

生物策略格式

KJC, 2019/10/21

類別	生物策略 (Strategy)	
生物策略 STRATEGY	疏水性的葉片表面 (Leaf surfaces are hydrophobic)	
生物系統 LIVING SYSTEM	日本蓍草 (羽衣草) <i>Alchemilla monticola</i> (Lady's mantle)	
功能類別 FUNCTIONS	#保護免受過多液體危害 #Protect from excess liquids	
作用機制標題	由於毛茸濃密，日本蓍草的葉子具有疏水的表面 (The leaves of the Lady's mantle plant have a hydrophobic surface due to dense hairs.)	
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>「來自弗萊堡大學的 Ulrike Mock 與其他人的報導了他們為了要模仿某些植物葉表面或葉子的潤濕行為所做的努力，尤其是日本蓍草 (<i>Alchemilla vulgaris</i> L.) [<i>Alchemilla monticola</i>]，它通過在葉子上所生長的一層緻密的毛狀物，來呈現所謂的超疏水性 (ultrahydrophobic)。」(由 Biomimicry Guild 提供)</p> <p>「近期的研究顯示 [實現『荷花效應』] 的最關鍵標準，主要依賴於將表面粗糙化成為多種尺度的粗糙度，以使滴狀液體可以保留在 Cassie-Baxter 狀態，也就是將空氣囊困在液體的下面，藉此減少固—液體間的接觸面。這些層次結構的表面已經通過各式途徑被製造並證明具有超疏水性質。這種驚人的防水性能也存在於包括多個柔性毛髮的其他生物系統中，並且其中一些已經被人類知悉超過 100 年。有絨毛的葉子，例如 Lady's Mantle，會使水滴形成完美的球體，藉由與毛接觸而被抬升和懸滯，而使它們容易滾落。</p> <p>在動物界中，這種多毛的外部對於許多生物來說扮演著更為重要的角色，不僅有效地保護牠們的身體不被淋濕，而且還為他們的生物活動提供各種機能。這些毛髮從它們的角質層突出幾微米，通常以一定角度傾斜，直徑在微米到亞微米範圍內。這些結構可以抵抗</p>		

雨滴的影響，允許在水面上運動，或者甚至在潛入水中時獲得一層空氣用於呼吸。一些節肢動物顯示出擁有的接觸角 (contact angle) 超過 150° ，這使牠們可以在水上行走。」 (Hsu and Sigmund 2010: 1504)

“Ulrike Mock and others from the University of Freiburg report on efforts to mimic the wetting behaviour of surfaces or leaves of certain plants, especially the lady’s mantle (*Alchemilla vulgaris* L.) [*Alchemilla monticola*], which are rendered ultrahydrophobic through a dense layer of hairs grown on top of the leaf.” (Courtesy of the Biomimicry Guild)

“Recent studies showed that the most crucial criterion [for achieving the ‘Lotus Effect’] mainly relies on roughening the surface into multiple length scales of roughness so that liquid droplets can be retained in the Cassie-Baxter state, where air pockets are trapped underneath the liquid, reducing the solid-liquid interface. These hierarchically structured surfaces have been fabricated through various routes and demonstrated to have superhydrophobic properties as well. This amazing water-repellent property is also found in other biological systems comprising a plurality of flexible hairs, and some of them have been recognized for over 100 years. Fuzzy leaves, such as the Lady’s Mantle, cause water droplets to form perfect spheres and allow them to roll off easily as a result of being lifted and suspended by coming into contact with the hairs.

In the animal kingdom, this piliferous exterior plays a more crucial role for numerous living creatures not only to effectively protect their bodies from getting wet but also to provide various functions for their living activity. These hairs protrude several micrometers from their cuticles, typically inclined at certain angles, with diameters in the micrometer to submicrometer range. These structures can resist the impact of raindrops, allow locomotion on the surface of water, or even trap a layer of air for respiration when submerged. Some arthropods have been shown to have contact angles above 150° , which allows them to walk on water.” (Hsu and Sigmund 2010: 1504)

參考文獻清單與連結 (REFERENCE LIST)

Ulrike, M., R. Förster, W. Menz and J. Rühle. (2005). Towards ultrahydrophobic surfaces: a biomimetic approach. *Journal of Physics: Condensed Matter* 17: 639-648. (<https://iopscience.iop.org/article/10.1088/0953-8984/17/9/021>)

Hsu, S. H. and W. M. Sigmund. (2010). Artificial hairy surfaces with a nearly perfect hydrophobic response. *Langmuir* 26: 1504-1506. (<https://pubs.acs.org/doi/10.1021/la903813g>)

延伸閱讀：

AskNature Team. (March 13, 2018). Hairy self-cleaning surfaces. *AskNature*. Retrieved from: <https://asknature.org/idea/hairy-self-cleaning-surfaces/>

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

文章貢獻/編修者與日期
吳冠宏翻譯 (2019/05/15)；朱天愛編修 (2019/12/19)；吳皓編修 (2020/01/04)； 譚國銜編修 (2020/05/25)；許秋容編修 (2020/11/26)；紀凱容編修 (2020/11/26)
AskNature 原文連結
https://asknature.org/strategy/leaf-surfaces-are-hydrophobic/