

生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	色素顆粒創造顏色 (Pigment granules create colors)
生物系統 LIVING SYSTEM	蜻蜓及豆娘 (Dragonflies And Damselflies)
功能類別 FUNCTIONS	#改變光線/顏色 #傳遞光訊號 (可見光譜) #Modify light/colors #Send light signals in the visible spectrum
作用機制標題	豆娘的身體有來自色素顆粒結構性排列的艷麗金屬顏色 (The bodies of damselflies have brilliant metallic colors derived from structural arrangement of pigment granules.)
生物系統/作用機制 示意圖	
作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)	
文獻引用 (REFERENCES)	
<p>「許多蜻蛉目昆蟲 (Odonata) 有著鮮艷的金屬色彩，尤其是豆娘 (damselflies)，來自色素顆粒的結構性排列。這些物種例如 <i>Agrion virgo</i> 豆娘，翅膀中的色素因光線的扭曲而產生華麗的綠-藍-紫色變換效果。在一些雄性蜻蜓中，例如蜻蜓科 (Libellulids) 腹部的淡劍橋藍 (Cambridge blue) 顏色即來自其獨特的結構，其表皮細胞的微細粉狀分泌物 (exudation) 會產生類似李子的果實蠟粉 (bloom) 效果：非常細小且整齊地排列的顆粒只反射了光譜中的淡藍色部分，實際上則經常接近白色。」 (Wootton 1984: 140)</p> <p>「成熟期的 <i>Austrolestes annulosus</i> 豆娘 (絲蟴科 Lestidae) 表皮色素細胞的外觀、微細構造及色素組成已被完整描述，將其與羽化期 <i>Austrolestes</i> 屬豆娘的發育中色素細胞，以及 <i>Diphlebia lestoides</i> 豆娘 (麗蟴科 Amphipterygidae) 和 <i>Ischnura heterosticta</i> 豆娘 (細蟴科 Caenagrionidae) 的成熟色素細胞進行比較。成熟的色素細胞含有許多接近球形的光散射體 (light-scattering bodies)，以及較大的不規則形狀色素囊泡 (pigment vesicles)。這些構造透過在相互連接的粗糙內質網小管道 (granular endoplasmic reticulum tubules) 系統間向著相反方向運移而造成變色效果。這些色素是由眼黃質 (xanthommatin) 及二氫眼黃質 (dihydroxanthommatin) 混合而成，具有液體或膠狀的黏稠度。羽化期昆蟲的發育中色素細</p>	

胞則缺乏光散射體，也沒有明顯的色素運移囊泡，但仍含有類似化學成分組成的不規則色素物質。」 (Vernon et al. 1974: 613)

“The brilliant metallic colours of many Odonata, especially damselflies, derive from the structural arrangement of pigment granules. Pigment in the wings of such species as *Agrion virgo* is similarly distorted by light to produce resplendent shifting effects of green-blue-purple. In some male dragonflies, as Libellulids, the pale Cambridge blue of the abdomen has a distinctive structural cause since it initially derives from a fine powdery exudation of the epidermal cells, producing an effect like the bloom on a plum: the granules are so small and regularly arranged that they reflect only the pale blue part of the light spectrum and, indeed, often appear almost white.” (Wootton 1984: 140)

“The appearance, fine structure and pigment composition of the epidermal chromatophores of mature *Austrolestes annulosus* (Lestidae) are described and compared with the developing chromatophores of teneral *Austrolestes* and the mature chromatophores of *Diphlebia lestoides* (Amphipterygidae) and *Ischnura heterosticta* (Caenagrionidae). Mature chromatophores contain masses of near spherical light-scattering bodies and larger irregularly shaped pigment vesicles. These effect colour change by migrating in opposite directions, through a system of interconnecting granular endoplasmic reticulum tubules. The pigment, a mixture of xanthommatin and dihydroxanthommatin, has a liquid or gelatinous consistency. Developing chromatophores of teneral insects lack light-scattering bodies and well-defined migratory pigment vesicles, but contain irregular masses of pigment of similar chemical composition.” (Vernon et al. 1974: 613)

參考文獻清單與連結 (REFERENCE LIST)

Linsenmaier, W. (1972). *Insects of the world (English and German edition)*. McGraw-Hill.

Veron, J. E. N., A. F. O'Farrell, and B. Dixon. (1974). The fine structure of odonata chromatophores. *Tissue and Cell* 6: 613-615, 617-626.

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延伸閱讀

生物系統延伸資訊連結 (LEARN MORE ABOUT THE LIVING SYSTEM/S)

<https://en.wikipedia.org/wiki/odonata>

<https://www.onezoom.org/life/@odonata>

<https://eol.org/pages/952>

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AskNature 原文連結

<https://asknature.org/strategy/pigment-granules-create-colors/>