University of Exeter, UK).

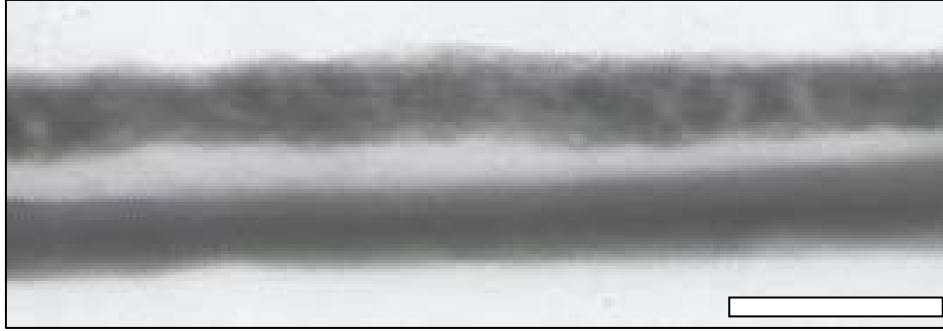
### Supporting online material.

Figure S1.



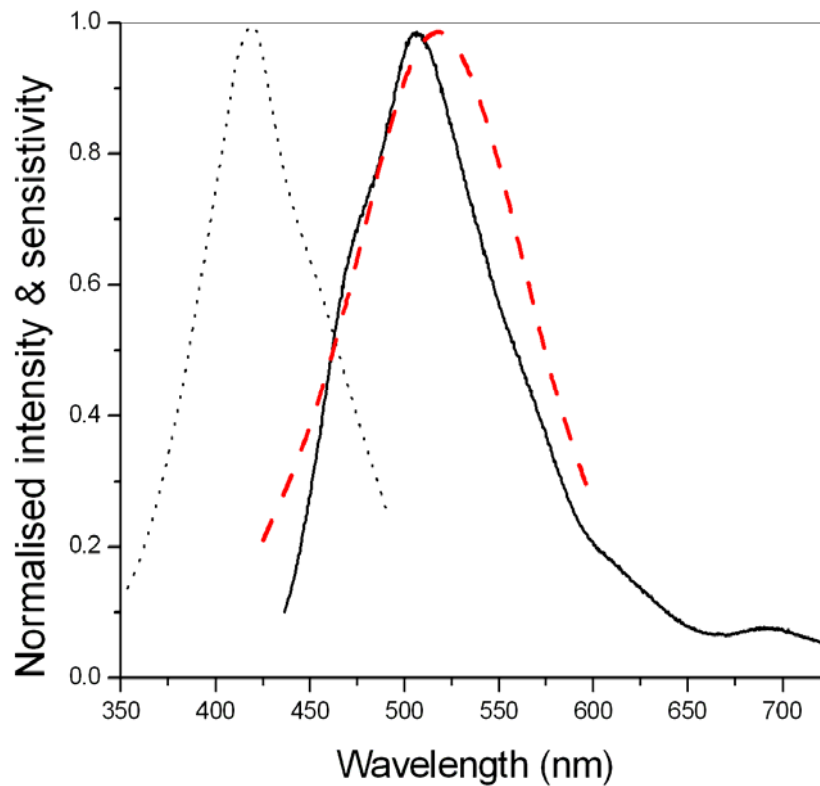
S1 caption. Optical photographs of the wing colour banding and scale colour on the dorsal forewing of *P. nireus* (Scale bars: A, 1 cm; B, 1 mm; C, 50  $\mu$ m).

Figure S2.



S2 caption. High magnification transmission electron microscope image of the 3-layer DBR at the base of a *P. nireus* coloured scale. [Scale ~200 nm].

Figure S3.



S3 caption. Normalised spectra showing fluorescent pigment excitation (dotted line), emission (solid line) and *Papilio* green photoreceptor sensitivity (dashed line).

Figure S4.

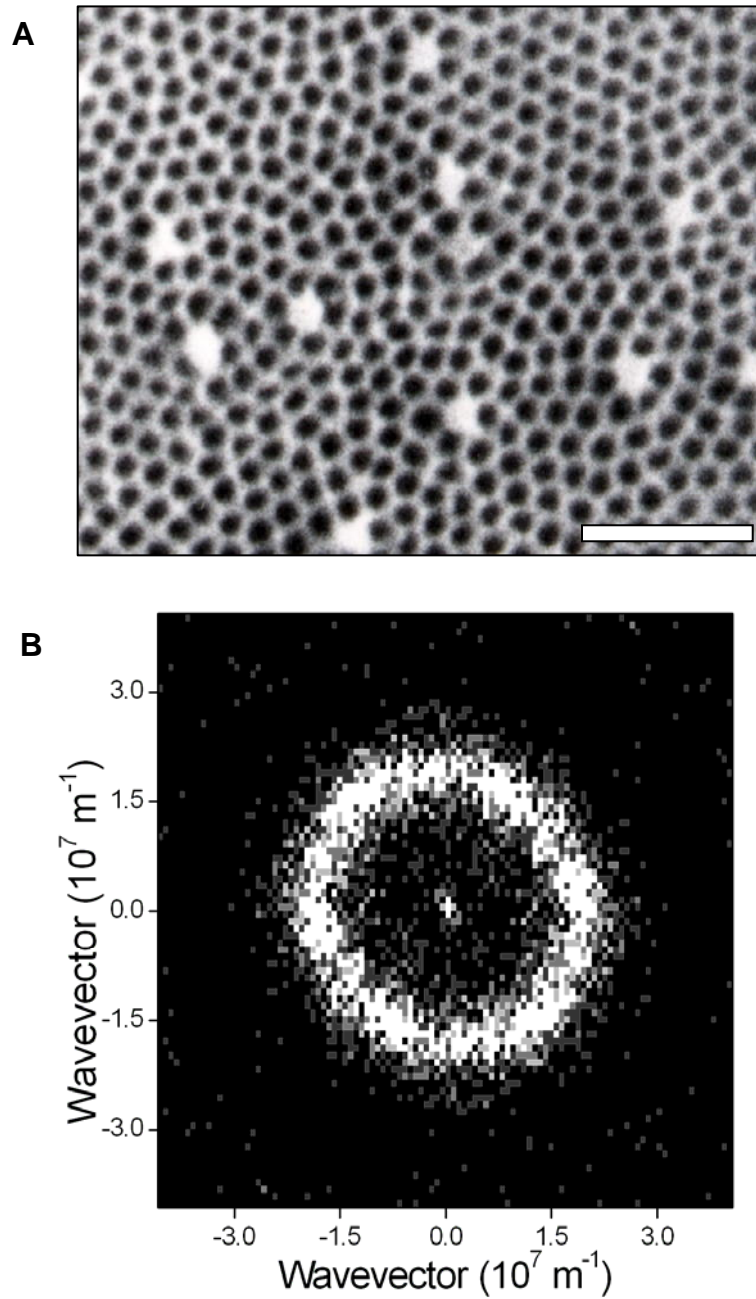
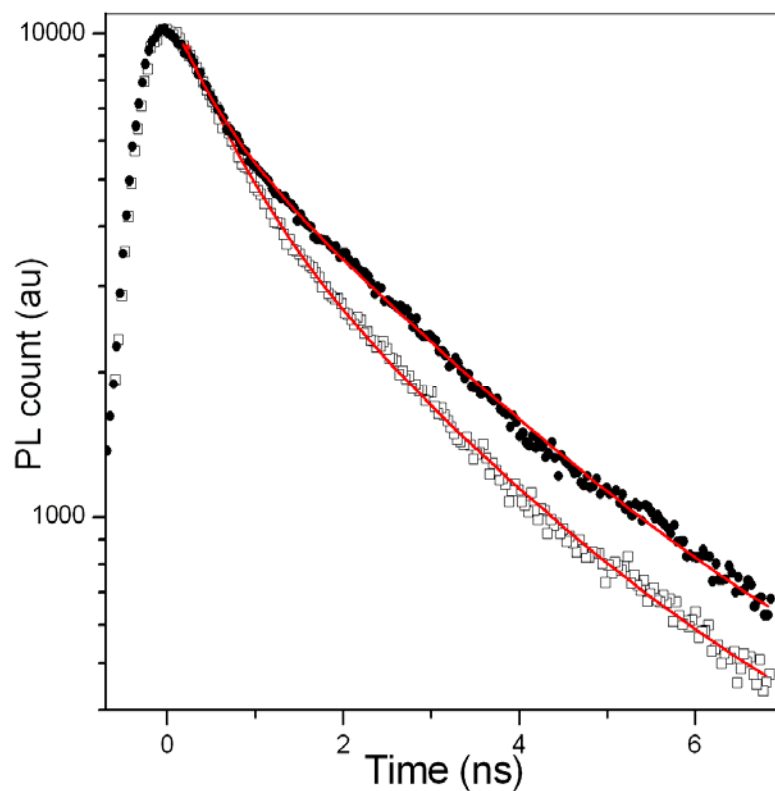


Figure S4 caption. A. Scanning electron microscope image of the underside of the PCS in a *P. nireus* coloured scale showing quasiperiodic arrangement of air cylinders (Scale  $\sim 1.4 \mu\text{m}$ ). B. 2D-fast Fourier transform of the image in A.

Figure S5.



S5 caption. Time-resolved fluorescence with fitted-lifetime curves from a *P. nireus* sample in air (hollow points) and in refractive-index matching fluid (solid points).

Supporting online references:

S1. G. Harburn, C. A. Taylor, and T. R. Welberry, *Atlas of Optical Transforms*, (G. Bell and Sons, London, 1975).

S2. J.D. Joannopoulos, R.D. Meade, and J.N. Winn, *Photonic Crystals: Molding the Flow of Light*, (Princeton University Press, Princeton, 1995).