

生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	更細的毛髮使袋食蟻獸溫暖 (Thinner fur keeps numbats warmer)
生物系統 LIVING SYSTEM	袋食蟻獸 (<i>Myrmecobius fasciatus</i>)
功能類別 FUNCTIONS	#捕捉，吸收及過濾系統 #維持體內平衡 #隔溫 #capture,absorb,and filter system #maintain homeostasis #protect from temperature
作用機制標題	袋食蟻獸藉由毛髮站立，使得更大面積的皮膚接觸太陽並形成隔絕空氣層來減少熱量散失 (By making their hairs stand up, numbats expose more skin to the sun and create an insulating layer of air to reduce heat loss.)
生物系統/作用機制 示意圖 (確認版權、註明出處；畫質)	 <p style="text-align: center;">numbat/Perth Zoo/Western Australia ; 1000*724 pixels</p>
作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)	

若袋食蟻獸無法從攝取白蟻中得到足夠的能量來維持體溫，他們會藉由吸收來自太陽的熱量代替。每平方英寸袋食蟻獸的毛，相較於其他有袋目和日行性哺乳類動物更短且稀疏。所以這件貧乏的外衣，不是為了隔絕寒冷，而是為了讓更多皮膚接觸到陽光，最大化吸收太陽輻射。

他們也讓毛髮直直站立，科學界的稱此為 piloerection（豎毛）。同於雞皮疙瘩產生。豎毛層使身體熱量不動並且貼近皮膚表面。該層阻止了身體熱量的喪失，如同創造了一條毯子讓袋食蟻獸在寒冷中溫暖。當溫度下降或冷風漸強，袋食蟻獸將有效地豎起毛髮來減少熱量散失。總的來說，袋食蟻獸毛髮的隔熱在讓多少能量進入及釋放中取得平衡。

(Since numbats don't get enough fuel from termites to maintain body heat, they rely on absorbing heat from the sun. Their pelts have shorter hairs and fewer hairs per square inch, compared with other marsupials and diurnal mammals. So their sparse coats are not made to insulate against the cold, but rather to expose more skin area to the sun, maximizing the amount of solar radiation they absorb.

They also make their pelt hairs stand up straight. The scientific term for this is piloerection. It happens to people when they get goosebumps.

Piloerection traps layers of motionless body-heated air close to the skin surface. These layers block heat loss from the body, creating a blanket that helps insulate numbats from cold. As temperatures drop or cold winds pick up, numbats effectively reduce heat loss by erecting their pelts. Altogether, numbat pelts strike a balance between regulating how much heat gets in and how much is allowed out.)

文獻引用 (REFERENCES)

袋食蟻獸皮毛的生物物理特性可能反映了它們對白天生活方式的適應。與其他有袋動物相比，他們的皮毛稀疏而淺，絕緣性差，反射率低，大概是為了最大限度地提高 SHG（太陽能熱增益）。... 通過在暴露於低 TaS（環境溫度）時豎立毛皮，食蟻獸有可能將毛皮的熱阻增加一倍，並減少風的影響，從而減少代謝熱損失。

The biophysical properties of Numbat fur may reflect their adaptation to a diurnal lifestyle. Compared to other marsupials, their fur is sparse and shallow, with poor insulation and low reflectivity, presumably to maximize SHG (solar heat gain). ... by erecting their fur when exposed to low TaS (ambient temperature), anteaters have the potential to double the thermal resistance of their fur and reduce the effects of wind, thereby reducing metabolic heat loss.

在哺乳動物中，毛皮有著類似的體溫調節作用。... 這意味著用於體溫調節的最佳毛皮密度是在達到皮膚存熱與排出的熱量之間的平衡。同樣，在日行食蟻獸中，稀疏的皮毛允許通過太陽能吸收加熱，而近緣的夜行有袋動物則優先考慮降低密集皮毛的熱阻和保溫性。... 在工程方面，服裝的創造（即模仿毛皮的存在）大概是最古老的仿生學例子之一。最近，已經開發了基於毛皮的材料用於建築絕緣和太陽輻射收集系統。

Within mammals, fur plays a similar thermoregulatory role. ... This means that the optimum density of fur for thermoregulation is a careful balance between regulating how much heat reaches the skin relative to how much may be allowed out. Similarly, in the diurnal numbat, sparse fur allows heating through solar absorption, whereas closely related nocturnal marsupials prioritize the reduced thermal resistance and heat retention of dense fur. ... In terms of engineering, the creation of clothing (i.e. mimicking the presence of fur) is presumably one of the oldest examples of biomimetics. More recently, materials based on fur have been proposed and developed for building insulation and solar radiation harvest.

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

Biophysical properties of the pelt of a diurnal marsupial, the numbat (*Myrmecobius fasciatus*), and its role in thermoregulation *Journal of Experimental Biology* | August 7, 2003 | C. E. Cooper

Design principles of hair-like structures as biological machines *Journal of the Royal Society Interface* | March 30, 2018 | Madeleine Seale, Cathal Cummins, Ignazio Maria Viola, Enrico Mastropaolo, and Naomi Nakayama

延伸閱讀: Harvard 或 APA 格式 (取自 AskNature 原文; 若為翻譯者補充, 請註明)

哺乳動物

哺乳動物類 (“乳房”) : 蝙蝠、貓、鯨魚、馬、人類

哺乳動物佔地球上所有動物的不到 1%, 但它們包括一些最著名的物種。我們親身了解了一些使哺乳動物獨一無二的特徵, 例如有毛髮、能夠出汗以及通過乳腺產生乳汁。另一個關鍵的共同特徵是一組高度專業化的牙齒。例如, 與鯊魚或鱷魚不同, 它們的牙齒通常大小和形狀都相同, 哺乳動物在頷骨的不同區域具有不同形狀的牙齒, 以針對特定的食物或覓食策略。

Mammals

Class Mammalia (“breast”): Bats, cats, whales, horses, humans

Mammals make up less than 1% of all animals on earth, but they include some of the most well-known species. We know first-hand some of the characteristics that make mammals unique, like having hair, being able to sweat, and producing milk through mammary glands. Another critical shared feature is a set of highly-specialized teeth. Unlike sharks or alligators, for example, whose teeth are generally all the same size and shape, mammals have differently shaped teeth in different areas of the jaws to target specific foods or foraging strategies.

生物系統延伸閱讀連結 (LEARN MORE ABOUT THE LIVING SYSTEM/S)

https://asknature.org/?s=&p=0&hFR%5Bpost_type_label%5D%5B0%5D=Biological%20Strategies&hFR%5Btaxonomies_hierarchical.system.lv10%5D%5B0%5D=Animals%20%3E%20Vertebrates%20%28Mammals%2C%20Fish%2C%20Birds%2C%20Reptiles%29%20%3E%20Mammals

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AskNature 原文連結

<https://asknature.org/strategy/thinner-fur-keeps-numbats-warmer/>



numbat/Perth Zoo/Western Australia ; 1000*724 pixels