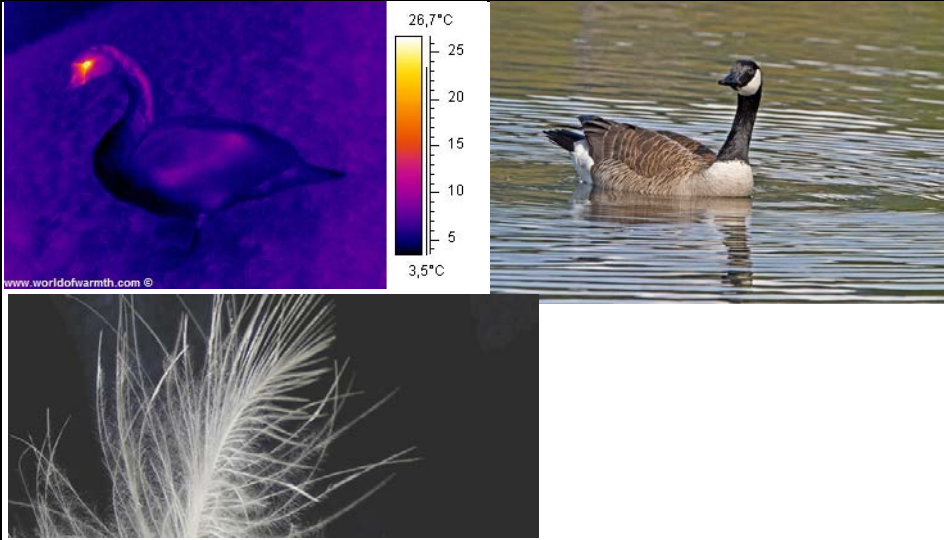


生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	隔熱的羽毛結構 (Feather structure insulates)
生物系統 LIVING SYSTEM	加拿大雁 <i>Branta canadensis</i> (Canada goose)
功能類別 FUNCTIONS	#保護免受溫度危害 #Protect from temperature
作用機制標題	雁鵝的絨羽藉由特殊結構來隔熱 (Down feathers of geese insulate through special architecture)
生物系統/作用機制 示意圖	 <p>The figure consists of three parts: a thermal image on the left showing a goose with a color scale from 3.5°C to 26.7°C; a photograph on the right of a Canada goose swimming in water; and a close-up photograph at the bottom of down feathers.</p>
作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)	
文獻引用 (REFERENCES)	
<p>「羽毛角蛋白 (keratin) 以 β 摺板 (b-sheet) 的構形呈現方式，並不同於哺乳動物角蛋白的 α 螺旋…我們測量了鴨、雁鵝和企鵝絨羽 (down feather) 的特性，並發現它們的特性與飛羽 (flight feather) 相似，實際上也與人造隔熱纖維中所使用的人造聚合物相似。這訊息告訴我們，在衡量絨羽跟合成材料優缺點時，絨羽的結構可能比材料特性更重要…最近，我們藉由使用儀器剪和剪刀來開始探索羽毛角蛋白的韌性。證明了 β-角蛋白的斷裂韌性是非常高的，大約是 10 kJ m^{-2}。」 (Bonser 2007)</p> <p>“Feather keratin occurs in a ‘b-sheet’ configuration which differs from the a-helices that occur in mammalian keratins... We have measured the properties of individual down feathers from ducks, geese and penguins and found that their properties are similar to flight feathers and, indeed, the man-made polymers used in artificial insulation fibres. The message is that the architecture of down feathers is probably more important than material properties in determining their advantages over synthetic materials... Recently, we have begun to explore the</p>	

toughness of feather keratin by using instrumented clippers and scissors. The fracture toughness of β -keratin has proved to be very high, around 10 kJ m^{-2} .” (Bonser 2007)

參考文獻清單與連結 (REFERENCE LIST)

Cameron, G. J., T. J. Wess, and R. H. C. Bonser. Young's modulus varies with differential orientation of keratin in feathers. *J. Struct. Biol.* 143: 118-123.

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/Branta_canadensis

撰寫/翻譯/編修者與日期

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AskNature 原文連結

<https://asknature.org/strategy/feather-structure-insulates/>