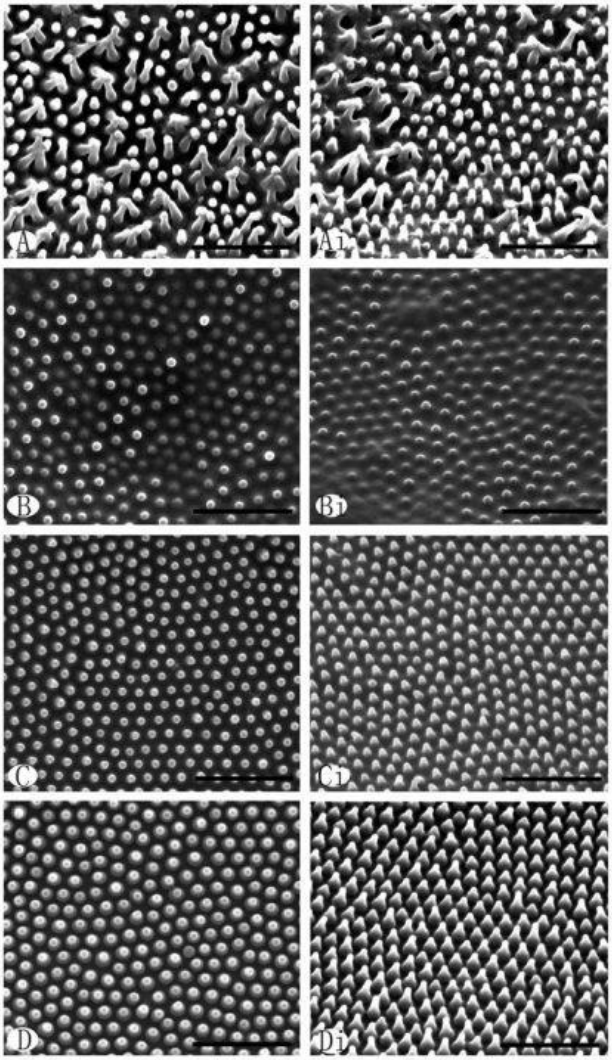
生物策略表(蟬的翅膀)

類別	生物策略 (Biological Strategy)
生物策略 STRATEGY	蟬的翅膀防水、除汙、滅菌和反光 (Cicada Wings Repel Water, Dirt, Bacteria, and Light)
生物系統 LIVING SYSTEM	蟬(Cicadidae)
功能類別 FUNCTIONS	#免於其他動物危害 #Protect From Animals #免於微生物危害 #Protect From Microbes #防止過多的液體 #Protect From Excess Liquids #防止污垢或固體黏附 #Protect From Dirt/solids
作用機制標題	蟬的翅膀上錯綜複雜的奈米結構能幫助它們防止水、污垢和細菌的附著，也能反射光線以避免被捕食者發現。 Cicada wings' intricate nanostructure helps them shed water, dirt, and bacteria and reflects light to avoid detection by predators.
生物系統/作用機制示意圖	 Free non-commercial use Wetting properties on nanostructured surfaces of cicada wings | Journal of Experimental Biology | The Company of Biologists 比例尺 = 一微米(The scale bar = 1 micrometer.)

作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)

放大看蟬的翅膀，你會發現一排排細小的柱子。每個「納米柱 (nanopillar)」的尺寸只有幾百納米高。
而一滴水要大得多。因此，水滴落在蟬翅膀上不會黏住。即使是在霧氣中的微小液滴也不會附著。
翅膀上有各種疏水性的蠟質。這些奈米結構和蠟質促使水在翅膀傾斜的時候脫落，也順便將所有表面的污垢或細菌一起帶走。
奈米柱還能避免蟬被吃掉。光線照射到禪的翅膀上時會被困在奈米柱裡，而不會反射進入掠食者的眼睛。

Zoom into a cicada's wing and you will see that three are tiny pillars arrayed in row upon row. Each "nanopillar" measures only up to a few hundred nanometers high.
A drop of water is much larger. So a drop that lands on the cicada wing won't stick to. Even tiny droplets in fog can't get traction.
The wings are also coated with a variety of naturally water-repellent waxy substances. These nanostructures and waxy substances induce water to slide off when the wings tilt a little, often flushing away any dirt or bacteria particles in the process.
In addition, the nanopillars avoid cicada from being eaten. Instead of being reflected towards the eyes of predators, light that hits the wings gets trapped in nanopillars.

文獻引用 (REFERENCES)

「許多天然表面具有微/奈米結構，具有非凡的功能，例如超疏水性 (superhydrophobicity)、自潔性、抗霧和抗菌功能。其中一個例子是蟬的翅膀，其中物種之間奈米柱幾何的形狀和組成的差異會影響所表現性質的強度。」
"Numerous natural surfaces have micro/nanostructures that result in extraordinary functionality, such as superhydrophobicity, self-cleaning, antifogging, and antimicrobial properties. One such example is the cicada wing, where differences in nanopillar geometry and composition among species can impact and influence the degree of exhibited properties."
(Advanced Materials Interfaces | April 1, 2020 | Jessica Román-Kustas et al.)

「蟬的翅膀由於表面高度有序的垂直奈米陣列而引起了大家的興趣，並且展示了在寬波長範圍內最小化光反射的獨特方法。翅膀表面上的次波長 (subwavelength) 結構產生光阻抗的變化，在空氣和角質層的交界面，這增加了光子收集並降低了反射。」
"[C]icada wings have attracted significant interest owing to the highly ordered vertical nano-nipple arrays on their surfaces, and represent a unique approach to the minimization of light reflection over a wide range of wavelengths. The subwavelength structures on the wing surface create a change in optical impedance, matching at the air-to-cuticle interface, which increases the photon collection and reduces reflectance."
(Applied Physical Letters | Oct. 11, 2016 | Imran Zada et al.)

參考文獻清單與連結 (REFERENCE LIST) **Harvard 或 APA 格式**

Jessica Román-Kustas (2020). Molecular and Topographical Organization: Influence on Cicada Wing Wettability and Bactericidal Properties. Advanced Materials Interfaces Volume 7, Issue 10 2000112 https://doi.org/10.1002/admi.202000112
Imran Zada (2016). Angle dependent antireflection property of TiO2 inspired by cicada wings. Appl. Phys. Lett. 109, 153701 (2016); https://doi.org/10.1063/1.4962903

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生物系統延伸資訊連結 (LEARN MORE ABOUT THE LIVING SYSTEM/S)
撰寫/翻譯/編修者與日期
楊宗叡翻譯 (2022/03/19)；許秋容編修 (2022/5/14)
AskNature 原文連結
https://asknature.org/strategy/cicada-wings-repel-water-dirt-bacteria-and-light/