

生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	絨毛吸收紫外線輻射 (Hairs absorb ultraviolet radiation)
生物系統 LIVING SYSTEM	高山薄雪草 <i>Leontopodium nivale</i> (Alpine edelweiss)
功能類別 FUNCTIONS	#保護免受光危害 #Protect from light
作用機制標題	高山薄雪草毛茸茸的絨毛透過作為與紫外線互動或吸收紫外線的光子結構，保護植物的細胞免受紫外線輻射危害 (The wooly hairs of the alpine edelweiss protect the plant's cells from ultraviolet radiation by acting as photonic structures that interact with and absorb the UV radiation.)
生物系統/作用機制 示意圖	
作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)	
<p>「想保護自己不被陽光曬傷嗎？塗上一層厚厚的薄雪草可能會有幫助。薄雪草是一種高山花卉，所以會曝露在大量紫外線下。比利時那慕爾大學 (University of Notre-Dame de la Paix in Namur, Belgium) 的 Jean Pol Vigneron 說：『薄雪草如何在這種高海拔的環境中保護組織免受傷害是一個謎。』。他和同事們測量了薄雪草植株反射光線的光譜，發現儘管多數的波長都會被反射，但是紫外線不會。Vigneron 說：『這很令人驚訝，但薄雪草完全吸收了紫外線。』。研究團隊隨後使用掃描式電子顯微鏡檢視覆蓋薄雪草葉片的微細白色絨毛。他們發現這些絨毛是由平行排列的纖維組成，直徑為 0.18 微米，與紫外線的波長相近。Vigneron 說，這表示這些絨毛能沿著葉片的長度與紫外光互相作用。透過這種方式，紫外線被大量的絨毛吸收，不穿透到植物體內。Vigneron 表示這種秘訣應該被利用來生產『自然』的防曬乳供人們使用。Vigneron 又說：『我們目前使用的防曬乳是由二氧化鈦粒子所製成，但這種物質可以經由皮膚吸收，而且可能是有害的。』」 (New Scientist 2007)</p> <p>“Want to protect yourself from sun damage? Slathering yourself in edelweiss could help. Edelweiss is a mountain flower and so is exposed to a large amount of ultraviolet light. Just how it protects itself from tissue damage at such high altitudes has been a mystery, says Jean Pol Vigneron at the University of Notre-Dame de la Paix in Namur, Belgium. Vigneron and his colleagues measured the spectrum of light reflected from the plants and found that while most</p>	

wavelengths are reflected, UV is not. 'It's astonishing, but the plant completely absorbs the UV,' says Vigneron. The team then examined the tiny, white hairs that cover edelweiss leaves under a scanning electron microscope. They found that the hairs are made up of parallel fibres 0.18 micrometres across, which is close to the wavelength of UV light. This means they can interact with UV light, steering it along the length of the leaves, says Vigneron. In this way, the UV light is absorbed over a large number of hairs instead of penetrating to the plant's body. The trick should be exploited to create a 'natural' sunscreen for people, says Vigneron. 'We currently use sunscreens made of titanium dioxide particles, but these can be absorbed through the skin and can be harmful,' he says." (New Scientist 2007)

文獻引用 (REFERENCES)

「構成絨毛層的細絲被發現具有一種內部結構，這可能是在植物中已知少數光子結構 (photonic structure) 的例子之一。測量從苞片 (bracts) 取出的絨毛墊層的透光率結果，支持了覆蓋在植株上毛茸茸的絨毛層，在近紫外線輻射還沒到達細胞組織前，就先將其吸收的想法。根據光子晶體 (photonic crystal) 模型的計算，提供了輻射可以被纖維狀絲線吸收的見解。」 (Vigneron et al. 2005: 011906-1)

“The filaments forming the hair layer have been found to exhibit an internal structure which may be one of the few examples of a photonic structure found in a plant. Measurements of light transmission through a self-supported layer of hair pads taken from the bracts supports the idea that the wooly layer covering the plant absorbs near-ultraviolet radiation before it reaches the cellular tissue. Calculations based on a photonic-crystal model provide insight on the way radiation can be absorbed by the filamentary threads.” (Vigneron et al. 2005: 011906-1)

參考文獻清單與連結 (REFERENCE LIST)

Vigneron, J. P., M. Rassart, Z. Vértesy, K. Kertész, M. Sarrazin, L. P. Biró, D. Ertz, and V. Lousse. (2005). Optical structure and function of the white filamentary hair covering the edelweiss bracts. *Phys Rev E Stat Nonlin Soft Matter Phys* 71: 011906. (<https://doi.org/10.1103/physreve.71.011906>)

NewScientist. (31 October, 2007). Slap on the edelweiss for the ultimate sunscreen. *NewScientist*. Retrieved from: <https://www.newscientist.com/article/mg19626285-100-slap-on-the-edelweiss-for-the-ultimate-sunscreen/>

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/Leontopodium_nivale

撰寫/翻譯/編修者與日期

譚國銓翻譯 (2021/03/22)；洪麗分編修 (2021/04/10)

AskNature 原文連結

<https://asknature.org/strategy/hairs-absorb-ultraviolet-radiation/>